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THE MIDDLESEX CANAL

1793—1860

BY

CHRISTOPHER ROBERTS



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CAMBRIDGE, MASS., U. S. A.

To

W. R.

PREFACE

THE DISCOVERY of unusual collections of source material made possible a history of this early canal. The research of Mr. Walter R. Harper uncovered the official records of the canal corporation which afford a basis for continuous narrative and analysis. Later the writer traced another collection, now in the Baker Library, to the possession of the Baldwin family, descendants of the civil engineer who constructed the canal. Loammi Baldwin had kept a file of letters received and sent, had preserved copies of instructions to artisans and overseers, and had seldom destroyed even preliminary drafts of notices, regulations, and reports. The historian delights to honor a man with such a present sensitiveness to posterity. These papers cover the ten years of construction and the early years of operation, and in addition provide for the later years much material supplementary to the corporate records.

Favored by this available mass of evidence, I have attempted to treat the historical background and the technical difficulties which surrounded inland transportation in post-revolutionary Massachusetts. Many features of contemporary economic life are revealed in the intensive study of this one institution. Its history entails an account of early civil engineering, of initial experiment in corporate organization, and of the relations of a public utility to the state and to the community which it served. The knowledge of scientific methods and the stages of industrial organization at different periods are representatively exhibited in the activities and structure of this corporation. In its adjustments to competing modes of carriage, the Middlesex Canal faced problems that are duplicated today, and encountered under less complicated conditions many of the forces that impinge upon modern public utilities.

The first chapter is an outline based on familiar secondary material, with the emphasis placed on contemporary economic dimensions. Thereafter unpublished manuscripts predominate as sources. The simple statistical methods used correspond to limita-

tions imposed by the data, which unfortunately preclude the computing of index numbers that would be other than doubtful summaries. The treatment throughout is concrete and detailed, giving weight to the activities of contemporary individuals, retaining failures and other elements of anticlimax. The value of an intensive study of an economic microcosm through time may be said to arise, however, less from the details in themselves than from the insight which they afford into the nature of the very process of economic adaptation and change.

I am greatly indebted to Professor Edwin F. Gay, who suggested this study, for judicious advice, for innumerable acts of kindness, and for the stimulus of his unflinching interest during its progress. The generosity of Professor Arthur H. Cole, who placed his notes on the canal at my disposal, is gratefully acknowledged. My earliest interest in economic history came from contact with the penetrating mind and profound scholarship of Professor Abbott P. Usher; my debt to him, though general rather than specific, is very great.

It is a pleasure to record my appreciation of the profit derived from the aid and suggestions of Mr. Edward B. Carney, of Lowell, and of Mr. Thomas F. O'Malley and Mr. James Hall Brooks, of Cambridge. The scholarly advice and seasoned wisdom of Dr. Allan Evans of Harvard University have been of inestimable value. In no way do these acknowledgments imply a sharing of responsibility.

CHRISTOPHER ROBERTS

Cambridge, Massachusetts
November 20, 1937

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THE MIDDLESEX CANAL

1793-1860

CHAPTER I

MASSACHUSETTS AFTER THE REVOLUTION

MASSACHUSETTS has blazed the trail of economic progress in the western world through many new regions. A marked influence has been hers, and the initiative of her sons has often shown others the way of the future. The natural handicaps under which they labored gave hardihood and ingenuity to her race of men, who experienced direct contact with those difficulties which produce strength and a spirit of innovation. Oblivious to hazards that would deter others less disciplined, her people have been keen to seek and to prove new methods and new techniques which promise a partial escape from the hard determinism of their environment.

Such attempts to overcome natural obstacles absorbed public attention in many of the new states during the closing decades of the eighteenth century. It was hoped that artificial waterways might serve profitably to extend the limits of internal and coast-wise trade, which then suffered severe physical restrictions. Before the year 1793, eight of the original thirteen states had incorporated a total of thirty canal companies. General Greene in the South, Washington on the Potomac, Robert Morris in Pennsylvania, and General Schuyler and Elkanah Watson in New York had long been active, planning, promoting, or organizing companies for the improvement of internal navigation. A great many of these early projects were very small, and a few were majestically impracticable. Most of them were abandoned before completion or lived on for decades in a fitful fashion with little show of progress in actual construction.

Canal navigation was, nevertheless, already familiar to many western nations in the eighteenth century. Holland had long operated an extensive system of water communication; France, Germany, and Russia possessed important lines of artificial navi-

gation. Coming into the field relatively late and profiting from continental examples, England could, by 1790, count thirty years of successful experience in canal construction. New technique was at that time transmitted very slowly. Knowledge of what other peoples had accomplished, however, without knowledge of the methods they had employed, was sometimes sufficient to foster similar undertakings at home. The rough facts of European experience made part of the general knowledge of well-informed public men in America, and there existed a desire to match foreign success; yet the science of civil engineering was here in its infancy. Costly errors had to be made before an adequate appraisal of the factors involved and of the precautions to be taken could lead to success.

Informed opinion in the United States was most immediately influenced by the prominence given to canal undertakings in Great Britain. In the early nineties of the eighteenth century the English nation suffered from an obsession of canal building. During the four years ending in 1794 Parliament passed eighty-one canal and navigation acts. On one day in August of 1792 the *Gazette* published notices of eighteen fresh ventures. Applications were made for many times the disposable shares in new companies, and canal stock in general stood at high premiums.¹ Such a ferment of speculation, stimulated by the large profits accruing to investors in successful canal undertakings, could not fail to affect business opinion across the Atlantic. Aware of what others had achieved, conscious of the need at home, and fired by British enthusiasm, American enterprise was ready to act.

The business man and the statesman in America appreciated the need for an immediate effort. With the means of transportation then in use, the resources of the coastal United States were being relatively exhausted,² while the inexhaustible hinterland beckoned to ambition. The roads, along which much trade necessarily traveled, were appallingly bad. Successive European observers vied with each other in discovering the worst thoroughfares

¹ W. T. Jackman, *The Development of Transportation in Modern England* (1916), I, 394-396. Samuel Smiles, *James Brindley and the Early Engineers* (1864), pp. 18, 296, 297.

² J. R. Smith, *Industrial and Commercial Geography* (1922), p. 342.

in America.³ Well-metaled highways were rarities, and the few then in existence were very short. A clumsy stage took passengers from New York to Boston, making about forty miles in a day and consuming all but a week for the passage. A variant route, through Long Island Sound by sloop to Providence and thence by stage to Boston, was filled with uncertainty, taking anywhere from three to nine days.⁴ Few traveled men of that day failed to spend a fair portion of their lives on horseback. Under such conditions news was extremely sluggish. It was an age in which a bridge a few hundred feet in length brought forth public encomium. The Charles River Bridge, the first of any considerable magnitude to be built in America, occupied a unique position.⁵ It was the sole permanent bridge spanning a river of size in the year 1790. From New England southward along the coast the Merrimack, Connecticut, Housatonic, Hudson, Passaic, Hackensack, Raritan, Delaware, Susquehanna, Lehigh, and Potomac rivers — all had to be ferried.⁶ With great expense and considerable hazard, teams of horses or oxen hauled goods overland; and huge pungs — ox- or horse-drawn sledges — gave master service in the north during the winters. Commerce between the states hugged the seacoast and penetrated inland by the rivers.

The attention of men of that day consequently turned to plans for uniting the isolated inland centers, usually by means of canals or by the improvement of streams, to the coastal cities, most of which were situated near the mouths of important rivers. The effort, in the form of the incorporation of companies, and the actual beginning of canal construction preceded the attempt to accomplish the same end by the building of turnpikes. The early plans for artificial inland navigation in the eighteenth century thus constituted the initial salvo which inaugurated competition among

³ J. L. Mesick, *The English Traveller in America, 1785-1835* (1922), p. 50.

⁴ H. E. Scudder, ed., *Recollections of Samuel Breck, with Passages from His Note-Books, 1771-1862* (1877), p. 90.

⁵ In the importance of her bridge construction Massachusetts far outstripped the other states in the decade 1790-1800. See J. S. Davis, *Essays in the Earlier History of American Corporations* (1917), II, 187-198.

⁶ Davis, *op. cit.*, and Scudder, *op. cit.*, p. 103. During the Revolution a floating bridge was thrown across the Schuylkill at Market Street, Philadelphia. It was swept away by a flood in 1789, but may have been immediately replaced.

the seaboard cities for the commerce of the hinterland. From this time forward, although the competitive weapons changed with a changing technique and the victors' shares were variously divided, the gage of battle was thrown, and most of the contestants — Boston, New York, Philadelphia, and Baltimore — had already entered the lists.

Three proposals of this nature were considered by citizens of Massachusetts after the successful Revolution. Viewed in the light of the knowledge and experience of their proponents, the projects seem of heroic magnitude. The first of these, a waterway to unite Boston with the Connecticut River, happily never materialized; the second, the Cape Cod Canal, a plan of ancient standing revived at this time, waited for its completion more than a century; yet, nevertheless, a third, the Middlesex Canal, was fully constructed decades before the fulfillment of equally courageous projects elsewhere in the Union. By this stroke Massachusetts secured the primacy, shared only with South Carolina, in the initiation of internal improvements in America. Reasonably enough, Boston, the contestant with the more easily appreciated physical handicaps, spurred by her greater need, scored the first success.

The conditions of transportation toward the close of the eighteenth century predicate a simple society. An understanding of this period requires the concept of an America with only three incorporated manufacturing companies, all of them failures — for economic conditions were not yet ripe — and only three chartered banks. Many projects, however, stood hesitatingly on the threshold of corporate organization. The extension of commercial contacts and the consequent expansion of markets were among the prerequisites of a successful forward movement.

The population of the United States in the year 1790, omitting Indians not taxed, and including 700,000 slaves, numbered under four million. Of this total, Massachusetts and Vermont, possessing no slaves, contained respectively about 379,000 and 86,000, and New Hampshire, roughly 142,000. About 19 per cent of the free citizens lived in these states; they were outnumbered in the Republic by nearly three-quarters of a million of an enslaved race.

Boston then ranked third in size among cities in the Union, if the designation "city" be permitted a town of 18,000 inhabitants. Three other towns in Massachusetts — Salem, Marblehead, and Gloucester — sheltered more than 5,000 people each. For the rest, it was a land of small villages or scattered farms. The sea-board and island counties contained somewhat over 60 per cent of the population in the state; while the remainder, except for a concentration on the banks of the Connecticut River, was spread thinly over the three great inland counties. At this same period New Hampshire had not a single town of 5,000 inhabitants; Vermont, not one containing 2,500. Indeed, of the 211 towns in this last state, 165 harbored less than a thousand persons, and 23 were returned in the census of 1790 as uninhabited.⁷

Classifying as urban all towns in these states that had 2,500 inhabitants or more and as rural the rest of the area, one may compare the degree of urbanization in the years 1790 and 1930:

PERCENTAGE OF URBAN POPULATION

	1790 ^a	1930 ^b
Massachusetts	27.6	95.3
New Hampshire	9.0	66.3
Vermont	0.0	33.0

Striking as these figures may seem, they perhaps mislead in showing an undue urbanization in 1790 as contrasted with the later date. Many towns existing today have been carved from towns of the earlier year. The average area covered by country towns at present is therefore less. It may follow that of the population classed as urban a larger proportion in 1790 than in 1930 was in reality scattered over the land. Such facts and inferences, indicative of a simple rural economy, furnish a requisite orientation with reference to the states of northern New England of that period. Further germination of centers of activity in the interior waited upon the development of new highways of commerce.

Overland transportation struggled against severe handicaps,

^a Bureau of the Census, *Heads of Families at the First Census of the United States, 1790* (1908).

^b *Ibid.*

^c *Statistical Abstract of the United States* (1935).

and population spread slowly into the interior, gathering mainly in little villages. Dimensions, other than those of extent or area, were almost universally small. The only farming was small culture; industry was conducted on a diminutive scale; and commerce was measured in tonnage figures which seem insignificant. The purchasing power of the dollar, to be sure, was very high as compared with the present. Since a high value of money is merely the obverse of low prices, the emphasis on general smallness is fortified. As regards size at least — though not completely as regards methods — the general features of the times were those of a pre-capitalistic era. With considerations of relative magnitude continually in mind, as aids in judging the meaning of the amounts of capital, labor, and managerial talent involved in a public work, it is justifiable to characterize the canal projects of this period as heroic.

Industries in Massachusetts were mainly confined either to the household or to small, yet active, mills.¹⁰ The home dominated the manufacture of textiles. The apparel of the farmers and much coarse linen cloth for the use of the southern states came from country households. Faulkner's fulling-mills at Watertown announced with pride in 1790 that 9,500 yards of cloth, "belonging to individuals that had spun and wove in their families," had been fulled the previous year.¹¹ Hawke's mills at Reading fulled and dressed upwards of 8,000 yards annually. The *Columbian Centinel* noticed as a "pleasing specimen of the progress of manufactures" that Moses Barnum of Stockbridge fulled approximately the same quantity in one year.¹² The making of wool hats thrived as a specialized local industry. Nathaniel Balch, principal hatter in Boston, advertised "Beaver, beaveret, castor, and felt HATS, of American manufacture, and of the various fashions — deep crowns

¹⁰ The following books have been drawn upon for material relating to Massachusetts industry, agriculture, and trade: Samuel Blodget, *Economica* (1810); Davis, *Essays*; S. E. Morison, *Maritime History of Massachusetts, 1783-1860* (1921); Jedidiah Morse, *The American Geography* (1789), and *The American Universal Geography* (1793, 1796); C. D. Wright, *History of Wages and Prices in Massachusetts, 1752-1883* (1885). Many economic data are found in successive editions of Morse's geographies. The author, who lived in Charlestown, was in touch with conditions in Boston and Massachusetts.

¹¹ *Massachusetts Centinel*, March 31, 1790.

¹² *Columbian Centinel*, Sept. 4, 1790.

— draw linings — round and cocked.”¹³ With this minor exception, no woolen manufacture of any extent was then carried on successfully as a separate employment. Faulkner in Watertown had indeed made about 2,000 yards of cloth; yet the famous factory at Hartford, Connecticut, which furnished the material for the crow-colored suit of clothes worn by Washington when he addressed Congress in January 1790, stood practically alone in New England.¹⁴ Throughout most of Massachusetts there dwelt a race of homespun provincials.

The state was dotted over with diminutive fulling-mills, saw-mills, and gristmills. To these must be added a few mills for slitting and for the making of snuff, chocolate, powder, paper, and linseed oil. The cotton industry had barely germinated. Although the kilns were not continuously operated, local brick-making was nonetheless widespread. Not one hundred forges existed within the borders of the state, and most of these were very small. With them are not included, however, the chimney-piece forges about which country families gathered on long winter evenings to make hand-wrought nails. Some specialization existed in the making of agricultural implements for sale; but custom work, local fabrication, and importation in considerable quantities remained characteristic. At the time of the building of early Massachusetts canals, the English shovel was still considered by many superior to the American. The manufacture of hollow ware was increasing in the nineties, while the making of copper and brass goods had considerable relative importance. By the beginning of the decade the tanners had started their competition with imports; and the shoe industry thrived in an organized condition, principally at Lynn, exporting to southern markets.

Among the many small industries of this period, the manufacture of duck for sails and the making of paper may be considered in some detail. The first, although focused in public attention as a remarkable new growth carrying a warrant of future greatness, was nevertheless doomed to failure. From the outset the pro-

¹³ *Massachusetts Centinel*, Jan. 13, 1790.

¹⁴ *Massachusetts Centinel*, Jan. 16, 30, 1790; B. J. Lossing, ed., *Diary of Washington: from the First Day of October, 1789, to the Tenth Day of March, 1790* (1858), p. 68.

moters, solid citizens of wealth, conceived the enterprise on a scale splendidly large for the time. A factory 180 feet in length and two stories high was built in Frog Lane, Nassau Street. Here the Boston Duck or Sail Cloth Manufactory began business in 1788. Some years later it was reported to have sold in one year as much as 1,700 bolts of nearly forty yards each and to be employing over 300 persons.¹⁵ Six merchant shipowners, including Stephen Higginson and Samuel Cabot, and eight "Sail Makers of the Town of Boston" testified publicly in May 1790 to the excellence of the product. They asserted that it was much superior to the foreign duck they had been using.¹⁶ After the works had been enlarged in 1791, Hamilton was informed that the capital invested amounted to \$4,000 in buildings and \$2,200 in tools and other equipment and that 50 men and 200 women and girls were employed.

Washington had visited this struggling concern in October of 1789, when he wrote in his diary that it

appeared to be carrying on with spirit, and is in a prosperous way. . . . They have 28 looms at work, and 14 Girls spinning with Both hands, (the flax being fastened to their waste.) Children (girls) turn the wheels for them, and with this assistance each spinner can turn out 14 lbs. of Thread pr. day when they stick to it, but as they are pd. by the piece, or work they do, there is no other restraint upon them but to come at 8 o'clock in the morning, and return at 6 in the evening.¹⁷

An account of certain features of the internal regulation of this establishment was published by the *Columbian Centinel* in 1790:

The Weavers and Spinners are formed into two distinct societies each of which has a code of laws. If a Weaver uses any bad language, or attempts a quarrel or otherwise misbehaves, a court of his fellow Weavers is called on the spot, who hear, judge and determine; a fine is levied and deducted from his wages; the money is put into a box, and kept until any of the fraternity is sick, who then have an allowance per week from this fund. If anyone is careless in executing his work, it is judged of in the same manner, and if condemned as unfit for sale, he is obliged to make good the damage.

Among the Spinners, there are similar regulations and no one is admitted into the company but by a general vote.¹⁸

¹⁵ *Columbian Centinel*, Jan. 19, 1791; *Massachusetts Centinel*, April 20, 14, 1790.

¹⁶ *Massachusetts Centinel*, May 29, 1790.

¹⁷ Lossing, *Diary of Washington*, pp. 36, 37.

¹⁸ *Columbian Centinel*, Oct. 20, 1790.

The spinners, of course, were women. "They are the daughters of decayed families," wrote Washington in 1789, "and are girls of Character — none others are admitted."¹⁹ The *Centinel*, likewise inspired by soothing thoughts, remarked, "These young females are taught not only the habit of industry but of self government which everyone knows is the best government in the world."²⁰ It is a pity the spinners themselves remain inarticulate. The whole scheme, and particularly the insurance feature, must have presented difficulties in execution. That it should have been conceived and adopted, even for a time, indicates nonetheless the unusual character of this early factory. The expectations of the promoters soon proved unduly optimistic. Whether the scale of operations was too large for efficient management in that age, whether the expected demand for the product failed to materialize, or whether foreign competition proved ruinous, the record does not indicate. There appears to have been no question of the quality of the merchandise; in the year 1794 Stephen Higginson was still bestowing praise on the sail cloth made by the concern. From whatever cause, the company's operations finally became unprofitable. Before the year 1800 it had ceased to exist.

In contrast to this unfulfilled promise, paper making, with a long history behind it, prospered and grew and fed the many printing presses. Most of the twelve paper mills in the state in 1793 contained two vats each and employed, when in action, ten men and as many girls and boys, producing annually about 60,000 reams of writing, printing, and wrapping paper. Massachusetts newspapers numbered fourteen in the year 1790, about one-fifth of the total in the Union.²¹ More were shortly to be founded. Faced with the increasing demand from the printers, the paper manufacturers were improving their old mills or building others. In the opening years of the decade new editions of the Bible and of Jacob's *Digest of the Laws of England* reflected honor on the printers. Among the proposed new books, *The New England Farmer* by Samuel Deane, later printed at Worcester, dealt with a subject of practical importance to the nation.²²

¹⁹ Lossing, *Diary of Washington*, p. 37.

²⁰ *Columbian Centinel*, Oct. 20, 1790.

²¹ *Massachusetts Centinel*, June 16, 1790.

²² *Massachusetts Centinel*, June 5, 1790; *Columbian Centinel*, Dec. 5, 1792.

The paper industry stood on a sure footing. Several competing paper-staining manufactories in Boston printed wallpapers in "Plain Blue, Green, Buff &c. with elegant festoon, gilt, frosted, patch, wide and narrow Borders, with a great variety of handsome figures."²³ Soon the paper base for these elaborations, then mostly imported, would be of home production. Diminutive though the paper manufacture might be, it was an industry more characteristic of the period in its organization and in the dimensions of its unit plants than the single spectacular factory for the making of sail cloth.

The making of cotton and wool cards was another leading occupation. The three principal makers in Boston, around the year 1796, produced annually about 12,000 dozen, consuming somewhat less than 200 casks of wire at \$130 per cask and about 35,000 tanned calf, sheep, and lamb skins. The sticking of the cards, organized on the domestic system, is reported to have given part employment to about 2,000 people, chiefly children, and full employment to about sixty men, who finished the cards and made the card boards and card tacks.²⁴ Three smaller concerns plied the same trade in Boston and several more in other parts of the state. Other principal occupations, organized on the characteristically small scale, were distilling, sugar refining, and, most important, shipbuilding. The last, together with the ancillary industries of rope and cordage, after a long stagnation following the peace, gave by the year 1790 unmistakable indications of returning vigor. By the year 1796 the town could count thirty distilleries, two breweries, eight sugar houses, eleven ropewalks, and Paul Revere's one furnace for casting iron.

Growing industries might indeed contain the seeds of future greatness, yet at that time other pursuits formed the main basis of New England's wealth. Agriculture, commerce, shipping, and the fisheries — herein lay the economic strength of the past and, it was even thought by many, of the future. Although Massachusetts was favored in general by relatively good soil for grain and for grazing (with the exception of the southeastern and island counties

²³ *Massachusetts Centinel*, April 14, 1790.

²⁴ Morse, *American Universal Geography* (1796), p. 403.

where the soil is sandy), her country districts furnished no important staple crop for export. Pot and pearl ashes, beef, pork, and lumber came from the land, however, and constituted the principal articles of export, together with New England rum, fish, and the various products of the fisheries. At this time New England dominated American fishing and was the principal carrier by water, as well as the leading cattle country in the Union. Products of both land and sea formed the bulk of outward cargoes.

Inhabitants of Massachusetts employed vessels totaling some 29,000 tons in the fisheries, 46,000 tons in the coastal trade, and 96,000 tons in foreign trade in the early 1790's. Considerable indeed for the period, the fleet comprised about one-third of the floating tonnage of the United States. Borne in diminutive vessels, in diminutive quantities, the external trade of Massachusetts was nonetheless far-flung and various. Among other articles, merchantmen of 1790 carried to Great Britain staves, pot and pearl ashes, flaxseed, and beeswax; fish and whale oil to France, Spain, and Portugal; masts and provisions to the East Indies; beef, pork, lumber, spermaceti candles, fish, and whale oil to the West Indies; roots, vegetables, fruits, and small meats to Nova Scotia and New Brunswick; rum to Africa; and hats, saddlery, cabinetwork, men's and women's shoes, nails, tow cloth, barley, hops, cheese, and many more provisions to the southern states. Clearances from the ports of Boston, Salem, Marblehead, and Gloucester of vessels bearing these many wares formed an index of the prosperity of the state, more nearly basic than the records of the hesitant growth of new industries. Yet, in the year 1790 the totals of both clearances and exports from Massachusetts still hovered below the figures reached in the pre-revolutionary era.

Although small dimensions characterized the period, it seems a time of considerable activity. Viewing Boston of the year 1790 from the vantage ground of the twentieth century is comparable to sighting, through the wrong end of a telescope, a prosperous ant hill. The town had seventy-nine streets, though without footwalks, thirty-eight lanes, and twenty-one alleys. As traders from the country drove their wagons over the Charles River Bridge, Boston seemed to them fairly to stand in the water, at least to be

surrounded by it, and the shipping, together with the houses, trees, and churches offered a pleasing view. As yet no State House, "hub of the solar system," topped Beacon Hill, though in a few years its admirable proportions and contrasting soft red and white would lend grace and a discriminating beauty to an already inviting town. Although days of stagnant trade and falling standards of living had been endured, the new State House was to presage the arrival of happier times.

Through crooked streets, whose path was formed "by one calf near [two] centuries dead," the dealers and teamsters from the interior led their loaded carts to the market places. Nearing the wharves, they found an odd provision of merchandise spread before their eyes: salt from Liverpool, sea coals, and crockery wares in crates. Displayed before them were pewter plates, dishes, and basins; a variety of buttons, buckles, knives, forks, and other hardware; baizes, serges, low-priced broad and narrow cloths, satinets, royal ribs, denims, jeans, fustians, and other Manchester goods — for the more prosperous country folk had occasional need for other than homespuns. They could also purchase copperas, allum, brimstone, paints of all kinds, stone jugs, and pickle pots of many sizes, bar iron, tea, sugar, and rum. Or "Plaster of Paris both French and Nova Scotia," its excellence "as manure" highly praised, might be had at the North Mills. The country trader, as a favor to friends at home, might stop at Rumney's Manufactory in Back Street to buy chocolate at fourteen pence per pound, "warranted to be made of the richest cocoa"; or at John Rand's, manufacturer, purveyor of Kitefoot tobacco "equal to any manufactured here or imported." Peters, the drug vendor, was ready to supply country practitioners with the best of medicines, "fresh from Europe every six months," for which he took "Shipping FURS, Bees WAX, pot and Pearl ASHES" at the ruling cash price.²⁵ Their wagons loaded with an assortment of many goods, the traders began their slow inland journeys.

In the decade of the nineties new suppliers in Boston attempted to turn the demand of these country traders and of the city dwellers alike from foreign to domestic products. An appeal to

²⁵ *Massachusetts Centinel*, Jan. 13, Mar. 24, 31, 1790; *Columbian Centinel*, June 19, 1790.

patriotism became a device of competitive advertising at a time when shops stocking goods of foreign origin still dominated local trade. Graham's Comb Manufactory offered ivory combs, stating that they were of the "same quality, and price as in London or in Liverpool." Glue and neatsfoot oil were domestically manufactured by Hewes at his works in Pleasant Street and sold, at wholesale and retail, at his shop near "Liberty Stump." Abraham Hunt termed himself a cork manufacturer, advertised for sheet cork, and made and offered for sale "at his house in the Middle Street" corks of every size "at as low a price as any from Europe," and, he opined, "of equal goodness." He also refined and bottled wine, cider, and porter, wiring on the corks if occasion required. Flannels, madder red, yellow, and white of American manufacture were advertised by Abraham Adams as "equal to any Welsh Flannels imported, and much cheaper." The same supplier laid his snare for men of fashion with a description of the best elastic patent doeskin breeches.²⁶ An increase in the number of articles of the order noted here, handicraft products in the main, was usually in the minds of contemporaries who spoke of the growth of American manufactures.

Boston merchandising of the period had certain other characteristics. The shops were unspecialized; the goods, of diverse origin. Newcastle coals appeared cheek by jowl with tea sets of Nanking china; Spanish iron with Irish linens; German steel with Hyson tea and Bristol glass. In one building Russian bolt rope and Russian duck jostled superfine flour, sherry wine, codlines, split peas, and sheet lead. Such stores lined the wharves. In some cases, specialization existed, but it was generally modified by a few startling items. The several slop shops, indeed, practiced a well-defined trade. An advertisement that emphasized an offer of lemons for sale is, however, typical of the bizarre combinations of the period:

FRESH LEMONS to be sold, at
STORE no 31 State-Street
Also, Seville Oil, in jugs, choice
sherry wine, German Steel, new Rice,
and a few quintals of best Dumb Fish.²⁷

²⁶ *Massachusetts Centinel*, Jan. 6, 9, 23, April 28, 1790.

²⁷ *Columbian Centinel*, July 14, 1790.

The situation is understandable. It arose from the general nature of the incoming cargoes, from the habitual barter — through the medium of a money of account — of foreign goods for country produce, and from the undifferentiated functions of the merchant-shipper. In the light of more nearly basic analysis, these conditions were directly related to the character of the markets, limited and unstable for most of the individual articles.

Greater specialization was achieved in shops run in connection with some trade. Paul Revere, gold- and silversmith, made and sold harness, bridle, and shoe buckles, and mended or replated all plate ware. A watch and clock maker, "late from Paris," made, sold, and mended articles related to his specialized calling, adding trinkets and paste kneebuckles. Ronna and Co., at once gardeners and florists, sold plants, vines, and plant and flower seeds, offering 38 species of the hyacinth, 10 kinds of Peruvian tuberose, and 104 sorts of crowfoot. The Ronnas also offered hats that they had brought from Lyons. Peter Smink in the silk-dyeing and "likewise the scouring business" added thereto the sale of French horns and violins "of the most superiour quality." Smink was probably among the more thoroughly specialized.²⁸ The merchants of Boston created variety in their lives, if only that of the simultaneous handling of disparate goods. The activities of both the small tradesman and handicraftsman of the time may be understood to have included much diversity.

During four years, before 1790, economical selectmen had kept dark the wrought iron lamps for lighting the streets of Boston.²⁹ Stout lads coming late from taverns had stumbled through pitch-dark lanes. One summer morning such roisterers might have waked to gaze from their attics near the wharves upon as fair and fine a sight as Boston men could hope to see. On that day many citizens marveled and knew the scene augured well. It was July, usually the dullest of seasons, yet there lay in the harbor, with a beauty known only to the sea, a baker's dozen of ships, three dozen brigs, a half hundred schooners, and scores of sloops —

²⁸ *Massachusetts Centinel*, Jan. 6, March 3, May 15, 1790; *Columbian Centinel*, July 14, 1790.

²⁹ *Columbian Centinel*, March 12, 1791.

vessels totaling 175 in all.³⁰ Beyond these pledges of trade rose the Castle, commanding the entrance to the harbor, the home of convicts who labored at the manufacture of nails. Near at hand spread out some of Boston's eighty wharves and quays, the largest of which extended 600 yards into the sea, the longest wharf in the United States. Sailormen and longshoremen were early at the hard human labor of unloading the goods of the world and were bearing heavy burdens to the shops and warehouses that crowded out even to the capsills of the wharves. Town dwellers and countrymen in pairs and groups everywhere bartered at this busy mart. Here teemed a life that Boston knew and loved.

Despite this free flow of activity, despite a quickening and varied life, Boston felt herself at a disadvantage in the new Union. She had, to be sure, a magnificent harbor and already knew the far paths of the sea, but no river of moment bound her to the interior. The sandy arm and fist of Cape Cod menaced the coastal trade to the south. Many were the complaints against this threat to the lives of small sailor folk. The Connecticut River to the west and the Merrimack River to the north flowed down to other harbors. The first was becoming tributary to Hartford and New York; the second, to Newburyport. Even shipbuilding faced a precarious future. The towering trees of earlier years were now rare near the coast, and a Boston man could appreciate New Hampshire as a well-stocked magazine of masts and naval timber. Rivers and rivers alone in those days unlocked the valleys. Boston, ill-favored by nature, possessed no key to their bounty.

The spirit of independence, goaded by the depression in foreign trade that followed the successful Revolution, turned the mind of America westward as never before. The rivalries of the states were framed by the Constitution to a peaceful struggle. Influence and prestige promised to be the rewards of those states that should be swifter and stronger in the race for dominating inland trade. The idea of an empire, if not continental in scope, yet extending far into the interior, had entered the vision of state leaders. What share of the trade would each state have in the future? How might the cities assure themselves future economic power? In

³⁰ *Columbian Centinel*, July 10, 1790.

the Commonwealth, Salem, Marblehead, and Gloucester had to rest content with their fisheries and trust that with time foreign trade would revive. Boston, however, spoke for a state that was the full rival of Virginia and New York. A merchant class, grown wealthy under the former prosperity of shipping and foreign trade, was in firm economic control. Traders as they were, they knew the value of communications and realized the implications of Boston's lack of contact with the developing hinterland. In this case, as in other periods in the history of Massachusetts, adverse circumstances eventually bred ingenuity.

CHAPTER II

EARLY ENDEAVOR

THE CONTEMPORARY realization of Boston's difficulties and the early plans for overcoming the obstacles in the path of inland trade are illustrated in unpublished letters and papers of the first Secretary at War, General Henry Knox. During one of his fleeting visits to Boston, the Secretary had suggested a waterway to the Connecticut River. The meetings of the merchants on 'Change — a genial institution for daily conversation in State Street — were shortly alive with talk of canals. Back once more at his post in the capital, the Secretary received news of these plans from one of his political henchmen who stayed at home and there kept the General's political fences in repair:

Your *Canal* from Connecticut River is much talk'd of and the subject of general conversation, — many substantial men of property and of sense are very sanguine as to the Practicability of the plan — I wish you to write Judge Lowell or some other influential person your Ideas on this subject, or submit them to the publick & I will communicate them — for if *anything* should take place in this business, I am ambitious you should be the father of it. . . . I have laughed at you on this subject, and I suppose you will return the complement — but I can assure what I have said is the general opinion.¹

General David Cobb, then Speaker of the House in Massachusetts, wrote Knox an ingenuous letter the same day. An interpretation of this correspondence as indicating that these men were promoting the canal for speculative purposes is partially belied by Cobb's later activities:

Since your departure from this Town I have frequently introduced the Canal between Charles River & the Connecticut as the subject of

¹ In a letter of General Henry Jackson of Massachusetts to Knox, Dec. 19, 1790: Knox MSS, XXVII, 86.

conversation; and altho' at first it appeared to a number of Gentlemen as impracticable, yet by frequently recurring to the subject, it has been so completely simplified as to meet the approbation of almost all Characters, and the money.d Men of this place, I conceive, will subscribe very liberally to the undertaking. — It is however necessary that a general plan should be form.d for conducting this business, pointing out where it is to come to this Town, & where to strike Connecticut River, (the intermediate route must depend on a survey) the width & depth of the Canal, the probable expence attending it, the probable business that will be done upon it, the rate of Toll & the number of shares into which it ought to be divided — such a plan I wish you to make out & forward to me as early as it can be convenient.

The Gentlemen are much divided in their opinions where the Canal ought to meet Conn R. . . . [Some preferred the shortest route to the Connecticut, then to continue the canal into the center of Vermont; others maintained that it should go only to the Connecticut there to enter the river high enough to avoid the rapids.] . . . all appear agreed that it ought to enter Charles River at Watertown.

Mr. Brown of the Insurance office, who is rather in favor of the first opinion, informs me that he has made a calculation of the cost of such a canal & that it will not amount to more than one million of Dollars . . .

The more I think of this business, the more I am convinced not only of the practicability, but of the dignity & importance of it to this Commonwealth; & I conceive that every well wisher to this Town or this Government ought to exert himself to have it put in execution as soon as possible; indeed it appears to me that a single year lost, is a loss forever, as the Gentlemen of Hartford will indubitably, in a very short time, conduct this *River* of Commerce to their Ports, and then Boston may bid adieu to it. . . .

Please to present my most respectful & affectionate compliments to the President & Lady. . . .²

Despite this plea, the Secretary at War failed to reply. General Henry Jackson returned to the subject in January:

I wrote you as did our friend Cobb sometime since respecting the *Canal* and the favorable light in which it was viewed by a large number of respectable & monied men in this Town, it is now the general subject of conversation. . . . Cobb is disappointed in your not writing him. he has been very active & serviceable in this business, and on every occasion brings into view the importance of the canal . . . it is calculated that it will cost £1500 Lmy³ to cut a mile — some say £2500.

² Knox MSS, XXVII, 85.

³ Lawful money of Massachusetts, 6 shillings to \$1.00.

. . . As you are considered the *Father* of this business, you must write Cobb or some other person on the subject.⁴

The same year, in February, Cobb and Jackson informed Knox that they had presented a memorial in his name to the General Court and the following month urged him to engage an engineer.⁵ No action resulting, Cobb wrote:

I must remind you of our Canal business, that whenever your hurry is over, you will engage a proper Engineer to survey the Country for that purpose; the Gent.n of this Town expect it, & are ready to advance whatever may be necessary to effect the survey, whether it will be of use hereafter or no — what makes it a matter of greater consequence at this time, is, that the Company at Hartford have now, on the Files of our Gen.l Assembly an Act, to empower them to clear the Falls on Connecticut River within this Commonwealth, which will pass at the next Session of the Gen.l Court in spite of all opposition, and unless the Canal from this Town to Connecticut River is soon undertaken, the commerce of Vermont & New Hampshire &c will infallibly pass down that River to New York, altho' some of our wise *ones* imagine that a Canal across to Buzzard's Bay will bring it to Boston — but you know they are novices in their Calculations.⁶

In April of the year 1791 Knox engaged a surveyor, Captain John Hills, and wrote several letters stating his belief in the practicability of the project.⁷ The preliminary survey, which was taken without proper leveling, occupied the summer months, encountered a number of difficulties, and resulted in the recommendation of Milton rather than Watertown as the eastern terminus. The plan was formed to enter the Connecticut above the falls near Miller's River, "to take the trade from Hartford."⁸ The type of

⁴ Knox MSS, XXVII, 126.

⁵ Knox MSS, XXVII, 147.

⁶ Knox MSS, XXVIII, 4.

⁷ John Hills came from London. Before coming to America he worked from 1767 to 1775 in the office of the British Board of Ordnance and engaged in outside practical work for the Board from 1775 to 1784. He was employed by Knox from 1791 to 1794, in part on surveys of the lands of the Waldo Patent. Mediocre though his abilities were, Knox expressed satisfaction with his services (Knox MSS, XXVIII, 16, 46, 55, 88, 133; XXXII, 5, 17; XXXIV, 69, 174). Articles of agreement for the survey to Connecticut River stated that the reports, levels, and surveys should be delivered to Knox and provided for a fine of \$1,000 if any other person should receive copies. The surveyor received \$3.00 a day and \$300 for expenses (Knox MSS, XXVIII, 17).

⁸ Knox MSS, XXVIII, 175.

cargo expected and an estimate of the tonnage are given in one of Cobb's letters:

. . . agreeable to your request . . . , I have frequently conversed with Gentlemen in Trade and others on the subject of the quantity of produce that would be conveyed on the canal from Connecticut River to this place in the course of the three first years after its completion; the result of these inquiries is that 28 to 30,000 tons would be quantity [*sic*], considered as bro't from the extreem distance, and arising only from the eight following articles, viz. Pot & Pearl ashes, Flaxseed, Flax & Hemp, Beef & Pork salted, Grain of all sorts, Flour, Timber & Plank, Hoops & Staves, the smaller articles, which must be to great amount, were not taken into the calculation, but together with the returning cargoes from this place, were considered as amounting to 15,000 tons — these calculations are undoubtedly far below the reality — The probable rate of toll has likewise been under consideration, and it is estimated at 12/ or 15/ pr. ton [\$2.00 to \$2.50] from the extreme distance and in proportion for a less; this however goes upon the idea that the canal enter the Connecticut by Miller River at Northfield, where you will have a complete monopoly of the freightage.⁹

The estimate of the down tonnage appears to cover the total to be expected over three years. When Cobb calculated the probable receipts, however, he reached a figure of \$90,000 annually, with a toll of \$2.00 per ton, indicating that he had in mind a total yearly average of about 45,000 tons. According to his calculation of the expense of the canal, this would yield "a neat ten pr. cent."¹⁰ He continued:

I conversed with Capt. Hill at Milton, he appears to understand, perfectly, his business as an Engineer, but he is no calculator; he is engaged by our Government to survey the Cape Cod Canal on the first of October next; let him if agreeable to you, survey from Miller's River into his present rout at Paxton. . . .¹¹

An act of incorporation¹² was secured the following March; and Cobb, throughout more active than any other, urged organization of the company and a serious start. He wrote to Knox:

⁹ Knox MSS, XXIX, 88.

¹⁰ Knox MSS, XXIX, 88.

¹¹ Knox MSS, XXIX, 88.

¹² Act of March 10, 1792, attested copy: Knox MSS, XXX, 139. Named in the charter were Knox, Cobb, John Coffin Jones, Benjamin Hitchborn, and Henry Jackson. It conferred powers of eminent domain, granted a toll of 6 pence per ton mile, and allowed five years for the completion of at least ten miles.

what measures are now necessary to be pursued will chiefly rest on you to determine, but that something should be done is of great consequence, if for no other purpose than to prevent the jealousy that is now increasing that this institution was designed for the purpose of speculation only — I will mention what I conceive ought to be done in the first place, — Hitchborn is going to Europe, — that Jones, Harry & myself should come on to you, and there concert such arrangements as are necessary to carry the design of the incorporation into full effect.¹³

Secretary Knox, occupied with other matters, secretly involved with Duer in a large speculation in lands, had been forced into a position of nominal leadership of the canal project. He apparently doubted its financial possibilities and had no courage for the business. He was furthermore vigorously assailed at this period by political foes.¹⁴ In these circumstances, he wrote a circular letter to the incorporators:

After mature consideration of the subject it appears to me to be of importance to our reputations individually as well probably as to our general and pecuniary interests, that all due investigation should be made immediately in order to enable us to form a conclusive judgement, whether the proposed plan of a canal, from Connecticut River to Boston shall or shall not be executed in the whole or in part.¹⁵

It was arranged that Hills should survey once more during the summer months. His accounts show that he was aided by five men.¹⁶ David Cobb accompanied the party and kept a journal. In forwarding it to Knox, he stated:

it points out the wish.d for communication from Boston to Connecticut River — easy to effected, [sic] and so simple, that the smallest quantum of knowledge is only requir.d to execute it; — Money however is necessary.¹⁷

Cobb was a tyro in these matters, as were most men of his time. The requisite knowledge was all but wholly lacking in

¹³ Knox MSS, XXX, 146.

¹⁴ F. S. Drake, *Life and Correspondence of Henry Knox (1773)*, and Noah Brooks, *Henry Knox (1900)* are the principal biographies. I found them unrewarding reading. For speculative and other activities of Knox, see Davis, *Essays in the Earlier History of American Corporations*, *passim*, esp. I, 321ff.

¹⁵ Knox MSS, XXXI, 148.

¹⁶ Knox MSS, XXXII, 17; XLIX, 30, 37.

¹⁷ "Journal on the Survey for a Canal," Knox MSS, XXXII, 7. See also XXXII, 48; XXXIII, 39.

America. Cobb's journal gives much detail that is without interest and adds that in bringing the canal to the Connecticut above the falls

you have a compleat monopoly of all the commerce of Vermont & New Hampshire, and that to an amount beyond any calculation that has hitherto been made on the subject, — indeed I was surpris'd at the . . . immense productions that pass down the river to New York. . . . Pot & Pearl ashes, no less than six hundred tons have passed this spring.

I am perswaded that near one third part of the commerce of New York depends on Vermont and New Hampshire — Countries that from nature, habit & every other principle ought, & they wish'd, to be connected with Boston, but the lengthy and expensive land carriage prevents, and in a very short time will totally destroy the little remaining connection with those states — Boston may continue its stupidity & sleep on, & like the Cities of Antiquity be deaf to the admonitions of its *prophets*, but unless the exertions of Individuals should open this Canal, she will sink for want of five righteous to save her.¹⁸

The Secretary at War, in touch with intelligent men at the capital, a friend of Morris, Duer, and Hamilton, and — it would be supposed — a judge of men and measures, praised Captain Hills highly, "believing from the elegant surveys he made the last year that he is more capable of surveying and levelling the ground than any other person we could obtain through the United States."¹⁹ The following note from the maker of "elegant surveys" indicates the significance, in technical concerns at least, of this early effort:

You may rest assured that I will make my work so accurate, that [neither] your Excellency nor I will run any risk of Incurring ridicule, tho in my Route this year I have taken no Levels. But this I can safely say that we have found water on the Highest ground we can carry it where we please, tho' in works of such magnitude it will attend with very heavy expence, and it is far beyond my Art to make any calculations respecting it . . . Sir . . . one of the letters which you enclosed was from England and the different Treatices on Inland Navigation will be forwarded to me at the first opportunity.²⁰

¹⁸ Knox MSS, XXXII, 7. See also XXXII, 48; XXXIII, 39.

¹⁹ Knox MSS, XXXI, 148.

²⁰ Hills to Knox, Oct. 4, 1792, after the second survey: Knox MSS, XXXII, 118.

Since they relied on slender technical support, the promoters, especially Knox and his alter ego Jackson, may either have been playing with the project for early speculative purposes, with the expectation of unloading their shares on the public, or they may have been wanting in judgment. Of the two possibilities, it seems more charitable to impugn their judgment. Their work at all events was without direct result. The company was one of six business corporations chartered in Massachusetts in February and March of the year 1792, as many as had been chartered in the two previous decades. It was never organized. The scheme, it is true, was impracticable, without relation to the means and the knowledge of the time. David Cobb, over-sanguine as he doubtless was, nevertheless conceived its meaning to the town and urged action. The idea became grounded in the public consciousness, and a way was clear for a more practicable scheme to the same end.

Business conditions in the Union had been prosperous in the year 1791, with the exception of a recession on the midsummer stock market in New York.²¹ This was a mild flurry, however, and the upward march of security prices, influenced by an alleged attempted corner in United States 6 per cents, reached full tide in January, February, and March of 1792. ". . . the credit & fate of the nation seem to hang on the desperate throws & plunges of gambling scoundrels," wrote Jefferson on March 16.²² It was a time of febrile promotion and speculation. The West Boston Bridge subscription was completed in January in three hours. At about the same time the Massachusetts Bank doubled its capital. Canal promotions in England were at their height, and Boston had been touched by a contagious fever. The general, highly speculative situation would be cured, wrote John Adams, "by a few bankruptcies which may daily be expected, I had almost said, desired."²³ The crash came in the latter part of March, when

²¹ Davis, *Essays*, I, 278-315.

²² Thomas Jefferson, *Works of Thomas Jefferson, Collected and Edited by Paul Leicester Ford* (1904-1905), VI, 468.

²³ George Gibbs, *Memoirs of the Administrations of Washington and John Adams, Edited from the Papers of Oliver Wolcott, Secretary of the Treasury* (1846), I, 72.

New York experienced its first financial panic worthy of the name. From April 7 to June 9 the Massachusetts Bank adopted a rigid policy of restricted discounts. ". . . in Boston the dead loss is about a million of dollars," wrote Jefferson to Randolph in April.²⁴ This figure seems, however, to have been an exaggeration. Boston men were involved, but not to a great extent, and no suffering ensued comparable to that of New York and Philadelphia. Yet in all the commercial and financial centers fantastic dreams had now to be scrapped, and the future must be built on the basis of conservative judgment and painstaking effort.

As a background to the canal enterprise of 1793, this check to the speculative interests has some importance.²⁵ Knox was involved in the aftermath of the panic and was obliged to give his energies to furthering his land schemes in the District of Maine. His interest in the survey of the summer of 1792 may well have been purely perfunctory. But the time was ripe, and the scene was laid for the advent of a similar proposition under serious auspices. Although purged of the delusions of a speculative time, Boston nonetheless was entering upon a period of expansion. She was beginning an average increase in population of about $33\frac{1}{3}$ per cent a decade, a rate of increase that was to last well into the nineteenth century. There were growth and vigor in this metropolis of the future, and good blood ran in her commercial veins. She reached out to bind to her the future of the regions to the northwest, where development was as yet mainly potential.

A new plan was evolved to tie Boston to New Hampshire by a canal through Middlesex County to the Merrimack River. Eventually a connection through to the Connecticut from the upper reaches of the Merrimack was anticipated in the minds of its promoters. Stone, iron ore, staves, timber, boards, plank, wood, and shingles, which could not come by land, would later come through the canal to Boston in large quantities, as well as ashes, butter, cheese, beef, pork, cider, and grains. Back from Boston would go English goods, groceries, codfish, mackerel, salt, lime,

²⁴ Jefferson, *Works*, VI, 480, 481.

²⁵ ". . . it has given a severe lesson: yet such is the public gullability in the hands of cunning & unprincipled men, that it is doomed by nature to receive these lessons once in an age at least." Jefferson, *Works*, VI, 479.

plaster, and many other articles. The two schemes, the abortive project sponsored by Knox, and the Middlesex Canal, had therefore much in common. They sought to reach the same general markets and to unlock the same products. But with the sober attitude of its promoters and with their practical capacity for accomplishment, the new project bore far greater possibilities than the old, and indeed the Middlesex Canal within ten years was actually in operation.

CHAPTER III

PERSONALITIES AND PROMOTION

THE ORIGINATING idea of the projected Middlesex Canal is attributed to James Sullivan, then Attorney General of Massachusetts.¹ His early associates were mainly Medford men — farmers, merchants, landowners, the prominent worthies of the village.² Medford, on the tidewater of the Mystic River, was at first considered the natural terminus of the canal and therefore stood to gain. Her leading citizens were interested both directly as landowners and more indirectly as men of business attracted by the prospect of general prosperity. Jonathan Porter, Samuel Swan, and five of the Hall family, all of Medford, with Loammi Baldwin of Woburn, united with Sullivan to further the scheme.³ These men, however, did not and could not form the main nucleus of the group furnishing capital for the enterprise. Although their contributions were relatively meager after the first few assessments forced them to dispose of the major portion of their holdings,⁴ they are to be credited with the preliminary organization.

With Benjamin Hall in the chair and Samuel Swan acting as secretary, "the Honorable James Sullivan, Loammi Baldwin, and Captain Ebenezer Hall were chosen a committee to attend the General Court . . . to obtain an Act of Incorporation, with suitable powers relating to the premises."⁵ They presented a petition and, after some hesitation by the legislature, received a charter "incorporating James Sullivan, Esq. and others by the name of

¹ T. C. Amory, *Life of James Sullivan with Selections from His Writings* (1859), I, 361.

² Draft of petition with list of signatures, Nov. 6, 1792: Baldwin MSS.

³ Caleb Eddy, *Historical Sketch of the Middlesex Canal* (1843), p. 3.

⁴ Book J, in Records of the Proprietors of the Middlesex Canal, hereafter referred to as Corporate Records.

⁵ Eddy, *Historical Sketch*, p. 3.

The Proprietors of the Middlesex Canal." On June 22, 1793, three years before the incorporation of the first Massachusetts turnpike company, the Governor, John Hancock, signed the act.⁶

The objects and powers of the corporation in this charter were ill-defined. The legislature, with relatively little experience in framing corporate grants, brought forth an act "obscure, confused, and almost unintelligible in its terms. . . ." ⁷ "Loosely and inartificially drawn," ⁸ it compelled additional legislation. Meanwhile, it served its purpose, authorizing the proprietors to build a canal from the Merrimack to Mystic River. The legislature doubtless intended to confer all the powers necessary for effecting that object. The process of securing private property for public purposes, developed and familiar through the building of public roads, constituted a prototype in the mind of the General Court for governing the grant of powers of eminent domain. Giving due compensation for the resulting damages, the proprietors might take water and lands belonging to individuals, "as in the case of Highways." The corporation actually acquired most of its lands by voluntary conveyance through purchase or, in a few cases, through gift. Of the total of 142 pieces of land, only 16 were taken under the authority conferred by the act of incorporation, and these were not of great extent.⁹ The least doubtful of the provisions of the charter were those establishing the procedure to which recourse could be had for the recovery of damages for lands flowed, for diversion of water courses, or for other injuries resulting from the activities of the canal company.¹⁰

The corporation was originally endowed with the right to purchase and hold land and real estate necessary for the purposes specified in the charter "not exceeding in value five thousand pounds."¹¹ Subsequent acts modified these limiting features, the

⁶ *Massachusetts Statutes Private and Special*, I, 465.

⁷ C. J. Parker, delivering the opinion of the Massachusetts Supreme Court in *Stevens v. Proprietors of Middlesex Canal* (1815), 12 Mass. 466-468.

⁸ C. J. Shaw, delivering the opinion of the Massachusetts Supreme Court in *Proprietors of Sudbury Meadows v. Proprietors of Middlesex Canal* (1839), 40 Mass. (13 Pick.) 36.

⁹ Book H, Early Records of Deeds of Lands: Corporate Records.

¹⁰ *Stevens v. Proprietors of Middlesex Canal* (1815), 12 Mass. 466-468.

¹¹ Act of June 22, 1793: *Massachusetts Statutes Private and Special*, I, 465.

act of February 28, 1795, permitting the receiving and holding of real estate appendant to the canal and for the general purpose of facilitating its business to the value of thirty thousand pounds.¹² Authorization to extend the canal from Medford to the Charles River or to the town of Boston was also covered by this act. A further bill conferred the rights to purchase and hold mill seats on waters connected with the canal and to erect mills, the total value of the mill property not to exceed \$130,000, — powers which had already been exercised on the assumption that they were implied in the original act.¹³

A toll, as distinct from a payment for the immediate expense of transportation, fixed at four pence (5 5/9 cents) per ton mile, was granted by the legislature with the proviso "that when forty years from the first opening [of the canal] are expired, the General Court from thence forward, may regulate the rate. . . ." ¹⁴ An amending act, more generous in its terms, increased the toll to 6¼ cents per ton mile and made the grant perpetual.¹⁵ The ten-year period allowed for the completion of the work from the Merrimack to Medford in the original act never required extension, an unusual occurrence in that day. The last act passed during the period of construction allowed three years for connecting the canal with Boston.¹⁶ As the work neared completion, the proprietors informed themselves of English practice and secured the power to make and ordain expedient bylaws and rules for regulating navigation and the privilege of providing certain limited penalties to follow from their infringement.¹⁷

After the charter was secured, interest in the enterprise passed beyond the village of Medford. The committee formed to arrange the order of business at the first meeting of the proprietors contained new personalities. James Winthrop, Christopher Gore, and Sullivan consulted together and reported: "that the business of

¹² *Massachusetts Statutes Private and Special*, II, 26.

¹³ Act of June 25, 1798: *Massachusetts Statutes Private and Special*, II, 241.

¹⁴ Act of June 22, 1793: *Massachusetts Statutes Private and Special*, I, 465.

¹⁵ Act of Jan. 25, 1800: *Massachusetts Statutes Private and Special*, II, 342.

¹⁶ Act of June 22, 1803: *Massachusetts Statutes Private and Special*, III, 131. It is needless to remark that the original charter states that the proprietors "may sue . . . and be sued . . . and . . . are vested with all the powers and privileges which are by law incident to Corporations of a similar nature."

¹⁷ *Massachusetts Statutes, Private and Special*, III, 131.

the corporation be transacted by a committee annually elected consisting of thirteen directors, who shall choose their President and Vice-President out of their own number." The members of the committee, with Loammi Baldwin, Thomas Russell, Joseph Barrell, Andrew Craigie, John Brooks, Captain Ebenezer Hall, Jonathan Porter, Ebenezer Storer, Caleb Swan, and Samuel Jaques, were chosen the first board of directors on October 7, 1793. James Sullivan became president and held office until his death fifteen years later. Loammi Baldwin was made first vice-president and John Brooks second vice-president.¹⁸

The surnames of Brahmans of the Back Bay ring familiarly on the modern ear. The Honorable John Brooks of Medford, with a long record of service in the Revolution, was at this time a United States marshal, becoming Inspector of Revenue in 1797. Outstanding facts in his later career were his services as adjutant general to Governor Strong during the War of 1812 and as governor of the Commonwealth from 1816 to 1823.¹⁹ Christopher Gore was wealthy and prominent in public life and belonged to the social upper crust.²⁰ His country mansion at Waltham, which he built as a retired capitalist, stands today an excellent example of the best architecture of the period. During the politically tumultuous years from 1789 to 1799 he "hovered on the outskirts" of the Essex Junto.²¹ In keeping with his Federalist ideas, his state visits were regal in their pomp and ceremony when in 1809 he succeeded Levi Lincoln in the governor's chair.

These men were no mere figureheads in the early corporate undertakings of the canal company. They are to be found inspecting the progress made on the line, actively at work "on the survey" or "staking out the ground," negotiating and closing land deals, sitting half of each day for fourteen consecutive days on a committee on accounts, and "waiting on the General Court" or on some political personage whose favor and influence it was hoped to gain.²²

¹⁸ Eddy, *Historical Sketch*, p. 3; committee report, Feb. 6, 1810: Corporate Records.

¹⁹ J. S. Barry, *The History of Massachusetts*, vol. III, *passim*.

²⁰ Morison, *Maritime History*, pp. 128, 153; Barry, *History*, III, 363.

²¹ Morison, *Maritime History*, p. 167.

²² Vouches, expense accounts: Corporate Records.

The Honorable James Winthrop was especially active in these pursuits. The son of Professor John Winthrop, mathematician and scientist, he was graduated from Harvard in the class of 1767. Postmaster of Cambridge in 1775 and librarian of Harvard College from 1772 to 1787, he served forty-two years as registrar of Probate and thirty years as judge of the Court of Common Pleas. The routine of office was much less formal than at present, and Judge Winthrop found considerable time to devote to the canal enterprise. Jonathan Porter and Captain Ebenezer Hall were among the Medford men who continued for some time to be identified with the practical progress of construction. Caleb Swan of Charlestown and Samuel Jaques of Wilmington, two lowly commoners — they lacked the esquire — were long associated with the undertaking, the latter becoming superintendent in the year 1805, when Loammi Baldwin retired.

Social, political, and commercial prestige is met again among the directors in the person of the Honorable Thomas Russell, distinguished in revolutionary history and as a friend of Washington. The Boston of that day had "a distinct class of merchant princes, who lived in magnificent style, surrounded by suggestions of Oriental opulence. The Honorable Thomas Russell was a sort of marshall of this mercantile nobility."²³ His name headed one of the original subscription lists to the canal shares and carried weight in Federalist circles, as did that of James Sullivan in the vigorous, although less pretentious, ranks of the Republicans.

Joseph Barrell of Charlestown, later a vice-president of the corporation, was a merchant prince in his own right. Both he and his son were important stockholders in the early period. Ebenezer Storer, chosen treasurer of Harvard University as successor to John Hancock after a dubious incident in that politician's career,²⁴ continued, together with Charles and later George Storer, to be drained by the series of assessments called for to complete the canal. Andrew Craigie, famous or infamous in Cambridge social annals, Apothecary-General to the Continental Army, New York

²³ Morison, *Maritime History*, p. 129.

²⁴ Josiah Quincy, *The History of Harvard University* (1840), *passim*.

importer of tea and drugs, Scioto associate, wily speculator,²⁵ although oddly enough not a stockholder for some time after his election as director, came to be one of the major contributors of capital. He was to buy land for the canal and to sell land to the canal, to go over the line in horse and carriage with Christopher Gore, and to give his counsel in committee on numerous occasions.

Reference in greater detail may be made to members of two gifted families, the Baldwins and the Sullivans, prominently connected with the canal for sixty years. Loammi Baldwin — shortly to receive more extended notice — was responsible as engineer and constructor for more decisions on the ground than any other of his associates. His interest and ability in technical subjects had been apparent in his youth. These characteristics were inherited by his sons, who were employed when still young in minor capacities during the work of construction. Consequently, Cyrus, Loammi, 2nd, James Fowle, George Rumford, and Benjamin Franklin Baldwin had early practical training, either as assistants on the survey, or as laborers, or later as overseers or inspectors. They formed a talented group destined to lead in many enterprises both in the Commonwealth and beyond its borders. Loammi, 2nd, in particular, achieved more fame as an engineer than his parent and rightly or wrongly came to be called the father of civil engineering in America.²⁶ Varied and widespread were the engineering achievements of the five brothers. They erected mills and bridges; built dams and raceways for waterpower; planned or constructed canals in Pennsylvania and Nova Scotia, naval dry-docks at Charlestown and Norfolk, water works in Quebec and at Charlestown, and early railroads in Massachusetts, Maine, and Vermont.

A second group of able young men received early training in the service of the corporation. Four brothers occupied different positions with the canal company; two served as secretaries in

²⁵ Davis, *Essays, passim*; A. B. Hulbert, "Andrew Craigie and the Scioto Associates," *American Antiquarian Society Proceedings*, XXIII (1913), 222-236. Also, Craigie MSS, American Antiquarian Society.

²⁶ G. L. Vose, *A Sketch of the Life and Works of Loammi Baldwin* (1885). See also Appendix B.

the early period; and one, John Langdon Sullivan, after several years spent in inspecting public works in England and on the Continent, acted as manager and engineer of the Middlesex Canal from 1808 to 1820, supervised the extension of the canal system into New Hampshire, experimented with steam propulsion, and introduced many improvements in canal operation.

The father of these men, James Sullivan, was more distinguished by deeds and position than any one of his sons. He was sent to the General Court at Boston in 1774 and two years later at the age of thirty-one was named a judge of the Supreme Court of Massachusetts, together with John Adams and William Cushing. A lameness dating from an injury in his youth and a tendency to epilepsy prevented his taking the field in the Revolution, but his public services during that period were conspicuous and too many to warrant enumeration. After serving as judge of Probate, he became attorney general, following Robert Treat Paine, and held office during the administrations of five governors. One of the organizers and the first president of the Massachusetts Historical Society, he was succeeded in that office by Christopher Gore. His *Path to Riches*, an "inquiry into the origin and use of money" and into the principles of stocks and banks, appeared in the year 1792. He was also the author of a *History of the District of Maine* and of a *History of Land Titles in Massachusetts*. Active in public improvements, he was supervising the erection of the West Boston Bridge and was the guiding spirit in the plans for the town water supply at the time of the organization of the canal company. He served as Governor of the Commonwealth from 1807 to 1808 and died in office. An indefatigable political writer under different pseudonyms, Judge Sullivan was usually a consistent and ardent Republican.²⁷

These two strenuous families, the Baldwins and the Sullivans, accomplished the major portion of the practical work of direction during the period of construction and during many years of the operating life of the canal. Their activity was united with the wealth of the capitalists. Without their tenacious faith and works,

²⁷ Amory, *Life of James Sullivan*, *passim*. H. H. Burbank, "James Sullivan," *Collections of the Maine Historical Society*, 3rd ser., I (1904), 322-338.

without the sustaining wealth of leading members of a rich community, the improvement could not have been effected. A fortunate marriage this was, of Republican vigor to Federalist money. As Sullivan lads took Russell wives, daughters of the Honorable Thomas, the language becomes more than figurative. The persuasion of their helpmates may have eased their transition to conservative politics, which took place in the first decade of the nineteenth century and which is perhaps to be explained both by their position in society and by the trend of opinion in Massachusetts during that difficult period.²⁸

A final place has been reserved in this list of personal sketches for an extended notice of the origin, early interests, and activities of the principal constructor of the canal. One of the earliest of Americans in his profession, he has been in large measure neglected by the chroniclers. A sturdy personality, possessing a few unfortunate, doubtless inevitable, limitations, he sired a veritable race of engineers.

Loammi Baldwin, great-grandson of Deacon Henry Baldwin, who was probably the first settler of Woburn,²⁹ was born in that village of Massachusetts on January 10, 1744 (O.S.).³⁰ James was his father, and Cyrus and Ruel were his brothers. The father is reputed to have been a carpenter. He was a master workman in the erection of the Burlington Meeting House.³¹ This was, however, but one of his activities. Shortly after the middle of the century a shop, stocking general goods, both foreign and domestic, was opened adjoining the house in Woburn. The family traded in hops, apples, cider, and other produce of the farm, exchanging these, often directly by barter, for molasses, brandy, coffee, tea, earthen ware, brasses, and dry goods for the shop.³² One brother, Ruel, carried on similar miscellaneous trading and

²⁸ Amory, *Memoir of Richard Sullivan* (1885), *passim*.

²⁹ *Transcript of Epitaphs in Woburn First and Second Burial Grounds* (1890), p. 267.

³⁰ C. C. Baldwin, *The Baldwin Genealogy from 1500 to 1881* (1881), p. 627.

³¹ S. Sewall, *The History of Woburn, Middlesex County, Mass., from . . . 1640 . . . to . . . 1880* (1868), p. 385.

³² Diaries of Cyrus Baldwin, 1761-63, 1767-69; Oct. 27, 1762: "My Brother Ruel went to Charlestown & Brought a Load of Erthan ware. I paid for it in Cyder": Baldwin MSS.

producing in Watertown. Cyrus, working in Samuel Blodget's store in Boston, ventured in mittens on the side, aided by his parents and brothers, who either bought them by the hundred pair from women who made them in homes in the outlying districts, or delivered the yarn to neighbors and relatives, collected the mittens, and brought them to Boston. There was much business visiting back and forth.³³

Samuel Blodget in Boston furnished supplies to His Majesty's sutlers; he himself may have been sutler to the troops for a time.³⁴ At all events, young Cyrus Baldwin made up the rolls. When Blodget's business went poorly, Cyrus came home to Woburn, where he and Loammi diversified their occupations. They "worked in the garden, . . . tended shop, . . . sat for pegions, . . . posted accounts, . . . went a Duning, . . . [and] a hunting, . . . turned Chisel handles, . . . raked hay," did carpentering jobs on the house and shop and for neighbors, and helped their cousin Joseph build his new sawmill.³⁵

By the year 1767 Cyrus was ready to start a shop of his own in Boston. Loammi helped him open his goods, bought from England, and then left to take care of the Woburn business with his father. The Boston and Woburn stores operated for many years in part on joint account. The new shop had been running but five months when difficulties arose regarding supplies from England, and Cyrus sailed for London, leaving his brother in charge. About this time or a few years later Loammi started in business as a pump maker, adding this to his other employments. He took orders and dimensions in Boston and Cambridge, boring the logs and finishing the jobs at home with "a set of pump makers tools."³⁶ It is recorded that he was also for a time a cabinet maker.³⁷

In the midst of these activities, when Loammi was eighteen and

³³Diaries of Cyrus Baldwin, 1761-63, 1767-69; "Accounts of Mittens"; Diary and entry, Nov. 9, 1762: "I went to Boston to Mr. Appletons to Tend Shop. . . . I Brought one Hundred pr Mittens at 7/6 per pair & one Hundred for mySelf in order to Send Them off to Halifax . . .": Baldwin MSS.

³⁴"Biography of Honorable Samuel Blodget," *Farmer's Monthly Visitor* (June 1852), pp. 161-170.

³⁵Diaries: Baldwin MSS.

³⁶Accounts and business notebooks of Loammi Baldwin, "Orders for Pumps": Baldwin MSS.

³⁷Baldwin, *Baldwin Genealogy*, pp. 627-629.

Cyrus twenty-two years of age, the brothers found occasion to continue "to go to school" for a few days at a time to Mr. Fowle. At home they studied "Mr. Barker's book on drawing" and experimented with electrical apparatus.³⁸ A well-thumbed copy of Potter's mathematics, acquired by Loammi, testifies to his application in a field later to prove useful.³⁹ His general scientific interests at this period are manifested in letters to and from his friend Benjamin Thompson,⁴⁰ who was later to be created Count Rumford by the Duke of Bavaria. Until his last days Baldwin continued an intermittent correspondence with this unusual person, acting for many years as his agent in America.⁴¹

Woburn, Aug. 14, 1769

Mr. Loammi Baldwin,

Sir,—Please to give the Direction of the Rays of Light from a Luminous Body to an Opaque, and the Reflection from the Opaque Body to another equally Dense and Opaque; viz. the Direction of the Rays of the Luminous Body to that of the Opaque, and the direction of rays by reflection to the other opaque Body.

Yours, &c

Benjn Thompson.

N.B. From the Sun to the Earth, Reflected to the Moon at an angle of 40 Degrees.

³⁸ Diaries: Baldwin MSS, Oct. 2, 1762: "I Finished my Electrical works But so late that I Could not set them to work to perfection"; Aug. 10, 1763: "my Brother [Loammi] & I got our Electerising works compleated." On May 14, 1767, Loammi took Cyrus' imported "Electrical Globes home with him to put in axes in 'em."

³⁹ John Potter, *A System of Practical Mathematics* (1757). This volume is extant in the Baldwin Library, which is on deposit at the Massachusetts Institute of Technology. The library, containing over two thousand books on engineering and technical subjects, was amassed mainly in the first three decades of the nineteenth century. Many scientific books published in the seventeenth and eighteenth centuries in Dutch, French, and English are in this collection. It is said to have been the best professional library in America.

⁴⁰ Benjamin Thompson (1753-1814), born in Woburn, Mass., died in Auteuil, France, one of the most distinguished of Americans. For adventure, worthy attainment, and brilliance his scientific, military, administrative, political, and worldly career has hardly an equal in the annals of American-born sons. See G. E. Ellis, *Memoir of Sir Benjamin Thompson, Count Rumford* (1871). "The Original Memoirs of Benjamin, Count of Rumford," *Literary Miscellany*, vols. I, II (1805-1806), by Loammi Baldwin evidently formed the main framework of the biography by Ellis. The authors of contributions to this short-lived periodical were not usually given. They are noted, however, in pencil in the Harvard College Library. From internal evidence it appears that this Baldwin was Loammi, 2nd (1780-1838).

⁴¹ Originals and copies of the letters interchanged are among the Baldwin MSS.

Woburn, Aug.t 16, 1769

Mr. Benj. Thompson,

Sir, — It is almost impossible to describe the directions the rays pass. Suppose one was at the Equinoctial Line, at twelve o'clock. At that place then I imagine that the rays of the Sun would pass directly straight to the eye of the beholder. But suppose the Sun to be just arising, then I imagine that the rays would pass in a curve line, and so grow straighter as it rises higher in the horizon. The reason is, I conjecture, owing to the Vapours that ascend out of the earth. I would prove it thus. Take a bowl and put a dollar in it, and then carefully filling it with fair water, till it seems to be heaped as it will do if the brim was dry, and go off to a distance that brings your eye level with the top of the bowl, and you can see the dollar in the bottom of the bowl; and that air nigh the ground is something of the same nature is the opinion of

Your Humble Servant,
Loammi Baldwin.

Woburn, August 16th,
1769.

Mr. Loammi Baldwin,

Sir, — Please to inform me in what manner fire operates upon Clay, to change the Colour, from the Natural Colour to red, and from red to black, &c; and how it operates upon Silver, to change it to Blue.

I am your most Humble, and Obedient Servant,

Benj.a Thompson.

God save the King.

Woburn, Aug.t 1769.

Mr. Loammi Baldwin,

Sir, — Please to give the Nature, Essence, Beginning of Existence, and Rise of the Wind in General, with the whole Theory thereof, so as to be able to answer all Questions relative thereto.

Yours,
Benj. Thompson

Woburn, Aug.t 15th, 1769.

Sir, — There was but few beings (for Inhabitants of this world) created before the airy Element was: so it has not been transmitted down to us how the Great Creator formed the matter thereof. So I shall leave it till I am asked only the Natural cause, and why it blows so many ways in so short a time as it does.

The last sentences, which are noted on the back of the previous letter, are evidently a copy of Baldwin's answer.⁴²

⁴²Loammi Baldwin, "Revolutionary War Papers" (MSS), Harvard College Library.

In the spring of 1771 and possibly also in 1770, through the intercession of certain friends in Boston, Baldwin secured permission to attend a course of lectures in experimental philosophy at Harvard College⁴³ given by Professor John Winthrop, the foremost mathematician and philosopher America had then produced.⁴⁴ On hearing of this opportunity, Thompson secured the same privilege, and the two friends for some time walked daily eight miles to Cambridge from Woburn, returning to contrive rough instruments to repeat the experiments. Parts of Baldwin's notebooks for June 1771 are extant. The headings for each day—"Experiments of the air Pump . . . Lecture upon Dioptics . . . Optics . . . Lences . . . Refractions . . . the use of the Tollyscope Display.d . . . Hydrostatics . . . Hydrolics & Pneumatics"⁴⁵—indicate the nature of the course. It was the knowledge so derived and its later development and application, and almost this alone, that formed a technical basis for the year-by-year construction of the Middlesex Canal.

The course of lectures and experiments furnished an incitement and gave direction to further study. Thompson shortly began his earliest experiments on the explosive power of gunpowder, a field in which he was later to achieve fame,⁴⁶ while Baldwin successfully performed Franklin's experiment with the kite.⁴⁷ Baldwin had only this opportunity for formal education. He continued to educate himself, concentrating particularly on problems connected with waterways. Years after, in 1794, coming fresh from the inspection of a number of incipient canals in America, he wrote:

Having had the honor of being appointed Superintendent of the Middlesex Canal it remains for me to give my answer on that appointment:

⁴³ L. Baldwin, 2nd, "Original Memoirs of Benjamin, Count of Rumford," *Literary Miscellany*, I (1805), 357.

⁴⁴ Quincy, *History of Harvard University*, II, 223. John Winthrop (1714-1779), Hollis Professor of Mathematics and Natural History, 1738-1779, second incumbent of the chair founded in 1727, Fellow of the Royal Society, and LL.D. (Edinburgh and Harvard).

⁴⁵ Parts of Notebooks, June 1771: Baldwin MSS.

⁴⁶ L. Baldwin, 2nd, "Original Memoirs of Benjamin, Count of Rumford," *Literary Miscellany*, I, 357.

⁴⁷ L. Baldwin, 1st, "An Account of a Very Curious Appearance of the Electrical Fluid Produced by Raising an Electrical Kite in the Time of a Thunder Shower," *Memoirs of the American Academy of Arts and Sciences*, I (1785), 257-259. A copy of this account in a letter to Rev. Pres. Willard of Harvard College, May 26, 1783, is in Baldwin MSS.

The first thing that presents in considering the question is ability to Execute the design in a proper manner, on this I certainly have nothing to boast, having had no Experience at all. It is true I have studied the theory for many years & have been at considerable pains to get possessed of the principles of Canaling but I have never yet seen one foot of Canal which has been compleated in a proper and the most approved manner. this I say upon the strength of what I have read on the subject and Mr. Weston's information.⁴⁸

Limited though Baldwin's engineering education had been, and acquired so largely as an avocation, there were few Americans in the United States of the eighteenth century who had given such great attention to canalling. Engineers, good and bad, of that period were usually imported.⁴⁹ An obituary notice said of Baldwin:

The talents of our deceased friend were more in his undertakings in Mathematics and Hydraulicks than in any other branch of learning. We may say with confidence, that no one in Massachusetts has excelled him in these; and that in the latter, he might vie with the English Brindley himself.⁵⁰

The American Brindley was indeed a lesser genius, but his qualities shone in the midst of a dearth of engineering talent.

The private pursuits and studies of the early seventies were interrupted by the Revolution, which led Thompson to influential positions with the British, and Baldwin, a vigorous and convinced patriot, to a commission in the American army and to a public career. He took part in the battles of Lexington and Concord with the rank of major and served as colonel of the 26th Regiment of the Continental Army; he was with Washington in the occupation of New York and in the Battle of Trenton. A member of the General Court of Massachusetts from 1778 to 1779, Baldwin became a year later the first sheriff of Middlesex County under

⁴⁸ "Answer on the appointment of a superintendent," October 1794: Baldwin MSS. Weston was an English engineer.

⁴⁹ Davis' work, already referred to, contains short accounts of all incorporated engineering projects in America prior to 1800. Many foreign engineers are mentioned — Irish, Scotch, Swedish, English, French — but very few Americans, and these few were not connected with successful undertakings. Engineers are to be distinguished from inventors, however, in this connection.

⁵⁰ *Independent Chronicle*, Dec. 10, 1807.

the state constitution. The honorary degree of Master of Arts was conferred on him in 1785 by Harvard College. After the Revolution, during which his active service had been cut short by ill-health, Baldwin lived the life of a country squire on his productive estate, continuing to perform the hardly engrossing functions of county sheriff. In this position, the advent of the canal enterprise found him.⁵¹

At the meeting at which the board of directors was chosen the proprietors of the Middlesex Canal divided the "privilege" into one thousand shares, promising "to have the property as equally distributed between the people in the country and in the seaports as may be, and also to prevent a monopoly of shares."⁵² As the act of incorporation contained an elaborate, unworkable, and well-nigh meaningless arrangement for voting, the directors expressed the wishes of the legislature in a more practical form and guarded themselves against popular prejudice by agreeing "that no subscriber should subscribe for more than twenty shares."⁵³ Eight hundred shares were shortly taken, and two hundred reserved for future disposal. The division into eight hundred shares was later prescribed by the act of February 28, 1795, which regularized the previous law by determining that each share should have one vote, "provided that no one Proprietor [should] have a right to more than twenty-five votes on any occasion."⁵⁴ The voting limit, however, did not prevent individuals from holding large blocks of stock. At first no actual shares were issued; signatures on subscription papers, the originals of which were kept with the company's records, were deemed sufficient as temporary evidences of ownership. The following February Benjamin Russell printed blank shares, which were distributed shortly afterwards to the subscribers.⁵⁵ Then began interminable assessments.

⁵¹ *Transcript of Epitaphs*, p. 56; C. C. Baldwin, *Baldwin Genealogy*; Sewall, *History of Woburn, passim*; Ellis, *Memoir of Sir Benjamin Thompson*; Baldwin Diaries: Baldwin MSS.

⁵² *Independent Chronicle*, XXV, no. 1299, September (?), 1793; also, "Report on the Means of Raising Money, 1799": Corporate Records.

⁵³ *Independent Chronicle*, XXV, no. 1299, September (?), 1793.

⁵⁴ *Massachusetts Statutes Private and Special*, II, 26.

⁵⁵ Vouchers, February 1794: Corporate Records.

Three of the original subscription papers are extant, headed severally by the names of Thomas Russell, John Hancock, and Loammi Baldwin. The last successfully exercised his influence with the country people. Among the subscribers were Peter C. Brooks, Jonathan Amory, Oliver Wendell, William Tudor, Aaron Dexter, and Charles Vaughan. Individual subscriptions usually amounted to twenty, ten, or five shares. When the first assessment was laid in the spring of 1794, twenty-nine persons held twenty shares each, eleven⁵⁶ held ten shares, and ten⁵⁷ held five shares, making a total of about 740 shares owned by fifty individuals. Sixty-odd shares were subscribed in small lots of less than five, in a number of cases by relatives of the principal shareholders.⁵⁸ John Quincy Adams, a subscriber to five shares, was to persevere to the end in meeting assessments, as an Adams would, and to receive with his father twenty-five years later the first checks drawn by the corporation in payment of dividends.

By December of the year 1796 there had been twenty-one assessments, totaling \$95 a share, and the ownership had already undergone a marked change. Eight of the subscribers to five shares, including Adams, still held their allotment and paid assessments with due regularity; five of those who had originally taken ten shares continued to hold severally this amount. Among the owners of twenty shares each, more striking changes in ownership had immediately begun to take place. Of the original twenty-nine, only five had neither bought nor sold. The Medford men generally had disposed of the bulk of their holdings,⁵⁹ keeping but one or two shares apiece. The Boston men of considerable financial standing constituted a group of large holders. Joseph Barrell headed the list with eighty shares, followed by Christopher Gore, with seventy; Andrew Craigie, fifty-one; John Peck, fifty; John Joy, Jr., forty; William Payne, thirty; and Charles Storer, twenty-three. Nine more had twenty shares each, including the five who

⁵⁶ One of these held thirteen.

⁵⁷ One of these held six.

⁵⁸ The statistics of ownership are compiled from the assessment books of the corporation. The memoranda lists of stockholders in the records of the company are inaccurate and incomplete.

⁵⁹ An exception was Benjamin Hall, treasurer of the corporation, who still held thirteen.

held over from the original group. In all, sixteen men owned 524 of the 800 shares.

Five further assessments in the year 1797 brought the total to \$120 a share, but few changes in ownership occurred. Of the seventy-six proprietors at the beginning of the year, seventy-one neither bought nor sold. The fifty shares of John Peck, the first of the principal stockholders to withdraw, lodged mainly in the hands of Benjamin Vincent and of Benjamin Hitchborn, the politician. It is proper to speak of Peck as withdrawing, since a seller was fortunate to receive the total of his paid-in assessments. The shares of this no-par, or indefinite-par, stock sold during the year neither at a discount nor at a premium.⁶⁰

The events attending the public opening of the first six miles of the canal toward the end of 1797 were inauspicious, and a year of discouragement ensued. Two men of property withdrew in favor of more adventurous souls. The canny Craigie, quick to sense an unprofitable speculation, found two buyers of his fifty-one shares, Rufus G. Amory, lawyer, and the Reverend Jedidiah Morse, widely known geographer and father of the inventor. Benjamin Joy assumed the burden of carrying seventy of Joseph Barrell's eighty shares. The latter, it appears, was in temporary financial straits. Some 260 shares changed hands this year, selling generally at a discount — a normal condition from this time forth.

The stock had now been shaken down into hands prepared to hold on. Henceforth, the few transfers followed mainly from the normal vicissitudes of human life. The shares of delinquent subscribers were ruthlessly sold. Instances requiring such action, however, were rare. Additions to the list of owners included Josiah Quincy, later politician, historian, and president of Harvard University, and that vain, irascible, yet high-minded statesman, John Adams.

The stock was thus soon lodged in the possession of men ready to stand by and support the concern until the completion of the undertaking. Speculative trading, if it existed at all, was of in-

⁶⁰ The consideration stated is merely nominal for five of the eighteen transactions on the company's transfer books for 1797; for the other transactions, however, the price is given, in each case practically equivalent to the amount of the paid-in assessments.

significant proportions. With all its public features, this first of Massachusetts utilities had through much of its life many of the characteristics of a close corporation. The concern came to be viewed by the proprietors as a joint enterprise and the stock as

TRANSFERS OF SHARES 1799 TO 1806

Year	Number of Shares Transferred
1799	81
1800	67
1801	61
1802	21
1803	41
1804	31
1805	80
1806	26

a long time investment. Those who had the requisite faith took the risk and paid assessments year after year. There was never any objective justification, expressed in a quoted premium on shares, for their persistent faith in the future. Their belief in their superior judgment of the commercial possibilities of the enterprise may be postulated; otherwise their actions are to be interpreted in the light of other than self-regarding motives. The following table indicates that their contributions were appreciable:

ASSESSMENT ON MIDDLESEX CANAL SHARES 1794-1806

Year	Assessment per Share
1794	\$ 10.00
1795	45.00
1796	40.00
1797	25.00
1798	35.00
1799	50.00
1800	55.00
1801	110.00
1802	85.00
1803	100.00
1804	40.00
1805	5.00
1806	10.00

\$610.00 *

* For detail of ownership of shares after the ninety-sixth assessment of May 1806, see Appendix C.

The stability characterizing these early years suggests a simple concept of the function of coöperating owners uniting to establish a public utility. The simple outlines of theory fit closely this initial attempt.⁶¹ Without governmental assistance a group of wealthy leaders in commercial and public life, their reputations for business acumen soon jeopardized by the project, persisted in supporting through the developmental stage an enterprise that they first believed and then hoped would be as profitable to themselves as it would be beneficial to the public. While in most of the states similar projects were dying miserably or were being kept but partly alive, subject to recurrent delay,⁶² this one went forward. Elsewhere the public spirit of private individuals was too weak to bear steadfastly the burdens of such hazardous schemes; and the speculative interests, as is their wont, blew hot and cold, to the damage of productive effort.⁶³ Boston, however, had the good fortune to possess a class of citizens tenacious of success. A number of her families, with ramifications through that part of society which liked to call itself best, became publicly identified with the plan from the outset. A pride of caste and a pride of judgment contributed to the result. The wealthy men of this rich little town obviously could not have afforded many such luxuries, but this one they could and did finance.

⁶¹ In this connection compare Adam Smith, *Wealth of Nations* (Everyman's ed., 1910), bk. V, pp. 243, 244, with W. Z. Ripley, *Main Street and Wall Street* (1927), chaps. II, X, XI.

⁶² The Santee Canal in South Carolina was the single notable exception.

⁶³ Regarding the early plans for canals in Pennsylvania, A. L. Bishop states: "These magnificent projects . . . were defeated partly by the want of public spirit among capitalists, but largely in consequence of the spirit of ruinous speculation," *The State Works of Pennsylvania* (1907), p. 162.

CHAPTER IV

SURVEY AND ORGANIZATION

THE MIDDLESEX Canal Company had not long been formed when the directors voted to commence "the necessary surveys of the most eligible route between Medford river and Chelmsford, by the Concord river."¹ Samuel Thompson, a magistrate of Woburn, self-taught in surveying, was appointed to conduct the business. He spent more than a week in August 1793 surveying a route from Medford Bridge to the Merrimack River without a leveling instrument. A committee accompanied him with a "chaise to carry victuals and baggage." Colonel Baldwin and Judge Winthrop were of the party, while Benjamin Franklin Baldwin, a boy of sixteen, helped out in odd jobs.²

Up Mystic River to Mystic Pond, through the pond and Symmes River to Horn Pond in Woburn, the survey progressed. At the head of Horn Pond apparently insurmountable obstacles stood in their way. Back they went to Richardson's mill on Symmes River and followed the valley through the eastern part of Woburn to Wilmington, finding an easy and regular ascent to Concord River. The distance traveled thus far was about eighteen miles and the ascent, reported by the surveyor, sixty-eight and one-half feet.³ A year later, with an accurate survey, apparently this same ascent from Medford Bridge to Billerica Mill Pond was found to be one hundred feet.⁴

This was not the sole error. The surveyor continued from Billerica on the Concord River to Chelmsford on the Merrimack and wrote in his report: "The water we estimate in the Merrimack

¹ Eddy, *Historical Sketch of the Middlesex Canal*, p. 4.

² Expense accounts, vouchers, 1793, 1794, 1795: Corporate Records; announcement, *Independent Chronicle*, vol. XXV, no. 1299, September (?), 1793.

³ *Independent Chronicle*, vol. XXV, no. 1299, September (?), 1793.

⁴ The ascent is given as 99.77 feet on the profile map of 1830 (County Commission, Middlesex County).

at sixteen and one half feet above that at Billerica Bridge, and the distance six miles.”⁵ In fact, however, the water at Billerica Bridge was about twenty-five feet higher than the Merrimack at Chelmsford. Thompson’s error in determining the elevation was no less than forty-one and one-half feet in a short six miles.

Nine days over the ground, four days to plot the route on paper, tavern bills from Richardson’s, Dean’s, Blanchard’s, Lewis’, and Pollard’s, seven shillings six pence (\$1.25) per day for Thompson’s wages, paid some two years later, and a summary report and map on the accuracy of which the directors soon found they could not rely — this is the story of the first survey.⁶ The surveying instrument used was probably simply a compass with sights; the elevations may have been roughly guessed. Some of the difficulties with which the promoters of the canal had to contend, for want of requisite scientific knowledge, are evident in the results of this first attempt.⁷

Aware of possible errors in the report, the directors regarded it as preliminary and somewhat over a month later ordered a second survey. Baldwin saw General Knox and his surveyor, John Hills, in Boston and spent three days with one Mr. Cross, possibly at their suggestion, constructing a device to be used in leveling. The exact nature of this instrument, made by combining an iron screw, some loops, and four pieces of cherry wood, is difficult to determine.⁸ It may have been a form of slope board or a crude clinometer. Beginning October 21, a committee spent a week “making observations on the level of the country for the canal.”⁹ The day’s

⁵ *Independent Chronicle*, vol. XXV, no. 1299, September (?), 1793.

⁶ Expense accounts, vouchers, 1793, 1794, 1795: Corporate Records.

⁷ One result of this effort to locate the line of the Middlesex Canal was unconnected with the business in hand. Thompson discovered the fruit of the Pecker apple tree, later named the Baldwin apple. (Inscription on monument, Wilmington: Rumford Historical Association. J. F. Baldwin, *Investigation of Origin, Notes, etc.*; “Plan of Butters Row in Wilmington, showing the site of the original tree,” surveyed by Cyrus Thompson, Aug. 8, 1856; affidavits and notes: Baldwin MSS. Cf. *The Horticulturist and Journal of Rural Art and Rural Taste*, December 1846, January 1847; *The New England Farmer*, March 20, 1852, April 19, 26, 1856, Feb. 4, 1860.) Loammi Baldwin did much to promote this apple which bears his name.

⁸ Expense account, Oct. 15–21, 1793, paid Aug. 7, 1794; vouchers: Corporate Records.

⁹ Expense accounts, Baldwin and Winthrop, Oct. 21–26, 1793, paid Aug. 7, 1794, and May 11, 1794, respectively: Corporate Records.

work done, Winthrop, Baldwin, and Jaques, the principal manipulators of the new instrument, doubtless sat over their brandy or rum punch at a country tavern, compared their results with those of the first survey, and found discrepancies.

At this juncture the directors were convinced that a person with previous experience had to be found. A politically bipartisan committee wrote General Knox the following letter:

The Directors are exceedingly pleased to find that you are friendly to the plan in which they are engaged and wish you to be interested in the business . . . we are under a . . . necessity to procure a man, who is skilled in the business of canaling, who can point to the place where, under all Circumstances, the Canal ought to be cut. We hear that such a person is in Philadelphia, — who has come to America on the Invitation of Mr. Morris. We beg favour of your inquiring whether such an artist is there and whether we can obtain his aid for a short time early in the ensuing Spring; and whether in your opinion he can answer the purpose.

James Sullivan
Thomas Russell ¹⁰

When Knox characteristically delayed his reply, an advertisement was inserted in the *Centinel*, in both English and French, for a "Person acquainted with making Locks and Canals."¹¹ General Knox responded, however, in February:

My remissness . . . was owing to an expectation that Mr. Weston, an Englishman, the director of the Canals in this State and brought over at a great expense would arrive in this City from the Country. . . . But he has not yet arrived. . . . it is my opinion that he will not be able to assist you owing to his engagements here . . . the business of deciding where a canal ought to be, and of [illegible] the execution . . . is more a matter of accurate perceptions and judgment than of science. I am persuaded that we have men among ourselves whose abilities in this respect, were they actually to inspect the Canals of England, would be equal to any man who may be obtained from that country at a great expense. Upon the morals and steadiness of our own people we may depend, while foreigners in so many instances are defective in these essentials.¹²

¹⁰ Nov. 9, 1793, Knox MSS, XXXIV, 138. A second letter contains a copy of the first, *ibid.*, XXXIII, 107.

¹¹ Bill for advertising in the *Centinel*, Feb. 19, 1794: Corporate Records.

¹² Knox to Sullivan, Feb. 1, 1794, Knox MSS, XXXV, 37.

The first Secretary at War of the United States is an example of an unchanging political type. His correspondence reveals both artlessness and a distinct note of political mediocrity.

On March 1, 1794, the directors voted that Baldwin "repair to Philadelphia and endeavor to obtain Mr. Weston's assistance in conducting the canal."¹³ Russell, Sullivan, and Craigie were a committee to write his instructions:

Should [Weston] recommend one as a person whose skill and honesty may be relied on, either in Europe or in America, you will forward letters engaging such Person to repair to Boston. . . . You will visit all the canals to which you can conveniently have access & gain all the information you can on the subject of canalling.¹⁴

After purchasing a traveling trunk and securing sixty pounds from the treasurer, Colonel Baldwin took passage, March 10, in Pease's stage for the "Southern states" "to view canals" and to seek out William Weston.¹⁵ His account of the trip gives a picture of the means of transportation at the time, of the state of the canal business in the country, and of the deference paid to English experience by men of that period:

In pursuing the object of my present appointment the first circumstance worth noting was conversation with a Mr. McIntosh an English Gent. & agent for a Respectable Co. I believe consist.g chiefly of English Gentlemen who are erect.g very large works on a River about 2 miles W. of the College in N. Haven for carrying on the Woolen & Cotton Manufactory¹⁶ under the more immediate direction of a Mr. Bewell an American Gentleman about 50 yr. old of vast Ingenuity & who had traveled thro England a good part of France and Germany to view and examin the improvements in arts.

Mr. McIntosh informed me that he himself served a regular apprenticeship to the engineering business in England and that he had superintend the Construction of a canal in England for a considerable time. I acquainted him with our project he gave it as his opinion fully that Mr. Bewell was quite competent to the undertaking.

Immediately on my arrival at N. Haven I made it my business to see

¹³ Eddy, *Historical Sketch of the Middlesex Canal*, p. 4.

¹⁴ Committee instructions, March 1794: Baldwin MSS.

¹⁵ Expense account; orders to the treasurer; vouchers, 1794: Corporate Records; also, Baldwin diary, March 10, 1794: Baldwin MSS.

¹⁶ One of several small unincorporated companies manufacturing woolen and cotton goods in eighteenth-century Connecticut (Davis, *Essays*, II, 268, 269).

Mr. Bewell but he was out at the works 2 miles off & the Stage would not allow me time to go there. However I found this character given by Mr. McIntosh so well supported that I concluded to quit my Seat in the Stage & take passage in a packet boat which was to sail for N. York at 9 o'clock in the evening as did the other passengers, *the roads were very bad*, but not withstanding all his & my endeavours to See each other after he arrived in Town we had but a few moments together on board the Packet Indulged by the Master. However I found he had never had any practical Experience in canalling but he said he was sure he could effect our business that he had paid particular attention to the construction of Locks & Canals while in Europe . . . must suspend my opinion. . . .

. . . after a pleasant passage down the Sound I arrived at N. Y. Saturday noon the same Hour with the Stage which I had quitted at N. H. I had Doct.r Craigie Letter to Mess.r Johnson¹⁷ which among other Civilities procured me an interview with one of the principal Directors of the Canals in the Northerly part of the State of N. Y. He informed me that they had commenced their work under the superintendence of Gen.l Schyler that they had expended large monies & he feared to no good purpose he imputed the failure to the want of Experience in the Superintendent however he said it was a work of great magnitude and difficult to execute. That it was suspended for the present, that they proposed to resume again as soon as they could procure an artist & that they had made application to Mr. Weston of Philadelphia but could not obtain him, a circumstance essentially interesting and painful to me.¹⁸

I suggested to him whether the two comp.s might not with propriety unite in procuring an artist from Europe to Superintend both the Canals he seemed to hesitate a little & say that if the State of N. Y. would not assist them that it was doubtful whether they should proceed just at present however I am to know more on my return I found that there were one or two persons in N. Y. that made pretensions of their abilities in the business of Canaling but were very indifferently spoken of by Gentlemen in that place.

¹⁷ Seth Johnson, one of Craigie's partners, a New York merchant and conservative speculator (Davis, *Essays*, II, 56, 81 n., 84).

¹⁸ The New York companies "worried along until May, 1795, without any capable engineer . . ." (Davis, *Essays*, II, 163). In May 1795 the western company secured Weston's services, one year after his work on the Middlesex Canal. About four and one-quarter miles of canal were opened by 1799. No further work was done, and the western company succumbed in 1818. The projects of the northern company, which likewise had Weston's assistance, were abandoned in 1796 or 1797, after some \$100,000 had been invested. See Davis, *Essays*, II, 157-167; Albert Gallatin, *Report of the Secretary of the Treasury on the Subject of Public Roads and Canals* (1807), pp. 40-45.

Sunday noon the 16th Int. left N. Y. for Phil. In traveling thro. the Jerseys made enquiry in the line of my business but there are no Canals going forward in the State. I found at Trenton that there was a Gentleman in that place from Europe by the name of John Hall in high Esteem for his ingenuity Skill and Experience in waterworks, Machines &c. . . .¹⁹

I arrived in Philadelphia Tuesday noon 18 Int. I delivered my letters . . . Msr. Breck²⁰ merits my most grateful returns . . . he introduced me to Msr. Morris²¹ M. Weston & several other Gentlemen. . . . I find Msr. Weston is very eminent in his profession and that he & his Lady are great favorites of Msr. Breck and family. . . .

Mrs. Weston has more than once expressed a passionate desire of visiting Boston and has frequently told me that she longed to be acquainted with Ladies and Gentlemen of that metropolis. She observed that all the English Gentlemen and Ladies enjoyed themselves better in Boston than any place on the continent &c, &c.

I dare say that in my important business you will think this a very trifling circumstance to report to you — however after all that our friends have done I declare that almost my only hope of securing Mr. Weston's assistance in season rests on this circumstance.

I find that Mr. Weston is now engaged for three different corporations, viz.

1. the Canal from the Susquehannah to the Schuylkill . . .
2. the Schuylkill canal . . .²²
3. for a company Incorporated for the purpose of making a Turnpike Road. . . .

The business of these three companies does necessarily occupy his whole attention he seems desirous of undertaking for us but does not see how it can be effected. I endeavored to work him up into a realization of such an event as much as possible touched him on terms he informed me that he was now employed at the rate of pounds 1500 Sterling a year that if he was to assist us there would be deducted from his salary

¹⁹ Baldwin did not see "John Hall." Possibly this man may have been William Hall, an English artisan of some repute, discharged in 1793 from the Society for Establishing Useful Manufactures, the first New Jersey business corporation (Davis, *Essays*, I, 493).

²⁰ Samuel Breck (1771-1862), born in Boston, educated in France. The family moved to Philadelphia from Boston in 1792 to escape heavy "Faculty" taxation, instituted that year. Breck and his father were intimates of the leading figures at the capital (Scudder, *Recollections of Samuel Breck, passim*).

²¹ Robert Morris (1734-1806).

²² Robert Morris was president of the first two companies, the Schuylkill and Susquehanna, and the Delaware and Schuylkill. Work was abandoned about 1796 (Davis, *Essays*, II, 148-157; Bishop, *State Works of Pennsylvania*, pp. 162-163).

here at the same rate according to the time he should be absent from their service which he should expect us to repay him with the Expense of his Journey and as to any thing further he should leave it entirely to our company to do as they pleased. . . .

however he would not have me depend much on his going thence nor should I if it were not for some hopes I have from the Delilahen quarter my reply to his terms was that if he would go our company would never leave him dissatisfied. . . .

I further told him that if I should not succeed the company would most certainly be obliged to dispatch some person to Europe and endeavor to procure a Gentleman there. I found that this observation seemed to effect him he then took me to the Canal office & shew'd me the proper tools for the purpose and told me that we must have such.

in conversation with Mr. Morris he tells me that he does not see how it will be possible under all Mr. Westons engagements to afford us any assistance however he further said that if the result of my application to Mr. Weston should be to endeavour to obtain the consent of the Board of Directors he would call them together for that purpose immediately I tho.t he seemed more cheerful in this and desirous of assisting me after Mr. Breck had informed him that it was in my power to afford his assistance in a favorite object which was to erect a Bridge over the Delaware near his seat opposite Trenton he seemed to embrace the Idea of Exchanging favors & desired that I would let him know when I returned that he might attend me to that place to View the Situation and consider of the practicability of such an enterprise which I cheerfully agreed to . . .²³

Generals Knox and Cobb have been attentive to me since my arrival here & truly consult and advise with me on the business I am out upon and are well disposed to assistance.²⁴

I frequently attend at the canal office in this city where Gentlemen in this line usual resort & unite in conversation & where much is to be heard & learned of the State of that business in America.

I do not find that there is one Lock fully completed yet those erecting on the potomack above Georgetown are nearly completed expect they will be open for use in about a month.²⁵

²³ The Trenton Bridge, although incorporated by an act of April 1798, secured subscriptions and letters patent only in 1803. It was opened in 1806 and proved profitable. "In 1835 its control passed into the hands of the Philadelphia and Trenton Railroad Company, and since then the Pennsylvania Railroad and its predecessors have enjoyed its benefits." (Davis, *Essays*, II, 211.)

²⁴ For canal activities of Cobb and Knox, see chap. II.

²⁵ Locks had been completed and opened by the new James River Company in Virginia in December 1789, on the stretch of their canal from Westham to Broad Rock (Davis, *Essays*, II, 139; Lossing, *Diary of Washington*, pp. 165-166).

" having arranged my business here so as to have all the influence I am able to make operate at the important period of Decision which will probably be next Wednesday or Thursday & not knowing what the event will be I concluded in order to provide against the worst to set out this morning for to view the Locks & Canals on the Potomack above Georgetown. . . .

Loammi Baldwin ²⁶

Successful in persuading William Weston to come north in the summer, the superintendent returned in May and made an encouraging report which closed as follows:

I consider the prospects before us in this undertaking much more flattering in respect to the execution of the work, in proportion to the extent, than any I have seen in the Southern States, the Washington canal excepted.²⁷

Colonel Baldwin brought back from Philadelphia an instrument which he had borrowed from Weston. Thereafter this instrument and, for the first time, a graduated "station staff" or leveling rod were used in surveying and leveling. Cyrus Baldwin, a young man of twenty-two, usually carried the staff, while Loammi 2nd, a boy of fourteen, took care of the horse, chaise, and baggage. In the expense accounts there are many references to "the Instrument." While the capitalization of nouns was endemic in eighteenth-century America, the use of the definite article indicates the importance attached to this object, which contained a "Magnitick Needle" and a spirit level. It was used on the canal until March 1797. At that time "Mr. Weston's Instruments for levelling," plus the leveling rod, were "sent to Philadelphia by direction of the superintendent," after the target had been venerated that everything might be in good order.²⁸

There is evidence for believing this to be the first perfected level-

²⁶ This letter ends with a description of what had been done on the Schuylkill and Delaware Canal. Baldwin to Sullivan, Philadelphia, March 24, 1794, copy: Baldwin MSS.

²⁷ Quoted by Eddy, *Historical Sketch of the Middlesex Canal*, p. 5. This report was not found among the Corporate Records.

²⁸ Expense accounts, 1794, 1795; bills, Campbell and Kelso, March 16, 1797, James Winchester, March 13, 1797: Corporate Records.

ing instrument ever used in America.²⁰ Instruments of direction, many of them simple and crude, rather than instruments of elevation fulfilled the requirements of early American surveying.⁸⁰ Water levels in various simple forms had been used by surveyors in Europe since the days of Vitruvius (63 B.C.—14 A.D.).⁸¹ It is thought that spirit was first used for a level in the year 1775 by Felice Fontana (1730—1805).⁸² That a spirit level combined with a telescope should not reach America before the last decade of the eighteenth century is, therefore, not surprising. The first fruitful use of this instrument, Weston having employed it previously in Pennsylvania, was in the location of the Middlesex Canal.⁸³

Before the borrowed instrument was returned, however, James Sullivan had imported two leveling instruments and two rods from England. Captain Scott had sailed carrying instructions to "add Mr. Weston's own words in writing . . . for a better understanding of the kind wanted: A Y Level with achromatic Glasses similar to that made for Mr. Weston. Mr. Troughton Mathematical Instrument Maker, Fleet Street, London."⁸⁴ Surveying instruments of that day could not have been purchased of a better firm. Successors to Wright and Cole, the Troughtons had set up at "Ye Orrery" in 1782. The firm was soon composed of Edward

²⁰ C. F. Adams states, "It is said that the first leveling instrument ever made use of in America was used in the location of the Middlesex Canal," *Memorial History of Boston* (1881), IV, 112. Adams refers to C. B. Stuart, *Lives and Works of Civil and Military Engineers of America* (1871), p. 129, who gives as his authority Gridley Bryant, engineer of the first railway in America, quoting a letter of February 1859. Weston first arrived in this country January 1793 (Davis, *Essays*, II, 153).

⁸⁰ See John Love, *Geodaesia, or The Art of Surveying and Measuring Made Easy* (1720); also Robert Gibson, *A Treatise of Practical Surveying which is Demonstrated from Its First Principles* (1798).

⁸¹ An excellent account of early surveying instruments is contained in R. T. Gunther, *Early Science in Oxford* (1923), I, 325-377. One of the oldest telescopic levels is that made by I. Rowley for Sir Isaac Newton in 1703, the year the latter became president of the Royal Society. It contained a water bubble. It is extant in Trinity College, Cambridge (Gunther, *Early Science*, I, 330).

⁸² Gunther, *Early Science*, I, 325-377.

⁸³ Weston returned to England about 1800 after working for the New York canal companies. Unable to find an experienced American engineer, the directors of a New York company discussed the need of recalling him to make certain instrumental examinations. A leveling instrument they had, possibly purchased through Weston, but no one seemed competent to use it. After some difficulty, Judge Benjamin Wright was found for the task in 1803 (Stuart, *Civil and Military Engineers*, p. 52).

⁸⁴ "Copy of Memo. for London for Capt. Scott," 1794: Baldwin MSS.

and John, brothers, and Edward, an uncle. Edward Troughton (1753-1835) was a principal leader in the development of the level combined with the telescope. In his hands it became an instrument of great precision.⁸⁵ The instruments imported for the Middlesex Canal were brought to Boston in November 1794. By error they were shipped on to Portsmouth, and some delay occurred before they were in use.⁸⁶ The total cost for the two sets, including commission, insurance, freight, duty, and exchange was \$163.35.⁸⁷

The note of optimism evident in the Colonel's report on his return from the south was sustained by the arrival of the English engineer, who reached Boston July 13, 1794. Baldwin and Jaques were a committee "to attend him during his survey and observations relating to the canal."⁸⁸ A few days later, with "three Horses and Phaeton," Baldwin, Weston, "his Man," and others proceeded to take an "Ocular Survey," dining eleven strong at Ichabod Parker's on "Rost Chickens, Lamb and Fryd Fish" and two

⁸⁵ Gunther, *Early Science*, I, 186, 330. John Troughton, instrument maker, was made an honorary member of the Society of Civil Engineers at its founding in London, 1793 (John Smeaton, *Reports Made on Various Occasions, in the Course of His Employment as a Civil Engineer* (1837), p. xxii). In 1826 Edward Troughton took William Simms (1793-1860) into partnership. James Simms, son of William, became proprietor of this firm (Gunther, *Early Science*, I, 186). See also *Encyclopaedia Britannica* (11th ed.), for Edward Troughton.

⁸⁶ Expense accounts, October, November 1794, paid Dec. 29, 1794: Corporate Records.

⁸⁷ "1794, Dr. The Proprietors of the Middlesex Canal to James Sullivan

to 2 Spirit Levels	£25 - 4 - 0
to 2 station staves for Do.	2 - 12 - 6
to postage paid James Scott	- 1 - 1
to paid expense of Shipping	- 3 - 1
to commission & Insurance	4 - 4 - 6
	<hr/>
Sterling	32 - 5 - 2
to exchange	10 - 15 - 1
	<hr/>
Lawful Money	43 - 0 - 3
to freight	- 10 - 4
to Impost paid	4 - 19 - 2
to paid Oliver Hartshorn for room & fire	- 9 - 0
	<hr/>
	£48 - 19 - 9 *
	\$163.35 *

 In Dollars
paid Jan. 12, 1795." (6/ lawful money to \$1.00.)

* Slight errors in addition and exchange.

⁸⁸ Eddy, *Historical Sketch of the Middlesex Canal*, p. 5.

"dubble bowls" of punch.³⁹ A Baldwin boy was then sent on horseback to Judge Winthrop's in Cambridge for the plans and papers of the former surveys, to return with them to Billerica, where the party was staying. The work began in earnest with the purchase of "Imperial paper for Plans" and "16 bottles of Porter @ 1/9 [29 1/6¢] for Mr. Weston." Nine days with horse and chaise, Cyrus carrying the station staff and Benjamin Franklin Baldwin the chain, Weston and the committee went carefully over the line.⁴⁰

On August 2, 1794, the English engineer presented a report⁴¹ which, although it possessed "much candour and fairness," was "too general to afford much information."⁴² Important matters were left for future decision. The engineer discussed two alternative routes for the portion of the line from Wilmington to south of Woburn, balanced the advantages and disadvantages of each, inclined toward a recommendation of the more easterly of the two (which passed through the towns of Reading and Stoneham), but finally left the matter open.⁴³ The report recommended that the work be done by contract jobs, stated that the canal was feasible, and estimated the cost of the undertaking at £100,000.⁴⁴ The

³⁹ Expense Accounts, 1794, 1795; Tavern Bills, July 1794: Corporate Records. The dinner for eleven persons cost two shillings (33 1/3 cents) per cover. This was a feast. Cf. "Prop. of Middlesex Canal to Reubin Durin [?], Dr. July 1794:

to entertaining Mr. Weston and his assistance while servaying the Canal:

to 94 meals of vituals @ 1/	4 - 14 - 0
to 5 mugs of flip and tody @ 10d.	4 - 2
to 22 lodgings @ /4d.	7 - 4
to carrying dinners into the wood	6 - 0
to cash paid for paper	1 - 10
to Horse Keeping	14 - 0
to my serveses 8 Days @ 6/	2 - 8 - 0

£ 8 - 15 - 4"

These meals are at 16 2/3 cents each.

⁴⁰ Expense accounts, Vouchers, 1794: Corporate Records.

⁴¹ Baldwin MSS.

⁴² This criticism was made by the English engineer, John Rennie, to whom the report was forwarded in 1798 (Rennie to William Vaughan, Edinburgh, Sept. 6, 7, 1798, copies: Corporate Records). See below, p. 107. Contrary to Weston, Rennie, as far as he could judge from the report, favored the western route which was finally taken.

⁴³ Reports, November 1794, May 1795, June 6, 1795: Baldwin MSS.

⁴⁴ If sterling, this amount equals \$444,444; if lawful money of Massachusetts, \$333,333. Apparently the estimate is expressed in lawful money (see below, p. 114).

estimate covered, however, merely the seventeen miles between the Merrimack and Mystic rivers.

Of the two proposed routes from Wilmington to south of Woburn, the more easterly is, in general, that later followed by the Boston and Lowell Railroad;⁴⁵ the more westerly is that finally taken by the canal. Both were resurveyed by a committee in November 1794 and in May and June 1795. The committee aimed "to preserve the longest possible Level, in the shortest possible course, [and to] unite as many links as possible, with the least possible Expenditure." Their conclusions, finally adopted, gave the decision to the western route, as it saved three or four public bridges, two or three culverts, and two aqueducts, and concentrated the major descent in a series of six locks at Horn Pond, thus providing longer uninterrupted levels.⁴⁶ The eastern route had the disadvantage of entailing payment of damages to a number of mill owners and met the protest of the scattered country people through whose lands it had to pass. Inhabitants of the towns of Reading and Stoneham had remonstrated strongly to the General Court. On the other hand, "The Inhabitants who are thickly settled on the West generally approve the plan"; and "far the greater proportion for six miles altogether have given of their land."⁴⁷ In consideration that the canal be cut on the western route, several hundred days' work were subscribed to be done gratis. These matters were of some influence in the decision, yet some who promised land at this time later refused to ratify their gifts, and labor subscriptions were found difficult to collect.

Weston likewise presented his bill for services at this time: For six weeks loss of salary from the Board of Managers of the Schuylkill and Susquehanna Canal, \$933.33;⁴⁸ traveling expenses,

⁴⁵ A branch of the present Boston and Maine, known as the Woburn Loop, follows in part the western route.

⁴⁶ Report of November 1794: Baldwin MSS.

⁴⁷ Report of November 1794: Baldwin MSS.

⁴⁸ This amount is reached as follows: Salary with Schuylkill Canal, £140 sterling per month for 1½ months = £210 sterling; plus a third to change to lawful money = £280 lawful money; changing to U. S. currency at the rate of 6/ to \$1.00 = \$933.33. This was the customary method employed in Massachusetts at this time to change sterling to dollars; a more direct method would be to change pounds to dollars at the rate of \$4.44 to the pound sterling, the ratio at which the Spanish dollar was valued at the London mint. The Act of Congress of April 2, 1792, made

\$174.60; six weeks' service in the employ of the Middlesex Canal, \$1,000. This made a total of \$2,107.93, a large stipend for the times. Weston arrived on July 13 and signed the receipt for this sum on August 3 — not three weeks of work for the corporation. He stated in his bill for services that his salary with the Schuylkill Canal was £140 sterling per month; that is, £1680 sterling or \$7,467 United States currency per year. John Rennie (1761–1821) advised the directors of the Middlesex Canal with reference to sending over an engineer from England:

A person capable of projecting and superintending the execution of a work of this sort may be had for about £800 to £1000 [\$3,556 to \$4,444] per annum. One capable of superintending but not of projecting a Canal and designing the different works may be had for about £300 [\$1,333] per annum.⁴⁹

Weston found the American demand relatively profitable.

The Middlesex directors were not loath to pay his bill. They passed it without quibble and ordered that their

thanks . . . be given him for his assiduity in the business and that they hope that the corporation may depend upon availing itself in future of his skill and ability in the progress of this important concern for which his compensation shall be made agreeable to him.⁵⁰

The contributions of the English engineer appear to have consisted chiefly in inspiring confidence in the feasibility of the plan and in instructing the Americans with reference to surveying, leveling, and the factors to be considered in forming judgments in canal engineering. Weston sent advice by letter on several occasions thereafter, but he never returned to aid in the progress of construc-

the American dollar conform to the average coin value of the Spanish dollar. If exchange were calculated at the ratio of \$4.44 to the pound sterling, the salary of £210 sterling would become \$932.40, instead of \$933.33.

"In computations of exchange with England, the Spanish dollar was uniformly estimated at 4s. 6d. . . ." (C. D. Wright, *History of Wages and Prices in Massachusetts, 1752–1883; Including Comparative Wages and Prices in Massachusetts and Great Britain: 1860–1883* [1885], p. 43.) If we add 1/6 (1/3rd) to 4/6, this gives 5/6 to the dollar, lawful money of Massachusetts.

⁴⁹ Rennie to William Vaughan, London, March 6, 1798, copy: Corporate Records.

⁵⁰ Order of the directors, noted on the bill for services, Aug. 2, 1794; vouchers: Corporate Records.

tion. His levels were accurate, however, and for this rare service the promoters had good reason to be grateful.

The preliminary hesitation was now over. The directors reached an agreement on part of the route and decided to start construction immediately. The elaboration of a plan known as "The System," for governing the conduct of the work, was considered a first essential. The experience of the directors in issuing instructions to shipmasters, in managing their stores, and in ordering and checking governmental payments and contracts doubtless exerted a guiding influence in the preparation of a plan of internal organization. No comparable undertakings in Massachusetts, with the exception of certain bridge companies, had been developed to serve as models.⁵¹

Stated quarterly meetings of the directors and a yearly meeting of the proprietors were arranged. In practice the directors met more frequently. Committees of the directors were formed — a committee on accounts, a committee on the purchase of land, and, more important, the committee of operations. To these should be added a host of committees formed from time to time to consider minor or temporary matters. The directors or the committee of operations discussed details of problems at their meetings at Union Hall in Medford, at Paul Wyman's in Woburn, at the County Court House or the Branch Bank in Boston, and frequently at Judge Sullivan's office on Summer Street, when called together there "at candlelighting" in the evening.⁵² To these conferences came John and Benjamin Joy, William Smith, Thomas Welsh, Joseph Coolidge, Aaron Dexter, and several others.

The undertaking summoned to coöperation the most varied talent of the Boston of that day. An example of this collaboration may be given: On September 12, 1795, Dexter, Gore, with the superintendents — there were then three — were a committee "to make a contract with some persons to lay Stones for the Locks" on the Merrimack. Here, conferring over a contract, were the

⁵¹ Davis, *Essays*, II, 22 ff.

⁵² Bills for room rent, vouchers: Corporate Records; letters arranging meeting: Corporate Records, Baldwin MSS.

Erving Professor of Chemistry and Materia Medica at Harvard College, the capitalist Gore, shortly to enter on his service as American Claims Commissioner in London, Colonel Baldwin, Samuel Jaques, and Jonathan Thompson, a practically minded, yet barely literate man in immediate charge of the work on the locks. Agreement was reached with Bemis and Stearns, "Stone Layers," and the document of September 28, 1795, bears all their signatures.⁵⁸ The directors of this corporation perpetually directed. Such practices were an effective cause of the successful completion of the canal. Careful supervision and sustained effort were needed to compensate in part for deficiencies in experience and in technical skill.

"The System" provided that all contracts should be drawn in writing when the value of labor or materials involved was over \$100. Sureties for performance were to be taken for all contracts exceeding the value of \$1,000. No contract over \$500 might be concluded "unless advertisements [should] be first made in two of the Boston Newspapers," requesting bids in writing. The superintendent or agents should make no contract in which they were directly or indirectly "interested or concerned otherwise than as agents of the corporation." All contracts made contrary to this rule were to be deemed void, and each contract was to have "a proviso for that purpose inserted in the body of it."

It was the duty of the superintendent "to give his whole undivided attention to the business of cutting and completing the canal," receiving his general instructions from the committee of operations. He could make contracts not exceeding \$100, binding without the approval of the directors or their committee, and not exceeding \$1,000, binding after such approval. He might appoint agents under him after receiving permission in writing from the president or one of the vice-presidents. He and his agents were to engage and direct the carpenters, blacksmiths, boatmen, stonecutters, stone layers, teamsters, or other workmen; to keep accounts of all tools, contracts, persons employed, and materials on hand; and to make monthly or in some cases weekly returns

⁵⁸ Votes of directors and contracts, 1795: Baldwin MSS.

and reports.⁵⁴ The superintendent's salary was fixed at \$1,000 per year, paid quarterly;⁵⁵ he could not serve as a director.

Such preconceived systems have an air of partial unreality about them. They are inevitably somewhat modified in practice. The disinterested proviso to be embodied in each contract seems to have been generally omitted after the first few agreements. There is, however, little or no suspicion of corrupt contracts. The committee on accounts, composed generally of three directors, did its work well and seems to have checked over every voucher. Sureties for the performance of contracts over \$1,000 were not usually required; the provision was no doubt impracticable. But the strict regulations had some effect and were followed in part. They probably contributed toward assuring the care in expenditure that characterized the acts of servants of the corporation.

The reply of Baldwin to the offer of the place of superintendent contained a protest against the elaboration of checks on the active men in the undertaking:

... our System I fear is rather to rigid a round of set rules for the Present occasion and savours, too much, I think, of the orders frequently given to Sea captains . . . to be executed in a foreign country where new orders or directions according to the varying circumstances must be had, therefore it has become a Maxim to obey orders if they break their owners which I conceive the present enterprize doth not require.

It is not limeting an agent to make contracts under one hundred dollars, it is not requiring weekly or monthly returns should be made and providing a clause shall be inserted in every contract [making] the agent disinterested that will insure success . . .

If integrity, Oconomy, and Enterprize are not in him and everywhere about him in such a large & Extensive a work, it will not prosper and then it will want the constant aid and support of the Directors & at some time perhaps of the whole body of the Proprietors.⁵⁶

Within fifteen years a system of management with greater concentration of responsibility emerged in this corporation. In the

⁵⁴ "The System," September or October 1794; committee report, changing "The System," April 17, 1795: Baldwin MSS.

⁵⁵ An appreciable sum. The President of Yale College received at this period a salary of \$1,000, plus a fee of \$4.00 for each diploma granted (W. W. Jennings, *A History of Economic Progress in the United States* (1926), p. 118).

⁵⁶ Baldwin to directors, October 1794, copy: Baldwin MSS.

interval, however, there were various experiments. The first year there was one superintendent, the second year three, then one again; along with these were different subordinate or partly subordinate offices — “overseers,” “agents,” “inspectors,” etc., — usually created directly by the committee of operations. These creations lived a while and died, and a new set would be formed the following year, involving somewhat different duties and subordinated in whole or in part to the superintendent. The treasurer and clerk were independent officers responsible to the directors. The former, although a director, performed continuous practical duties in relation to finances, keeping accounts and fulfilling in part the functions of paymaster, in which he was assisted by the clerk. Baldwin continued as superintendent. He received his general instructions each spring from the committee of operations and detailed orders and interference throughout the year from various committees of the directors. These last, as well as changes in his instructions, he sometimes resented.

In January 1798 he requested general instructions as early as possible,

so as to have no restraint on the mind of the superintendent in the first setting out, for there will always arise contingent embarrassments enough for him to encounter without old plans to alter and new ones to adopt. It will be well to have the first systems so fully digested as to require as few successive external regulations and instructions as the safety of the proprietors will admit. it is inconceivable how much such things embarrass. waiting for orders, expecting or realizing a change in the arrangements [or] operations confounds, obstructs, and defeats.⁵⁷

The tempers of those engaged on the canal were well frayed before the completion of the undertaking. The superintendent was the type of executive who wishes every item to come under his direction and decision. Of a similar inclination were many of the directors. Difference of opinion and friction developed, culminating in March 1803, when Baldwin made the following entry in his diary: “Canal Meeting at Boston — did not attend — pretty much determined to quit the Canal.” This decision was averted by James Sullivan through a letter of characteristic diplomacy and eighteenth-century rhetoric:

⁵⁷ Baldwin to directors, January 24, 1798: Baldwin MSS.

[I have learned, he states in effect, that you are dissatisfied with the orders and regulations and have] a wish to assume every burden in the extensive business and a sense of fatigue under the pressure of the whole. This is natural to me from my information in the business, and *from my knowledge of you.*

I am well assured of your firm attachment to this magnanimous enterprise, and have no fear, that you will ever, with premeditation, abandon a project which is so dear to you; and from which you have derived to yourself so much honour. But the swelling of a small seed produces a huge tree; and a drop, you know, may be rarified to burst a flinty mountain.

In the first place, there never was a distrust, or discontent in the minds of the Directors with you as an artist; nor had they ever, for a moment a want of confidence in you in regard to your attachment to the project, as a projector, or as to your integrity as a man . . .

Your zeal and the ardour of your spirits push you forward, to be everywhere, to effect everything, and to originate and terminate every point. We consider your abilities and life of too much consequence to the great design, to allow you to indulge yourself in this way. No man on earth can be equal to such a task; and yet you think hard of us for not being willing you should attempt it . . .

It is enough for you to give the carpenters the dimensions of the timber they are to use, and the position and organization of the works they are to erect. To give the spade men the level of their trenches and the direction and elevation of their banks. The stone layers the bottom and top of their walls, and the canal formers their windings and their slopes. To prepare descriptions for boats &c—and to give directions for an effectual perfection of the works on the extensive line.—To request or even to allow you to toil below this, would be degrading the rank your studies have raised you to . . .

Let me, therefore, not as a canal proprietor, but as a private and bosom friend, beseech you to lay aside all the feelings of an undue jealousy, and to unite with us in that harmony, confidence, and cheerfulness which have attended us for ten years. Let us in this year, which comes with its handful of laurels for our brows, pursue our enterprise in such a manner as to cast all our opponents in the background, gratify our families, friends, & connections, and be ready to maintain our rightful claim to the character of our country's benefactors.

I am, Sir, with great sincerity your friend,

James Sullivan.⁵⁸

The threatened withdrawal did not take place, and the dependence of the superintendent on frequent orders and instructions

⁵⁸ Sullivan to Baldwin, March 11, 1803: Baldwin MSS.

from directors continued. The undertaking, however, was nearly completed.

While friction between an executive and the directors who employ him is hardly unusual, the intimate coöperation of directors with foremen, engineer, and superintendent indicates here the carrying over into the corporate form of the psychology of the individual proprietor. Management indeed was uncertainly feeling its way at the time toward its particular sphere. The concern of committees with the minutiae of the business, although viewed by the engineer as "officious and interfering conduct," nevertheless contributed no little toward a fruitful issue. The recurring friction and the frequent provisional experiments in organization reflect rather the primitive state of the technique of coöperation for a work of any magnitude. Methods of coöperation and habits of efficient coördination of functions, accepted today for large enterprises, represent an achievement brought forth only by such travail as is evidenced in the early experience of this business corporation.

CHAPTER V

CAPITAL EQUIPMENT, CONTRACTORS, AND LABOR

ON SEPTEMBER 10, 1794 Baldwin turned the first sod. Others followed, each of whom pronounced a sentence chosen for the occasion. "May the Eye of Wisdom and the Eternal Mind aid this work designed for the benefit of the present & all Future Generations," prayed the Colonel. "May sloth be buried under this bank & no resurrection happen; & may enterprize spring up from this opening for the general Good of Mankind," contributed Jaques. "May Providence give eternal prosperity to this Canal," — with these words Judge Winthrop closed the ceremony.¹ Here was a flourish, but not a mere flourish. These men were conscious of their mission, and a continuing sense of public service was a characteristic that accompanied much of their practical activity.

The requirements for the undertaking were simple. A blacksmith shop, a sawmill, wheelbarrows, gunpowder, and hand tools constituted the principal capital equipment. Henry Putnam received \$200 "for his services in purchasing the Mills and Farms of Thomas Richardson in Billerica";² and here was built the company's first blacksmith shop. A master carpenter spent a month making wheelbarrows and other tools, "the best foreign gunpowder" was purchased,³ and the digging was properly under way. The first obstacle, a rock formation, required "blowing" and "drawing stones from the ledge."⁴ A premature explosion oc-

¹ "Sentiments on turning a sod," Sept. 10, 1794, memorandum in Baldwin's handwriting; Baldwin diary, Dec. 31, 1803: Baldwin MSS. Obituary, *Columbian Centinel*, Nov. 21, 1807. See Appendix F.

² Votes of directors, Nov. 24, 1794; vouchers, November 25, 1794: Corporate Records. The price paid for this property was \$6,265.

³ Vouchers, September, October, November 1794: Corporate Records.

⁴ *Ibid.*

curred, which injured four workmen.⁵ The results were meager the first year, for the season was so far advanced that little could be done except to purchase materials and to make contracts for future operations.

A year later, when the excavation and embanking were proceeding apace, the equipment had grown considerably. A return of tools⁶ gives in detail the instruments used in construction of the canal:

A RETURN OF TOOLS AND ARTICLES BELONGING TO THE PROPRIETORS OF
THE MIDDLESEX CANAL, OCTOBER 17, 1795

by Col. Baldwin

Canaling Tools, &c.	Blacksmith Tools, Stock, &c.
230 Wheelbarrows	2 Blacksmith Shops
274 Shovels	3 Forges or Fireplaces
49 Spades	2 Anvils
43 Pickaxes	2 Vices
41 Broad Hoes	11 Tongs
20 Narrow Hoes	2 Pookers [pokers]
6 Mattocks	2 Slices [slice-bars?]
51 Crowbars	11 Hammers
17 Axes	3 Sledges
10 Grab Hooks	39 Handrills, Punches & Chizzles
230 Wheeling Planks	25 Files
3 Ditching Knives	9 Small Punches, &c.
4 Sythes	2 Screwplates
2 Pitchforks	2 Pincers [pincers?]
3 Bettles [beetles]	5 Heading Tools
4 Wedges	1 Brest bits
Tools for Blowing Stones	4 Stamps & Brands
5 Chum Drills	1260 Pounds of Iron
31 Small Drills	106 Pounds of Steel
17 Hammers for Drilling	91 Spikes for Boat
5 Spoons & Worms	30 Bushels of Charcoals
5 Rammers	none Sea Coals
2 Priming Wires	

⁵ Baldwin diary, Nov. 1, 1794: Baldwin MSS.

⁶ Capitalization in this table has been systematized. Copies of the "Return of Tools": Baldwin MSS, Corporate Records. A "Return" of Jan. 11, 1800, showing tools in work and in stores, and tools wanted, gives no article not listed above except "Tampers."

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Tools for Splitting Stones	Carpenters Tools, &c.
5 Stone Hammers	3 Broad Axes
1 Picks	3 Hand Saws
41 Steel Chizzles	1 Back Saws
104 Wedges	1 Crosscut Saws
8 Hammers	2 Jointers
Miscellaneous Articles	3 Foreplains
4 Oxen	1 Smoothing Plains
1 Carts	1 Halving Plains
1 Yoaks	1 Rabbet Plains
2 Chains	5 Carpenters Chizzles
8 Stone Planks or Drags	6 Joiners Chizzles
8 Boats	2 Gouges
1 Boats on the Stocks	5 Augers
20 Thousands of Bricks	1 Squares
8000 Thousands, of 27 & 3 Inch	2 Compases
Oak Planks *	1 Addices [adzes?]
4000 Thousands of Boards *	3 Shares [shears?]
20 Pounds Gunpowder	4 Hammers
2 Spirit Levels with Station	7 Gimblots [gimblets]
Staves in Setts	1 Holdfast
24 Field Beds	1 Fraws [?]
20 Tow Cloth Bed Sacks	2 Mason Trowells
40 Tow Sheets	6 Iron Dogs for Saw Pit & Run
2 Bolster Cases	Work
16 Pillow-Cases	4 Grindstones
9 Old Sails	
3 Remnants Tow Cloth	
4 Pails	
2 Barracks	
1 Chimney Crains	
none Hooks	
4 Pots	
1 Kittles	
1 Tongs	
1 Fire Shovel	

[* Board measure]

Men of New Hampshire and of Massachusetts directed the construction of considerable sections of the trough of the canal under contracts with the company. Granted the inexperience of the time in organizing work on a large scale, it is difficult to conceive of any other possible method. English practice had proved

that the canal company itself should undertake to build all the more hazardous parts of the work, but the engineer's report recommending contract jobs neglected to emphasize this qualification.⁷ Failure adequately to regard this factor caused delay and difficulties with contractors.

Local landowners frequently undertook the building of the section of the canal running through their lands, an admirable arrangement in many respects. The degree to which they and other contractors were severally financed by advances of money as the work progressed varied widely. The company seldom advanced more than a sum equivalent to the value of the length of line already completed. "Canalling tools" were usually, although not always, furnished by the corporation.

Honorable Gentlemen [runs one letter], we have Concluded to make your Canal from the Road Leading from Medford to Boston, that is to say Job No. 1 and 2 . . . for sixteen Dollars per Rod and you to find Carts and Barrows and other tools as Usual Delivered upon the Jobs.⁸

An agent of the corporation checked over the tools returned on completion of a job and drew on the treasurer for the balance due the contractor.

The agreements were in general of identical form, but special clauses were in some cases introduced. Late contracts show the fruits of experience in the stipulation that if a solid ledge of rock be found, the agreement should be void for the distance covered by the obstruction. In the case of banking jobs, special provisions governed the construction of "puddle gutters."⁹ Unusual was the specification that the contractors should furnish themselves with "wheelbarrows, wheeling plank, shovels, pickaxes, bailing buckets, etc."¹⁰ The early printed forms contained the proviso: "if any stone is found in the course [of the canal], that two men cannot lift into a cart, then the . . . Proprietors are to blow the same at their own cost until two men can lift them as aforesaid." It was early changed to read: "if any stone is found in the course

⁷ Rennie to Vaughan, Edinburgh, Sept. 6, 1798, copy: Corporate Records.

⁸ Mills and Tenny to Middlesex Canal Company, March 25, 1803: Corporate Records.

⁹ For a description of "puddle gutters" see below, p. 90.

¹⁰ Contract with William and Seth Lawrence, Aug. 26, 1803; Baldwin MSS.

thereof, that two pair of oxen cannot draw out, then the . . . Proprietors are to blow the same until two pair of oxen can draw them out or else to add more help of oxen suitable to draw them, at their own choice."¹¹

There follow summary tables¹² of the statistics of seventy contracts covering over ten miles of construction:

10 MILES 264.8 RODS OF THE MIDDLESEX CANAL DISTRIBUTED BY CONTRACT COST PER ROD

Cost per Rod \$	No. of Rods	% of Total	No. of Contracts
1.00- 4.99	80	2.3	1
5.00- 9.99	544	12.8	14
10.00-14.99	1982	57.2	22
15.00-19.99	92	2.7	4
20.00-24.99	45	1.3	2
25.00-29.99	356.8	10.3	6
30.00-34.99	95	2.7	10
35.00-39.99	4	.1	1
40.00-44.99	85	2.5	4
45.00-49.99	14	.4	1
50.00-54.99	0	.0	0
55.00-59.99	0	.0	0
60.00-64.99	146	4.2	1
65.00-69.99	21	.6	1
Total	3464.8	97.1	67

The period covered by this table is from 1795 to 1803. Over 70 per cent of the distance covered by these contracts was constructed at a cost of less than \$15 per rod. This comprised the lighter excavation, simple digging with a shovel. Where the ground was harder and pickaxes were constantly needed, the cost mounted. The highest costs, however, were incurred either for embankments or for cutting through ledges of rock. It was roughly estimated that embankment cost three times as much as excavation.¹³ With the rise of wages in the later years, there was a tendency for the cost of comparable work to become higher. In part, also, the rise of costs as the years passed was related to an increasing emphasis on speed of construction.

¹¹ Contracts: Baldwin MSS.

¹² These tables are compiled from collections of contracts in the Baldwin and Frothingham MSS and from vouchers in the Corporate Records.

¹³ J. L. Sullivan to DeWitt Clinton, March 7, 1817: *Official Reports of the Canal Commissioners of the State of New York* (1817), p. 132.

THE MIDDLESEX CANAL

CONTRACTS COVERING 11 MILES 189.3 RODS OF THE MIDDLESEX CANAL
DISTRIBUTED BY SIZE OF CONTRACT

Contracts for Rods	No. of Contracts	No. of Rods	% Rods of Total
1- 9	20	100.3	...
10- 19	13	186.0	...
20- 29	9	196.0	...
30- 39	5	166.0	...
40- 49	3	124.0	...
1- 49	50	772.3	20.8
50- 99	6	361.5	9.7
100-149	5	566.0	15.3
150-199	2	342.0	9.2
200-249	2	472.5	12.7
250-299	2	545.0	14.7
300-349	2	650.0	17.5
Total	69	3709.3	99.9

Of the number of contracts here considered, 72 per cent were for lengths of construction under fifty rods. These account, however, for but 20.8 per cent of the distance. The larger contracts, over fifty rods, 28 per cent of the total number, represent 79.1 per cent of the distance, while the six largest contracts cover a little over five miles of canal. That the canal was mainly constructed by the relatively larger of these small contractors is brought out more clearly in the following table:

PRINCIPAL CONTRACTORS	No. of Rods	No. of Contracts
Roger and John Chandler of New Ipswich, N. H., yeomen (476 rods) (John Chandler alone 332 rods)	808	4
Benjamin Dowse of Billerica, Mass., yeoman (first contract with gentleman partner; others alone or with his son)	398	5
William Jay and Timothy Hunt, laborer, of Wilmington or Woburn, Mass.	338.5	2
Philip Mills and Joseph Tenny, yeomen	295	1
William Richey of Windham, N. H., and John Mahaney, yeomen	244	1
Hall and Eliot	182	1
William Richey of Windham, N. H., and Jacob Shed of Pelham, N. H., yeomen	170	2
John Kean of Medford, Mass., laborer	160	1
Total	2595.5	17

The extent of the canal constructed by these eight contractors, operating under seventeen agreements, represents 70 per cent of the 11 miles 189.3 rods analyzed in the previous table.

DISTRIBUTION OF 70 CONTRACTS FOR CONSTRUCTION OF THE MIDDLESEX CANAL
BY STATUS OF CONTRACTORS

Status of Contractors	No. of Contracts
Yeomen	36
Laborers	8
Clothiers	5*
Weavers	1
Seaman and Housewright, partners	1
Yeoman and Gentleman, partners	1
Status not specified	18
	—
	70

* Five contracts with Sprague, clothier.

The work was thus mainly done by the yeomanry, small land-owners or farmers, who contracted to build specific lengths. This class had had experience in digging ditches, draining meadows, and removing stumps, roots, and stones from their rocky farms. They possessed, however, no important financial resources, and few of them expected to give undivided attention to the work of building the canal. Their competing vocations interfered with the pace of construction.

The delays on the jobs were a source of annoyance and expense. The contracts were seldom fulfilled on time. Baldwin's report to the directors in November of 1797 on the state of the work east of the Concord River indicates a condition that was chronic. All of the ten jobs there considered were to have been completed by the spring or early summer of 1796. A year and a half later only two were finished, and the rest were from a sixth to a third incomplete. The Colonel added: "There has been very little work done on the above mentioned Jobbs for about a year past."¹⁴ The committee of operations discussed this recurrent difficulty in a report of 1801:

¹⁴ Report, Nov. 17, 1797: Corporate Records. An "Account of Subsisting Contracts," Feb. 7, 1797, had considered fourteen jobs, all to have been completed before July 15, 1796. Six months after the appointed time, although twelve contracts were from 5/6 to 9/10 complete, two were only half finished (copy: Baldwin MSS).

The idea of having the interest of such a capital lying dead has been felt by the Committee and they have made every exertion to carry on the business. There is no way to do it but by Jobs. The contracts have not been complied with generally from the circumstance that labourers could not be obtained. A contention with the undertakers would only retard the work. Threatening and coercive measures have been adopted wherever they could be useful.

Similar complaints were voiced in the year 1803: "the time for perfecting their work is expired and the business is very far from being done."¹⁵ The contentions of the contractors that they were waiting for tools or for a description of the route led the committee to write Baldwin for an answer as to how the work should be speedily completed. The harassed superintendent replied: "I shall not attempt to describe the agitation of my Spirits only say . . . that my mind has to fly like the chareats of Amminadib to keep pace with the avocations that constantly await me."¹⁶ Responsibility for the delay he placed in part on the contractors and in part on the members of the committee because of their failure to reach a decision on a disputed section of the route, three surveys of which he had sent them. Repeated disagreements of this nature indicate that an effective technique of coöperation within the company was lacking.

The contractors, however, were frequently the chief sufferers from adverse conditions. Unforeseen obstacles burdened them with important losses. Hall and Eliot, and John Kean, among the larger contractors who employed numbers of workmen, were compelled to ask relief from the proprietors when their agreements proved unprofitable. The case of Benjamin Dowse indicates this not infrequent source of disaster to the undertakers:

The petition of Benjamin Dowse humbly shews that he undertook to dig and make . . . [250 rods for \$13.50 per rod, which amounts to \$3,375]. That the work proved of a different magnitude from his calculations from obstructions that could not be foreseen by him. That instead of the sum the contract job . . . [has cost him \$4,592], beside his own trouble and attention to the taking care of it. He therefore

¹⁵ Committee to Baldwin, Aug. 23, 1803: Baldwin MSS.

¹⁶ Baldwin to committee, Aug. 23, 1803, copy: Baldwin MSS.

prays the said Proprietors to consider his case and to make him such further allowance as they shall find proper so as to save him and his family from distress which otherwise might come on them by his attention to the work of the Canal, the unknown disadvantages of which he did not and could not calculate against.¹⁷

Baldwin urged the deserts of Benjamin Dowse, Junior, who had "been indefatigable and labored hard in the Jobb and been much exposed to cold and wet." In suggesting a present, the Colonel thought "nothing could be more proper than clothes to warm those limbs which have suffered so much. . . ." ¹⁸ The directors paid Dowse an additional \$500 that his loss might not be so great and further ordered "that the superintendent make a present of a suit of Cloathes such as he may think most useful to Mr. Dowse son that assisted his Father in the Work."¹⁹ The order was construed liberally, and young Dowse received a complete outfit.²⁰

Neither workmen nor employers in this early period knew the ways of large-scale endeavor. Methods of working together under central direction were not generally familiar or accepted. This situation favored the attempt to accomplish much of the task by means of these small contract jobs. The plan presented difficul-

¹⁷ Petition, Oct. 20, 1797: Corporate Records.

¹⁸ Baldwin to directors, Oct. 23, 1797, copy: Baldwin MSS.

¹⁹ Report of committee, May 23, 1798, noted on the petition; acceptance of report by directors, May 25, 1798, noted on the petition: Corporate Records.

²⁰ Vouchers: Corporate Records: Sept. 17, 1798, "To Barney Smith, Dr. for 2 yds. broad Cloth for Benj. Dowse coat agreeable to vote of Directors @ \$4 . . . \$8.—"

Jan. 17, 1799, "To Timothy Foster, Dr.—

To making a suit of Cloth for Benj. Dowse, Jr.	\$3.33
To 1½ yds of casamer @ 15/	3.75
To a vest pattern	1.75
To Buttins for the suit	1.07
To linnen & other trymings	1.69
To Linnen & cambrick & th.d for a Shirt	2.43
To a pr. cotton Hse	1.42
To a pair of shoes	2.00
To a Hat	4.50
To a muslin handkerchief	0.50

\$22.44

paid June 4, 1799"

ties of its own. The organization of production on the individual job was defective. The lack of experience, the recurring shortage of labor, and the small-gauge character of many of the contractors operated to make the rate of progress both fluctuating and unpredictable.

It should not be inferred, however, that there were no organized gangs of laborers. The company employed groups in excavating and embanking as well as workmen engaged in preparing timber and stone, in making and mending tools, and in the construction or laying of culverts, bridges, locks, and aqueducts. The proprietors, not less than some of those who contracted to do specific lengths of the canal, were often seriously hampered by a shortage of hands. As reliable workmen sometimes later became contractors, the need of securing good men and accustoming them to the business was heightened.

Although men frequently worked by the day and by the week, the typical period of hire was the month. "Month men" usually agreed in advance to stay the season, which began when the weather cleared in March or April and lasted until the severity of the approaching winter in December, or even in late November, interfered with the progress of construction. The problem of seasonal employment, however, was not important. Directly, or indirectly through relatives, most of the workers were connected with the land. Either industry or agriculture could constitute a secondary employment to fill their spare time. Even in the winter there was work to be done in the country households.

The number of workmen required was not great, yet the local supply of labor was insufficient. In the late winter or early spring, advertisements were "sent to the printer at Amherst." It was there the *Village Messenger* was published, which went into the homes of the country folk. Appeals for labor were similarly carried in two Boston papers. The members of the committee of operations were mindful of the need for workmen and sent men out to the superintendent or overseers whenever they found them in the town. Some of these were newly arrived, hardy sons of Erin, who, though still far from dominating city politics, had already begun to dig Massachusetts ditches. The bulk of the labor, how-

ever, was drawn from numerous small villages in the back country of Massachusetts and New Hampshire.²¹

At a time of vigorous activity the superintendent was ordered to engage one hundred common laborers and forty carpenters. It is probable that at no one time did the company hire larger numbers of these types of labor.²² In addition, there were commonly employed a few blacksmiths and blacksmith's apprentices, boat-builders, boatmen, stone- and bricklayers, stone blowers, stone splitters, painters, pump makers, teamsters, millers for the grist-mills, men to tend the sawmills, a steward, overseers, clerks, cooks, and boys to carry rum.²³

At sunrise, before breakfasting, the men were at their work. During most of the months of the year their efforts ceased at sunset. The period allowed for breakfast and for the noon meal, in general, was solely the time necessarily consumed in eating. While the hot season lasted, however, an hour and a half of free time might be permitted at noon, in which case the hour for stopping work was extended to twenty minutes after sunset.²⁴ The heat of the year having passed, came the notice:

It is not expected that any class of workmen after this day will loose any time at noon except what may be necessary for to take their dinner.²⁵

Methods of control were gradually developed; and the company by strict provision for punctual and speedy meals, for get-

²¹ Vouchers, 1794, 1795; copy sent for insertion in the *Village Messenger* to run four or five weeks, March 5, 1798; advertising copy, July 23, 1800: Corporate Records. The two Boston papers were the *Columbian Centinel* and the *Independent Chronicle*. Reports, July 15 to Aug. 15, 1795, Sept. 12, 1795, Dec. 8, 1800, copies; order of directors, Dec. 12, 1800; advertising copy, March 4, 1801; letters introducing workmen: Baldwin MSS. Cf. Seth Johnson to Andrew Craigie, March 26, 1797: "is surprised at the character and number of recent Irish immigrants" (Craigie Papers, III, 103).

²² Regular, formal rolls of workmen apparently were not kept.

²³ Report, Oct. 17 to Dec. 1, 1795, number of men on rolls, 102, copy; "Memo. of no. of days worked in 1796," incomplete copy; votes of directors, Feb. 16, 1798, order employment of eighty-five common hands; "Orders and Instructions," 1799; "A Return of Workmen on the Line of the Middlesex Canal," Aug. 25, 1803, incomplete copy: Baldwin MSS. G. Sullivan, "Report of State of Canal," August 1803, 128 men on rolls: Corporate Records.

²⁴ "Articles of Regulations for the Workmen"; reports, Aug. 15 to Sept. 12, 1795; Dec. 2, 1796 to Jan. 6, 1797; Jan. 24, 1798: Baldwin MSS.

²⁵ "Orders and Instructions," entry, Aug. 31, 1799: Baldwin MSS.

ting the men up and out in the morning, and for the prodding attention of overseers endeavored to assure a full day's labor.

Pronouncements by the company on the necessity for order and decency throughout the works indicate that order and decency were not prevailingly evident. Drinking accompanied by disorderly conduct was occasionally the cause of dismissal of workmen. Under the pressure of the need for laborers the company was compelled to reemploy men so dismissed. Despite these facts, the impression is inescapable that the men were generally well-disciplined. They frequently worked with great good will.²⁶ Strict as it might attempt to be in its regulations, the company maintained toward employees an attitude consistently diplomatic. It ruled of necessity by reward rather than by punishment and was thus led to deal well with the workmen and to cajole them at times with little treats. Labor secured this measure of attention in part because it was scarce and in part because the simple assumptions of organized, impersonal discipline of laborers were not yet taken for granted either by the company or by the men.

With the exception of those whose homes were in the immediate neighborhood, workmen were usually lodged in the company's barracks. They slept in bunks on straw over which was thrown a piece of tow cloth. The living quarters at times were very unclean. A notice dealing vigorously and specifically with a range of abuses enjoined simple principles of hygiene. The workmen's fare under a boarding contract was described as "good and

²⁶ Sullivan to Hull and Pettingill, head carpenters, May 31, 1802: Corporate Records.

"Orders and Instructions"; "Articles of Regulations for the Workmen"; reports, Aug. 15 to Sept. 12, 1795; Dec. 2, 1796 to Jan. 6, 1797; Dec. 8, 1800; "Memo. of Supt. to Committee," May 27, 1802; copies: Baldwin MSS. The report of Dec. 8, 1800, outlines arrangements to be undertaken for the workmen for the next season, so that "everything shall be prepared for their accomodation & made as inviting as the nature of the thing will admit . . . by this we shall not only have a plenty of hands but we may likewise have a choice."

The memorandum of May 27, 1802 states: "The Workmen have exerted themselves of late & have with the greatest cheerfulness gone into the water many times up to their armpits & continued wet for whole days together . . . [The superintendent asks the directors if he may] . . . promise some kind of a treat . . . on the insuing 4th of July with liberty to suspend their work for a few hours on some part of the day to enjoy it. [Would not this] have a good effect in stimulating them to further Exertions." A labor problem artlessly simple!

wholesome." It consisted of bread, fresh and salt meat — one-third fresh to two-thirds salt — "a proper proportion" of the vegetables in season, with cider and beer at meal times and some beer at other times. The beer consumed should not exceed three or four barrels per month for about fifty men. When the company employed people to prepare and provide food the diet was somewhat more varied. In addition to the items already listed, the men then had fish at times in place of meat, and butter, sugar, chocolate, and Bohea tea — the cheapest grade.²⁷ The men "had their drink without hindrance to the business"²⁸ when regularly twice a day the cry of "Grog-O!" rang out along the line of work. The same diet and the same living quarters served for different classes of workmen, a fact that points to a high degree of social democracy among the skilled and unskilled laborers.

The rate for board was the same for all classes of workmen. A stable price, \$2.00 per week per man, ruled from 1795 to 1798. This obtained in the case both of those men who were boarded out in the neighborhood and of those who were fed in the company's barracks under a boarding contract. When, in some instances during these early years, workmen were lodged with local inhabitants but fed in the barracks, the price for lodging charged to the company was three cents a night per man.²⁹

In the year 1799, because of the tendency of the price of board to rise, the company instituted a system of providing meals through a steward and other employees. As the system was abandoned after a year's trial, it may be inferred that the anticipated saving was not secured. Thereafter, the cost of board began to mount, reaching \$2.50 per week in the year 1800. Both the com-

²⁷ Agreement by "Jeremiah Clap, Gentleman, and Jedidiah Wyman, Shopkeeper, to board and diet all men who may be employed by the month on the canal," Aug. 5, 1795; "Orders and Instructions"; "orders to Steward," May 31, 1799, copy: Baldwin MSS. "Directions to Steward of Canal," Jan. 11, 1799, copy signed by steward, Benjamin Fisk: Corporate Records.

²⁸ Report, Jan. 24, 1798, copy: Baldwin MSS. Vouchers, 1795-1798; committee report, Jan. 21, 1801: Corporate Records.

²⁹ Reports, July 15 to Aug. 15, 1795; Oct. 17 to Dec. 1, 1795; February 1797; March 30, 1798; March 24, 1800; "Orders and Instructions"; copies: Baldwin MSS. Votes of directors, Feb. 16, 1798; orders of committee of operations, April 2, 21, 1798; April 1, May 31, 1799; Aug. 25, 1800; accounts for boarding workmen, September, October, November 1803: Baldwin MSS.

pany and those contractors who employed labor were regularly paying \$3.00 a week for boarding men in the year 1803.⁸⁰ The work at this period was mainly on the line between Medford and Boston, nearer the latter town than it had previously been, and a growing emphasis on speed of construction was leading to a disregard of careful economies — two facts affording partial explanations of the higher price.

The price paid for common labor varied from year to year. There are a few instances, in 1794 and 1795, of men working for \$7.00 and \$7.50 per month.⁸¹ With the exception of the wages of boys, these are the lowest figures found. The following summary table⁸² gives the typical wages for common hands during the years of construction:

WAGES OF COMMON HANDS

Year	Typical Wage
1794	\$ 8.00
1795	8.00
1796	10.00-12.00
1797	10.00
1798	9.00
1799	9.00
1800-1803	11.00-14.00

These are wages per month exclusive of board and lodging, which cost \$2.00 per week per man from 1794 through 1799 and \$2.00 to \$3.00 from 1800 through 1803. With the exception of the years 1796 and 1797, the monthly money wage for common labor was roughly equivalent to the cost of boarding and lodging one workman one month.

The corporation was not without an articulate wage policy. For three years the price to be paid for common labor was fixed by a committee in the spring. The first of these years, 1797, Baldwin was ordered "to give not more than \$10.00 per month for Labourers."⁸³ Exceptions were made for stone blowers and blacksmiths, not properly included with common hands, but no excep-

⁸⁰ See note 29.

⁸¹ Except where stipulated to the contrary in the text or notes, it is to be understood that board and lodging were furnished all wage earners.

⁸² Vouchers: Corporate Records. Reports of the superintendent from 1795 to 1803 frequently state the current or average price paid for common labor. Copies of the reports are in the Baldwin MSS, some few originals in the records of the corporation. Votes and orders of the directors and committees make mention of wage rates for common hands.

⁸³ Committee to Baldwin, May 6, 1797: Baldwin MSS.

tion was made for teamsters. The superintendent found that he could not "get suitable men to drive teams, load & unload, under \$12.00 per month; or proper men to go in boats & handle Stone with dispatch, under \$12.00."⁸⁴

An attempt was made to limit wages of common hands to \$8.00 for the season of 1798. It was so ordered, but when the superintendent informed the men, a number withdrew. Of those who remained Baldwin stated: "Several of these hands I am sure will not suit us, and several others don't chuse to engage for the season."⁸⁵ In April the committee voted: "That the order for wages continue, excepting that where it may be necessary to procure good hands for extraordinary parts of the work, there be allowed not exceeding \$10.00."⁸⁶ As the limit of \$8.00 continued to act as a hindrance, the committee raised it to \$9.00 in May, but voted that the increase be kept secret and instructed Baldwin: "inform such men as you agree with at nine dollars a month that it is done under the expectation of their being peculiarly faithful and diligent in the works. We think nine dollars, as money is very scarce, great wages for good men."⁸⁷ Difficulty in retaining laborers was encountered in July. Farmers came at this busy season of the year and offered the men from \$12 to \$18 per month.⁸⁸ Although they had contracted to continue through the season, a number of laborers left the work.

In the year 1799 the authorized wage was \$9.00 per month and was adhered to in the main. Profiting by the experience of the previous season, the company made out wage accounts in the middle of the following month, that is, wages were held back one-half month. In addition to this, a progressive scale was established as a means of keeping men the whole season: for April \$7.50; for May \$8.50; for June, July, and following months \$9.00. Men who remained until the close of the year had their wages made up finally, "so as to average 9 doll. per. mo. for the whole time."⁸⁹

⁸⁴ Report to committee, May 26, 1797, copy: Baldwin MSS.

⁸⁵ Baldwin to president and directors, March 30, 1798, copy: Baldwin MSS.

⁸⁶ Committee to Baldwin, April 4, 1798: Baldwin MSS.

⁸⁷ Committee to Baldwin, May 12, 1798: Baldwin MSS.

⁸⁸ Report by Baldwin, July 23, 1798, copy: Baldwin MSS.

⁸⁹ Orders, committee of operations, April 1, 1799; "Articles of Regulations for the Workmen:" Baldwin MSS.

The wage policy of the directors underwent a change in the year 1800. A conviction that time was of great importance led to the abandonment of a flat rate for common hands and of attempts at economies of doubtful wisdom. This was a tardy conclusion. The capital was lying dead, and the work had proceeded more slowly than had been anticipated. Orders were therefore issued in June "to procure at high wages, if it could not be done without, Labourers enough to hold the whole line under operation."⁴⁰ The next year the superintendent was relieved of much of the hiring of common hands, and an overseer provided "board, teams, labour, and whatever [might] be necessary upon the terms in his opinion most for the interest of the concern."⁴¹ Instructions in the spring were again emphatic: the work was to be prosecuted "with all possible energy, let the expense be what it may."⁴² This note recurs for the next three years.

Partly as a result of the stimulus of this policy, wages rose and were erratic. A flat rate no longer ruled, but the wage of the common hand was determined only after chaffering between an overseer or the superintendent and the individual laborer. The upper limit of wages for common labor during these years, 1800-1803, reached \$17 per month; the lower limit was about \$10. The most numerous instances occurred, however, in the range from \$11 to \$14. No attempt was made to revive the policy of a fixed, authorized rate of pay for all common hands.

A study of the wages of workmen other than common laborers shows a variation from individual to individual in the rate of pay for the same general type of work performed at the same time. It may suffice to offer some observations, to give typical instances, and to refer to an excerpt from notes on the hiring of men for the years 1800 and 1801.⁴³ The running memoranda of the superintendent, extant for these years alone, indicate that there were at that time no customary prices for the several employments. Mas-

⁴⁰ Directors to Baldwin, Aug. 25, 1800, quoting June orders, copies: Baldwin MSS, Corporate Records.

⁴¹ Order of April 13, 1801, copy: Corporate Records.

⁴² Committee instructions, June 3, 1801; of similar import, orders, Nov. 27, 1801, Nov. 24, 1803, copies: Baldwin MSS.

⁴³ See Appendix D.

ter workmen in the same trade at the same time secured different wages; journeymen's wages, fluctuating on a lower level, likewise differed from man to man.

The wages of skilled workers in stone varied from 25 per cent to 100 per cent above the current rates for common hands during the years 1795 to 1803, the variation depending in the case of each individual on his training, skill, reputation for steadiness and industry, and similar factors, as well as on the relative need for the worker at the time. Stone workers were at times in great demand, and at the end of the season the company attempted to secure from capable workmen a promise to return the next spring.⁴⁴ Instances of variations in their rates of pay evidence the fluctuating character of the demand for their services. Men called "stone workers" and "stone blowers" received \$13 per month in the year 1795, a wage 63 per cent higher than the prevailing rate for ordinary laborers. "Stone layers" agreed in the year 1799 to work for \$13, for \$14, and for \$18 per month, varying roughly 45 per cent to 100 per cent above the wages paid for common labor in that year. In 1800 one designated as a master stone layer received \$20; others designated simply as stone layers received \$16, \$14-\$15, \$14, and \$13; still others hired "to work in the stone work," but not otherwise designated, received about the current wages for common hands. As the canal neared completion and labor was sought at any price, the percentage difference between the money wages paid to stone workers and those paid to simple laborers narrowed.⁴⁵

Carpenters were the highest paid skilled workers on the canal, the best paid carpenters receiving greater rewards than the best paid stone workers. Although the trade in Boston had long had a loose organization, publishing in the year 1774 a list of prices

⁴⁴ J. Emerson wrote to Baldwin from Salem, New Hampshire, April 21, 1800: ". . . I have an invitation to go to Philadelphia to work on stone work but as I have worked at the canal last season & promised you I would come when you sent me word I will not engage until I hear from you. . . . Sir, I can furnish you with hands enough better than myself in our business but will come if it is your desire. From your real Friend, Jona. Emerson." This is but one of numerous instances of great geographical mobility of labor.

⁴⁵ "Memo. of Persons who Enter and Rates of Pay," April 1795; notes on men employed and wages, 1800, 1801: Baldwin MSS. Vouchers, 1799: Corporate Records.

to be charged for specific items of carpentering, the rules of the craft seem to have had no influence beyond the limits of the town and very little influence within the town.⁴⁶ Pettingill, the head carpenter on the canal, received \$1.00, \$1.33⅓, and \$2.00 per day at different times.⁴⁷ Other master carpenters received similar rates of pay: Richard Hall, master carpenter, 1799, \$1.33⅓ per day; James Baldwin, master carpenter, 1800, \$1.00 per day, and his two journeymen \$15.50 each per month. Men designated simply as "carpenters" received in 1800 from \$18 to \$20 per month plus board — a wage \$4.00 to \$6.00 more than that received by the average stone layer the same year. In these later years, the average "carpenter" received a wage about equivalent to that of the highest paid master stone layer, that is, about \$20 per month plus board.⁴⁸

The typical workman of that day was a versatile fellow. Recurring in the charges for labor is the phrasing: "for working as a blacksmith," "as assistant blacksmith," "as a teamster," "as a mason," "as a stone blower." The wording often indicated casual changes in occupation. Passage from employment to related employment was unimpeded. Blacksmiths engaged to "blow, split and hammer stone," and ships' carpenters agreed to build boats. Such instances were typical. A man was hired if he claimed he could do the particular work that was needed. Men also engaged by the month to do more than one type of work. They would work, for example, "at carpentering and stone blowing" or "at blacksmithing and stone blowing," going from one job to the other, as directed by the overseers or superintendent. Lines of craft demarcation were loosely drawn at best. The jacks of several trades practiced on contract wages not one but a number of occupations in which they were no doubt indifferently proficient. Even the shoemaker did not stick eternally to his last.⁴⁹ The period was one in which specialization was only gradually emerging.

⁴⁶ See Appendix E.

⁴⁷ Workers in receipt of wages per day may have boarded themselves in whole or in part; the data on this point are not clear.

⁴⁸ "Memo. of Persons who Enter and Rate of Pay," April 1795; notes on men employed and wages, 1800, 1801; Baldwin to committee, Dec. 19, 1803, copy: Baldwin MSS. Vouchers, 1796, 1799: Corporate Records. See Appendix D.

⁴⁹ Although the putting-out system, with the domestic worker making the complete shoe for a capitalist-merchant, was established in parts of Massachusetts by

The relations between employer and worker were diverse. Work under direction for contract wages was an important, but far from an exclusive feature. The building of principal portions of the trough of the canal and of parts of the masonry, the digging of lock pits, the laying of wheeling passages, painting, pump making, and other tasks were undertaken by individuals or groups under specific contracts, some of which were agreements for wage-work typical of a handicraft system of production. When the tasks to be performed were diverse and extensive and the clauses in the contract elaborate, the resemblance to the handicraft type of organization was less marked. In fact, the scale of coexisting forms of organized work extended from those peculiar to the handicraft system through hybrid types to the modern entrepreneurial, or factory, system.

If it should seem unusual that the word factory is here used, it may be noticed that for the factory form to exist a building is not necessary. The factory may be described rather as a stage in the development of the division of labor. It is characterized by the subordination of the workers, through the medium of contract wages, to a directing and coördinating authority which owns, or controls as an agent, the means of production. The definition covers instances of organized effort in which workers are not gathered together under one roof. The factory is distinguishable from the less advanced putting-out system in the extent of ownership of the means of production and in the degree of coördination and control of the workers. Further, the contractual wage relationship could rarely prevail under the putting-out system. The factory form may also be contrasted with craft-work and wage-work. The worker under the handicraft system, after learning his trade, usually owns at least certain simple tools necessary to his calling. But with the advent of the factory system and its greater division of labor, ownership itself becomes highly specialized. The immediate control or ownership of the means of production by others than those who use them makes possible the more efficient direction of energy. Once the system is generally accepted, the

this period, "even as late as 1811 conditions like those of Revolutionary days survived in shoemaking as a by-industry." B. E. Hazard, *The Organization of the Boot and Shoe Industry in Massachusetts before 1875* (1921), pp. 24-41, 183.

productive advantage of added control through the ownership of equipment and materials is but partially offset by the occasional hostility of the workers. The factory, so viewed, is an advance in the effective ordering of the productive process. During the early period covered by this study it can be seen emerging in a hesitant fashion.

Examples of this new form were reflected during the building of the canal in agreements with self-sustaining contractors. These men furnished capital, made advances to labor, directed and drilled their workmen, and received payment from the canal company after inspection of the completed work. Other contracts, however, were simple wage-work agreements characteristic of the handicraft system. In these the worker alone performed the stipulated task, furnishing usually a modicum of capital. If he was fed and lodged by the company, the wage-worker received part payment from the moment of entering upon his task.

Together with these two systems under which work was organized, intermediate forms, elaborated wage-work and inchoate factories, were current during this transitional period. Although some who contracted to build lengths of the canal did not employ labor, they were assisted by their sons, provided their own food and lodging, and furnished part or all of the necessary tools and materials. Such a contractor performed the function of the entrepreneur, with the exception of the employment of labor. He owned the tools of several trades and other means of production, omitting consideration of the land on which he worked; yet the element of contractual wages was lacking. The form of organization was a simple one, adapted from the handicraft system. Other contractors employed many workmen, while the company furnished the tools, kept them in repair, or financed the work in large measure by advances, and provided some or all of the materials. Here are instances of the direction and coördination of employed labor by men working usually beside their employees; instances, further, of the immediate control, although not the ownership, of the means of production. The form may be termed that of an inchoate factory organization. Combinations of differing degrees of extent of ownership of the equipment and materials with differing degrees of

direction and coördination of wage earners had simultaneous existence.

Agreements with stone workers reflected the current variety in organizing work. The canal company furnished materials but might or might not prepare the stone or make it available to the contractor at the spot where it was to be used. Some of the stone workers who operated under agreement employed labor; others did not. The extensive stone laying at the Merrimack was governed by a contract whose terms were complex. The proprietors agreed "to see to the provision of Lime, Land, Stone, Stages for rolling up stones, Board for making mortar . . . , to remove the Stone split at the quarry . . . ,⁵⁰ to build barracks . . . and a Blacksmith Shop with proper tools to repair the Instruments," and to prevent want of materials and obstruction by water. On their part, Bemis and Stearns, "Stone Layers," agreed to build three stone locks in the manner that should be specified, "to split and get the Stones out of the quarry . . . , prepare the mortar necessary . . . , lay the whole in courses in Lime Mortar," provide their own tools, and repair them at their own expense, "except the shops & tools provided for repairing as aforesaid." They should receive twenty shillings (\$3.33 $\frac{1}{3}$) per perch laid.⁵¹ Bemis and Stearns, although denominated "stone layers," may be termed either quasi-entrepreneurs or quasi-wage-workers. The form of productive organization indicated by their agreement is not embraced snugly by any category; it may be described as an imperfect factory organization. In this case the canal company furnished continuously much of the means of production needed for the formation of a factory type of organization for building locks, paying by the piece the entrepreneurs, who were active skilled workmen as well as extensive employers of labor.

The scale of coexisting forms of the organization of work thus passed from the handicraft system⁵² through hybrid types to the

⁵⁰ This was the proprietors' quarry at Tyngsboro, five to six miles up the Merrimack from the head of the canal, purchased after an unsuccessful search along the proposed line for suitable material.

⁵¹ Contract, Sept. 28, 1795, signed by Bemis and Stearns, and by Dexter, Gore, Baldwin, Jaques, and Thompson, for the canal company: Baldwin MSS.

⁵² In the class of simple wage-work, characteristic of the handicraft system, fell agreements with painter and pump maker; for example, contract, Aug. 20, 1799,

modern entrepreneurial, or factory, system. From this complex, the directing, disciplinary, and capitalistic features of the new factory form were emerging. The most fully developed example of the new system was the canal company itself. Together with the various forms adapted for specific work under the series of contracts, there existed an articulated wage policy on the part of the corporation and straight work under coördinating direction for daily, weekly, and monthly wages of unskilled, semiskilled, and skilled workmen. It was an age of free contract, in fact, and one which freely adapted its methods to the demands of a changing economic life.

Thoroughly American in its pliancy, this was a society in which craft organization was in most occupations nonexistent; in a few, of a tenuous nature; in none, highly developed. The lines of craft demarcation were often blurred. Current apprenticeship practices were loosely interpreted and at times disregarded. There existed no relatively large, clearly defined classes of laborers permanently divorced from property. An important class of yeomen possessed both free time to diversify its employments and the integrity requisite to the undertaking of tasks of varying magnitude. Yet in this class few members had command of free capital. The yeomen lived at a time when no source of loans existed for such as they. In that age a man was not "of all sorts of luggage the most difficult to be transported,"⁵³ but there was a marked movement

between Baldwin, for the proprietors, and Russ, a painter. The proprietors agreed to furnish all materials, colors, and oil, to permit the worker to have the use of their paint mill without expense, and to board him at the company's table. Russ bound himself to grind and prepare the paint and to do all the putty work, setting of glass, and painting on two newly erected mills. For this he should receive \$25 (Baldwin MSS). Certain charges for piecework by men employed in making pumps indicate a similar type of agreement (Corporate Records). During the same period men were also employed on a time-wage basis at painting and pump making. In general, the parties to contracts for wage-work seem not to have thought in terms of craft limits. They thought rather in terms of the piece of work to be done, which was frequently work that would embrace, in a more developed society, a number of related but separate crafts.

⁵³ Adam Smith, *Wealth of Nations*, I, 67. The complete sentence reads: "After all that has been said of the levity and inconstancy of human nature, it appears evidently from experience that a man is of all sorts of luggage the most difficult to be transported." The statement is less nearly universal and more nearly relative to the latter part of the eighteenth century, the tight little island, and the British temperament.

of labor from place to place over relatively long distances. The flow of labor from one occupation to a related occupation was fairly free. Profitable specialization and localization waited, in the case of numerous skills, both upon a further extension of the market and for the time when the progress of an extending market should be quickened by canal and turnpike.

These conditions in the older, settled parts of New England that enjoyed contacts with the seaports were not duplicated at the frontier. There society was more egalitarian and still less specialized in regard to the means of earning a living; there men could not, by choosing among opportunities, be proficient in a few pursuits, but were of necessity proficient in most.

CHAPTER VI

TECHNICAL METHODS EMPLOYED

EXCAVATION and embankment in these early days were done principally by hand labor, aided simply by tools and wheelbarrows. "Very few machines for lessening labor in canals have been found to answer the purpose," wrote John Rennie in his letter of advice:

Whenever the Cutting does not exceed 12 or 14 feet & where the earth is to be laid by the side of the Cut, the common Spade & wheelbarrow will be found the cheapest; but when it is greater, animal strength may be applied with advantage to raise the earth out of the Cut, after it has been dug by the Spade; this is effected by temporary or moveable railways with small Waggon, which being filled with earth is [*sic*] pulled up by the plane by a Horse Gin placed at the top and moveable as the work advances.¹

These methods were to govern deep cutting. For embankments, "where deep cutting or earth of a hill is to be carried into a valley," Rennie also sent a few rules of thumb for Baldwin's² use:

For distances not exceeding:	Cheapest method:
30 yards	wheelbarrows
30-100 "	man carts *
100-400 "	single horse carts
400 yds - $\frac{3}{4}$ mile	railways and wagons
more than $\frac{3}{4}$ "	boats

* A form of large wheelbarrow, dragged by a horse to level ground and then wheeled over the level by hand.

As the price of labor was higher than in England, John Rennie's advice was doubtless modified to accord with American conditions. Overseers were instructed to see that the men were "properly di-

¹ Rennie to Vaughan, London, March 6, 1798, copy: Corporate Records. John Rennie (1761-1821), was a British engineer, builder of harbors, docks, bridges, and canals. Among his principal works were the Avon and Kennet, the Rochdale, and the Lancaster canals.

² Rennie to Vaughan, London, March 6, 1798, copy: Corporate Records.

vided and placed on the wheeling runs . . . [and] relieved and succeeded in regular rotation.”³ The crude railways used in the construction of the canal had for parentage these simple wheeling runs. A double line of planks fixed by cross braces became a primitive railway for wagons. Oxen and horses, principally the former, constituted the animal strength. A model of a special form of low-lying cart to be backed into a height of earth was designed and constructed by James Sullivan. Colonel Baldwin changed the model, lowering it somewhat, and ordered carts made. Workmen were instructed to dig under the hummock, to thrust the back of the cart in the space so made, “so that when the ground is moved by an Iron bar, it will fall into the cart & thus far save the labor of the Spade. . . . The cart can be discharged of the loading as quick as a wheelbarrow.”⁴ This was no other than a primitive ancestor of the dump cart.

The removal of stones was an onerous task. High-powered explosives were unknown; and black gunpowder, often defective, both domestic and foreign, was alone used for reducing stones to manageable dimensions. The foreign article was usually the more reliable. Labor was hired proficient “in the art of blowing stones.” A contractor made and delivered stone drags, 3 x 8 feet of 2½-inch white-oak plank, with “a good timber crook on the head,” for \$2.00 each.⁵ Stones were removed from the bed of the canal “by drawing them up the banks . . . with proper blocks and pullies” or by floating a boat up to them, draining off the water, loading the boat, and floating it off by refilling the canal.⁶ A strong “Gin Pole” was specially designed by the Colonel for lifting stones for the high piers of the aqueduct over Shawsheen River.⁷

The interference of water during the construction of lock chambers and masonry at the Merrimack, Concord, and Charles rivers and during the forming of the canal across meadow and swamp

³ Baldwin to directors, Jan. 24, 1798, copy: Baldwin MSS.

⁴ Sullivan to Baldwin, Dec. 17, 1795; on same subject, orders of directors, Oct. 12, 1798, orders and instructions, Aug. 31, 1799, orders of committee, April 14, 1800: Baldwin MSS.

⁵ John Ford, contract for twenty drags, Feb. 17, 1795: Baldwin MSS.

⁶ Orders to Wilkins, May 6, 1797, copy: Baldwin MSS.

⁷ “The gin or Crain finished to raise the Stone for the Piers, &c.,” orders and instructions, 1799; “Plan of Gin Pole for Shawsheen,” September 1799: Baldwin MSS.

led to a continuous use of pumps. Simple bored logs they were, some "upward of 20 feet in length," with plungers flanged with "Soal Leather."⁸ At times shifts of workmen manned these pumps for twenty-four hours. A contrivance called the "bucket" or "water" machine, driven by a horse, was used day and night in the difficult work on the Merrimack.⁹ The Aqueduct Corporation, organized under a Massachusetts charter of the year 1795 for the purpose of piping water from Jamaica Pond to Boston, shared its experience with the Middlesex Canal Company.¹⁰ As James Sullivan was president and principal promoter of both, the relations of the two organizations were close; pump "tapers" were borrowed back and forth, the timber used in forming the "aqueduct logs" in the later years came through the canal, and the superintendent of the Middlesex company gave aid and counsel in the erection of a "boring machine" in the year 1804 on the canal land at Concord River for the use of the Aqueduct Corporation.¹¹ The difference in the work of boring wooden culverts and pumps was but the difference of magnitude.

In all parts of the canal where banking was raised, "puddle gutters" were cut "in the natural ground . . . so as to make the banks solid & tight to hold water." These were ditches three feet broad and deep enough to take out all the roots and hollow places or false ground. The space was filled with the "Best of earth, clear of stones and rubbish," which was then rammed down. "That part of the bank directly over the puddle gutter [was] done in the same manner up to the top."¹² Thus was formed a central core of

⁸ Vouchers, Nov. 28, 1795, September and June 1796, May 31, 1798: Corporate Records. Report to directors, Oct. 17 to Dec. 1, 1795, copy; orders, June 26, 27, 28, 1799, April 16, 1802: Baldwin MSS.

⁹ Vouchers: Corporate Records; for example, "To night work driving horse in water machine"; "To $\frac{3}{8}$ gal. W. I. Rum for the men at Extra work Bailing water in night."

¹⁰ Davis, *Essays*, II, 69, 251 ff., 291; Amory, *Life of James Sullivan*, I, 373-376.

¹¹ Baldwin to Sullivan, Sept. 3, 1803, copy; Sullivan to Baldwin, Sept. 5, 1803; George Sullivan to Baldwin, Sept. 6, 1803; Cunningham, Secretary of Aqueduct Corporation, to Baldwin, March 9, 1804; "Memo. for Canal," Baldwin, May 7, 1804: Baldwin MSS. Order to Patterson, May 7, 1804: Corporate Records.

¹² Clauses concerning "puddle gutters" were inserted in contracts for banking jobs; quotations are from contracts with Barker and Barker, Dec. 25, 1795; Dickenson and others, January 1796; Farmer, Wilson and Pettingill, March 1796: Baldwin MSS.

choice, packed earth in all of the embankments. If the filling had been of layers of well-worked loam or clay, it would have been effective. As constructed, however, the puddle gutter constituted an inadequate provision against leakage through the banks.

Of puddling proper, the thorough tempering of clay with water by chopping and working it with narrow spades to produce a semi-plastic state, Colonel Baldwin had knowledge from the beginning. Puddle, the product of this process, when spread as a lining of thin layers each of which has been so worked as to be firmly united to the lower stratum, constitutes an impermeable cover for the trough of a canal. The full thickness of a completely effective puddle would vary from two to three feet. Its use is imperative in porous ground and on most embankments; but no adequate covering was completed on the Middlesex Canal. Failures in some early and partial essays prevented the growth of staunch faith in the method. Judge Sullivan thought the banks could be made "more tight by slimy and glutinous substances"¹³ — an indefinite suggestion. Ramming and pounding the banks were frequent expedients. Water was let in and out of the canal "to season and consolidate the banks."¹⁴ Loaded carts drawn by oxen were led from unfinished excavation along newly finished banks partly as a convenient path of exit but definitely for the purpose of packing down the earth.

There were many complaints of "weeping" of the canal. Puddle was the single sure remedy. Contractors who constructed specific lengths were not generally expected to employ the method, but agreed "to arrange their work so that the said proprietors may wet and puddle the bank as they progress in the execution" and "to provide & make it convenient for the workmen employed in the puddling work."¹⁵ The expense of the process was great. Failure was not due in all probability to a poor grade of clay but to insufficient puddling. A story, possibly apocryphal, is related of a visit made by some canal undertakers to the famous Brindley as he lay dying. They must have his advice, as their canal would not

¹³ Report of directors to proprietors, Oct. 29, 1802 (Sullivan's handwriting): Corporate Records.

¹⁴ "Memo. of Supt. to Committee," May 27, 1802, copy: Baldwin MSS.

¹⁵ Contract, Richey and Mahaney, November 1799: Baldwin MSS.

hold water. "Then puddle it," said Brindley. That they had already done. "Then puddle it again — and again." This was the final word of practical wisdom.¹⁶ The constructors of the Middlesex Canal lacked persistence of this sort; they early became resigned to leakage, considered it inevitable and, if of modest proportions, of no great concern. The courts of that day held similar opinions:

[A plaintiff before the Supreme Court of Massachusetts in 1815 averred that since 1799 the defendants had] suffered the banks of their . . . canal to be and to remain in such a porous, open, and imperfect state, that the waters issuing from the . . . canal have overflowed his land . . . and rendered the same wholly unproductive and of no value to him. . . . On the trial, the plaintiff offered evidence to prove that his lands had been damaged, as set forth in his declaration; but he did not offer to prove that the defendants had done any thing which was not authorized by the act of their incorporation; nor had they been guilty of any negligence, or other default, in the manner of making and maintaining the canal; it appearing that the damage complained of was the natural consequence of the existence of the canal at that place.¹⁷

Considered opinion at the time held leakage to be inseparably connected with canals.

A continuous leak at a specific spot might grow and develop into a true breach in the bank. Baldwin's diary records eight such occurrences.¹⁸ There were events of this sort near the aqueduct over Ipswich River in July of the year 1801 and less than a week later near the Shawsheen Aqueduct. Teams were rushed to the place with "wheelbarrows, planks and tools."¹⁹ This experience led to the installation of stop gates by which the canal could be divided into isolated reaches in case a breach should occur.²⁰ At

¹⁶ Smiles, *Lives of the Engineers* (1862-1868), I, 475.

¹⁷ *Stevens v. Proprietors of Middlesex Canal* (1815), 12 Mass. 466-468. The case came to the court on a motion to set aside a nonsuit. The motion was overruled on the ground that, as a special process was provided in the act of incorporation for compensating those whose lands were damaged, the action at common law was not maintainable.

¹⁸ Entries, Nov. 9, 1797; July 19, 23, October 12, 1801; July 16, Dec. 12, 1803; June 18, 1804; June 9, 1805; Baldwin MSS.

¹⁹ Baldwin to Pettingill, July 18, 1801, copy: Baldwin MSS.

²⁰ Committee to Baldwin, Aug. 3, 1801: Baldwin MSS. This gives the location of ten or twelve stop gates and indicates that more will be built as the work progresses.

certain points waste weirs were provided to prevent overflow or undue pressure of water. Without a strong and effective lining of puddle the employment of devices for lessening the extent of the damage was often necessary to prevent catastrophe.

Although there were a number of iron works of various sorts in the state, the casting of iron parts needed to compose the apparatus for opening and shutting the valve gates of the locks could not be entrusted, it was thought, to a Massachusetts foundry.²¹ Cogged bars or rails, somewhat over three feet long, with double rows of staggered teeth, and small cogwheels, cheek pieces, trucks or rollers, gudgeons, and dogs were the simple castings required. Sets of racks and pinions and their appurtenances were originally cast under the direction of the English engineer, Weston, "from molds of his own forming" in a New York foundry.²² Weston had returned to England when further sets were wanted. Ichabod Parker, United States postmaster at Woburn and emissary of the canal company, spent eight days going through foundaries in New York City and overhauling patterns in a fruitless search. He advised having new forms made and sent on to New York to a highly recommended firm, Barker Parson & Co., who would produce the castings at "six pence per pound York Currancy, which [was] four pence half penny per pound Massachusetts Currancy," or 6¼ cents, United States currency. Parker offered to pay the bill in New York and to draw on Baldwin in favor of creditors in Woburn.²³

The proposal was not considered advantageous, however, and for some months nothing was done. Baldwin then heard of a foundry of repute in Pawtucket, Rhode Island, run by David, Abraham, and Israel Wilkinson. A Mr. Clap was sent to inspect their plant in April of 1802, and one of the family conferred with Baldwin in Boston. The Wilkinsons had helped to build the cotton machinery made for Moses Brown by Samuel Slater and to construct, in 1792 or 1794, the engine used in Elijah Ormsbee's steam-

²¹ For the early iron industry in Massachusetts, see J. M. Swank, *History of the Manufacture of Iron in All Ages, and Particularly in the United States from Colonial Times to 1891* (1892), pp. 108-135.

²² Baldwin to Parker, instructions, Nov. 30, 1801, copy: Baldwin MSS.

²³ Parker to Baldwin, New York, Jan. 5, 1802: Baldwin MSS.

boat.²⁴ Baldwin wished them to make the castings for the canal "in the most perfect manner & of the best Iron as the service [was] hard. . . ." Wooden patterns were sent to Pawtucket, and the work was in process. Disputes over the price ensued for the next two years, the charge varying, four pence, four pence farthing, four pence half-penny, or from 5½ to 6¼ cents per pound, United States currency.²⁵

Ancillary industries in those days were not generally to be trusted to follow specifications to any high degree of precision. Despite their reputation for excellent workmanship, the Wilkinsons delivered irons that were imperfect, "owing in some degree to the patterns but more to inaccuracy in molding and casting." Baldwin thus stated the discrepancies:

The semicircular boxes in the cheek pieces for the axeltree of the pinion to turn in are not square across the pin by more than ¼ of an inch which makes it exceeding diffeult to fit the Axeltrees to play freely in them — the bolt holes also in the cheek pieces are not parrallel but are so in opposite directions as to make it difficult to secure them to the wooden parts or blockheads. These with some other alterations make it necessary for me to wait on you at your works in order to alter the patterns & attend to such improvements as shall render the remainder of the Castings perfect & compleat . . . neither do the racks and pinions play quite so freely in geere as they ought to.²⁶

Supplies of pig iron came to the Wilkinsons by water from New York. In explaining delays, they complained that the pigs not infrequently proved of poor quality and castings therefrom had to be destroyed. The types of difficulty encountered by the canal engineer in securing proper castings are simply normalities of business, yet the particular problems serve to measure the industrial infancy of the period.

The masonry required on the Merrimack presented the question of a proper hydraulic cement. Ignorance of the subject was widespread and not confined to America. Ill-considered notions led to

²⁴ W. B. Weedon, *Economic and Social History of New England, 1620-1789* (1890), II, 850, 851; G. H. Preble, *A Chronological History of the Origin and Development of Steam Navigation* (1883), pp. 26, 27.

²⁵ Baldwin-Wilkinson correspondence, originals and copies, June 19, 24, Oct. 18, Nov. 27, 1802; Feb. 12, March 28, 30, May 4, 25, Oct. 18, Nov. 8, Dec. 7, 1803; Jan. 6, 1804: Baldwin MSS.

²⁶ Baldwin to Wilkinson, Feb. 12, 1803, copy: Baldwin MSS.

peculiar compounds that sometimes caused the gradual or even sudden ruin of the locks of canals. In England one could turn to the discordant written opinions of Semple, Smeaton, and Higgins. Practical men held unrecorded opinions no less divergent.²⁷ With regard to the theory of cements, Vitruvius had occupied for nearly two thousand years a position of Aristotelian authority. Belidor in France, Semple in England, and many other authors repeated by rote his errors and prejudices.²⁸ A sound theory of cements had not yet been evolved.

Directors of the Middlesex Canal heard in 1795 from one Diggen that pozzuolana, the volcanic ash found near Pozzuoli, Italy, was then being exported to England for use in hydraulic cement.²⁹ The trade had begun a short time before the year 1756 with the importation of a cargo from Civitavecchia on venture by a merchant of Plymouth. The material was unknown and had no market. Smeaton, however, who was then engaged in his experiments during the building of the Eddystone Lighthouse, had read of pozzuolana in Belidor's *Architecture Hydraulique*.³⁰ Belidor may have secured his information in part from Vitruvius.³¹ Procuring a sample, and finding that pozzuolana formed in combination with lime a more effective hydraulic cement for his purpose than a similar mixture of trass³² and lime, which he had been using, Smeaton purchased the cargo. An account of his experiments, giving a number of formulas for hydraulic cements, was published in 1791.³³

Smeaton's discoveries and recommendations became known in

²⁷ C. W. Pasley, *Observations on Limes, Calcareous Cements, Mortars, Stuccos, and Concrete; and on Puzzolanas, Natural and Artificial* . . . (1847), p. iv.

²⁸ Pasley, *Observations on Limes*, p. v.

²⁹ Note on "Terra Puzzolana," Nov. 3, 1795: Corporate Records.

³⁰ John Smeaton, *A Narrative of the Building and a Description of the Construction of the Eddystone [sic] Lighthouse with Stone* (1813), p. 109.

³¹ Marcus Vitruvius Pollio, *De Architectura*, Bk. II, chap. VI: "de Pulvere Puteolano et ejus usu," beginning, "Est etiam genus pulveris, quod efficit naturaliter res admirandas. Nascitur in regionibus Baianis et in agris municipiorum, quae sunt circa Vesuvium montem, quod commixtum cum calce et caemento, non modo caeteris aedificiis praestat firmitates, sed etiam moles quae construuntur in maris, sub aqua solidescunt."

³² Trass, vulgarly known as Dutch terrace, is found on the Rhine between Mainz and Köln and is common in volcanic regions. Like pozzuolana it communicates to lime the property of setting under water.

³³ Smeaton, *Narrative of the Eddystone Lighthouse* [first edition, 1791].

England previous to the publication of his book, and the trade with Italy grew and flourished. Down to the perfection, commercialization, and acceptance of Portland cement, about the year 1860,³⁴ public works in England requiring strong hydraulic mortar were generally built with pozzuolana combined with different limes and sand.³⁵ In 1796 Joseph Parker patented the so-called Roman cement, the process consisting of a conversion by calcination and pulverization of the nodules, or clay balls, found in the London clays. Many early railway tunnels were built with this as a cementing agency.³⁶ It had for decades, however, but a local use, principally in private works.³⁷ A similar product made at Boulogne, France, in 1802, marked the beginning of the cement industry in that country.³⁸

Mr. Digger, in 1795, had promised the directors of the Middlesex Canal to write for a quantity of pozzuolana for experiment and "to obtain particular information as to compounding."³⁹ That he did so, however, is not on record. Six months later Aaron Dexter, conversing with a Captain Williams, learned that Dutch trass was "produced as common earth" at St. Eustatius.⁴⁰ Judge Sullivan immediately called a meeting of the directors that trass "might be had timely enough for the Lock on the Merrimack." The sloop *Industry* was chartered from Theodore Lyman,⁴¹ June

³⁴ Joseph Aspin, a bricklayer of Leeds, patented in 1824 a cement which he called Portland cement. It was used on the Thames Tunnel in 1828. His process differed essentially from the manufacture of modern Portland cement. See R. K. Meade, *Portland Cement; Its Composition, Raw Materials, Manufacture, Testing and Analysis* (1911), p. 6; Meade refers to Michaelis, *Thonindustrie Zeitung*, Jan. 16, 1904. In the *Transactions* of the Society of Civil Engineers, the publication of the reasons for using Portland cement in the construction in 1859 of the London drainage canal marked its acceptance. After some years of abortive attempts, the manufacture of Portland cement in the United States may be said to have started in 1875 (Meade, *Portland Cement*, pp. 6, 10-12).

³⁵ Pasley, *Observations on Limes*, pp. 190-193; Meade, *Portland Cement*, p. 5.

³⁶ Henry Reid, *The Science and Art of the Manufacture of Portland Cement* (1877), p. 29.

³⁷ Pasley, *Observations on Limes*, p. 191.

³⁸ Meade, *Portland Cement*, p. 5.

³⁹ Note on "Terra Puzzolana," Nov. 3, 1795: Corporate Records.

⁴⁰ St. Eustatius is an island in the Dutch West Indies, about eight square miles in area, composed of a number of volcanic hills with intervening valleys. It forms part of the colony of Curaçao and today has a small export trade in sweet potatoes and yams (*Encyclopaedia Britannica*).

⁴¹ The founder of the Lyman fortune, and first of the Theodore Lymans. See C. F. Adams, *Memoir of Theodore Lyman* (1906).

16, 1796, and sent "on the first wind with all possible dispatch." Captain Banks was back in Medford harbor by the twenty-third of August with forty tons of trass.⁴²

If trass is not thoroughly pulverized, its union with lime is incomplete. The rule was not consciously objectified by Smeaton, although his practice of heavy and prolonged beating of the mortar insured ultimate pulverization. He considered it a good day's work for a laborer to mix and beat two bushels of lime with one of trass, a proportion he recommended.⁴³ It is of interest to find that Baldwin omitted any extended beating of his mixtures from the outset and saved considerable labor by substituting, in accord with practice in Holland,⁴⁴ careful preliminary grinding of the trass.⁴⁵ As late as 1820 Pasley made the error of using similar material in his experiments without preliminary grinding. Before the year 1830, the beating of mortar had become generally obsolete.⁴⁶

With the cargo of trass came the following certificate:

This is to certify that the Duch terrace put on board the sloop Industry of Boston is of the first quality of this Island & for the using of it I recommend for dug walls one Bushell of lime to three of Terrace & for walls under water one Bushell of Lime to four Do. of Terrace which in forty eight hours after laying under water will become hard as flint.

⁴² Sullivan to Samuel Swan, Boston, May 24, 1796; instructions to Captain Josiah Banks, Boston, June 16, 1796 (signed copy); account of Josiah Banks, "St. Eustatia," Aug. 1, 1796; bill for charter of sloop, Boston, Aug. 23, 1796; expense accounts, Benjamin Hall, Aug. 25, 1796: Corporate Records. In the "Report of the Directors to the Proprietors on the Means of Raising Money," January 1799, the cost of this voyage for trass is given as \$2,000. The charter of the sloop cost \$1,000. The down cargo of boards cost \$403 and sold on the island for \$554.36. The trass was bought at \$10 a ton. Incidental expenses for customs, rum, water, provisions, harbor master, and the captain's 5 per cent commission on the sale of lumber totaled \$67. The cost of hogsheads, coopering, and unloading came to about \$200. Transporting the trass from Medford to Chelmsford, at \$6 per ton, the regular price for cartage over this haul, involved a further expense of \$240. With the gain from the sale of boards deducted, the accounts show a total expense of about \$1,750, rather than \$2,000.

⁴³ Pasley, *Observations on Limes*, p. 192.

⁴⁴ A Hollander, one Van Santen, is said to have erected a mill on the Rhine for grinding trass in 1682. See Henry Reid, *A Practical Treatise on Concrete and How to Make It; with Observations on the Uses of Cements, Limes, and Mortars* (1869), p. 16.

⁴⁵ Report to directors, March 31, 1797, copy: Baldwin MSS. Charges for labor employed in grinding trass, 1796, 1797, vouchers: Corporate Records.

⁴⁶ Pasley, *Observations on Limes*, pp. 23 n., 194.

I have worked as a mason in this Island thirty eight years & from my knowledge of Mortar I do hereby declare that what I have said above is truth.⁴⁷

This prescription erred in favor of an undue proportion of trass. It accorded well, however, with the commercial interests of the little island of St. Eustatius.

Some source brought forward the following formula in October 1796:

Two thirds of Tarras to one of Lime beaten well together, & work up with but little water, for the stiffer it is and the more it has been beaten, the better it will be, laying it on about 2 Inches thick & very smooth, taking care that no Sticks, Straws or Stones be mixed with it, as soon as the whole has been plaister.d in this Manner it is to be rubbed over with Oil or Bullocks Blood which will harden it equal to stone under water, and it will continue as long sound.⁴⁸

Baldwin seems to have followed no man's prescriptions. Indeed, Smeaton's book reached his hands only in 1798,⁴⁹ after the completion of three stone locks set in trass mortar, and after he had perfected experiments of his own. He reported in 1797:

I have made a mortar for one of the courses of brick round the Culverts in the proportion of

2 bush.l Terras

1 bush.l lime

3 bush.l Sand which seems to answer the best of any yet tried some like this I made last fall which is now very hard.⁵⁰

Smeaton had dispensed with the use of sand in building the Eddystone Lighthouse, mixing pozzuolana and lime in the proportion of 1 : 1. Baldwin's proportion appears to be deficient in lime.⁵¹ Much depended, however, on the nature and quality of the lime; and success, the arbiter of opinion in such matters, attended his efforts. In July of 1798, nine months after the public opening of the locks on the Merrimack, the Colonel reported:

⁴⁷ "Ruic (?) Granger, Certificate for preparing Dutch Tarrace": Baldwin MSS.

⁴⁸ Note on "Dutch Terras," October 1796: Corporate Records.

⁴⁹ William Vaughan to Charles Vaughan, London, March 9, 1798, copy: Corporate Records. Vaughan states he has sent "Smeaton's Works" by Mr. Apthorp.

⁵⁰ Report to directors, May 26, 1797, copy: Baldwin MSS.

⁵¹ On these points see Pasley, *Observations on Limes*, pp. 190-195.

I have found the Terras mortar which had been under water since it was first laid almost as hard as the stone itself nothing can be more firm, solid and durable than this Lock, especially that part that continues constantly under water the small drawing stroaks of the Trowel at the seemes are now as perfectly visible as at the moment when the trowel left them and not a perticle crumbled or washed off but has the colour and appearance of well dried putty that has never been painted.⁵²

The stone locks continued to be admired by contemporaries and were correctly believed to be the most durable works on the canal. Years later, in 1823 or 1824, in a case of minor repairs, another Baldwin experimented in an admittedly tentative fashion with imported Roman cement on the same set of locks.⁵³

The use of hydraulic cement on the Middlesex Canal antedated the cement industry in the country by twenty years. It was not until 1818 that the discovery of natural cement rock was brought about by a keen search for this article, of which canals were then the greatest users. Early cement mills were almost always started as adjuncts to canals. The following list gives the dates of a number of the early discoveries and the location of the industry:

Year	Location of Industry	Discovered in Connection with ⁵⁴
1818	Chittenango, N. Y.	Erie Canal
1825	Ulster County, N. Y. (High Falls and Rosendale, N. Y.)	Delaware & Hudson Canal
1829	Shippingport, Ky.	Louisville & Portland Canal
1836	Round Top, Md.	Chesapeake & Ohio Canal
1838	Utica, Ill.	Illinois & Michigan Canal
1848	Balcony Falls, Va.	James River Canal
1850	Siegfried, Pa.	Lehigh Coal & Navigation Co.

Decades ahead of other attempts, the Middlesex Canal bore every burden of a pioneer work. Experiment with new methods, pressure from restrictions set by expense, and early defective results may be accepted as the normal concomitants of any business progress. The growth of an invention has usually such accompani-

⁵² Report, July 23, 1798, copy: Baldwin MSS.

⁵³ J. F. Baldwin to Benjamin Joy, chairman of standing committee, March 1823 (possibly misdated): Corporate Records.

⁵⁴ Meade, *Portland Cement*, pp. 7, 8. For the state of knowledge of hydraulic cements in the United States in 1817, see Joshua Secor, ed., *A Treatise on Internal Navigation* (1817), chap. xiv.

ment. All pioneering in construction or production means just such discouragements to those who see behind the finished product its process of development. The significance of this history lies rather in the simplicity of the methods and matters that caused the usual vexations.

These years of struggle with methods were a gain to American engineering. To the Middlesex as the most extensive work of its kind in the United States, the canal commissioners of the state of New York turned, in 1817, for example; and to the agent of the corporation, for precept.⁵⁶ Of equal importance, the empirical knowledge acquired during these years became a family heritage. Young Baldwins aided in the undertaking and shared their father's interest in the achievement. They shared his pride in the well-built Merrimack locks and his bitter disappointment when he was later compelled to employ less appropriate materials;⁵⁶ for, though a man of careful economy, he chafed — when did engineer do otherwise? — at financial limits placed to his desire for technical perfection. The many engineering problems, met and conquered, had constituted an integral part of the family life for a decade. Capable and prominent engineers, stemming from Loammi Baldwin, were to build their country important works in the succeeding generation.⁵⁷

⁵⁶ *Official Reports of the Canal Commissioners of the State of New York* (1817), pp. 109-117, 131-141.

⁵⁶ Loammi, 2nd, to J. F. Baldwin, London, Dec. 14, 1807: Baldwin MSS.

⁵⁷ See Appendix B.

CHAPTER VII

PROGRESS OF CONSTRUCTION

THE BUILDERS of the canal first attempted the arm of shorter distance and of lesser drop, from the summit level at Billerica to the Merrimack River. In addition to the necessary excavation and embanking, accomplished mainly by piecework under contract, this section entailed the building of several bridges, two aqueducts, and a flight of three stone locks. Weston, writing to Aaron Dexter from New York, where he was aiding General Schuyler, had advised stone or brick locks and strongly deprecated the use of wood, which had found favor with some of the directors.¹ Plans, sections, and elevations of the locks, adapted to the dimensions of the proposed boats,² were sent by Weston from Philadelphia in February of 1796.³ The proposals and directions of the English engineer were modified by Baldwin from time to time, partly in the interest of economy and partly in the light of better principles.

About one year after the date of the contract with Bemis and Stearns for stone laying at the locks, the superintendent made the following laconic entry in his diary: "Opened Lock and Canal Merrimack River and the first Lock Broak and failed."⁴ The second, finished in the rough a month later, though far from perfect, was more successful. Experiment that finally developed an effective hydraulic cement was in progress at this time.

Work on the Black Brook Aqueduct likewise proceeded. Again, this was a task of a new and unusual kind; yet the difficulties en-

¹ Weston to Dexter, May 12, 1795: Corporate Records.

² The proposed boats were 75 feet long by 9 to 9½ feet wide. Weston's plans were altered, and these first locks constructed 81 feet long (reports, Aug. 15 to Sept. 12, 1795; Nov. 17, 1797: Baldwin MSS). Cf. Thompson to directors, Sept. 8, 1795: "I have it as my mind that Locks shall [be] so long as to omet masts of 80 feet to pas through": Baldwin MSS.

³ Weston to Sullivan, Feb. 25, 1796: Corporate Records. "Plan of First Lock," seventy-five feet in the clear: Baldwin MSS.

⁴ Diary entry, Oct. 18, 1796: Baldwin MSS. See Appendix F.

countered in constructing a watertight trough of wood were, for a people experienced in bridge building and boat construction, not to be compared to those which attended the forming of adequate locks. A model of this first aqueduct, sent by Baldwin to the directors, underwent their practically minded, although unskilled, scrutiny. Some changes were advised which Baldwin characterized as impossible and ridiculous. The timber, cut to the dimensions and form first proposed, had been ordered; and the aqueduct was built in general accordance with the model.⁵

With no length of line completed and opened, and with two aqueducts and a flight of three stone locks still unfinished and untested, there was little to show publicly at the beginning of 1797 for three years of effort. With determination the work was prosecuted. The directors insisted that the level from the Concord to the Merrimack should be opened before the end of the year. When matters were shaping to a close, orders were issued for a public test of the first six miles, and Baldwin's state of mind approached consternation. He pleaded with the directors for postponement: next year would be time enough. Failure at any point or the appearance of even minor defects would give encouragement to the enemies of the project. "Malice [wanted] nothing but pretext." His masonry had not properly dried; the work was "unseasoned." "Should a vessel green from the wheel of the potter be proved in that state before it is baked?" There were no stop gates. It was true that "the front of the stones for four inches into the wall [had] been laid in Terras mortar . . . the principal quality of which is to harden in . . . water . . . but it requires time for water to produce this indurating effect. The attack of the water [would] be instantaneous, while its indurating effect [would be] progressive." His protest was to no avail. Two weeks of grace were allowed the Colonel; then the test should be made.⁶

⁵ Report of committee, May 6, 1797; reply of Baldwin, May 26, 1797; report and directions, June 25, 1797; instructions from committee of operations, Sept. 1, 1797; Baldwin MSS. The aqueduct covered eleven spaces of ten feet each, with ten framed timber pieces serving as piers, exclusive of two stone abutments. The piers rested on stone foundations raised about one foot above the ground.

⁶ Orders of directors, Oct. 20, 1797; Baldwin to directors, Oct. 23, 1797, copy: Baldwin MSS.

On November 9, 1797, the directors and a party of prominent citizens traveled to Billerica and embarked in two canal boats. Towed by horses, they progressed, stopping at a basin midway to the Merrimack to christen it Sullivan's Harbor. Workmen, instructed to carry tools proper to their several callings over their shoulders, flanked the boats, walking on either bank. After pausing to give the name of Baldwin to the aqueduct over Black Brook, the party continued without mishap to the locks at the Merrimack, where the expedition passed down through the two upper locks, the first boat resting, possibly somewhat ignominiously, on the floor of the third and last lock. The huzzas of the ambulating workmen and of local inhabitants accompanied the naming of Sullivan's Harbor and the successful passage of aqueduct and locks.⁷

The workmen were orderly. They had read a long notice which ended: "It is requested that the dress of the workmen be decent & clean, their movements active but regular, their behaviour civil & respectful; in short, their general conduct such as shall do honor to themselves and those concerned will consider themselves honored thereby."⁸ Preceded by such genteel laborers, the directors and their friends walked the short distance from the locks to Howard's Tavern, passing between two rows of men drawn up before the door, still martially holding their tools. When the directors had entered, the workmen followed and went above to Mr. Howard's large upper chamber, where they consumed 150 pounds of good beef roasted, excellent gravy, two bushels of potatoes, bread made from two bushels of meal, and a barrel of cider.⁹

The day had not been without discouragements. A fissure appeared between the floor and wall of a lock, and a fair breach in the bank near the Black Brook Aqueduct. Colonel Baldwin described the achievement and assessed the damages:

The three brick culverts conveying brooks under the canal were totally unaffected by the large column of water which lay over them. . . . The

⁷ Notice to workmen, Nov. 9, 1797: Baldwin MSS. "Report to the President and Directors of the Middlesex Canal," Nov. 17, 1797 (pp. 4-8 missing): Corporate Records. Draft of the report of Nov. 17, 1797: Baldwin MSS.

⁸ Notice to workmen, Nov. 9, 1797: Baldwin MSS.

⁹ "Memo. for Mr. Jacob Howard," Nov. 8, 1797, copy: Baldwin MSS.

two aqueduct Bridges are perfectly secure & almost watertight. . . . I do not expect that one barrell of water will leak thro both of them in 24 hours . . . altho both will contain about three hundred tons of water. . . .

The level by which the work was executed from Concord River to the Merrimack, about $5\frac{3}{4}$ miles, proves exact. I cannot perceive by the water that it varies one quarter of an inch. . . .

the banks in general appeared to resist the effect of the water beyond what was expected, however the high embankments in River Meadow threatened to give way, but we took a boat of about 4 or 5 tons burden out of the Merrimack & applied it with a number of men to convey earth to the parts most effected and thereby an actual breach was prevented the old well seasoned base of those banks which had lain near two years added greatly to their support they must surely answer very well when properly seasoned.

[The breach was caused] by the violent motion of the water in passing out of the Great Aqueduct upon opening the stop gate to fill the Lock for the Boat to pass. . . .

the time was so short between the completion of the mason work of the Locks and the opening of the Canal that even with the most favorable concurrence of natural circumstances it was not possible to complete the work it did not afford opportunity for the carpenter the blacksmith and stone cutter altho they were employed early and late and considerable work was done in the night time. . . .

The connections of the upper gates were altogether of Stone excepting the iron hinges. . . . The Blockheads for raising the paddlegates were all made & fitted into the stone in their proper places. . . . The Paddle gates were all nicely made & fixed, the cast Iron racks and pinions on the east side were fitted & adjusted to their particular office and their operation was pleasing. . . .

The naked situation of the walls & the limberness of the mortar left them much exposed to the effect of such an elevated column of water the dimensions of which are 81 feet in length & 12 feet in depth (10 feet 4 inches in Breadth — however the breadth is totally immaterial) which by the invariable Laws of Hydrostatics exerts a force against each wall pressing outwards equal to $182\frac{1}{4}$ tons. . . . This emense force has proved too great for the western wall solid as it is and has produced a small fisure. . . .

The undertaking generates a new species of property and will open new sources of wealth not only to citizens of the metropolis but to the inhabitants of a wide extended country which is luxuriant in the substantial of life.

The water has again risen in the River so that it now stands more than ten feet in the first lock . . . the frost seems to be setting in, the

tools are exposed by working in the frozen ground, the days are short, the Thanksgiving in New Hampshire has taken away a good many of our hands, some of whom have had their amounts made out and do not expect to return again.

[Baldwin ends his account by advising] closing with the month men [for the season] if the weather should not soften in a few days.¹⁰

Even the Colonel's account seems to have been overoptimistic. Banks fell in, and the masonry, other than that set in trass mortar, was defective.¹¹ Difficulties multiplied. Faced with this condition, the superintendent employed practical expedients, effectual and ineffectual. The need of the assistance of someone skilled in the business was again apparent; and, as before, the directors turned to England.

One of the directors, Charles Vaughan, wrote to his brother in London¹² during the month in which water was admitted from the Concord to the Merrimack. He asked for information about English canal practice, for books on canals, and stated the condition of the American enterprise. William Vaughan,¹³ merchant and author, had long been a prominent promoter of the London dock projects, which he had urged before committees and in a series of pamphlets and tracts. He was well acquainted in engineering circles and could turn for advice on canals to his friend

¹⁰ "Report to the President and Directors of the Middlesex Canal," Nov. 17, 1797 (pp. 4-8 missing): Corporate Records. Draft of the report of Nov. 17, 1797: Baldwin MSS. The quotations are from both documents.

¹¹ William Vaughan to Charles Vaughan, London, Feb. (?), 1798, copy: Corporate Records.

¹² Charles Vaughan (1759-1839), merchant, was associated with his brother-in-law, Charles Bulfinch, the architect, in the erection of the Tontine Crescent, the first solid block of residences in New England. At Hallowell, Maine, he built houses, mills, stores, a distillery, a brewery, and a printing office, and established a seaport at Jones Eddy near the mouth of the Kennebec, where he constructed a large wet dock for ship timber. In 1798 he met with serious financial reverses and surrendered his property to creditors. Returning to Hallowell, Maine, in 1799, he was employed as agent for a number of large non-resident landowners, among whom was General Knox. By importation of seed and livestock he promoted the agricultural and stock-breeding interests of Maine. See Appleton's *Cyclopaedia of American Biography*; Morison, *Maritime History*, p. 126; Knox MSS.

¹³ William Vaughan (1752-1850), Fellow of the Royal and Linnean Societies, member of the New England Corporation, and honorary member of the Society of Civil Engineers (founded 1793). See *Dictionary of National Biography*. The father of these brothers was a West Indian planter and merchant; their mother was a daughter of Benjamin Hallowell of Boston.

John Rennie, an engineer at the forefront of his profession. Christopher Gore, appointed a United States claims commissioner under the Jay Treaty, was then in the midst of his eight-years' residence in England, while John Apthorp,¹⁴ purchaser of the major portion of Charles Vaughan's canal shares, was a recent arrival in London.

Gore and Apthorp interviewed William Vaughan and John Rennie, discussing with them the problems of the Middlesex Canal.¹⁵ Smeaton's works and Chapman's *Observations on Canal Navigation* were sent March 8, 1798, by Apthorp, who was returning to Boston, together with a letter from Rennie outlining the relative advantages of inclined planes and locks, advising locks for the Middlesex Canal, and urging that they be built of brick or stone and not of wood:

In Canals where the Locks, Bridges, etc. . . . are of Timber the expense of repairs in a few years becomes immense; not to mention the loss sustained by the stoppage of Trade. In my opinion works of this kind cannot be *too well executed*, particularly those whose repairs require the trade to be stopped such as Locks, Aqueducts, Culverts and the foundation of Bridges.¹⁶

This was sound advice, and inability to follow it brought on some of the major difficulties encountered by the Middlesex Canal during the years of operation.

Rennie had the practical man's poor opinion of the aid to be derived from books, believing that they "only tend to involve the question in more obscurity."

Few authors [he writes] have wrote on the subject of Canals who are in any respect versant in the practical execution of them. Their books are filled with ingenious but impracticable theories, little applicable to the cases that usually occur in the construction of Public Works, — such theories can be formed as well by Gentlemen in America as in England and therefore it does not appear to me that many books of this sort can be of use. . . .¹⁷

¹⁴ John Apthorp was related to Charles Vaughan.

¹⁵ William to Charles Vaughan, London, March 9, 1798; Rennie to Vaughan, London, March 6, 1798, copies: Corporate Records.

¹⁶ See note 15.

¹⁷ See note 15.

Further advice concerned the securing of an English engineer. Vaughan and Rennie both urged "the sending of a man from hence capable of superintending and directing the works." "I am persuaded," wrote Vaughan, "it would be found the most eligible and economical plan to purchase Knowledge by the experience of others than gaining yourselves by woefull experience."¹⁸

Hampered in giving counsel by a lack of detailed information, Rennie and Vaughan asked for the surveys and sections. Weston's report and a section of the line were forwarded to Vaughan, who transmitted the papers to Rennie, then in Edinburgh. After studying the papers, Rennie wrote that he could say little, as "there is neither plan, nor Estimate of the line, and Mr. Weston's report is too general to afford much information." "I suspect," he concluded, "they will never do well until a proper superintendent is secured." In returning the documents and forwarding Rennie's letter, Vaughan added, "I now beg to suggest again of sending over for some steady person from hence. I know it is Mr. Gore's opinion."¹⁹

No change occurred, however, in the superintendence. Baldwin had friends among the directors, and the whole system was in operation. He was loyal, hard-working, economical, and undoubtedly an able man for his time. Although costly errors had not been absent, Baldwin had achievements to his credit that no one the directors knew in America could boast. Past experience, it may have been believed, would lead to an avoidance of future difficulties. The expense, the chance that a man from England might prove intractable, wasteful, inefficient — these and other considerations delayed and finally deterred decision.

The course of construction might be followed in exhaustive detail. The locks on the Merrimack were finally perfected. When Baldwin and about fifteen of the workmen made the first passage up and down the flight of three on August 24, 1798, "everything answered completely the purpose designed."²⁰ At the close of 1798

¹⁸ See note 15.

¹⁹ Rennie to William Vaughan, Edinburgh, Sept. 6, 7, 1798, copies; William to Charles Vaughan, London, Sept. 14, 1798, copy: Corporate Records. Rennie's further criticisms of Weston's report have been incorporated above, p. 56.

²⁰ Baldwin diary, Aug. 24, 1798; memorandum of same date: Baldwin MSS.

nine and three-quarters miles of canal had been completed.²¹ Months and years passed, and dogged persistence forced a gradual advance.

In the year 1798 the proprietors erected a new gristmill and a new sawmill on Concord River. These were of the most approved types. Advice was secured from Eleazar Spofford of Jaffrey, New Hampshire, renowned as a millwright,²² and from Mr. Smith of Peterboro, New Hampshire, "a man of great genius," whose "whole works" were a "Prodigious stretch of engenuity, enterprise, & economy."²³ Spofford's gristmill lacked the usual meal trough. "The meal," wrote Baldwin, "runs directly through the meal spout into the bags . . . so that no meal is ever seen at his mill except they look into the bags for it and the millstones are so perfectly enclosed that no dust at all arises. . . ." ²⁴ Spofford came down as consulting engineer for about two weeks at \$12 per week,²⁵ drew plans for the mills, and made a pattern for cast-iron rounds for the trundleheads.²⁶ With the purpose of stimulating rivalry between two leaders and two teams of laborers, Baldwin employed Richard Hall as master workman on the frame of the sawmill and Samuel Spofford, a relative of Eleazar, in a similar capacity for the frame of the gristmill. Each was provided "with suitable and equal assistance." The millstones were contracted for at Lynn, the thirty-two oval iron rounds for the trundleheads of two gristmills — the old mill was evidently overhauled at this time — were cast in New York, a new bolting machine was acquired, and Baldwin had "Exceedingly good luck in purchasing saws for the gang"; six bought at \$7.00, "2 doll. each less than the common price," and

²¹ Baldwin to Sullivan, "Amount of Canal Finished," Dec. 28, 1798, copy: Baldwin MSS.

²² Committee of operations to Baldwin, March 21, 1798, *re* Spofford and "his uncommon skill as a mill wright": Baldwin MSS.

²³ Baldwin to Sullivan, Jan. 27, 1798, copy: Baldwin MSS.

²⁴ Report, Baldwin to Sullivan, Jan. 1 (?), 1798: Baldwin MSS.

²⁵ In urging adequate foresight Baldwin wrote the directors: "Mill wrights who excell in their profession are generally under engagement several months before hand," Jan. 24, 1798, copy: Baldwin MSS.

²⁶ Committee of operations to Baldwin, March 19, 1798; "Memo. of Superintendent," March 19, 1798; Baldwin to Eleazar Spofford, March 24, 1798, copy: Baldwin MSS.

six at \$6.00, "something less than the value of the stock before it was worked."²⁷

"A moderate collation and Treat" was a feature of the raising of the first completed mill. Mrs. Baldwin was called upon to send up tent poles, cords, and "the awning" ("pray let it be mended and clean," wrote her husband); neckerchief, shoes and buckles, blue coat and satin breeches, that the Colonel might shine among men; "one of our middling cheeses of last year," "an old cheese or two" bought in Woburn, a batch of her cakes made from twenty-eight pounds of flour, a loaf of sugar, crackers, "the Lemmon Squeeser and a Sive." A satisfying afternoon was that of August 4, 1798.²⁸

The proprietors now had two gristmills and two sawmills on Concord River, all in going order. The cost of building two and of repairing another in the year 1798 was estimated roughly at \$3,000.²⁹ Work in the sawmills was principally for the canal; the gristmills ground at a price for the public. All four mills did capacity business for a number of years,³⁰ and an income accrued to the proprietors which was used in the works.

A further source of income came in 1802 with the establishment of a daily passenger service between Billerica and Chelmsford. The passage was accomplished in two hours, at a speed of three miles per hour; the fare one way, twenty-five cents, with baggage paid "in proportion."³¹ The "Great Boat" on this service was christened the *George Washington* on her maiden trip by General Lee of Virginia.³² Occasional tonnage had been carried for some

²⁷ Orders of committee of operations, April 4, June 16, 1798; votes of directors, May 25, 1798; instructions to Captain Bunt of the New York Packet, enclosing letter to Edmund Priers of New York, copies, not dated, but cf. Baldwin diary, April 8, 1798: "Writing for Irons to New York"; reports, July 23, 1798, Dec. 12, 1798, copies; instructions, Jan. 3, 1799: Baldwin MSS.

²⁸ Baldwin to overseers, Baldwin to Mrs. Baldwin, Aug. 3, 1798, copies: Baldwin MSS.

²⁹ "Report of Directors to Proprietors on the Means of Raising Money," January 1799: Corporate Records.

³⁰ Report, Baldwin to directors, Dec. 12, 1798: Baldwin MSS. Report of committee of operations, Oct. 8, 1801: Corporate Records.

³¹ Advertising copy, "to be published in 2 of the Papers of Boston," July 10, 1802: Corporate Records. Draft of same: Baldwin MSS.

³² "Memo. of Voyage on Canal," June 14, 1802; Baldwin diary, June 15, 1802: Baldwin MSS.

time. Infrequent boats loaded with freight and slow-moving rafts of lumber attested feeble beginnings.⁸⁸

Junketing trips for directors, for shareholders whose morale was flagging, and for prominent personages visiting the region were frequent after 1800. Records of Babylonian feasts, always a feature of such occasions, show amazing lists of meats consumed at one sitting.⁸⁴ John Coffin Jones,⁸⁵ Samuel Parkman,⁸⁶ and ten other shareholders, many of whom had never seen the canal, plus servants, comprised one such party;⁸⁷ Governor Trumbull of Connecticut, General Pinckney of South Carolina, and Colonel Humphreys⁸⁸ were among the principal figures in another.⁸⁹ Gaudier than a circus wagon was the pleasure barge that bore them. The black bottom and white wale line contrasted with the vivid red of the wale and quarter railing; the awning, the posts, and the inside of the top were a light blue; the seats and the interior to the coping above the timber heads, "a strong high Orange."⁴⁰ Such voyages were an outward show, a painted veil thrown before the ugly face of facts. On the ground, over the line of work, Baldwin toiled and struggled with unforeseen problems, made mistakes, and bore the consequences.

A change in policy came in the year 1799; locks were, henceforth, to be built mainly of wood. The change was unwise. Heavy

⁸⁸ Baldwin diary, May 26, June 7, 16, 23, Aug. 21, 1798; Sept. 21, Dec. 12, 1801; June 3, 21, 1802: Baldwin MSS.

⁸⁴ Dinner ordered for twelve persons at Richardson's Tavern: "A boiled Leg of Mutton or Lamb. Some boiled Porke and Checkens. A small roast pig of not more than 10 or 12 lbs. killed in the morning. A Young Goose killed in the morning roasted rarely. Shelled beans—pease if there are any—turnips and new potatoes—boiled corn if there is any fit—Squashes Cabage if there is any. The next day the same company will dine there in nearly the same manner. . ." (Sullivan to Baldwin, July 29, 1800, instructions for trip of Aug. 5, 1800: Baldwin MSS).

⁸⁵ "Mr. Jones is a merchant of eminence in Boston. His abilities, his honor, and his liberal Fortune unite to render him a valuable member of our republic." (Knox to Jefferson: Knox MSS, XXIII, 31.)

⁸⁶ Opulent and eminent merchant. See Quincy, *History of Harvard University*, II, 416, 417; Morison, *Maritime History*, pp. 57, 87.

⁸⁷ Aug. 5, 1800.

⁸⁸ Probably the Colonel Humphreys who had been Washington's "court chamberlain." See C. G. Bowers, *Jefferson and Hamilton; the Struggle for Democracy in America* (1925), p. 17.

⁸⁹ Baldwin diary, Aug. 18, 1803; Sullivan to Baldwin, Aug. 15, 17, 1803: Baldwin MSS.

⁴⁰ Instructions to painter, July 31, 1800, copy: Baldwin MSS.

expenses for repairs and renewals consumed the profits for some twenty years. The problem at the beginning of 1799 was financial.⁴¹ The foundations of one lock plus the wing walls buttressing the set of three locks had taken about one thousand tons of stone. "All these stones [were] torn out of the . . . Ledge by the effect of severe hard Labour. Little gun powder [was] used about it, the nature of the Ledge was such as did not require much powder, altho. very hard to work."⁴² Forty tons of Dutch trass, costing about \$2,000, laid down in Chelmsford, were almost entirely consumed by the first three locks. The superintendent was calling for more. The boating of stone was expensive, the floating of timber was cheap. It is doubtful whether sufficient capital could have been raised at the time to sustain the added cost of constructing thirteen locks of stone. The slackening of progress would have further increased the expense and made improbable a successful attempt to find the needed money. The Middlesex might then have shared the fate of the Pennsylvania canal companies, whose activities were dormant for a quarter-century. The decision seems to have been inevitable. Where the locks were adjacent to rivers, they continued to be built mainly of stone; all other descending locks from the summit level to Charlestown were constructed in large part of wood.

The water took its way through the newly formed trough eastward toward Boston from the summit level at the Concord in December of 1800.⁴³ The following year, with the difficult works on the Shawsheen completed, water filled the canal to the first descending lock in Wilmington.⁴⁴ In April of 1802, a raft of timber, boards, and planks, over 600 tons, came sixteen miles to Woburn.⁴⁵ Celebrating Independence Day and the approaching completion of the canal to Medford River, 126 "ladies and gentlemen went up the canal in the Washington Barge to Maple Meadow."⁴⁶

⁴¹ "Report of Directors to Proprietors on the Means of Raising Money," January 1799: Corporate Records.

⁴² Report, Baldwin to directors, June 25, 1797, copy: Baldwin MSS.

⁴³ Baldwin, report to directors, Dec. 8, 1800, copy: Baldwin MSS.

⁴⁴ Report of committee of operations, Oct. 8, 1801: Corporate Records.

⁴⁵ Baldwin diary, April 16, 17, 19, 24, 1802: Baldwin MSS. Amory, *Life of James Sullivan*, II, 105.

⁴⁶ Baldwin diary, July 1, 5, 1802: Baldwin MSS.

At the annual October meeting during these years the directors were compelled to come before the proprietors with a skillfully worded apology. Sullivan's efforts in this connection were frank, disarming and able. He noted in 1802 the great impatience among the proprietors, their long sufferance under the burden of assessments, but urged them to consider the magnitude of the work:

This we can say with certainty, that from the most careful inquiry the Directors have been able to make, they are convinced, that the same quantity of work, in the business of canalling, has never been done in Europe, in less time, or at a less expense. . . .

One or two ledges, concealed by great depths of earth have been revealed by the spade, and one or two morasses have disappointed calculations formed from the most assiduous experiments within the reach of human power. These have called for great quantities of labour, and retarded the accomplishment of the proprietors wishes. . . .

Since the annual meeting of last year, the ledge in what is called Roger's ground near Concord river has been obliged to yield to the Canal. The sinking morasses at Lubber's Brook and in Carter's field near Woburn meeting house have been rendered competent to bear the weight of the canal banks thrown on them. The banks, which appeared to be unable to retain the water, have become more consolidated and firm, so that they afford a certainty that no permanent injury will ultimately result from their leaking.

The Canal is now completely formed down to the bank of Medford river . . . and the Directors expect that the Superintendent will come in at the meeting where this report is read, with an account of the water's being in the canal on the bank of that river.

[In this work there have been nine locks, one aqueduct and a number of accommodating bridges] formed, placed and finished in the course of the present year. . . .

There are now 1200 tons of timber on the waters of the canal, . . . moving on towards Boston. The banks of the canal appear to be firm and the mechanism of the Locks complete and easy in their operations.

The canal being in operation from the Merrimack to the Mystic river will call the attention of the Proprietors to a consideration of what measures are proper to form a connection between the waters of that and the waters of the tide. . . .

This appears to be a faithful, though a general statement of the business of the corporation . . . any one of the directors present at the meeting will be ready to answer more minutely to any inquiries the Proprietors shall be pleased to make. . . . The Directors' labour, anxiety, and attention are compensated by a firm confidence that the work will

be crowned with success and that the project will become no less useful and beneficial to the proprietors than to the public.⁴⁷

How firm was this confidence? In order to lift the formal mask from official communication, we may quote Judge Sullivan against himself. The first consciousness of future failure bore in upon him at about this period. Letters to Baldwin, to be sure, were so couched as to incite the greatest exertions to secure speed in construction. With all allowance made, however, a doubt, coming almost as a hopeless conviction, yet wisely omitted from public reports, was forced upon the principal promoter for the first time:

When the canal shall be completed we shall not be able to use it more than half the year; and whence it follows that unless we shall receive \$2000. toll every week, we shall not receive the interest of the capital expended, therefore every weeks delay now, is a loss, of at least \$2000 . . . to the proprietors. . . .

When we take a survey of the business as it now stands, we have to lament that our sanguine hopes will be probably disappointed; and what is still more mortifying, that we are made the instruments of disappointment to our friends. . . .⁴⁸

Judge Sullivan could only continue to persuade and to persist, erecting once more a façade of official optimism. Situated as he was, no other course availed.

As the work was pushed forward toward Charles River, it became important to possess the mill pond in Charlestown. The mills there located, the milldam, and the pond were therefore purchased for \$11,250 to form a terminus and a place of deposit for lumber and merchandise.⁴⁹ Another of Sullivan's reports was read at the proprietors' meeting in October:

The canal is so nearly completed that the Directors had sanguine hopes to have seen the waters flow from the Merrimac through it into the Charles river before the annual meeting of the Corporation in 1803. To effect a thing so very desirable to themselves, they have made every

⁴⁷ "Report of the Board of Directors, including Report of the Committee of Operations, Read and accepted in Director's Meeting," entitled, "To the Proprietors of the Middlesex Canal" (in Sullivan's handwriting), Oct. 29, 1802: Corporate Records.

⁴⁸ Sullivan to Baldwin, Aug. 23, 1803: Baldwin MSS.

⁴⁹ "Report of Directors to Proprietors" (in Sullivan's handwriting), Oct. 28, 1803: Corporate Records.

effort in their power, and from all the appearances at present, they hope to be gratified by this termination of their labour within a few days. . . .

Had this work been carried on with more celerity, it would have prevented, in some measure, a very great misfortune which the directors exceedingly deprecate: A number of original proprietors who have sold their shares at a loss might have retained them or have sold out at a less discount, but the hurrying a business of such magnitude and new in this country, would have increased the expense and denied to us the great advantages which have resulted from our deliberation and experience. The work has been well done without mistakes or errors and far within the calculation originally made — for \$320,000. was calculated for the first project of seventeen miles only. The whole is now nearly thirty miles in length, nearly completed at the expense of \$444,000. Beside this the estates purchased independant of the canal and mills etc. are estimated at \$60,000. . . .

The fact now under the eye of the public of one yoke of oxen drawing on the Canal eight hundred tons of timber, as much as six hundred teams of four oxen each could carry, opens to the country where the saving of labour is a principal object a great source of wealth.⁵⁰

The completion of the canal took not a few days, as Sullivan opined, but two months. The end came, however, in the year 1803. On the thirty-first of December at two o'clock in the morning "the water for the first time pass'd thro the Middlesex Canal into the waters of the Mill pond in Charlestown."⁵¹ A communication to the public announced the achievement:

The Proprietors of the Middlesex Canal, having had on all occasions . . . the attention of the Government and the countenance of their fellow citizens, as an expression of gratitude, notify the public, that the canal is completed. . . .

The enterprise, which has been thus successfully executed, exceeded in magnitude any other project in the northern part of the United States. Those who first undertook it had no principles resulting from experience to recur to, by which they could calculate the practicability of the scheme, or the measure of the expense; but the application of natural principles, with assiduity and firmness by them, and those who soon after united with them, has crowned the hopes of all with success.

The public utility of the canal may be seen in its forming a connection, by water, between the town of Boston, and an extensive fine country on the Merrimack, up to Winnisaucopi [*sic*] Lake, one hundred and thirty miles, and more. The vast advantage resulting from it, is evinced, by

⁵⁰ "Report of Directors," Oct. 28, 1803: Corporate Records.

⁵¹ Baldwin diary, Dec. 31, 1803: Baldwin MSS.

having the timber and plank for the extensive bridge from Chelsea to Charlestown, which terminates the turnpike from Salem to Boston, and the important bridge south of Boston over the Neponsett river, brought down on the canal in the past summer. This timber has been transported by water, from the places where it grew; a hundred miles, to the place where it is in use. Without the aid of water carriage, thus given, those bridges could not have been built in the summer past; nor ever, without a much greater expense, unless aided by the Middlesex Canal.⁵²

A valid record of achievement was thus announced. Fittingly breathing an eighteenth-century reliance on the application of natural principles, the document does not overstate the facts. That the problems of operation and of extension of the system would prove no less difficult than those of construction could hardly have been expected by the successful promoters.

Loose ends in plenty remained to be gathered together. The banks had to be strengthened, the terminal facilities improved, and a communication across the Charles River and through the center of the town of Boston effected. Rules for the guidance of private carriers, which would own and operate most of the canal boats, had still to be formulated and published, and landing places, horses,⁵³ tackle, and boats to be provided by the company. The problems of operation in their entirety awaited solution.

Authority to pass and to enforce expedient bylaws for governing the traffic had lately been granted by the legislature.⁵⁴ Here, as in other instances, the directors at first started courageously forward into new territory and then, encountering difficulties, sought and derived aid and direction from English experience. A committee, meeting at Judge Sullivan's during January of the year 1804, framed the first formal bylaws.⁵⁵ Until the printing in August of forms of bills of lading, the company accepted shipments under rough passports.⁵⁶ Pamphlet copies of bylaws, transcribed

⁵² "Advertisement at the Completion of the Canal": Frothingham MSS, package, "Middlesex Canal, 1795-1855."

⁵³ Silas Whitney, sent to Canada to purchase strong young horses, bought at Montreal in February 1805, eight at prices ranging from \$35 to \$50, receiving for each horse delivered \$15 in addition to its initial cost (Frothingham MSS, 60c).

⁵⁴ *Massachusetts Statutes Private and Special*, III, 131.

⁵⁵ Baldwin diaries, Jan. 13, 30, 1804; draft of provisional bylaws, Aug. 1, 1804: Baldwin MSS.

⁵⁶ "Blank bill Lading Canal Boats printed Aug., say 21, 1804 by Committee of Operations": Baldwin MSS.

extracts, forms, notices, and other material illustrative of English practice came over in June and July through the good offices of William Vaughan.⁵⁷ The forms of the accounts of collectors, of the bills of lading, and of similar systematizing were adapted from English models to the uses of the American corporation. Later, however, under a new, Anglophile superintendent, more complete imitation of English procedure in the management of canals removed, possibly unwisely, some of the American improvisations of these early days.

⁵⁷ The material concerned the Thames and Severn, the Hereford and Gloucester, the Grand Junction, and the Birmingham canals. It was forwarded through Vaughan by Lowbridge Bright, John Disney, and Sir Christopher Baynes, Bart. (Corporate Records).

CHAPTER VIII

LAST WORKS OF EARLY LEADERS

1803-1808

COINCIDENT with the advent of new problems came a succession of changes in leadership. Colonel Baldwin, a director once more in 1805, having been succeeded as superintendent by Jaques, was among the first of the active leaders to withdraw from the direction of operations. His fame as an engineer was assured, and other projects were claiming his attention. Men seeking to devise or to patent mechanical improvements of various sorts came to him for advice.¹ Massachusetts, Maine, and New Hampshire were rife with plans for canals, small and large, and many of their promoters sought his services. Surveying, advising, directing, constructing — with these his last years were replete.

An improvement of the time which owed its success in small part to the Colonel was the work undertaken by The Proprietors of the Locks and Canals on Merrimack River, a corporation, chartered in 1792, which leads a prosperous life today. Baldwin's advice and assistance in 1796 carried the company through an apparent impasse. A short channel, opened during that year from the Merrimack to the Concord at the present site of Lowell, allowed lumber and firewood to pass around Pawtucket Falls, feeding the shipyards of the lower Merrimack, especially of Newburyport. Deepened and widened, the waterway was used after 1823 as an important source of power and constituted one principal factor in determining the location of the textile city. Under the control of Boston capitalists the corporation achieved a dominant position in the new manufacturing city of Lowell.²

¹ For example, Sullivan to Baldwin, July 18, 1803: "Messrs Vickers & Coates have a patent right for an improvement on a saw mill . . . I advise them to see you, as you have much more science in this way than any other man within my acquaintance." Baldwin MSS.

² S. A. Mitchell, *Compendium of the Internal Improvements of the United States* (1835), p. 13; Davis, *Essays*, II, 170, 171; B. H. Meyer, ed., *History of Transporta-*

A canal at Amoskeag Falls, New Hampshire, owed its successful completion more definitely to the Colonel. Judge Blodget had commenced operations on his own resources in 1794 with a buoyant faith in his untried inventions of a lock and of an ingenious, yet impracticable, system of check gates. On an ill-fated day in the year 1798, at the public opening before a mass of spectators, the upward pressure of the water lifted the sides of his lock into the air, and the whole was carried downstream. A high freshet the next spring all but completely demolished the remainder of the canal. Unable to continue without assistance, Blodget obtained a charter in December and employed Baldwin to make a new survey and an estimate. With a view to the renewal of confidence in the public mind, the Judge published Baldwin's report, favoring a route east of the old to avoid freshets and containing the pertinent warning "that it would never do to depart much from established principles, nor presume much on new theories, or to introduce works of speculation in canaling." Funds were derived from the sale of stock and from lotteries granted by New Hampshire and Massachusetts.³

Baldwin traveled regularly to Derryfield, New Hampshire, to attend to the progress of the work. He noted in his diary in October of 1805: "sunk the lower lock of Blodget's canal on to its foundation & bed whereon it rested level & true, great satisfaction." On May Day of the year 1807 the new portion of the canal, about a mile in length and having four locks, was successfully opened. In Blodget's words, written the previous winter:

here are the locks that command an immense property of a great and goodly country of many hundred miles in circumference, round the lakes

tion in the United States before 1860 (1917), p. 146; Morison, *Maritime History*, p. 151; Baldwin diary, 1796: Baldwin MSS.

³"Biography of Honorable Samuel Blodget," *Farmer's Monthly Visitor* (June 1852), pp. 161-170; *Manchester Historic Association Collections*, vols. X, XI, XII. A very early plan of the canal is in the Knox MSS, LV, 110. See also L. L. Dame, "The Middlesex Canal," *Old Residents Historical Association*, III (1886), 272-290; G. Stark, "Navigation of the Merrimack River," in *ibid.*, III, 291-308; Mitchell, *Compendium*, p. 12; Davis, *Essays*, II, 183, 327, 337; B. H. Meyer, ed., *History of Transportation*, p. 144. On the lotteries, see most of the references listed above, and *Independent Chronicle*, Nov. 23, Dec. 24, 1807; *Columbian Centinel*, Dec. 2, 1807; Gilbert & Dean, brokers, to Henry Knox, March 6, 1806, Knox MSS, XLVI, 122; *Boston Gazette*, Nov. 26, 1807. See Appendix G, n. 1.

and heads of streams that empty into and form the Merrimack before they reach the locks at the Blodget Canal; this goodly country abounds with beef cattle upon a thousand hills and all kinds of produce, and lumber in abundance, with wealthy inhabitants suitably interspersed all over it who wish a commercial intercourse with the Inhabitants of the commonwealth of Massachusetts.⁴

The first cotton factory came to Derryfield at Amoskeag Falls in 1810.⁵ Some years later the canal was rebuilt in part, at an expense of \$10,000, bringing its total cost to about \$30,000.⁶ Industrial development at the falls was moderate until the newly incorporated Amoskeag Manufacturing Company acquired the canal property in 1836. Another Baldwin, Loammi 2nd, viewed the ground bought by the company and examined their plans for the erection of an extensive plant. His report urged location on the left bank:

The Amoskeag Canal is situated . . . [there] . . . and [the company] may arrange and modify it so as to make it very serviceable in the construction of their new works, and afterwards, the navigation on the Merrimack River and the Middlesex Canal will afford great facilities to all the mills for the transportation of raw material and goods between the Manufactories and Boston.⁷

Following upon this development the former Derryfield — which Samuel Blodget before 1800 had delighted to call "The Manchester of America" — blest with a change of name, began the fulfillment of its early promise.⁸

The proposed Weymouth-Taunton canal uniting Boston Harbor with Narragansett Bay and hence with Long Island Sound, a variant for a waterway across the Cape, gave further vent to

⁴ *Farmer's Monthly Visitor* (June 1852), p. 169.

⁵ Samuel Batchelder, *Introduction and Early Progress of the Cotton Manufacture in the United States* (1863), p. 56. The date is given as 1809 in *Manchester Historic Association Collections*, XII, 14, and as 1811 by Stark, "Navigation of the Merrimack River," *Old Residents Historical Association*, III, 304.

⁶ B. H. Meyer, ed., *History of Transportation*, p. 144. See below, p. 130.

⁷ Loammi Baldwin, 2nd, to Francis C. Lowell, agent of Amoskeag Manufacturing Co., Aug. 29, 1836, copy in "Letters Regarding Canals, Railroads, etc., with index attached": Baldwin MSS.

⁸ *Manchester Historic Association Collections*, X, 16, 238. *Farmer's Monthly Visitor* (June 1852), p. 168. The name Manchester was substituted for Derryfield in 1810.

Colonel Baldwin's abilities in the first years of the century. "The Pilgrims began to agitate for a Cape Cod Canal," writes Mr. Morison, "as soon as they discovered the head of Buzzard's Bay."⁹ A committee is said to have viewed a route in 1697.¹⁰ Mr. Machin, an Englishman, reported the results of a survey taken in 1776 to a legislative commission headed by James Bowdoin.¹¹ Revived and urged several times, the plan lapsed about the year 1792. In his famous report of 1807 Gallatin outlined two different routes across the Cape preliminary to a discussion of the Weymouth-Taunton project, the first link in the series of canals required to accomplish the Secretary's plan of uniting the coastal states by a line of protected navigation. The surveys of this route were the work of Colonel Baldwin, in company with a committee appointed by the General Court. The report to the state legislature, forwarded to Washington, formed the basis of Gallatin's recommendation.¹² Many men of the day believed that a few years would see the completion of a new passage which would avoid a treacherous sail; yet the Cape Codders were to wait until the year 1914 before excavation through their sandy soil would add one more unprofitable canal to a long American list.

In the years 1804 and 1805 Baldwin laid out the Medford Branch Canal, one-quarter mile in length with two locks, uniting the Middlesex Canal with the Mystic River.¹³ Among other services, this small feeder let timber from New Hampshire pass down to Thatcher Magoun's newly established shipyards at Medford. Here Magoun achieved after 1815 a reputation among shipbuilders

⁹ Morison, *Maritime History*, p. 7.

¹⁰ Frederick Freeman, *The History of Cape Cod: The Annals of Barnstable County, Including the History of Mashpee* (1860), I, 333.

¹¹ "Machin's Map of a Canal from Barnstable to Buzzard's Bay," copy, noted thereon: "the original of Machin's cannot be found": Massachusetts Archives; *Massachusetts Magazine*, III (January 1791), 26, 27.

¹² Baldwin died in the midst of this work; his son, B. F. Baldwin, protracted the map of Feb. 1, 1808, extant in Massachusetts Archives. For report to the Legislature, see *House Journal* (1808), pp. 316-318. Cf. Gallatin, *Report*, sec. 1. See also, Amory, *Life of James Sullivan*, II, 65, 245, 286; J. L. Sullivan, *The Answer of Mr. Sullivan to . . . the Hon. Cadwallader D. Colden* (1823), p. 40; "Estimate of the expense of making a Canal from Barnstable Bay to Buzzard's Bay," Dec. 3, 1791: Knox MSS, XXX, 37.

¹³ "Plan of Medford Branch Canal, 1804 and 1805"; Baldwin to Sullivan, Feb. 23, 1804, copy, forwarding survey and estimate; contract between Medford Branch and Lock Proprietors and Middlesex Canal, October 1804, copy: Baldwin MSS.

second to none in America; and "Medford-built" came to denote a sure warrant of excellence.¹⁴ During these years Baldwin also drew the plans for the Dorchester Bridge, for a bridge joining Lechmere Point to Boston, and directed the building of the new India Wharf.¹⁵ This last construction, designed by Charles Bulfinch, with its brick block of thirty-two stores topped by counting rooms or warehouses, has been characterized as "the boldest bit of harbor development" undertaken to that date in the United States. It gave the water front "an air of solidity and permanence more common to European than to American ports."¹⁶

Frequently voyaging long distances on horseback, at times with special permits for Sunday travel, to supervise the organization and laying out of the town of Baldwin, Maine; to report on the feasibility of the Saco Falls and Gardner canals in that district; to undertake surveys for the promoters of the new Concord, the Stony Brook, and the Montreal turnpikes, the Colonel filled with strenuous exertion his last measure of life.¹⁷ Poor health irregularly interrupted his effort. He grew steadily thinner, losing over fifty pounds in the space of two years. When too ill these final days to do aught but obey Dr. John Hay's advice, he was forced to ignore the demands upon his skilled hand and brain and to send one or more of his sons in his place — to Bath, to Saco, or to Taunton. At times he would work the ague out of his system by severe manual labor on the farm. On horseback once more, he undertook a long surveying trip — his last — which carried him far into New Hampshire. Returning to Woburn, he became continually weaker over two months until his death on October 20, 1807.¹⁸ A measure of the man were his final words to his children, in which he showed a touch of native simplicity as he enjoined them to do all the good they could and to cherish the Middlesex Canal.¹⁹

¹⁴ Morison, *Maritime History*, pp. 102, 103.

¹⁵ Baldwin diary, 1804-1807: Baldwin MSS.

¹⁶ Morison, *Maritime History*, p. 127.

¹⁷ Baldwin diary, 1804-1807: Baldwin MSS.

¹⁸ Note on last page of Baldwin diary: "L. B. Died about half past 5 o'clock in the morning of the 20th Oct. r 1807": Baldwin MSS.

¹⁹ Last injunctions given in letter, Loammi, 2nd, to J. F. Baldwin, London, Dec. 14, 1807: Baldwin MSS.

To estimate the abilities of this early American engineer justly is not a simple task. His works should speak for him, but they are no longer eloquent. It is well, in this account of things as they were, to guard against an exaggerated appraisal. In the list of those who have contributed to the advancement of his profession Colonel Baldwin cannot be accorded a conspicuous place. Practical engineers applying and adapting known science to effect improvements were lacking, however, among Americans in the age in which he lived. Judged in relationship to his times, his abilities were rare and noteworthy and his accomplishment was outstanding. This comment, in a very real sense, serves to characterize the period.

One may speak generously of his personal qualities. His sturdy personality has pervaded parts of this record. He was honorable in his dealings, resourceful and tenacious in action, and painstaking in his work. He combined dignity, force, and a kindly humanity in his relations with laborers; and hence merited the respect and loyalty generally reflected in the attitude workmen adopted toward him. The account of Loammi Baldwin may close with an estimate of him by his most famous son, written within a few months of the Colonel's death:

Destitute of vanity, hypocrisy, and that kind of address which elevates presumption & ignorance above real worth, he practised those virtues & exercised those talents which he was blessed with, for the happiness of society only, & left the world to comment as it would. Influenced by an uncommon modesty and diffidence, he kept himself aloof from society, acquired habits, planted in youth and fixed by defective education, that were considered unsocial. I have often reflected upon his unsullied character and unspotted integrity. . . ."²⁰

The older leaders of this early period were fast departing. The president of the corporation, James Sullivan, Governor of Massachusetts after a life during which few years had failed to show accretions in reputation and public favor, died in office about a year after the death of Colonel Baldwin. The treasurer, Benjamin Hall, keeper of single-entry books since 1793, was succeeded in 1808. The chairman of the committee of operations, Aaron Dexter, had temporarily withdrawn in 1805; and Winthrop,

²⁰ Loammi, 2nd, to Cyrus Baldwin, London, March 26, 1808: Baldwin MSS.

Vaughan, Gore, and others had long since been inactive. New leaders were to master the details of the problems of the operation and extension of the system. The period 1793-1808, now terminating, has roughly a unity. Within its limiting years, the canal was built and put into operation, and the promoters who shouldered the burdens of pioneering died or withdrew.

CHAPTER IX

THE MERRIMACK RIVER CANALS

"The Indians tell us of a beautiful river lying far to the south which they call Merrimack." —
SEUR DE MONTS, *Relations of the Jesuits* (1604).

DURING the years directly preceding the Embargo, years of great prosperity in Massachusetts, the Middlesex Canal stood unfavored by fortune, and its directors were concerned for the future. They assigned two general causes for the financial condition of the canal: "The one the great length of time required to achieve an object of such magnitude — the other . . . the obstructions of the river Merrimack & of the river Nashua, which confined the transportation by the Canal to narrow limits on the former and barred it altogether on the latter."¹

[In those past times, one entered the] State of New Hampshire on the bosom of the flood formed by the tribute of its innumerable valleys. The river was the only key that could unlock its maze, presenting its hills and valleys, its lakes and streams, in their natural order and position. The Merrimack, or Sturgeon River, is formed by the confluence of the Pemigewasset, which rises near the Notch of the White Mountains, and the Winnipiseogee, which drains the lake of the same name. . . . From their junction it runs south seventy-eight miles to Massachusetts, and thence thirty-five miles to the sea. . . .

Rising at an equal height with the Connecticut, the Merrimack reaches the sea by a course only half as long, and hence has no leisure to form broad and fertile meadows, like the former, but is hurried along rapids and down numerous falls without long delay. . . . Between Chelmsford and Concord, in New Hampshire, it varies from twenty to seventy-five rods in width. . . . Like all our rivers, it is liable to freshets, and the Pemigewasset has been known to rise twenty-five feet in a few hours. . . .

Unfitted to some extent for the purposes of commerce by the sandbar at its mouth, see how this river was devoted . . . to the service of manufactures. Issuing from the iron region of Franconia, and flowing

¹ Petition to the General Court, February 1809, copy: Corporate Records.

through still uncut forests, by inexhaustible ledges of granite, with Squam, and Winnipiseogee, and Newfound, and Massabesic Lakes for its mill-ponds, it falls over a succession of natural dams, where it has been offering its *privileges* in vain for ages, until at last the Yankee race came to *improve* them. Standing at its mouth, look up its sparkling stream to its source, — a silver cascade which falls all the way from the White Mountains to the sea, — and behold a city on each successive plateau, a busy colony of human beaver around every fall. Not to mention Newburyport and Haverhill, see Lawrence, and Lowell, and Nashua, and Manchester, and Concord, gleaming one above the other.²

In this fashion is the Merrimack of the year 1839 seen with the eyes of the Hermit of Walden Pond. Its rapids were canalled, and a busy traffic of many years was yet to be stilled on its waters. More prosaic, of necessity, will be a study of the obstacles in this stream, surmounted by engineers so that a way might be cleared for the efflux of products of the industries natural to its borders and of the growing manufactures at its falls.

Three decades before, Thoreau's week on the river would have been greatly extended. Even in 1808, however, he might have been "let down into the Merrimack through the locks at Middlesex, just above Pawtucket Falls";³ he might next have passed around the Great Bend and glided near the quarry for the stone known as Chelmsford granite; then passed over Wicasee Falls at Tyngsboro, already partly improved; then thirteen miles more to Cromwell's Falls, New Hampshire, recently made passable and later to be locked; and five miles still onward to Moor's Falls in the town of Merrimac.⁴ Here his further progress would have been stopped; here, in 1808, was the terminal for canal boats from Charles River. Regular traffic then plied at an expense of \$7.00 per ton, including the canal toll of \$1.69, from the base of Moor's Falls to Boston Harbor, saving about half the expense of land carriage.⁵ About one-third of all the goods carried into the east-

² H. D. Thoreau, *A Week on the Concord and Merrimack Rivers* (1906), pp. 85, 88, 89. The trip was made in August and September of 1839.

³ Thoreau, *A Week on the Concord*, p. 80.

⁴ "Committee Report on the Middlesex Canal," March 8, 1811: Boston Athenaeum. "Report on the Obstructions of the Merrimack River," Oct. 27, 1808: Corporate Records. "Report to Proprietors of the Middlesex Canal," Jan. 25, 1809: Boston Public Library.

⁵ "Report on the Obstructions of the Merrimack River," Oct. 27, 1808: Corporate Records.

ern part of Vermont and the western part of New Hampshire came by the canal and river, as well as a much larger proportion of the goods seeking the seaboard.⁶

Through a distance of some nine miles or more from Reed's Ferry in the town of Merrimac to Blodget's Canal, the river fell untamed, a section of the stream later to be converted by law into the Union Locks and Canals, "comprehending in that space six distinct falls; at each of which, and at several intermediate places" ⁷ passages were to be blasted or locks to be laid. Although requiring improvement as soon as it reached completion, Blodget's Canal would have carried Thoreau in 1808, could he have reached so far on the river, upward one further flight. He would then have had seven miles clear passage to Hooksett Falls, near which the Londonderry Turnpike, connecting Concord, New Hampshire, to Boston through its juncture with the Essex Turnpike,⁸ crossed the Merrimack. Companies had been chartered to lock both Hooksett and Garven's falls, ten miles above, but as yet little work had been undertaken. One further hindrance, Sewall's Falls, blocked the way ahead to the confluence of the Pemigewasset and Winnepesaukee rivers. To reach, by the latter river, the New Hampshire lakes, with their two hundred miles of timber-studded shores, had long been an expected goal of the Middlesex promoters. But here nature interposed forbidding obstacles; within four miles of her confluence with the Pemigewasset, the Winnepesaukee drops at least one hundred and fifty feet.⁹

The new superintendent of the Middlesex formulated a detailed plan for the extension of the system into New Hampshire. The work was to be accomplished in part through coöperation with companies then locking different falls. Eventually, however, full control of the river was in contemplation:

If we could have a controuling interest in all the works on the river, and reduce the whole to one system, and preserve the whole in order so that there should always be a safe and uninterrupted transportation from

⁶"Report on the Obstructions of the Merrimack River," Oct. 27, 1808: Corporate Records.

⁷Thoreau, *A Week on the Concord*, p. 245.

⁸F. J. Wood, *The Turnpikes of New England and Evolution of the Same through England, Virginia, and Maryland* (1919), pp. 128, 231.

⁹"Report on the Obstructions of the Merrimack River," Oct. 27, 1808; "Report on Merrimack River Canals," January 1812: Corporate Records.

Boston far up the river, I cannot doubt that the Middlesex Canal would become good property.¹⁰

John Langdon Sullivan, who thus outlined the plan, was thirty-one years of age when in 1808 he became at once secretary,¹¹ treasurer, and superintendent of the canal company. He had taken his degree at Harvard and been educated for business in the counting room of Thomas Russell, whose daughter he married. He traveled for some years, inspecting public works, principally canals, in England and Scotland, and visited in 1804 the Canal of Languedoc, the link which united the Bay of Biscay to the Mediterranean. The installation of the English system of canal management he considered to be his first duty as superintendent of the Middlesex. Abroad he had made the acquaintance of Robert Fulton, from whose studies of canal engineering America was never to reap any considerable advantage.¹² The two men later became antagonists in a dispute over the patent rights to the steam towboat.¹³

Sullivan was a man of aggressive spirit, with ability as a manager, organizer, and manipulator, together with a flair for engineering. He was less interested in public service than others who had guided the concerns of the enterprise. Of a sanguine disposition, beset with large ideas that were both a source of strength and a cause of failure, he was cramped by the relatively meager opportunities of his time and strove against their limits. A greater, although possibly not a fairer fortune might have been his had he lived two generations later in the expanding America of the seventies. Then, at all events, he would have felt more at home.

But even in 1808 the prospect seemed promising to a man of native optimism. To unite the growing back country to the growing town by a series of canals operating as one system offered

¹⁰ Report, Sullivan to directors, June 30, 1809; Corporate Records.

¹¹ The office was called "clerk." Its duties were more detailed than those of a secretary of a modern corporation.

¹² Fulton's *Treatise on the Improvement of Canal Navigation* (1796) was of slight merit even for its time. None of his designs were from actual practice. Although he styled himself "civil engineer," "he had not been in practice, nor had he assisted in carrying out any engineering works." H. W. Dickinson, *Robert Fulton, Engineer and Artist; His Life and Works* (1913), pp. 38, 39, 93.

¹³ Details of the life of J. L. Sullivan are drawn from T. R. Sullivan, *Sketches of the Lives of John L. Sullivan and Thomas Russell* (1861); J. L. Sullivan, *Answer . . . to . . . Colder*; William Sullivan to Aaron Dexter, Jan. 23, 1814; Corporate Records.

opportunities for generalship and a chance of rewards that should be high by the standards of the time.¹⁴ Sullivan entered upon the task with decisiveness and weathered the usual course of success and failure that filled the years leading to the completion of the project. Much has been written in this study of the difficulties of canal construction of the period; it may suffice to consider the completed system, worked out for the most part under Sullivan's direct guidance.

A resolve of the General Court of the year 1809 granted the proprietors two townships of land in the District of Maine in aid of the contemplated improvements on the river. The resource furnished a needed incitement to work, but eventually proved delusive.¹⁵ Empowered by an act of 1810 to hold shares in any New Hampshire corporation engaged in the development of inland navigation on the Merrimack or its tributaries, the company availed itself of the privilege.¹⁶ After the organization of the Merrimack Boating Company, earliest corporation to run a fleet on these waters, the first boat ascended to Concord, New Hampshire, in 1814; and regular traffic began the following spring.¹⁷ Canal by canal up the Merrimack the completed system may be reviewed:

Wicasee Canal

One lock, dam, and short canal

Constructed under the terms of an act of February 26, 1813, the Wicasee Canal was in fact an appendage of the Middlesex

¹⁴ Sullivan received a salary of \$1500 a year plus a commission of 5 per cent on the income of the Middlesex Canal. This was exclusive of the pay he received from the several canal companies for overseeing the river canals. In 1818 the commission was changed to 5 per cent on the dividends. "Report on Agent's Compensation," March 24, 1819: Corporate Records.

¹⁵ *Massachusetts Statutes Private and Special*, IV, 239. Maps of the two townships in Massachusetts Archives. Agreement for survey, Feb. 23, 1816; reports of June 30, 1809, Jan. 16, 1822, in Corporate Records. A bill granting lands to the Middlesex Canal, similar in terms to the bill for the Delaware and Chesapeake Canal, passed the United States Senate on April 2, 1810, but failed to pass the House (letter from Senator Lloyd of Massachusetts to Aaron Dexter, Washington, April 2, 1810: Corporate Records).

¹⁶ *Massachusetts Statutes Private and Special*, IV, 310.

¹⁷ R. B. Sherbourne, *What Has Been; a Sketch of the Old Middlesex Canal* (1888). G. W. Browne, *The Amoskeag Manufacturing Co. of Manchester, New Hampshire; a History* (1915), p. 244. The Merrimack Boating Company received

Canal, was owned by its proprietors, and governed in part by the same charter.¹⁸

Cromwell's Canal

One lock, dam, and short canal

New Hampshire incorporated Sullivan and associates for the purpose of locking Cromwell's Falls. Section seven of the act permitted the transfer of the right to the Union Locks and Canals to serve, in that event, as an addition to their charter. The transfer was effected on August 14, 1813.¹⁹

Union Locks and Canals

Seven locks, dams, and other improvements in nine miles

New Hampshire Charter of December 23, 1808²⁰

Number of shares: 83

Assessments: \$684 per share

Cost: \$56,772²¹

Completed: 1812

First dividend: 1817 — \$7.00 per share

Proprietors²²

Middlesex Canal	73 shares
Isaac Riddle	2 "

its Massachusetts charter June 11, 1811, and its New Hampshire charter June 18, 1812 (attested copies: Baldwin MSS).

¹⁸ *Massachusetts Statutes Private and Special*, IV, 471; Act of Feb. 11, 1815, *ibid.*, V, 44. Report of agent, Jan. 6, 1824: Corporate Records.

¹⁹ *Laws of New Hampshire*, VIII, 187. Transfer of act of incorporation, Cromwell's Lock, copy: Baldwin MSS.

²⁰ *Laws of New Hampshire*, VII, 782. The charter granted certain maximum rates of toll for forty years, to be regulated, however, after four years by the justices of the Superior Court of Judicature, so that the amount of annual toll received should not exceed 12 per cent of the amount spent in construction, nor should it be less than 6 per cent. The act of June 23, 1809 (*ibid.*, VII, 812) increased the maximum limit of toll and granted it forever, but again provided for regulation by the justices five years after completion of the canal. An act of June 20, 1815 (*ibid.*, VIII, 379) allowed specified, maximum toll rates on rafts, the previous acts having provided only for toll on boats.

²¹ This figure does not include the lottery losses. See Appendix G, The Union Canal Lottery.

²² The proprietors, officers, and directors are as of 1822. The situation is typical of the period 1815-1850. Previous to 1820, John Langdon Sullivan occupied the position held by James F. Baldwin, as representative of the Middlesex, in this canal

William Parker (heirs)	3 shares
J. L. Sullivan	1 "
Amoskeag Canal	1 "
Joseph Moor	1 "
Cyrus Baldwin	1 "
Jonas Harvey	1 "

Directors and officers²⁸

James F. Baldwin, President (representing the Middlesex Canal)

Isaac Riddle, Vice-President (?)

Joseph Moor

Samuel P. Kidder (representing the Middlesex Canal)

Other officers

Frederick G. Stark, Clerk

James F. Baldwin, Agent and Treasurer

Amoskeag Canal

(formerly Blodget's Canal)

Several dams and four to nine locks at different times, in one mile

New Hampshire Charter of December 24, 1798²⁴

Number of shares: 5,000²⁵

company and in those to be presently listed. Much of the detailed material on the Merrimack River canals is drawn from a report entitled, "Questions proposed to James F. Baldwin — and by him answered — on the subject of the Canals," July 1822: Corporate Records.

²⁴ "Questions proposed . . ." July 1822: Corporate Records.

²⁵ *Laws of New Hampshire*, VI, 524. Extensions of time, *ibid.*, VII, 247, 311. An act of June 21, 1810 (*ibid.*, VII, 891) repealed the provision that the rates of toll be subject to the direction of the legislature after thirty years, but provided that justices of the Superior Court should regulate tolls after a similar period, so that the proprietors should receive dividends of not more than 9 per cent annually on their expenditures. Minor amending acts, *ibid.*, VIII, 24, 233, 349. The act of June 26, 1815, changed the corporate name from Blodget's Canal to "Proprietors of Amoskeag Canal," *ibid.*, VIII, 442. For early history of Blodget's Canal, see chap. viii.

²⁶ On the books of the company 4,000 shares stood in the name of the Union Bank of Boston in the year 1809, constituting collateral against Blodget's debt for advances of \$10,000. For some time these shares had been considered redeemable by the executors of Blodget's will, but were finally sold by the bank to the Middlesex Canal, probably in 1810. "If the shares fall into other hands, perhaps it will be to speculate on the necessity of this corporation," warned Sullivan prior to the decision to buy (report, June 30, 1809: Corporate Records). Shortly thereafter, the shares lodged as shown on p. 131.

Cost: about \$60,000 (to 1816)

Completed: 1807

First dividend: 1817 — 16 cents per share

Proprietors²⁶

Abraham Touro	1,000 shares
Jonathan Amory	900 "
William Payne	700 "
Aaron Dexter	500 "
Benjamin Joy	500 "
Joseph Head	400 "
Joseph Coolidge	400 "
J. L. (?) Sullivan	300 "
William Sullivan	140 "
Others ?	160 "

Directors and Officers

Aaron Dexter, President²⁷

Abraham Touro, Vice-President

Jonathan Amory

Joseph Head

Joseph Coolidge

Abraham Touro, Treasurer and Clerk

The directorate of the Amoskeag Canal largely interlocked with that of the Middlesex Canal until about 1835.

Hooksett Canal

Three locks in about fifty rods

New Hampshire Charter of February 18, 1794.²⁸

Number of shares: 100

Cost: \$15,000

Completed: 1812 or 1813²⁹ (nominally in 1811)

²⁶ The ownership here recorded is as of 1822, but apparently this was a stable situation from about 1810 to 1835 ("Questions proposed . . ." July 1822: Corporate Records).

²⁷ Aaron Dexter was at this time also president of the Middlesex Canal, having occupied the office since 1809.

²⁸ *Laws of New Hampshire*, VI, 149. Extensions of time, *ibid.*, VI, 408; VII, 189, 516, 681. An act of June 13, 1810, recites that "associates are now obtained, the Company organized, and two of the locks nearly completed," and extends the time for completion to September 1, 1811 (*ibid.*, VII, 853).

²⁹ "Report on the River Canals" (Sullivan), January 1812: Corporate Records.

First dividend: 1816 — \$5.00 per share

Proprietors ⁸⁰

Middlesex Canal	45	shares	
William Sullivan }	20	"	joint owners
Jonathan Amory }			
William Sullivan	24	"	
J. L. Sullivan	7	"	
Nath. Head	1	"	
Leonard Pratt	1	"	
James F. Baldwin	1	"	

Officers and Directors

John Langdon Sullivan, President

Nath. Head, Vice-President

James F. Baldwin

Other Officers

Theodore French, Clerk

John Langdon Sullivan, Agent and Treasurer

The control of the Hooksett Canal by the Middlesex was not secure in the year 1822. The machinations of Sullivan, who left the services of the Middlesex in 1820, prevented his immediate replacement as president, agent, and treasurer of the Hooksett Canal by James F. Baldwin, the new superintendent of the Middlesex. A combination of Amory and the two Sullivans voted fifty-one shares in the year 1821, and the Middlesex lost control of the river at this point for nearly two years.⁸¹

⁸⁰ From 1794 to 1809 the work on the Hooksett Canal was carried on without proper organization of a company by the original grantees, Robert MacGregor and William Duncan (or his heir). The works already executed, as well as mills, a house, and eight acres of land were then sold to the corporation for \$3,000, the first board of directors ordering an assessment of \$30 per share to make payment. MacGregor paid a debt owed to the Middlesex Canal, which had a judgment against him, by turning over twenty-five shares free of the first assessment. The ownership given above is as of 1822.

⁸¹ The first fruit of Sullivan's control was the passage of votes refusing to agree to new tolls proposed by the Middlesex, granting half rates to the Merrimack Boating Company, of which Sullivan was sole proprietor, and reserving the profits of the Hooksett Canal "for future repairs." Retaliatory measures sufficed to secure within two years full control by the Middlesex (Reports, June 19, 1821, July 1822: Corporate Records).

Bow Canal
(Garven's Falls)

Four locks in three-fourths mile

New Hampshire Charter of June 11, 1808 ⁸²

Number of shares: 157 (200 authorized)

Assessments: \$120 per share

Cost: \$21,000 (the income in the early years was expended for the completion of the works)

Completed: about 1813

First dividend: 1816 — \$7.00 per share

Proprietors ⁸³

Middlesex Canal	106 shares
William Sullivan	31 "
Joseph Head	15 "
David White	2 "
Jonathan Eastman	2 "
Richard Ayer	1 "

Directors and officers

Richard Ayer, President

James F. Baldwin, Vice-President

Jonathan Eastman

David White

George Kent (?)

Other officers

George Kent, Clerk

James F. Baldwin, Treasurer and Agent

⁸² *Laws of New Hampshire*, VII, 654. Specified, maximum tolls were granted for six years, then to be regulated by justices of the Superior Court. An act of June 15, 1810 (*ibid.*, VII, 856) increased the term of the grant of toll to thirty years, further providing that at the expiration of every ten years the justices of the Superior Court should reduce the toll if the proprietors should have received more than 12 per cent annually on all actual expenditures, but should not reduce the yield below 12 per cent.

⁸³ A report of June 30, 1809, advised that the Middlesex take a one-fourth interest in the Bow Canal. Failure of other shareholders to take up their subscriptions or to continue to pay assessments led the Middlesex Canal, in this case as in others, to increase its holdings. Full control of this canal by the Middlesex lasted until 1850.

From one end to the other of the line of navigation, changes in toll rates advised by the directors of the Middlesex received prompt ratification, with the exception already noted, by the boards of the several companies. A superintendent thus voiced the situation to the governing powers of the main canal:

. . . however informal the proceedings may be at this board touching the detail of operations on other canal companies, it is known that we are largely interested as proprietors and that any Agent of them would not feel justified in causing any extraordinary expenditures without the sanction of this Board.⁸⁴

The whole enterprise was by the year 1814 finally completed and formed a working unit. At the Boston terminal, an ingenious arrangement of buoys and cables enabled boats to be drawn across the Charles from Almshouse Wharf, where a depot was maintained, to the entrance of the Middlesex at Charlestown Mill Pond.⁸⁵ Thence to the Merrimack River and through Wicasee, Cromwell's, Union, Amoskeag, Hooksett, and Bow canals the way was clear to Concord, New Hampshire.⁸⁶ Small boats ascended still further to Plymouth, one hundred and thirteen miles from the mouth of the Merrimack, while down from Baker's River, which joins the Pemigewasset at Plymouth, timber had come since the year 1805 through the Middlesex to Boston.⁸⁷

No further extensions of the canal system and no further improvements involving material expense were immediately in contemplation. The plan of the early founders, executed apparently to its fullest practicable extent,⁸⁸ including the original and sub-

⁸⁴ Report, J. F. Baldwin to directors, Jan. 6, 1824: Corporate Records.

⁸⁵ Reports, 1807, 1808; "Business submitted," May 13, 1808; "Plan of Fixing Bouys"; "Sketch of proposed alteration in the Boats": Corporate Records. Report to proprietors, Jan. 25, 1809: Boston Public Library.

⁸⁶ Short side-canal were built to permit boats to pass from the Merrimack to warehouses in Piscataquog Village and Nashua (Stark, "Navigation of the Merrimack River," *Old Residents Historical Association*, III, 293). Cf. *Laws of New Hampshire*, VII, 226, 530; IX, 129. The Contocook and Cohas Brook canal companies apparently were never organized (*ibid.*, VII, 357, 696; VIII, 475).

⁸⁷ "Report on Business Done in 1805": Boston Public Library. Thoreau, *A Week on the Concord*, p. 88.

⁸⁸ Sewall's Falls, above Bow Canal, however, were still unlocked. Two or more abortive attempts were made before 1833. (*Laws of New Hampshire*, VI, 295; VII, 271, 585; VIII, 147, 179, 579, 735). Finally the legislature gave the proprietors of the Sewall's Falls Locks and Canals command of the river from Concord to the

sidiary canals, had become a reality. Although the corporation was burdened with new debt, contracted to finance the river companies, the directors felt more optimistic than ever before as they looked toward the future. Heading a committee in the year 1816, Josiah Quincy presented a long report. Despite sad facts there recorded, it was practically a paean of relief and joy. Underlined in bold handwriting are the words: "*The work is done!*"³⁹

And thus Thoreau, as he mentally pictured the belying canvas of the canal boats, could write: "From the steeples of Newburyport you may review the river stretching far up into the country with many a white sail glancing over it like an inland sea."⁴⁰

junction of the Pemigewasset and Winnepesaukee rivers by the act of July 6, 1833. Toll was granted, "forever, . . . the rates thereof to be established by the Court of Common Pleas . . . and on application made by any person to them for that purpose, to be by them at any time altered in such manner as they may think just and reasonable." Five years were allowed to make the section passable for boats "as large as are used in the Merrimack River" (*Laws of New Hampshire*, X, 490). The corporation completed the works in the year 1837 [H. S. Tanner, *A Description of the Canals and Railroads of the United States, Comprehending Notices of All the Works of Internal Improvement throughout the Several States* (1840), p. 33].

Many companies were formed to unite Winnepesaukee Lake with Squam, Little Squam, and with the Piscataqua, Connecticut, and Merrimack rivers (*Laws of New Hampshire*, VIII, 21, 122, 865; IX, 231, 298, 304, 322, 405, 426). No one of these accomplished any work. The rights of the five principal companies—the others had expired—were conferred in the incorporating act of July 7, 1827, on the New Hampshire Canal and Steam Boat Co. (*ibid.*, IX, 687).

³⁹ Report of committee, late 1816 or early 1817: Corporate Records.

⁴⁰ Thoreau, *A Week on the Concord*, p. 88.

CHAPTER X

BOATS AND FREIGHTS IN INLAND TRADE

MANY YEARS before the extension of the canal system into the uplands of New Hampshire, a busy life of plying boats broke the calm of Massachusetts villages. First came small skiffs, early aids in the work of construction; and then, good, strong boats of the "gondola" type, forty feet in length, sloping down at each end to a thirty-two-foot base, the shortest scow permitted on the canal. Two quarts of brandy, two quarts of rum, "& 1 Bottle broke" launched the first "gondola" in 1795.¹ The later authorized dimensions were from forty to seventy-five feet for the length and from nine to nine-and-a-half feet for the width. Most of the boats were of the largest size. The higher limits held likewise for rafts, of which as many as ten were frequently united in series and separated only for the passage of locks. The upper limit of the rate of progress of the traffic was for passenger boats four miles; for "luggage boats," two-and-one-half miles; and for rafts, one-and-one-half miles per hour. As these were merely official regulations, there was doubtless some speeding of freighter and raft.²

Man power, not infrequently seen today on canals in Belgium and France, was not permitted on the Middlesex. Oxen or one or more horses plodded along the towpath. For propulsion on the river, however, the boatmen employed scull oars, poles tipped with iron, and sails, according to the varying circumstances of the current, the depth, and the weather. "With their broad sails set, [the canalboats] moved slowly up the stream in the sluggish and fitful breeze, like one-winged antediluvian birds, and as if impelled by some mysterious counter-current."³ Or, on other occasions, they

¹ Vouchers, 1795: Corporate Records.

² Bylaws of the corporation: Corporate Records. Stark, "Navigation of the Merrimack River," *Old Residents Historical Association*, III, 291-308, gives detailed description of the boats, rafts, and methods of propulsion.

³ Thoreau, *A Week on the Concord*, p. 274.

sculled their way down with the flow of the water, or poled along close to the shore.

The canals were open for business on the average a full eight months of each year. No boat might be received unless the craft's name was marked conspicuously and unless it was numbered, from one to the greatest number owned by the same person or company. Locking after dark was forbidden, and dark was well defined as after seven in spring and autumn and, except on moonlit nights when the lock-tenders stayed on duty until ten o'clock, after nine in summer. "In consideration of the distance from home at which those persons using [the canals] generally" were — an instance of pious hypocrisy — business on Sunday was permitted, perhaps encouraged; but no sounding of horns might disturb the worshippers on that day.⁴

The corporation's fleet of six to nine boats, seventy-five by nine-and-a-half feet, was put into commission in 1804, when the *George Washington*, thirty tons, Joseph Wardwell "Commander," began to take passengers regularly on the route from Charlestown to Chelmsford. The river traffic was left to private enterprise, and no boat owned by the Middlesex proprietors passed into the Merrimack. One company, with a fleet of five boats, gave regular service in the early years to Moor's Falls, fifty miles from Boston. A host of private craft carried for their owners. By the year 1809 these carriers were doing more than 90 per cent of the business in wood and lumber.⁵

The freighters, the *George Washington*, and "The Pleasure Boat," owned by the canal company, brought small losses in seven years and small profits in three years from 1808 to 1817. From

⁴ Bylaws of the corporation: Corporate Records. A table giving the date of closing in December from 1808 to 1822 is with the records. The date of opening in April is frequently given in reports.

⁵ Subcommittee report, Jan. 16, 1804; contract with P. Buck, of Lebanon, New Hampshire, Feb. 22, 1804; report on inspection of boats received, Oct. 19, 1804: Corporate Records. Broadside re Boat Washington, noted on Baldwin's copy: "Wardwell with the Boat Washington set out from the Beachum Landing in Charlestown for the head of the canal for the first time August 22, 1804": Baldwin MSS. "Account of Wood and Timber brought down . . . in 1809" by private and company boats: Corporate Records. The largest boats, 75 x 9½ feet, cost \$200; the price was very stable during the life of the canal.

the beginning this branch of the business had been maintained from motives of policy. The fleet was finally sold at auction in 1818, when John Langdon Sullivan bought the packet with the privilege of running it two years free of toll. Coincident with the growth of population around Lowell, the corporation acquired a new, covered boat for passengers and derived profits from the service until the advent of railroad competition. A traveler took the stage in Boston at seven in the morning, with time to catch the *Governor Sullivan*, which left Charlestown an hour later. After paying seventy-five cents for the seven hour journey and lunching aboard or at a lock tavern, he reached Chelmsford at three o'clock in the afternoon and connected with the stage to Lowell.⁶

The private carriers, operating in large part on owners' account for the down trade, usually carried the bulk of the freight to Boston. A busy season employed about fifty of these boats which ran irregularly and were known in those days as transients. The casual nature of their business is indicated by the fact that their owners sometimes ceased to be boatmen during the reaping and haying season. They carried down fourteen to fifteen tons in the early years, mostly of stone, wood, and lumber to provision Boston with fuel and building and packing materials and for export, loading back with anything that was offered. Previous to the growth of the manufactures on the Merrimack, however, most of them went back empty from Boston. Litchfield, Nashua, Merrimac, Souhegan, and Piscataquog villages each had its carrier by water who, though classed as a transient, occupied a position midway between that irregular and uncertain fellow and the boating companies running regular through-freight boats to Concord, New Hampshire.⁷

⁶"The Canal Boats in account with the Canal," 1807; "Project of Improvements," 1808; "Retrospect of the Packets," 1808-1817; "On Boating," 1812; "Report on Auction Sale," 1818; reports of Oct. 28, 1803, Jan. 25, 1809; Corporate Records. "Packet Boat Expence," 1822; Baldwin MSS. *Baker & Porter's Stage Register*, July 6, 1830. L. L. Dame, "The Middlesex Canal," *Old Residents Historical Association*, III, 272-290, gives a good imaginative account of a voyage through the canal.

⁷"Questions proposed to James F. Baldwin — and by him answered on the subject of the canals — July 1822," in particular his answer to "Question 15 — What number of boats are employed on the Canals and used in transportation — Do they

The principal boating companies were three: the Merrimack Boating Company,⁸ 1812-1823; the Union Boating Company,⁹ 1819-1821, a rival concern which shortly ruined both itself and its competitor; and the Boston and Concord Boating Company,¹⁰ 1823-1842, the residuary legatee of the first. Their fleets varied in number of boats from eight to twenty of the largest size, increasing as the years passed. The Merrimack Company erected warehouses on Rust's Wharf, first above Charles River Bridge, Boston, as well as at Charlestown, Medford, and at Litchfield, Pembroke, and Concord, New Hampshire. These buildings, as well as boats, tackle, and livestock, were bought by the Boston and Concord Boating Company in 1823.

The rates for freight charged by these companies, including, as

go regularly whether full or empty? How much more could these boats carry in the course of a season than they do carry?": Corporate Records.

⁸Incorporated in 1811 and 1812 in Massachusetts and New Hampshire, the company was simply empowered to own and use boats and tackle, engines and apparel, landing places and storehouses, to the value of \$100,000. The stockholders were personally liable for debts of the company. The motives for incorporation seem to have been purely formal, or possibly the legislatures proved unexpectedly niggardly in their grants of power. At all events, John Langdon Sullivan remained practically sole owner, with a nominal interest at most held at times by a few others. In 1822 Sullivan, "being sole corporator or proprietor thereof," transferred to his brother, William, the warehouses and landing places owned by the company, as well as the rights of leases, for \$10, apparently for the purpose of avoiding an attachment about to be secured by the Middlesex Canal for his non-payment of tolls. Judgments were entered in both Massachusetts and New Hampshire, and settlements arranged with the Boston and Concord Boating Co., successor to the Merrimack Company.

⁹This company was not incorporated. Richard H. Ayer was the leading figure in the enterprise. Although in its first active year, 1820, it did more business than its rival, it soon succumbed because of the half rates given the latter by Sullivan, then temporarily in control of the Hooksett Canal. An agreement between the Middlesex Canal and the Merrimack Co., allowing discriminatory tolls, which could not be immediately abrogated by the former, militated further against the chances of success of the Union Co. It suspended business on July 1, 1821.

¹⁰The Massachusetts act of incorporation, Feb. 11, 1823 (*Massachusetts Statutes Private and Special*, VI, 84) did not confer limited liability. The New Hampshire act (*Laws of New Hampshire*, LX, 230) authorized 100 to 500 shares with limited liability. Named in the last act were William and Richard Sullivan (brothers to John), Richard H. Ayer, and Theodore French. William Sullivan had been one of the three commissioners appointed by Massachusetts to proceed to Washington to present to Congress the resolutions of the Hartford Convention of 1815. Richard Sullivan was on the Board of Overseers of Harvard College from 1821 to 1852 (J. S. Barry, *The History of Massachusetts*, (1857), III, 419; Amory, *Memoir of Richard Sullivan*, p. 17).

THE MIDDLESEX CANAL

the figures do, the tolls paid at the several canals, constitute the total price to the public for haulage by water.¹¹

FREIGHT RATES — 1815

Between Boston and:	Up	Down
Concord (upper)	\$13.00	\$8.50 per ton
Concord (lower)	13.00	8.00 " "
Pembroke	12.00	7.50 " "
Merrimac	7.00	6.00 " "

The next year the following figures ruled:

FREIGHT RATES — 1816

Between Boston and:	Up	Down
Concord (upper)	\$12.50	\$8.50 per ton
Concord (lower)	12.00	8.00 " "
Pembroke	11.50	7.50 " "
Dunbarton	10.50	7.00 " "
Manchester	9.25	6.50 " "
Merrimac (upper)	6.00	4.50 " "
Thornton's	4.50	4.00 " "
Litchfield	4.50	4.00 " "
Chelmsford	4.50	4.00 " "
Billerica	3.50	3.00 " "
Woburn	2.50	2.50 " "
Medford	2.00	2.00 " "

Furniture, \$24 to \$30 per ton, according to weight and room; empty hhd. from Concord, 50¢; tierces, 25¢; bbls., 18¢; hf. bbls., 11¢ each; hhd. staves, \$10 per M; barrel staves, \$6 per M.

As the boats ran through to Concord on every trip, and as this was the point of transshipment for the back country of Vermont and New Hampshire, the company soon left most of the intermediate business to the transients. Many of the rates to points other than Concord were discontinued. The following table of rates charged by the Merrimack Boating Company and the Boston and Concord Boating Company contains the essential data on

¹¹ The material on freight rates and other information relating to the boating companies, unless otherwise specified, is drawn from a pamphlet by Reuben B. Sherbourne, who was employed by the Merrimack Boating Company from 1816 to 1823 and by the Boston and Concord Boating Company from 1823 to 1842, as their Boston agent. He was a stockholder and officer in the second company. The freight rates given in his pamphlet have been found to accord with rates given in reports of superintendents of the Middlesex Canal (Sherbourne, *What Has Been; a Sketch of the Old Middlesex Canal*).

light costs between the terminals, for the period of economically significant operation of the system:

FREIGHT RATES 1815-1842

Between Boston and Concord, N. H. (lower landing)

Years	Rates per ton	
	Up	Down
1815	\$13.00	\$8.00
1816-1818	12.00	8.00
1819-1822	10.00	7.00
1823-1824	8.00	6.00
1825-1830	7.00	5.00
1831-1836	5.00	4.00
1837	6.00*	4.00
1838-1842	5.00	4.00

* Raised because of the temporary necessity of hauling by at Bow Canal.

An average over twenty years indicates that the time consumed in the downward voyage was four days and by the upward five days, or nine days the round trip. The divergence of time accounts in a measure for the spread between the rates up and down. Moreover, the general merchandise shipped inland could bear a higher charge than the country produce seeking the town and port.

The securing of full loads in both directions constituted a permanent problem. In part the principle of joint cost governed the fixing of the upward and downward rates. The canal-toll structure, however, as distinct from the through-freight-rate structure, shows a more complete application of the principle. Toll rates were differentially adjusted according to the charge the several articles would bear, with the aim of increasing the utilization of the plant. Such adjustment of tolls bore directly upon the activities of the transient carriers and indirectly upon the business in materials in which the boating companies engaged. Rather than adopt differential freight rates, generally, as a means of insuring full utilization of their capacity,¹² the boating companies entered the business of supplying salt, lime, plaster, and wood to fill the spaces in the loads. The first three, bought by the cargo and stored

¹² Note the exceptions indicated at the foot of the table of freight rates for 1816. Another exception may be mentioned: at their convenience the boating companies loaded granite from Concord for many years at \$3.50 per ton.

in Boston, completed upward loadings and found a market in Concord, while the agent in New Hampshire stored wood on the river bank to serve in like manner as a filler for the down trade. Receipts from the articles, with the exception of wood, generally covered cost, handling, and canal tolls and yielded a substantial freight, somewhat less, however, than the standard rate. The sale of wood in Boston usually covered cost, handling, and canal tolls — attributable expense, in short — and left a small surplus, much less than the standard freight rate. Obviously, the prime cost downward, except for the toll paid to the canal companies, was not materially increased by its presence as part of the loading.

This method of meeting the loading problem meant that the boating companies became traders on their own account in certain materials, weaving into the general risks they bore as common carriers the special risks of particular businesses. In its combination of functions the method is predicated upon a relatively undeveloped situation. Greater specialization, a limitation of function solely to that of a carrier, with reliance on the device of adjusting freight rates to secure traffic in profitable volume, leaving to others the special risks attached to merchandising, would be characteristic of a later stage of development of the market. In a somewhat unusual sense, it is a case of the limitation by the extent of the market of the degree of profitable specialization.

Interest in economy led to early experiment with steam propulsion on the Middlesex and River canals. Here was developed the first steamboat in Massachusetts,¹³ which was also the first tugboat in the United States.¹⁴ In the year 1810 John Langdon Sullivan, superintendent of the Middlesex Canal, contrived a ma-

¹³ The year 1818 is usually given as the date of the first steamboat in Massachusetts (Preble, *Chronological History of . . . Steam Navigation*, pp. 95-97; Morison, *Maritime History*, pp. 235, 236). The short accounts of the Middlesex Canal by Yeaton and Mann give the date of the steamboat as 1818 or 1819. The records show that such a boat was in operation in 1812. Nathan Read of Salem, who took out a patent on a boiler in 1791, apparently never succeeded in building his proposed steamboat (Preble, *Chronological History of . . . Steam Navigation*, p. 17; R. H. Thurston, *A History of the Growth of the Steam Engine* (1878), pp. 247, 248).

¹⁴ Jonathan Hulls published a pamphlet in London in 1737, containing the idea of a steam towboat (Preble, *Chronological History of . . . Steam Navigation*, p. 9).

chine to move paddle wheels in a boat by the power of men, horses, or oxen, for the purpose of towing other boats astern. Placed in none too effective operation that year, the mechanism furnished insufficient power. The next spring, through one John Fairbanks, Sullivan met Michael Morrison, inventor of chain floats for moving steamboats — apparently a variant for paddle wheels — and shortly thereafter purchased the right to use his appliance on the Middlesex Canal and the Merrimack and Connecticut rivers. On the latter river, it had been tried with some success by Jehosophat Starr. Morrison was sent to inspect one of Oliver Evans' engines then in use in Middletown, Connecticut. On receipt of his favorable report, Sullivan wrote Evans, July 12, 1811, requesting prices and terms for an engine adapted to the proposed tugboat. After the interchange of several letters, Sullivan ordered a twenty-horsepower engine, costing \$5,000, to be delivered the following spring, and built a boat during the winter to receive it.¹⁵

The engine arrived at Boston in April of 1812 and was conveyed to Charlestown for installation. One Captain Carey, who had interviewed Evans in Philadelphia with reference to particulars of managing the machinery, took charge of the engine on its arrival. It proved difficult at first to adapt the machine to the boat that had been prepared, and Sullivan sent Asba Bradley to Philadelphia to secure further advice. The emissary returned with John Mulholland, one of Evans' workmen, and the two installed the engine in the boat, to which Michael Morrison then affixed his patented chain floats. The whole was tried out not later than the month of July of 1812, both on the Middlesex Canal and the Charles River.

The chain floats, however, were disadvantageously placed in a trunk in the center, and the boiler was situated so far astern that

The tug "Charlotte Dundas" built by William Symington and used on the Forth and Clyde Canal in 1802 is characterized by Ewing as the first practical steamboat (J. A. Ewing, "Steam Engine," *Encyclopaedia Britannica*, 11th ed.). There had apparently been no tug in America before the one employed on the Middlesex Canal.

¹⁵ The material in this and following paragraphs, unless otherwise specified, is drawn from an eight-page memorandum, elaborated for submission in 1813 to a board of referees chosen to decide a dispute between J. L. Sullivan and Robert Fulton. Opposite each fact there detailed is listed the supporting evidence: affidavits, correspondence, conveyances, acts of the legislature, etc. The document is with the records of the Middlesex Canal.

the boat drew unequal depths of water and was otherwise inconvenient. A new boat was constructed with the chain floats arranged so as to move on the outside of the boat in recesses within the wale piece. Mulholland having returned to Philadelphia, Asba Bradley came up again from Connecticut and transferred the engine to the new boat. She was placed in operation early in October of 1812, moving at seven miles per hour on the Merrimack River and at four miles per hour on the canal. The slower speed was said to be due to the narrowness of the artificial waterway. On the open river she hauled canal boats at the rate of four miles per hour. During 1813, loaded boats were thus towed up the Merrimack and, by means of an attached windlass, to turn which the whole power of the engine might be directed, the tug warped herself up rapids, drawing other boats after her.

Hearing of the experiments, Robert Fulton wrote to one Swan in the summer or autumn of 1812, asking for information regarding the tugboat. Swan referred the letter to Sullivan, who answered the inquiries directly. On May 24, 1813, Fulton made application to the Secretary of State for a patent right to "the combination and connection of several boats, constructed and connected in a manner so as to be propelled or drawn forward by one boat, containing a steam engine with the machinery necessary to the propelling such steamboat." The invention consisted "essentially in the separation of the steam engine and the boat containing the same, from the boat or boats which carry the passengers and cargo."¹⁶ Before applying for a patent, Fulton not only had knowledge of Sullivan's experiment; he had also ridden in the tugboat *Charlotte Dundas* on the Forth and Clyde Canal. The most probable date of his visit, when the inventor, Symington, freely offered a demonstration, is the year 1804.¹⁷ It is not improbable that Sullivan also saw the British tugboat during his visit to Scotland in the early years of the century.¹⁸

¹⁶ Robert Fulton, petition for a patent, filed at Washington, June 11, 1813 (Sullivan, *Answer . . . to . . . Colden*, pp. 37, 38). "I must do Mr. Fulton the justice to say that in explaining my plan I may not have informed him of my intention to take out a patent" (*ibid.*, p. 14).

¹⁷ Dickinson, *Robert Fulton*, pp. 179-181, 256.

¹⁸ Sullivan later wrote of himself: ". . . I am less of a mechanic, than man of business" (Sullivan, *Answer . . . to . . . Colden*, p. 12).

The claim of Fulton clashed with Sullivan's application made some months later, and the question of priority of discovery, as required by law, was submitted to referees. Accordingly, James Hillhouse, appointed by Secretary Monroe, Eli Whitney, chosen by Fulton, and Theodore Dwight, chosen by Sullivan, comprised the arbitrators. They met at Hartford and decided unanimously on December 16, 1813, in favor of Sullivan. Letters patent for his invention of the "Steam Tow-boat" were therefore issued on April 2, 1814.¹⁹

The significance of the appliance became apparent as the years passed. Sullivan spoke of it as "a striking invention that effectually extends the Erie Canal to the city of New York more conveniently than if a towing path had been effectuated along the shores of the Hudson."²⁰ Its use in New York, however, was estopped by the steamboat monopoly in that state, even though the North River Steamboat Company, assignee of the Fulton-Livingston rights, was restrained by charter from conducting a freighting business. In an attempt to open the waters of the state to competitive steam traffic, Sullivan became one among those besieging the New York Assembly. "I shall never regret," he wrote, "the personal sufferings of two unsuccessful winter campaigns in Albany."²¹ His efforts were instrumental, he believed, in creating the sentiment needed for the passage by Congress of a law (1819) "to extend the jurisdiction of the Courts of the United States to an original cognizance as well in equity as at law, of all cases, arising under any law of the United States, relative to patents, with authority to grant injunctions to prevent the violation of the rights of inventors."²² This had broken certain of the New York monopolists' extraordinary remedies at law.

Aware that his invention might prove more profitable elsewhere than on the Merrimack, Sullivan secured exclusive rights to the use of his tugboat on the Connecticut River in Massachu-

¹⁹ Sullivan, *Answer . . . to . . . Colden*, p. 38; T. R. Sullivan, *Lives of John L. Sullivan and Thomas Russell*.

²⁰ Sullivan, *Answer . . . to . . . Colden*, p. 14.

²¹ *Ibid.*, p. 22.

²² *Ibid.*, p. 11.

setts during the twenty-eight years that should follow the expiration of his patent.²³ To make the scheme yield profits, the falls at Enfield above Hartford had to be locked. The Connecticut act of incorporation of the canal company reserved to the legislature, as was then usual in the case of the incorporation of banking and insurance companies, "the right to amend, alter, and annul."²⁴ This was an efficient cause of the failure to secure capital for the undertaking. "The [Massachusetts] grant . . . expired under the hostile caution of Connecticut."²⁵

Thwarted in New York, Massachusetts, and Connecticut in his desire for success, Sullivan took his patent to the waters of Georgia, where a company was created which carried his plan into effect. He sold his share and rights for \$5,000 and returned to Boston to form a company for the navigation by tugboats of the Santee River in South Carolina. "In the little steamer 'Patent'," he wrote, "we sailed, late in the season [of 1821] from Boston, arrived, ascended, [and] fulfilled expectations."²⁶ Later he reported: The "engine . . . towed loads of merchandise up the Santee against its heavy freshets bringing down large quantities of cotton."²⁷

But the scheme was doomed to failure. A lock fell in on the Santee Canal, forcing the steamer to make the circuit of the seacoast. This was followed by the bursting of the tugboat's boiler after grounding in the Santee River. The concern was closed at a loss, and Sullivan returned north to continue the fight in New York. A hostile pamphlet in 1823 against Colden, the principal apologist for the New York "monopoly of fire and steam," seems to have constituted his final effort to capitalize on a patent right of great commercial possibility. General discouragement or an accumulation of debt may have deflected Sullivan's interest from business. He turned to other pursuits,

²³ *Massachusetts Statutes Private and Special*, V, 42, 286. This extension of a patent right on one river has been referred to as similar to the monopoly granted by New York to Livingston and Fulton (B. H. Meyer, ed., *History of Transportation*, pp. 106, 107).

²⁴ Sullivan, *Answer . . . to . . . Colden*, p. 16.

²⁵ *Ibid.*, p. 17.

²⁶ T. R. Sullivan, *Lives of John L. Sullivan and Thomas Russell*.

²⁷ Sullivan, *Answer . . . to . . . Colden*, pp. 6, 7.

finally to an active professional career in both engineering and medicine.²⁸

The early tugboat on the Middlesex Canal and the adjacent rivers had been succeeded in 1818 by the *Merrimack*, containing a Morey engine. The superintendent's report for the year 1819 referred to it as follows:

In the freshets, and generally, the steam Towing boat has been very useful, being able to take two loaded boats against the current when otherwise they could not have moved at all — at other times carrying them in half a day as far as they could have gone in two by the ordinary means. This boat tho not so well adapted as it might be easy to have them has served to prove the practicability and diffuse confidence and expectation through the greater part of New Hampshire and Vermont on this subject.²⁹

Such expectation and confidence were ill-founded. The advantage of employing steam on early canals was usually more than offset by delays at the locks. Boats can be hauled at a particular speed, depending on the depth of the waterway, with a smaller expenditure of energy than at a higher or lower speed. There was danger, furthermore, of erosion of the banks from the wash of a boat operated at speeds much exceeding three and one-half miles per hour. Between the several canals on the Merrimack these considerations did not obtain. Yet the traffic there was not sufficiently regular, nor were the intervening reaches of the river between the canals long enough, to insure profitable employment of tugboats. Towing by steam power was abandoned on the canal in 1820 and never resumed.

²⁸ T. R. Sullivan, *Lives of John L. Sullivan and Thomas Russell*.

²⁹ Agent's report for 1819, Feb. 29, 1820: Corporate Records.

CHAPTER XI

CROWDING COMPETITION

TWO COMPETITIVE modes of carriage troubled the canals and boating companies. The menace of the competing teamsters hovered in the background and was never completely banished. More ominous still were the effects of the competition of a railroad which extended year after year a parallel line of communication. The boating companies fought a losing battle against the latter for ten years, the canals for more than fifteen, before they finally succumbed. A principal cause of their early misfortunes, however, was the progressive reduction in the price of hauling by land. Jeremiads on this subject were the rule in the reports of succeeding superintendents. The outspreading of the turnpikes, the increase of tonnage consequent upon the development of the back country, the multiplication of wagons and livestock, and the growing competition among teamsters operated to lower the price of overland carriage.

On this and related matters, the ablest of the superintendents of the Middlesex Canal wrote in 1825:

Attempts have been made to stop the teaming from Concord, N. H., and to change the transportation from land to water carriage, but as yet the encouragement held out has not been sufficient. Before the canals were opened, the price of carrying by land was 14 dolls. per Ton from Concord to Boston and as much back to Boston.¹ The Boats carried . . . for the last two years for 8 dollars up and 6 down, making the water carriage *both* ways only equal to the land carriage one way before. . . .

It has not been very difficult to ascertain the rates of toll which the manufacturing companies . . . were willing to pay, because they are accessible & their views readily known & therefore the rates of toll have been so fixed and arranged with them that they have done their carrying for the last two years by the Canal. But when the large and extensive trading interests of New Hampshire & Vermont are to be consulted and their carrying drawn on to our waters nothing but repeated experiments

¹ The reference is to about the year 1814.

by reducing the water carriage will shew what limits are necessary to fix in order to gain their business and at the same time to keep up the productive income of the Canals. It is very difficult to tell to what price water carriage should be reduced to ensure the carrying. The nominal price of land carriage seems not to be a guide, for so many considerations enter into the agreements with teamsters that the actual cash cost of transportation to the trader is to us rendered very uncertain and indefinite.

As we have succeeded in bringing into our Channels the carrying trade of the Manufacturing Companies in Chelmsford [Lowell] at certain reduced rates of Toll, it would seem probable that a proportionate reduction, open & equal to all, on the River Canals might ensure an increase of business from the upper country. . . .²

Special features of the agreements with teamsters are shown in an earlier report, a document from which considerable quotation will be made. The road haul was the more costly, yet much of the tonnage continued to move by teams. James F. Baldwin was therefore asked to "state, in detail, the reasons why the land carriage is preferred; — embracing in this answer the *savings*, of whatever nature, which lead to a preference of land carriage?"

Answer — Those traders and others who live immediately on the River between Boston & Concord generally have their property carried by water. — Those in the interior who must employ teams to go to the river and the landing places thereon often send their teams quite thro' to Boston; for the expense is less in proportion to the distance than it would be, were they to send them only to Concord. For instance, a teamster charges 30 dollars to carry to & the same to bring a Ton from Boston to Bath in N. H., a distance of 160 miles — & charges from Bath to Concord 20 Dolls. per Ton, distance 88 miles.

Land carriage is probably preferred:

First — Because the teams take the goods to & from the warehouses in Boston without the expense of truckage.

Second — There is almost a certainty as to the time of the teams' arrival — and the country Trader has not often to wait in Town after making his purchases for his teams, nor at home for his goods — the security from storms is provided by coverings of leather which will bring the cost at home.

² Agent's report for 1824, Jan. 8, 1825: Corporate Records. The author of the report was James F. Baldwin (1782-1862), superintendent of Middlesex Canal, 1820-1825, engineer for the first survey for a railroad from Boston to Albany, engineer employed in building the Boston and Lowell Railroad, 1831-1836. See Appendix B.

Third — Land carriage is more employed as country produce abounds — and good loads down lessen the expense up. . . .

Fourth — Pot & Pearl Ashes (which have for a few years past been low in the market & consequently few made) now form nine-tenths of the loading down country of the teams — for there is more encouragement to manufacture them — these articles are principally carried the fore part of the season — and make a good remittance, for they generally bring cash — In the fall neat cattle are *driven* to market, and they furnish a great source for cash to the trader — This great article of produce . . . furnishes no loading to the teamsters down & on this account more carrying may be expected for the boats in the fall than at any other season of the year.

Fifth — There is so much shifting of the goods necessary when sent by water, that if any damage arise, it is difficult to charge it upon the proper person — The truckman, Boatman or teamster may be in fault but which, it is not easy to say. There are more bargains to make by the owner of goods for carriage — more attention, to provide a conveyance — more bills to pay. . . . — The trader who sends by land agrees with the teamster at his own store & the produce taken from it & the goods returned there without further attention as to carriage.

Sixth — The trader prefers paying the expense of land carriage (even if it is a little more) in his way, that is, out of his store — to paying cash to the Boatmen — there is however an advance of cash necessary for land carriage — that is, for the cash expences on the road — this in the instance I have mentioned from Bath to Boston amounts to 3 dolls per day for 16 days provided the grain & meals are bought at the Taverns — making the expences on the road 48 Doll. & for teamster & Team 72 which make at 30 Dollars per ton

— 4 Ton that is 2 up & 2 down 120 Doll.

Should the teamster carry any grain & victuals — the expence of 3 Dollars per day would be lessened. When the trader pays this sum of 72 dollars from his store it is probably at an advance on the cost of the articles given in payment of $33\frac{1}{3}$ per cent.

Seventh — Many traders have sent their teams from the interior to the river for their goods, when they had not arrived. . . .

Eighth — When produce is sent by land to Boston, the trader is there, to dispose of it — and loads back his teams with the goods he has purchased — When sent by the Canals & rivers; he must be in Town to purchase his goods & truck them to the Boat which carries them to Concord — & wait till the return of this boat which his teams should have met at Concord before he can receive and dispose of his produce & finish his business — after a trader has made his

purchases and sent his goods on, he is unwilling to remain much longer in Town. Were there teams going from Concord regularly, like stages, into the interior — this inconvenience would not exist for the trader would not feel bound to supply the team with a load any more than the returning boat.

Ninth — The difference of expence in favor of water carriage actually made to the interior traders is not great enough to induce him to overlook many unavoidable delays and disappointments incident to this mode of conveyance — when displeased ever so unreasonably — they seek another mode of conveyance even if it is against their interest — and their remedy (the teams) are generally at hand. . . .³

It would be unwise to conclude from Baldwin's analysis that the canals were without business. Certain classes of goods were carried solely by water; no class of goods was confined to the teams.⁴ But the fight with the teamsters was persistent and could not be solved by votes in committee "that tolls be recommended to be reduced so as to undercarry the waggoners."⁵ The tolls were but one constituent and not necessarily a governing factor in freight rates. Negotiations between the canals and the boating companies consequently took the form of proposals to lower tolls if freights should be likewise lowered, or vice versa. Year after year the negotiations were successful. Steadily falling tolls, steadily falling freight rates by canal and river, and steadily falling costs of land carriage thus marked the period from 1815 to 1842. Nourished by this favoring stimulus, the factories on the Merrimack took root. The cheapening of transportation was a prerequisite to their start and to their growth.

A more sanguine superintendent, Caleb Eddy, in the year 1826, thus presented the situation:

New Hampshire depends in a great degree on Boston and Chelmsford as markets for their staple articles which must be conveyed through the river. There appears likewise to exist a spirit of enterprise in the Capitalists of this Metropolis to encourage the Manufactures of our own Country. They have already invested great sums of money in New Hampshire and in all probability would expend still larger sums in erecting works upon the numerous water privileges upon the Merrimack and

³ Report, "Questions proposed . . . July 1822": Corporate Records.

⁴ A discussion of goods and tolls in chap. XII covers these matters.

⁵ Committee report, May 17, 1820: Corporate Records.

streams connected therewith if the transportation thereto could be rendered light and certain. The lands in the vicinity of all these water privileges would become very valuable for Agricultural purposes. A ready sale and near market would be found for all and every surplus article the farmer might possess, full employment to the enterprising artist, the laborer great wages for his hire, and the Capitalist a sure interest on the amount invested. . . .⁶

On the line between Lowell and Boston the competition of the teams was likewise vigorous. The full custom of the manufactories was not always secured by the canal. The factories attempted to force reduction in tolls and seem often to have shipped overland without other motive. In the year 1827 all raw material from Boston came by the canal; but the down freight of finished goods, amounting to 522 short tons for six of the Lowell factories,⁷ was in large part teamed to Boston. The teamsters then charged \$4.00 per ton, while the freight rate for merchandise by transient boats was \$2.00 per ton to the warehouses in Charlestown, to which must be added 50 cents a ton for truckage to any part of Boston.⁸

The Middlesex Corporation found it necessary to act in reply to certain strictures, published in 1827 by Kirk Boott, agent of the Merrimack Manufacturing Company,⁹ on the subject of boats and toll policies. The toll committee formed the new classification "Factory Cotton Cloths" — formerly included under merchandise at \$1.00 — and assessed it 50 cents per ton for passage through the Middlesex. In a test arranged the next year, two boats operated by the Hamilton Company of Lowell transported 2,937 tons, of which 437 tons comprised the finished goods shipped to Boston. "The whole expense during the season with an allowance of 150 dollars for depreciation of the boats added, amounted to the sum of \$2601.57 cts. a little short of ninety cents per ton."¹⁰

⁶ Agent's report for 1825, Jan. 16, 1826: Corporate Records. Eddy was superintendent from 1825-1845.

⁷ Estimated annual production of six factories by Kirk Boott, quoted by Eddy, annual report, Jan. 15, 1828: Corporate Records.

⁸ Annual report, Jan. 15, 1828: Corporate Records.

⁹ Open letter from Kirk Boott to Matthew Carey of Philadelphia (father of the economist), quoted extensively in Eddy's report.

¹⁰ Eddy, report, Jan. 26, 1829: Corporate Records.

This did not include the toll. The results with reference to the shipment of finished goods — the sole object of the experiment, since the goods bound upward to the factories were already carried by the canal — indicated a saving of over 50 per cent on the cost of hauling by land.¹¹ Many transient boats this same year had carried goods for the manufacturing companies. All the corporations then in being at Lowell shipped both ways by the canal in the year 1829.¹²

The decade of the twenties had witnessed a remarkable development. Consequent upon the rapid expansion of the factories, the major source of the receipts of the Middlesex Canal had completely changed in five years. The superintendent reported:

Our canal revenues will depend much upon the support the 'American System' receives in future, the receipts of the past year shews the necessity of giving every encouragement to Manufactures. It is a fact that about one half of the whole receipts the past year were derived from that source. Can there be a more striking evidence of the necessity of aiding, as far as in your power, Corporations so nearly allied to your interests by affording them cheap, certain, and regular conveyance during as many months of the year as possible?¹³

Little more is heard of the competition of land carriage. Reductions in tolls had been made to secure the shipping of the expanding factories¹⁴ and to enable the transient boats profitably

¹¹ "Goods transported from Lowell to Boston by two Company boats 437 tons:
Dr. Cr

Tolls on 437 tons	\$218.25	437 Tons transported on teams, at the price paid the year previous — \$4. per ton —	
Boating at Cost 90¢	393.30		
	<hr/>		
	611.55		
Wharfage & Truck g to any part of the City	218.25		\$1748.00
	<hr/>		
	829.80		
Balance in favor of Canal..	918.20		
	<hr/>		
	\$1748.00 ¹⁵		

Report, Jan. 26, 1829: Corporate Records.

¹² Report, Jan. 31, 1831: Corporate Records.

¹³ Report, Jan. 26, 1829: Corporate Records.

¹⁴ The magnitude of the manufacturing interest at Lowell, as of Jan. 1, 1835, and the dates of the founding of the several concerns are indicated in the statistical table in Appendix H.

to carry the river trade. Negotiations with the main boating company had brought about the lowest freight rates in the history of the region. The carrying trade sought the waterways in increasing volume. Future prospects were consequently agreeable. There would be a continuation of acceptable, probably increasing, although hardly large, dividends. Six per cent on the total cost of the enterprise, calculated with compound interest to 1819, the date of the first dividend, could not be anticipated. The canals might yet be blest, however, if nothing untoward arise, with growing usefulness and with a prosperous middle age. The laboring noise of a locomotive forever shattered this expectation.

The second generation of civil engineers in the United States had turned its attention to the railroad. The work of two men, James F. Baldwin in Massachusetts and George R. Baldwin in England, had now a dramatic value; for they were preparing the *coup de grâce* that should at last extinguish an institution in which their father took peculiar pride and which at his death he enjoined them to cherish.

The Boston and Lowell Railroad was chartered June 5, 1830. "A doubtful speculation," said the *Transcript*,¹⁵ giving voice to popular hesitancy. The annual report of the canal company of 1829 had already contained mention of the railroad, as the agent urged durable rebuilding of portions of the canal:

. . . every precaution should be taken in rebuilding the necessary works to satisfy the public that a due regard is had to their interest. . . . Recent events shews the necessity of guarding against wrong impressions, Rail Roads, the rival of Canals, are as yet, in this country, in a state of infancy, in the minds of many the infant with legislative nursing will expand to Giant form, and swallow Canals and Turnpikes with as much ease, as a modern Legislator would ride upon a free bridge, McAdamized with unexpired charter rights granted by former governments.¹⁶

A year later James F. Baldwin's survey for the Boston and Lowell Railroad was before the General Court. "Your interest is greatly involved," wrote the canal agent in his annual report to the Middlesex proprietors.¹⁷ Within a month a committee, com-

¹⁵ *Boston Transcript*, Sept. 1, 1830.

¹⁶ Report, Jan. 26, 1829: Corporate Records. The allusion is somewhat baffling. The canal was also to experience legislative obtuseness to its rights.

¹⁷ Report, Jan. 27, 1830: Corporate Records.

posed of William Sullivan, Joseph Coolidge, and George Hallett, remonstrated to the legislature: They believed no cheaper or safer mode of conveyance than the canal could ever be established, nor one better adapted to carrying heavy freight. They stated that the canal carried passengers as rapidly and safely as anywhere in the world; that a railroad solely for passengers had never been tested by experience; and that there could never be a sufficient inducement to extend a railroad westward and northwestward from Lowell. Finally, they argued that no exigency existed for granting the charter; and that if it should be granted, the canal corporation should be indemnified. This protest availed them nothing; the proprietors' vested rights were disregarded. The railroad was incorporated, and compensation to the canal company refused.

A branch canal from Billerica to Lowell, reducing the distance from eight to four miles and designed to prevent the future railroad from taking the Lowell trade, was surveyed in 1830. The plan was soon abandoned; but a new lock constructed at Billerica Mill Pond let boats into Concord River and accomplished nearly the same result. Needless to remark, it did not effect its purpose. Already in 1831, Patrick Tracy Jackson, president of the rival corporation, wrote: "I am now laying out the route of the Rail Road from Boston to Lowell, we must cross your canal and in some places pass so near as to take some of your land."¹⁸

Meanwhile, in England George Rumford Baldwin,¹⁹ employed by the Boston and Lowell Railroad, was going on foot over the lines of all railroads built or being built near Liverpool and Manchester,²⁰ taking measurements and making drawings, or copies of plans, which he sent back to James F. Baldwin and to Patrick T. Jackson. He saw, questioned, and received aid from George and Robert Stevenson and from George and Sir John

¹⁸ P. T. Jackson to proprietors, Nov. 10, 1831: Corporate Records.

¹⁹ The material in this and following paragraphs is drawn from correspondence in the Baldwin MSS from G. R. Baldwin to J. F. Baldwin, written in England and Scotland between Nov. 30, 1831 and Dec. 29, 1832. Sketches and notes came with the letters; rolls of plans were sent separately.

²⁰ The first lines constructed after the Liverpool and Manchester were built in connection with it (Jackman, *The Development of Transportation in Modern England*, II, 535).

Rennie.²¹ He kept a stream of letters crossing to America for more than a year, concerning the manufacture of parts and the technique of railroad construction.

He noted the details of prices of fares on railroads and the comparative merits of different locomotives, shapes of rails, tenders, wheels, roadbeds, crossings, switches, cars, dump cars, repair shops — plans of these last he made and sent — terminals, sleepers, radii of turns, embankments, bridges, and modes of policing the line, of signaling, and of stopping. Samples of the stone used in England came across by ship to the hands of Patrick T. Jackson. When Baldwin went to St. Helens to see the opening of a short branch railroad, he counted the number of strokes the engine made on different parts of the road — ascending, 50 per minute; descending, 105; on the level, 96; descending at full speed, 120.

He placed orders for a locomotive, chassis, tender, and rails, and then interviewed and shipped on or aided on to America a number of mechanics anxious to come over. On April 6, 1832, he wrote that the first locomotive and the first mile of straight rail ordered by Jackson for the Boston and Lowell were shipped. Meanwhile, he had covered more railroads near Liverpool, including the Warrington and Newton, the St. Helens and Runcorn Gap, and the Bolton and Wigan; and had noted the notches marking the place where Huskisson²² fell and had talked with a workman who had administered aid to the dying statesman.

Scientific books and copies of parliamentary reports on roads, railroads, and docks passed over the Atlantic. In April, 1832, voyaging toward London — with the expectation of returning “by way of Newport in Wales which is near where our Rails are making” — Baldwin covered, in his usual manner, the Peak Forest Railroad, which he found “interesting by reason of inclined planes worked by stationary steampower.”²³ He traversed eight miles of road near Buxton and Cromford, and his sketches of cast iron bridges traveled to America as a result.²⁴

²¹ Sons of John Rennie, also engineers — George (1791-1866) and John (1794-1874).

²² William Huskisson (1770-1830), reputedly the first railroad casualty.

²³ Letter, May 22, 1832 (London). ²⁴ Letter, April 30, 1832 (Liverpool).

Through the kindness of Admiral Sir Isaac Coffin — who talked of leaving his ribbon to the Boston Athanæum²⁵ — he visited the Royal Arsenal & Royal Military Repository, sometime after he had inspected the progress of the rails being rolled for the Boston and Lowell at the ironworks of Builey [?] Brothers & Co. He then traveled northward from London to Ashby-de-la-Zouch to see the new railroad partly made from Leicester to Swannington, and so into Scotland to Lanark. At Glasgow he inspected the Garnkirk Railroad; at Edinburgh, the Dalkeith horse railway; at Falkirk, the Carron Iron Works. Southward once more, he journeyed to the colliery railways at Newcastle and Shields and to the great iron bridge at Sunderland. He was unable to see Vignoles,²⁶ to whom he had letters, as that gentleman, he heard, was on railroad business in Ireland. A day's walk of nineteen miles up and down the Stockton and Darlington resulted in a long description and a number of sketches. These were sent at once to the United States. The Leeds and Selby Railroad, details and drawings of several improvements in boilers, an ironworks at Coalbrookdale — but the list is endless. The process of making blocks for sailing vessels by Brunel's machinery impressed this Yankee mightily.

The Boston and Lowell Railroad thus drew on contemporary experience and experiment in Great Britain, and the chief engineer at the Locks and Canals Machine Shops, George W. Whistler, father of the artist, was later brought in touch with English developments. The Locks and Canals Machine Shops were the builders of locomotives in Lowell and put "The Patrick,"²⁷ their first, upon the rails on June 30, 1835. Baldwin, so employed

²⁵ ". . . if they will allow it to be hung over his Bust now there. . . . He is introducing to the English the Yankee mode of catching mackerel, & of eating clams, the latter, tho in abundance here, are not used as food" (letter, July 18, 1832). Isaac Coffin (1759-1839), born in Boston; created a baronet, 1804; admiral, 1814; in Parliament, 1818-1826 (*Dictionary of National Biography*).

²⁶ Charles Blacker Vignoles (1793-1875), re-inventor in 1836 of the so-called Vignoles rail, a flat-bottomed rail now in general use in the United States and on the Continent, invented by Stevens in 1830 ("Railroads," *Encyclopædia Britannica*, 11th ed.).

²⁷ Named after President Patrick T. Jackson of the Boston and Lowell. Whig directors objected, in 1835, to naming the engine Jackson. The first two large and powerful engines built in Lowell, 1850, were "The Baldwin" and "The Whistler."

by the Boston and Lowell to secure technical details abroad, was at his work in England within a year after the epoch-making opening of the Manchester and Liverpool Railroad.

Throughout its life the Middlesex Canal was forever building and rebuilding. Alone of its works the flight of stone locks on the Merrimack stood the assaults of water and time. In strict contrast, the precision, care, and solidity which characterized the building of the Boston and Lowell Railroad have become proverbial. Laying its own tombstones, the canal brought granite sleepers for the roadbed of the railway. They were so solid as to cause undue wearing of rails and equipment. The joints between lengths of rail were needlessly chiseled to a smooth finish. The road was built for an eternity. English practice, to be sure, formed a precedent for stone sleepers. Yet it can be said that a generation of experience — daily present to their view in the canal which passed their door — proved that public works should be built of lasting materials and led the engineers of the railroad to an emphasis on durability.

With a warning against future expectations — “in a short time a large part of the Tolls to Lowell will be paid to another Corporation”²⁸ — the agent of the Middlesex Canal announced a dividend of \$30 a share in 1834. The Boston and Lowell Railroad was building principally for the transportation of goods to and from the Lowell factories. Its projectors estimated a total freight of 15,247 tons annually, to bring a revenue of \$30,434.²⁹ If this be taken to indicate a freight rate of \$2.00 per ton, it represents no saving over the freight rate on the canal. The service offered, however, was much superior. Slowly, at three miles per hour, the locomotive “Stevenson,” built at Newcastle-on-Tyne, traveled in a canalboat from Boston to Lowell. On June 24, 1835, the railroad was opened for passenger service, and by the following January it was transporting cotton and coal.³⁰

²⁸ Report, Jan. 31, 1834: Corporate Records.

²⁹ H. C. Taft, *Early Days of Railroading* (1913), p. 15.

³⁰ Freight began to be carried on the railroad in July 1835, but apparently the first year's freight business was not great (Taft, *Early . . . Railroading*, pp. 20, 21; report, Jan. 20, 1836: Corporate Records).

CHAPTER XII

CARGOES AND TOLLS

1804-1853

THE TOLL rates charged, the types of goods carried, and the volume of the traffic going in each direction on the canal varied at different times. Four periods are roughly discernible. The first, from 1804 to 1814, is characterized by the highest rates of toll and by the predominance of the downward tonnage, composed mainly of timber and timber products. The second, from 1815 to 1835, begins with the opening of the Merrimack River canals and is marked by the development of the carrying of other kinds of goods and by a steady increase in upward shipments. It is a time of recurrent lowering of toll rates with severe reductions occurring at its mid-point and during its later years. The principle of charging what the traffic will bear is adopted more consciously and applied to a much greater extent than before. The canal secures the custom of the growing factories; and, toward the end, the highest dividends in the history of the company are paid. The period closes as the railroad from Boston to Lowell is completed, although before it has begun to carry freight in any volume.

The years from 1836 to 1842 differ from the preceding period in that the canal has in large measure lost the local tonnage between Boston and Lowell, and similarly, in 1839, the tonnage between Boston and Nashua. Practically sole reliance begins to be placed on the through river traffic between Boston and Concord, a reversion in a sense to the more primitive beginnings of the second period, before the development of the factories. It is, like its predecessor, a time of falling tolls.

The fourth period, from 1843 to 1853, starts with an abrupt change — consequent upon the opening of the extension of railroad communication to Concord — and with a drastic reduction

in tolls. The fight is sharp, and the waterway is immediately marked for defeat; in 1843 the expenses of the canal are greater than its receipts. The end has come; the reversion is complete. Until June 1, 1853, the canal continues to exist as a carrier mainly of lumber products. Some rafts still find it effective for their passage. At best, in some few of these years, it manages to cover current expenses.

Each of these periods may be considered in order with reference to toll rates, toll policy, kinds of goods carried, and volume of the traffic. The available tonnage statistics are few; but changes in the amount of income from toll, with certain qualifications, indicate changes in tonnage carried. No modification of the figures of annual receipts from toll is needed by reason of changes in the value of money; the rates are levied per physical unit of the goods and not ad valorem. Modifications are introduced, however, by changes in the toll rates themselves. In each period the character of the rates will first be discussed, and thereafter will be given a table of annual toll receipts. Where reductions in tolls are established, increasing or stationary receipts indicate increased tonnage. More refined analysis is not feasible, since rates differed on each article, and since the proportions the amounts of different goods severally bore to the total tonnage varied from year to year.

Except where the contrary is stated, the figures for toll receipts will be free from the inclusion of miscellaneous income, such as that from rents, sales, and from dividends declared by the river canals. In some instances it has proved impossible to make these eliminations.

1804-1814

The toll granted the Middlesex Canal was $6\frac{1}{4}$ cents per ton mile. The legal maximum was at first exacted for all goods, with the notable exceptions of stone, pine timber, wood, and certain other lumber products.¹ The situation in the year 1805 is given in the following announcement:

¹Instructions to Paterson, April 4, 1804: Corporate Records. "Additions and Alterations of Tolls," May 7, 1804: Baldwin MSS.

AMOUNT OF BUSINESS DONE ON THE CANAL IN THE COURSE OF
THE YEAR 1805^a

Wood, 3997 cords, weighing	5000	tons
Oak Timber, 422 tons measure	422	
Pine do., 1405 tons measure	1200	
Oak Plank, board measure, 187,200	374	
Pine Plank, 912 thousand, board measure, weighing ..	1100	
Stone	310	
Cyder, 3242 barrels	405	
Ashes, 33 barrels	8	
1848 empty hogsheads	42	
2196 empty barrels	12	
154 half barrels	2	
360 kegs	3	
36,920 hogsheads hoops	*70	
11 tons, 13 hundred & 23 pounds of hoops	11¾	
Shooks	23¾	
Hoop poles	1¾	
Grain, 155 bushels	3½	
Apples, 493 bushels	5	
Other articles	20½	
Sumack	2	
3750 Clapboards	3¾	
4569 Staves	5	
147 thousand Shingles	29	
77 barrels of Beef	9	
237 bushels Flax Seed	6	
Ranging Timber	5	
1800 Rails	3	
Goods carried up	308½	
	<hr/>	
	9405	tons

* This may be overrated as to weight.

The above property was transported 27 miles, on an average: at 25 cents, the common price of land carriage, it would amount to 53,484 dollars;^b carried on the Canal, the tolls would amount to 13,371 dollars. . . . The sum received in toll is 1,539 dollars less than the above calculations, which arises from setting wood at only one cord for a ton, and other lumber in proportion, which was done to encourage the business. . . .

The above goods, if carried by land, would have taken 9,405 teams of four oxen, one cart, and one man, a day and a half each. Thus the labour of 56,430 oxen a day, and the wear of 9,405 carts a day and a half each,

^a Printed notice, Middlesex Canal Scrapbook: Boston Public Library.

^b This figure should be \$63,484. Note also error of one-half ton in the addition of total tonnage carried.

without calculating the return; this is saved to the public; because, the expenses of animal labour on the Canal may be nearly balanced by the advantage of having the goods transported in large quantities, and claiming less care and attention of the owner. . . .

The comparison of the saving of labor of men, oxen, and carts contained in this announcement is indisputable. Countless days' labor of men, oxen, and carts had gone into the forming of the canal, and saving of this order was to be expected from a capital outlay expended over ten years. But the correct test is rather the saving achieved in the money cost of haulage. A comparison of the canal toll of $6\frac{1}{4}$ cents per ton mile to 25 cents per ton mile, the full price of hauling overland, is misleading. Including both toll and freight, the canal reduced carrying costs at best to about one-half of what they had been before it went into operation. Coincidentally, as has been indicated,⁴ the cost of carriage by land was falling.

The general type of goods carried and, very roughly, the proportions the quantities of the several goods bore to each other, as indicated by the figures for 1805, were characteristic of this first period. Few reductions in toll were made. Schedules in Appendix I show the rates of toll in 1808 and the charges for dockage, wharfage and storage in 1809.⁵ All the years from 1808 to 1815, with the exception of 1810, were years of general stagnation in foreign trade. The quantities of the principal articles carried downward, for the years for which the figures are available, follow:

QUANTITIES OF PRINCIPAL ARTICLES CARRIED DOWNWARD, 1809-1813⁶

	Oak Timber Tons	Pine Timber Tons	Oak Plank B.M.
1809	359	570	51,680
1810	1513	3623	204,292
1811	722	2528	244,400
1812	487	1204	257,269
1813	1862	3686	95,112

⁴ Chap. XI.

⁵ Appendix I, 1, 2. Schedules in Appendix I are taken from copies in the Corporate Records.

⁶ The quantities for the year 1809 are taken from an "Account of Wood and Timber brought . . . to Charlestown, April 1809 to Dec. 30, 1809": Corporate

	Pine Plank B. M.	Wood Cords	Stone Tons
1809	349,007	1867	not given
1810	586,678	5266	456
1811	615,358	5089	1201
1812	906,193	4105	546
1813	388,550 ^v	4969	850

For the year 1810, a more detailed analysis is available:

ABSTRACT OF THE PRINCIPAL ARTICLES TRANSPORTED ON THE CANAL IN THE
YEAR 1810^a

	Pine Timber		Pine Plank B. M.	Oak Plank B. M.
	Oak Timber Tons	& Masts Tons		
To Charlestown				
for Home Use	930	1117	104,292	331,048
for Export	183	2412	.....	203,037
To Medford	400 (abt.)	94	100,000	52,593
To Boston .....	.....	.....	.....	.....
Total	1513	3623	204,292	586,678
	Wood Cords	Stone Tons	Ashes Tons	Cider Tons
To Charlestown				
for Home Use	3358	212	..	..
For Export .....	...	...	70	..
To Medford	827	...	..	..
To Boston	1081	244	..	51
Total	5266	456	70	51

Upwards, in private boats, 533 Tons.

The Embargo had suspended business in Boston in 1808, and its injurious aftereffects continued to be felt in 1809. When commerce revived in 1810, the year became for the canal one of favorable but misleading omens. The export of timber and plank

Records. There is a note to the effect that the quantities contained in three boats (or rafts—it is not clear which) are not included. The figures for 1810, 1811, and 1812, are from J. L. Sullivan, *Remarks on the Importance of Inland Navigation from Boston by the Middlesex Canal and Merrimack River* (1813); and the figures for 1813, from "Abstract of the articles and tonnage transported on the Middlesex Canal, 1813": Corporate Records.

^v This item is listed as pine lumber rather than pine plank for this year.

^a Report to proprietors, March 8, 1811: Boston Athenaeum.

to Great Britain seemed to warrant the expectation of an increasing demand.⁹ The following year, "in consequence of the restrictive measures of the government," the amount of tonnage carried on the waterway decreased. Then came more barriers to trade. A new embargo act of December 1813, although repealed in the spring, was followed by the extension of the British blockade to Massachusetts ports. Despite the continued depression in foreign commerce, toll receipts on the canal for the last two years considerably augmented.

TOLL RECEIPTS 1803-1814¹⁰

1803	..... \$ 3,300	1809	..... no data
1804	..... 4,900	1810	..... 14,900
1805	..... 9,900	1811	..... 12,500
1806	..... 11,500	1812	..... 10,600
1807	..... 10,700	1813	..... 15,700
1808	..... 7,200	1814	..... 24,800

No appreciable qualification of these figures is apparently required by reason of changes in toll rates. They properly indicate changes in the volume of goods carried. The sums for the last two years show in part a transference from land to water carriage and in part a development of the commercial relations between Boston and the interior during a period of depression in external trade.

1815-1835

With the year 1815 began the period during which the Middlesex Canal, with no lasting gain to itself, tapped and quickened to life remote and uncultivated parts of New Hampshire. The river canals were opened, and the increase in upward tonnage was marked. In 1816, the agent reported:

⁹ Report to proprietors, March 8, 1811: Boston Athenæum.

¹⁰ The figures are to the nearest \$100. From 1803 to 1807 they are taken from the early account books, and yet must be considered approximate. The totals contained miscellaneous items that may not have been entirely eliminated. The figure for 1805 given here seems more reliable than that contained in the public announcement quoted above. The figures for 1808 and 1810 are respectively from report, Jan. 25, 1809 (Boston Public Library) and report, March 8, 1811 (Boston Athenæum). The remaining figures are from the treasurer's accounts which are available for the years 1811 to 1824 (Corporate Records).

Until the latter part of last year, the Income of the Canal had been almost wholly derived from rafts, and wood boats. But the transportation of merchandize and produce had always been *looked forward to*, as a productive source of revenue. To secure it however, it was necessary to subdue the prejudices, and change the habits of the country, and excite confidence in the new mode of conveyance.¹¹

Statistics of goods carried are scarce among the canal records; but the following, imperfect though they are, clearly indicate the change:

	UPWARD ¹² — TONS ¹³	
	By all Boats	By Merrimack Co. Boats
1805	308½	
1810	533	
1813	399	
1815		700 ¹⁴
1817	1751	
1818	2496	947
1820		1221
1821	2313	1531

Statistics given in abstracts for the main landing in Charlestown¹⁵ indicate the character and volume of the traffic downward in the early years of this second period:

	1817	1818
Oak Timber — tons	516	1,031
Pine Timber — tons	1,070	1,592
Lumber — B. M.	807,225	933,930
Wood — cords	5,355	5,723
Stone — tons	2,126	2,810
Shooks and hogsheads	4,594	5,553
Staves	235,084	308,560
Boxes of glass	1,066	1,973
Ashes — barrels	226	530
Empty barrels	6,534	19,006
Hops — tons	70	(not given)
Charcoal — bushels	5,500	(not given)

¹¹ Report, Jan. 31, 1816: Corporate Records.

¹² The figures apparently do not include intermediate traffic.

¹³ The figure for 1805 is from "Announcement" (Boston Public Library); that for 1810 is from report to proprietors, March 8, 1811 (Boston Athenaeum), entitled: "Upward, in private boats." Other figures from: abstracts, 1813, 1817, 1818; reports, Jan. 31, 1816, Jan. 31, 1821, Jan. 16, 1822: Corporate Records.

¹⁴ From July 1 to Dec. 7, 1815.

¹⁵ Corporate Records.

Although important increases occur in the second year in every item for which there are comparable figures, the toll receipts for these two years are nearly equal.¹⁶ From this fact a general reduction in toll rates early in the year 1818 is to be inferred, the first of a long series of downward adjustments.

Extensive loading upcountry of salt, lime, and plaster in the Merrimack Boating Company's boats had begun at least by 1817. The continuation of teaming led to the formation of an investigating committee¹⁷ in 1819, which thus diagnosed the situation:

At least eight tenths of all the goods, merchandise, produce, and various articles which pay toll to this canal are brought down, or carried up, the Merrimac River — . . . The day this committee went up twenty-four loaded boats were on the Canal coming to Boston — Twenty of these had come up through the Stone Locks from the Merrimac River — They were mostly loaded with wood — some of them had various description of casks — There was some agricultural produce — The boats which were going up had almost every article which is vended in country commerce — No rafts of timber, or of wood were seen. . . .

To bring water carriage into use and approbation it must be cheaper & materially cheaper, because there must be land carriage during four or five months in a year, a great proportion of the trade between Town and Country is still done on *wheels*; and will be so done until the conveniences of water carriage and an obvious saving in expence, shall overcome the long continued habits of our Country.

The value of Canal property is subject to fluctuations from other causes. There are not any great *staples* for transportation — The business of the Canal is the carrying of a great variety of articles; all of these are not always in demand, accidental circumstances cut off the demand at times; as appears to be the case at present, with Ship Timber — sometimes the want of water, and at other times the excessive flow of it, tend to discourage river transportation.¹⁸

These circumstances brought before the proprietors by their committee, combined with the falling off of toll receipts consequent upon depressed business conditions after 1819, led to a general revision of the toll rates with the aim of securing the total carrying trade for the canal. The toll structure had apparently been

¹⁶ About \$100 less in the second year.

¹⁷ James F. Baldwin, William Payne, William Sullivan, and Abraham Touré (report, November 1819: Corporate Records).

¹⁸ Report, November 1819: Corporate Records.

stable from 1808 to 1817. Important reductions seem to have occurred in 1820, as well as in 1818. The situation in 1821, indicated in the toll schedule,¹⁹ makes possible certain comparisons with 1808.

The total toll per ton on merchandise had descended by 1821 from \$1.68 $\frac{3}{4}$ to \$1.50; salt, lime, and plaster, taxed in 1808 as merchandise, were now charged for the whole distance \$1.35 per ton; severe reductions had been made, amounting in some instances to over 50 per cent, on the several varieties of hoops, hoop poles, staves, and wood. Oak timber was unchanged; pine timber lowered from \$1.08 to 90 cents; and lumber was not appreciably reduced. A further reduction on merchandise from \$1.50 to \$1.35 and on salt, lime, and plaster, from \$1.35 to \$1.20 was made effective September 1, 1822,²⁰ allowable on those boats which should reduce their freight rates to \$8.00 per ton upward and \$6.00 per ton downward. From this time, revisions of rates are frequent, and it becomes difficult, therefore, to gauge, in terms of tonnage carried, the meaning of changes in the annual receipts from tolls.

At first the decisions to reduce the tolls on merchandise seem to have been largely motivated by a desire to defeat the teamster; later the principle of charging what the traffic would bear, and presumably the underlying idea of joint cost, is a factor consciously governing adjustment of rates. Certain bulky articles, salt, lime, manure, and plaster were carried upward by the canal alone; none went by teams.²¹ There was likewise no competition for certain other goods, bulky or of low value, carried downward. Among those brought down solely by the canal were stone, iron ore, timber, wood, boards, plank, shingles, clapboards, staves, and empty hogsheads and barrels.

Certain other articles, best described as general merchandise and country produce, although the classification is not inclusive, came by both canal and team. For the carrying of these goods

¹⁹ Appendix I, 3.

²⁰ Report on tolls, Aug. 27, 1822: Corporate Records.

²¹ The diversion of the traffic is as of 1822 and is mainly drawn from the report, "Questions asked . . ." July 1822: Corporate Records.

competition was active. For the downward trade they comprised: beef in barrels, cider, butter, cheese, ashes, and grains; and for the upward trade: groceries, English goods, iron, flour, codfish, mackerel, and cotton. Charcoal came down early by both modes of conveyance; while "Sea coals" — bituminous — were going upward on the canal by 1825 in sufficient volume to warrant a separate toll. This same status Lehigh and Schuylkill coal achieved by 1830. The factories at Lowell were said to be consuming 11,239 tons of anthracite annually by 1835.²²

The manufacture of copperas was developing during this period at Hartford, White River, Vermont, and special rates on this article were adopted in 1825 — too late to go on the printed sheet — to enable the factory to ship more cheaply by team to Concord and thence by canal and river to Boston rather than by hauling overland for the full distance. The total tollage for copperas, then classed with merchandise, was \$2.00 per ton in 1825, covering all the canals. A reduction to \$1.00 was voted that year with the proviso that the Boston and Concord Boating Company reduce its freight on the article to \$3.50 per ton. It was argued that the boating company would have the benefit of carrying the goods that would otherwise be returned by the teams bringing copperas to Boston. In recommending a further reduction the canal agent stated:

. . . there are reasons that should induce the directors to make this article toll free, if it cannot be brought upon the Canal upon any other condition, it must be impressed upon their minds that their [*sic*] is manufactured in one town in the State of Vermont about one thousand hhds. of that article annually. If teams are employed to bring the thousand hhds. weighing about 800 tons to the Boston market, it is certain that those teams will carry back to the State of Vermont through the town of Concord eight hundred tons of Merchandise.²³

The rate on copperas came steadily downward. The total toll for all the canals on other articles on which important reductions occurred in 1825, as compared with 1821,²⁴ is given below:

²² See Appendix H.

²³ Report, Jan. 16, 1826: Corporate Records.

²⁴ Appendix I, 3, 4.

TOTAL TOLLAGE: ALL CANALS

	Old Rate (1821)	New Rate (1825)
Red Oak Timber, per ton	\$3.01 $\frac{1}{4}$	\$1.50
Rough Spruce & Hemlock, per ton	1.69	.86
Red Oak Hhd. Staves, per M.	4.20	2.80
Red Oak Bll. Staves, per M.	2.46	1.67
Merchandise, per ton	3.20	2.00
Salt, Lime, Plaster, Bar Iron, Iron Castings, per ton	2.48	1.50

Wood, 10 per cent reduction in 1825, if brought from above Union Locks. Bricks²⁵ on the Middlesex were reduced from \$1.35 to 75¢ per thousand. Manure, 13¢ per mile per boat load in lieu of \$3.00 per boat load any distance. Iron ore was reduced from \$1.44 to 54¢ on the Middlesex and Wicasee canals.

The principle of charging what the traffic would bear governed the fixing of the several rates. The way in which this rule was conceived may be given in the words of the canal agent:

On establishing the rates of toll on certain articles we must be guarded [*sic*] First by the value of the article at the place where it is taken upon the Canals, Second by the labour of expense of transportation and incidental expences [*sic*] and Third the value of the article at the market place. If there remains after deducting the first two from the last of these premises a large profit, we should then take a reasonable proportion thereof for tolls, but if from other places, the articles can be brought in great abundance and thereby reduce the profit to a very small amount, we must be content with a small amount of toll.²⁶

Still further reductions were made in 1830 upon the same principle, and thereupon was inaugurated the five-year period during which the canal gave master service to the community. The increase in toll receipts in these years, despite drastic reductions in rates, indicates a great expansion of tonnage. Some part of the increase was filched away from the teamsters; but the greater proportion was new business. The toll receipts for this period follow:

²⁵ The schedule of 1821 gives the rate on bricks at \$1.35 per hundred. This is apparently a typographical error. In 1825 Lowell was building with brick brought down the Merrimack. The new rate was to further the competition of Medford and other upward-bound brick (agent's report, Jan. 16, 1826: Corporate Records).

²⁶ Agent's report, Jan. 16, 1826: Corporate Records.

THE MIDDLESEX CANAL

TOLL RECEIPTS 1815-1835^m

1815	.....	\$24,900	
1816	.....	28,100	
1817	.....	22,900	
*1818	.....	22,800	
1819	.....	25,400	
*1820	.....	14,100	
*1821	.....	21,200	
1822	.....	18,900	
1823	.....	18,300	
*1824	.....	21,800	Gross receipts (including rents, etc.)
*1825	.....	21,700	\$26,300
1826	.....	.....	26,700
1827	.....	.....	25,600
*1828	.....	.....	(no data)
1829	.....	21,500	
*1830	.....	23,400	
1831	.....	28,200	
1832	.....	36,500	
1833	.....	45,500	
1834	.....	41,600	
*1835	.....	41,800	

* Years in which important reductions in toll rates occurred. (Appendix I, 3, 4, 5, 6.)

The last years of this period were years of vigorous expansion. Population was growing rapidly, towns were being built, water power was being developed and utilized, and old factories were being enlarged and new factories founded. At last the canal had achieved success. It had reached a high position of usefulness to the communities it served, and their degree of prosperity was dependent upon the cheap transportation it furnished. Yet at this stage of its growing momentum, a force, destined to transform the waterway into a dry waste, had been for some time in preparation.

1836-1842

In the year 1836 business on the canal "went on as usual with the exception of the amount of transportation to Lowell by the Rail Road."²⁸ The extent of the diversion of traffic is indicated by the following table of the amounts received from tolls on Lowell goods:

^m Items for the years 1811-1824 are taken from Book P; those for the period 1825-1835, from the agent's annual reports in Corporate Records. The figures do not include toll receipts on the river canals.

ⁿ Report, Jan. 25, 1837: Corporate Records.

TOLLS ON LOWELL FREIGHT RECEIVED BY THE MIDDLESEX CANAL ²⁰

Paid by	1835	1836
Appleton Company	\$1,001.38	\$ 118.28
Hamilton Company	1,801.78	667.21
Lowell Company	1,141.08	89.24
Lawrence Company	1,520.20	1,043.95
Suffolk Company	719.98	495.70
Tremont Company	662.10	510.91
Boott Mills	2,541.47	1,068.07
John Wilson, Jr.	833.30	298.97
Lincoln Drake	1,112.43	1,163.51
John Waugh	155.00	445.50
William Livingston	486.79	294.43
	\$11,975.51	\$6,195.77

Assuming an average of 50 cents per ton in tolls paid, the figures represent a diversion of about 11,500 tons the first year.

Through traffic to Concord persisted, however, and constituted the mainstay of the canal during this period. Tonnage borne by the principal carrier, the Boston and Concord Boating Company, is available for two of these years:

GOODS CARRIED BY BOSTON AND CONCORD BOATING COMPANY ²¹

Upward Tonnage

	1837	1840
Boston to Concord		
Merchandise	2472	2954
Salt, Plaster, Bar Iron, Pig Iron, Iron Castings, and Slate	1216	1179
Hard Coal	90	50
Sea Coal (bituminous)	3	5 (abt.)
Total upward including way-stations	4268	4507

Downward Tonnage

Concord to Boston		
Merchandise and Produce	678	605
Factory Cotton Cloth	29	78
Copperas	54	19
Hewn Stone	297	...
Total downward including way-stations ..	1265 *	893 *

* Does not include timber and wood products.

²⁰ Report, Jan. 25, 1837: Corporate Records, quoting report of Richard Frothingham, Collector.

²¹ Return for toll, Boston and Concord Boating Co., 1837: Corporate Records; for 1840: Frothingham MSS.

Covering activities of the main boating company alone, these figures fail to give a complete picture. Apparently the boating company carried a greater proportion of the upward tonnage in 1840 than in 1837. During the year 1839 the Nashua and Lowell Railroad went into full operation "and had the effect to reduce the amount of tolls to that place nearly three thousand dollars."

Great pains were taken by the projectors of this Road to get every merchant in Nashua & vicinity interested in one or more shares for the purpose of securing their goods upon the Road and thereby take them from the Canal. They held out great inducements to those that were keeping store houses for receiving of goods for the Canal and gave them a commission for forwarding them by the Road of twenty five cents on the ton and hired others over into their employ. I am in hopes to be able to meet this contingency in part at least, another year, by having a regular line of good boats, [i.e. from Boston to Nashua] managed by a new company of young men — arrangements are in progress . . . we shall meet the enemy, take a share of the honor, and improve your interest. . . .⁸¹

This was probably wholly ineffective. Indeed, the fighting spirit had departed from the canal agent by the following year. He reported his difficulties:

I have been obliged to resort to many and new arrangements to meet the opposition of Rival Corporations who seem willing to do business without profit for the purpose of destroying our mode of transportation. Instead of the regular Tarif of tolls, we have been obliged to conform to circumstances, and in some instances to take one half the established toll or loose the whole amount. In addition to this, business . . . has been almost forgotten the past year in New Hampshire. Never have I known so small a quantity of ship timber brought to market during any one year of the sixteen I have had charge of the Canals. . . .

We are not entirely down, and shall survive one year more at least. . . .⁸²

The Concord and Nashua Railroad, the final link required completely to parallel the canal system, was projected at this time. In treating of the probable results of this extension, the agent of the Middlesex outlined the defects of canals:

There are many reasons why a Rail Road will be preferred as a mode of transportation over Canals, even at a higher charge. Our navigation

⁸¹ Report to proprietors, Jan. 24, 1840: Corporate Records.

⁸² Report to proprietors, Jan. 25, 1841: Corporate Records.

being partly by river and by freshets subject to detentions renders it extremely uncertain when merchandise will reach its destination. In some instances I have known goods to remain on board the boats twenty days. No such delays will happen on a Rail Road. The Merchant from Vermont and the northern parts of New Hampshire will be enable[d] to place his goods in Concord the very next day after purchase, and know the very hour his teams should be at the terminus of the Road to receive them. I have known teams detained by none arrival of Boats more than a week, which creates a heavy and extra charge. . . . In addition, great exertions are making to bring in as Stock holders, all the merchants of Concord and other places who do business to any amount on the line, and northward of Concord. . . .

We must look ahead and if destined to [illegible], save all we can from the wreck.²⁸

TOLL RECEIPTS 1836-1842²⁹

1836	\$34,300
1837	27,400
1838	28,000
1839	27,300
1840	24,800
1841	23,700
1842	20,600

1843-1853

Operation of the Concord and Nashua Railroad began in 1842 one month before the canal closed for the season. A formidable rival now covered the whole length of the waterway and fought for the traffic at every point of shipment. The rates published by the road were \$4.00 per ton from Boston to Concord on light goods and \$3.00 per ton on heavy goods or goods of low value, such as salt, lime, plaster, coal, iron, pig lead, sand, and clay. In September 1842, the boating company demanded reductions in toll — effective when the railroad should operate — to enable them to continue in business. Their proposition reveals the situation which caused them to cease operation at the end of the season:

1. If the Boating Company should continue to charge four dollars pr. Ton . . . instead of three dollars, the rate on the Road, the Rail Road would monopolize the carriage.
2. If the Boating Company offers to carry at three dollars paying the toll they now do, or any Toll, they cannot do it without a loss.

²⁸ Report to proprietors, Jan. 25, 1841: Corporate Records.

²⁹ Annual reports: Corporate Records.

3. If the Directors take off the toll entirely from the specified articles, the company would barely save themselves from running in debt in carrying them, and all they could hope as a result of the whole business for the remainder of the season would be a small profit on carriage of merchandise generally at four dollars.

4. On all other articles the Boating Company must have an immediate reduction in toll of 50 per cent.

5. [If these conditions are refused], the company will not undertake to compete with the Rail Road & they will decline at once to receive more goods for transportation.⁸⁵

The canal agent was voted ⁸⁶ full authority to make any reductions that might prove necessary until the canals should close for the season. During the winter months he was convinced that under the ruling schedule of tolls not one hundred tons of goods would be borne by water the following year. Consequently, toll rates, with the exception of those on certain wood products, were practically slashed in half.⁸⁷

In 1843 appeared the pamphlet entitled an *Historical Sketch of the Middlesex Canal*,⁸⁸ published to influence sentiment in favor of the proposal for using the canal to supply Boston with water. In 1848, when the carrying of brick to Lowell was transferred to the railroad, the receipts of the Union Canals almost vanished; and in 1849 the negligible business that remained to the Middlesex was seriously hindered by the diversion of the water of the upper reaches of the Concord River by the city of Boston. Receipts from all sources were not sufficient to keep the canal in repair.

TOLL RECEIPTS 1843-1853 ⁸⁹

1843	\$12,000	1849	\$3,400
1844	(no data)	1850	2,600
1845	12,400	1851	1,200
1846	7,700	1852	(no data)
1847	5,700	1853	(no data)
1848	6,000		

These rapidly declining figures indicate the substitution of rail for water carriage in the case of class after class of goods.

⁸⁵ Richard Sullivan to Caleb Eddy, Sept. 14, 1842: Corporate Records.

⁸⁶ Vote of Sept. 15, 1842: Corporate Records.

⁸⁷ Appendix I, 7.

⁸⁸ By the agent, Caleb Eddy.

⁸⁹ The figures are from annual reports, 1834-1845: Corporate Records; and annual reports, 1846-1853: Frothingham MSS.

The Nashua and Lowell and the Concord and Nashua railroads were markedly prosperous; the Boston and Lowell proved to be one of the most productive roads of its length in the United States. An indirect cause of their success, yet a predominantly important cause, was the work performed during a whole generation by the Middlesex and River canals in fostering and quickening economic development throughout the Merrimack valley and its ministering back country. Turnpikes had been slowly built to clear the path to the waterway, and gradually expanding commerce had been directed along this route. At last an interrelated complex of commercial contacts had been brought about by the traffic which had sought the canals in larger and larger volume. Without these services, the growth of the agricultural and manufacturing interests would have been retarded until the coming of the railroads, which would then have waited upon a gradual increase of tonnage before achieving financial success. As it was, in the space of a few years every last ton of the traffic, which included the whole result of the canals' influence on the region, inured to the benefit of the railroads. Somewhat ironically, the waterway fulfills at its death the words of the first promoter of its early life, who characterized it as a magnanimous enterprise.

CHAPTER XIII

FINANCES

BEFORE considering the finances of the Middlesex Canal in complete historical perspective, it is necessary to notice shortly two main sources of expense as yet inadequately treated. At the outset, the land required had to be purchased. Furthermore, in the course of its activities, the company was subject to claims for damages brought by owners of property adjacent to the route of the canal.¹

Early arrangements with landowners often took the form of agreements to sell to the company at a stated price per acre as much land as might prove to be needed. The location of the land was vaguely indicated. This course was adopted since the route of the canal was often shifted slightly as the work proceeded. When the time came for translation of such provisional agreements into deeds conveying specific pieces of land, the chances for dispute and misunderstanding were many. Inconstant human nature was impulsively generous in 1795, and yet keen to attempt by shift, delay, evasion, and special pleading to reopen the matter and to drive a sharper bargain in 1800. Notwithstanding its possession of signed agreements, the company perforce had to tread softly. The effective securing of undoubted rights was widely influenced by immediate public opinion.²

Of far more concern to the directors, although at last less financially significant, was the settlement of claims for damages. A charter provision stipulated that, in case the company should not tender a reasonable offer to the satisfaction of a person whose property had suffered harm, the latter might pray the Court of General Sessions to appoint a committee of five disinterested free-

¹ Unless otherwise indicated, financial data used in this chapter are drawn from account books and annual reports in the Corporate Records.

² Memoranda on lands purchased during the years 1794-1804: Corporate Records. The total cost of lands was about \$50,000.

holders who should estimate the payment due. The court, on accepting the committee's report, might issue an execution, with costs, "against the property only of the corporation, or of any individual belonging thereto."⁸ There was thus no limit to the liability of directors or shareholders in the single instance of payment for damage to property. Legal costs were chargeable to the corporation, however, only when the sum estimated by the committee of freeholders exceeded the sum previously tendered, if any, by the corporation. Claims arose from the removing of mills, or milldams, the diversion of water courses, the draining of wells, injuries done to adjacent property during construction, but principally from the flowing of lands by leakage from the canal.

Meadow owners in Chelmsford complained of damage in 1798, applied in 1800 to the court, secured executions in 1802, and thereupon had certain property of the corporation attached to be sold at auction. The Ipswich River meadow owners next combined to press similar claims. The high points of tension created by such actions were reached in 1802, when for a moment the completion of the works was jeopardized, and again in 1804.⁴ In the latter year, when another series of claims of meadow owners was in the hands of a committee of freeholders appointed by the court, James Sullivan wrote the superintendent asking him

to obtain a delay of the report for the next court we can do much to lessen the damages before November. . . . You can by not facilitating the plans and suggesting difficulties prevent the report now. If a large sum of money is reported in the present state of the canal, the whole project is ruined.⁵

The few records of the verdicts of juries seem to indicate that as a rule the awards increased the sum previously offered by about 10 per cent.⁶ In the year 1805 a number of executions were granted against the corporation, and by 1808 three important lawsuits were pending.

⁴ *Massachusetts Statutes Private and Special*, I, 465.

⁵ Report, July 23, 1798; memoranda, Sept. 9, 1800, May 15, 1802; letters, June 1, Aug. 2, 11, 1802; memorandum, July 1804: Baldwin MSS.

⁶ Sullivan to Baldwin, Sept. 5, 1804: Baldwin MSS.

⁷ Frothingham MSS.

The original charter contained the provision that aggrieved parties might obtain redress only if they should make application within one year after the damage had been suffered. Many, unaware of this provision, waited to press their claims until the canal company should be more prosperous. The limitation outlawing claims after one year had yet to be tested at law, and doubt existed concerning the probable action of the courts. The canal company was chary of forcing a test case for many years. In 1808, the situation is indicated in the following words of the agent:

Settlements of . . . claims have been made, notwithstanding this protecting clause, on principles of equity, and unless ordered to set up this defence . . ., I shall proceed to liquidate them on those principles, having recourse to that provision for defence against exorbitant demands.⁷

A test case, *Stevens v. Proprietors of Middlesex Canal*, finally took its way through the courts and came to judgment on appeal in 1815. The Supreme Court of Massachusetts thereupon sustained the nonsuit ordered by the lower court, on the ground that the plaintiffs had failed to make application within one year after having suffered damage. The decision held that the special method of securing amends, set up in favor of the corporation in its charter, precluded an action otherwise maintainable at common law.⁸ This victory for the company effectually estopped many claims. The corporation had merely to demonstrate that the damage forming the basis of a complaint was attributable to an action occurring more than a year previous to the application for redress. By 1815 this was in most instances a simple matter to prove. Two cases in later years were similarly decided.⁹ The year 1815, bringing the decision in *Stevens v. the Proprietors*, forms a landmark in the financial history of the corporation. Thereafter, it was practically freed of one of the more carping of its cares.

⁷ Agent's report, 1808: Corporate Records.

⁸ The Court stated: "it must be considered as intended by the legislature to deny that remedy [the remedy at common law] on account of the inconveniences and vexations it would bring upon the proprietors, who had engaged in an extensive experiment principally with a view to the public benefit" (*Stevens v. the Proprietors*, 1815, 12 Mass. 466).

⁹ *Proprietors of Sudbury Meadows v. Proprietors of Middlesex Canal* (1839), 40 Mass. (23 Pick.) 36; *Heard v. Proprietors of Middlesex Canal* (1842), 46 Mass. (5 Metc.) 81.

The contributions of the shareholders from 1794 to 1806 have been considered in detail.¹⁰ These assessments constituted almost the exclusive source of permanent funds. The sale of mortgage obligations was never employed as a resource. After 1806, however, four further assessments were laid. The contributions of the stockholders are resumed and completed in the following table:

ASSESSMENTS ON MIDDLESEX CANAL SHARES 1794-1817

Years		Total per Share
1794-1806	96 assessments	\$610
1811	3 "	50
1817	1 "	80
<hr/>		<hr/>
1794-1817	100 assessments	\$740

Throughout this period, although few shares were sold for non-payment of assessment, the levies were not always promptly met. Many of the hundred-odd shareholders would be several months behind in their payments. The sum that had been assessed would come but gradually into the treasury. Since expenditures were unevenly distributed in time, a form of temporary financing was required to bridge the intervening periods when expenses should be temporarily greater than receipts. Apparently there was no recourse to bank loans, at least not directly, until the year 1801. During the eight preceding years the treasurer provided the necessary short-time funds. His annual accounts usually show: first, his actual expenditures; second, the amounts he should have received during the year from assessments levied; third, his nominal surplus or deficit; fourth, the amount of unpaid assessments; fifth, the actual surplus or deficit. From time to time he was voted a compensation for his advances on account of the proprietors. As the amounts voted are round numbers, the compensation may have been roughly estimated.

At the end of five of the six years from 1794 to 1799, there was an actual deficit averaging about \$2,000. The next year, 1800, insufficient assessments were laid, and there resulted an actual deficit, which was not offset by a nominal surplus arising from the inclusion of levies voted but not yet entirely collected. The tax

¹⁰ Chapter III.

per share was doubled for March, and it was ordered: "That the treasurer on the present exigency obtain \$3000 of the Bank and to indemnify Mr. Coolidge and Dr. Joy as endorsers."¹¹

This is the first record of bank borrowing appearing in the available documents. Financing by loans from the bank, on notes endorsed by wealthy directors, was thereafter fairly continuous. From 1806 to 1811 considerable borrowing of this sort met the costs of repairs, extensions, and betterments. Expenditures under these heads were heavy; for by 1809 thirteen years had passed since some of the works had been constructed, and much damage had been done by "perverse and inexperienced people who first traversed the canal."¹²

In 1810 the board of directors was authorized to secure a predominant interest in the river canals and for that purpose they were empowered to

borrow any sum of money on account of the corporation that they might think necessary . . . , giving security therefor by obligation, or by mortgage of any Real Estate. . . . But it having been found difficult to obtain a loan on this security, the gentlemen of the Board joined in a bond, guaranteeing the sums that had been, or that might be obtained on loan of the Massachusetts bank. This they did, justly expecting that the sale of the two townships of eastern land [granted by the legislature] will supply the means of discharging a portion of this debt.¹³

The obligations outstanding at the end of the year 1811 were about \$40,000 and the gross income for the year about \$15,000. The account with the Massachusetts bank for 1811 indicates that total borrowing amounted to \$33,700 and repayment to \$23,700 — probably the first considerable cancellation of loans. Previous to this date, the bank carried the company's borrowings in the form of endorsed notes frequently renewed and consistently augmented. It was mainly to pay this growing debt that the three assessments, yielding a total of \$40,000, were levied in the year 1811.

¹¹ Jan. 21, 1801: Corporate Records.

¹² Report, Jan. 25, 1809: Boston Public Library.

¹³ Report, March 8, 1811: Boston Athenaeum. Attempts to sell these townships for \$16,000, a price deemed reasonable, were unsuccessful. They were finally disposed of in 1831 for \$9,000 (report, Jan. 21, 1831: Corporate Records).

Additional building proceeded, and receipts from toll were sunk further in the canals. The total cost of the corporation's share in the river companies finally reached \$74,000. During the nine years from 1808 to 1816, \$102,600 were expended under the head of betterments, repairs, old debts, damages for lands, and location of townships, an average of about \$11,000 per year. In 1815, however, the river improvements were completed, and victory in the litigation before the Supreme Court had terminated the necessity of paying important damages to landowners. Although the company was still heavily in debt, certain difficulties had been removed from future consideration.

The property held in 1816, independent of the canal and its immediate dependencies, consisted of shares of the river companies, real estate, mills, two townships of land in the District of Maine, and certain lottery rights. Together these were estimated as worth \$80,000. Against these special assets should be written \$30,000 owed to the Massachusetts Bank, \$30,000 borrowed from individuals, and some \$3,000 due on unsettled claims. Since the times were thought unfavorable for liquidating the real property held independently of the canal, it was voted to assess each share \$80 — an action which would yield \$64,000 and free the corporation of debt. The facts were placed before the stockholders, who then paid the hundredth, final, and greatest single assessment in 1817, nearly a quarter-century after the organization of the company.

The same vote constituted the shares in the river canals, the mills, and real estate, including the townships of eastern lands, a permanent fund, to be denominated "the fund for the repairs of the Middlesex Canal."¹⁴ The rents, dividends, income, and profits thereof were appropriated "forever" for the payment of expenditures for repairs or improvement of the main or subsidiary canals: "And the faith of this corporation is hereby pledged that at no time hereafter shall any of the said Rents, incomes, Dividends or proceeds, be otherwise expended or appropriated. . . ." ¹⁵

¹⁴ Report by committee (Josiah Quincy, Joseph Hall, and Joseph Coolidge), late 1816 or early 1817: Corporate Records.

¹⁵ Same report: Corporate Records.

The fund was consistently set aside in this manner for somewhat less than a decade. By that time dividends had become customary.

The year 1819 marks the advent of the period when some return on their investment came to the shareholders. It may be pertinent to determine the total cost of the undertaking to this date. The amount received from assessments was \$740 per share, or a total sum of \$592,000. This had been paid, however, over some twenty-three years. Adding simple interest at 6 per cent ¹⁶ on the amounts of the assessments from the dates of the levies, severally, to the date of the first dividend, the burden to the shareholders becomes on this basis \$1,445.25 per share; and the total cost of the enterprise, \$1,156,200.

Throughout the years from 1804 to 1819 receipts were ploughed back into the business. When no dividends are declared, the compound-interest test may well be met. If interest at 6 per cent be compounded annually to December 31, 1818, on the amounts received from assessments from the several dates of the levies, the cost on which an annual yield thereafter of at least 6 per cent might reasonably be expected becomes \$1,620,700. Rather than 6 per cent, the first dividend in 1819 constituted $\frac{3}{4}$ of 1 per cent of this last sum; or 1.03 per cent of the cost calculated with simple interest added. To recapitulate:

Cost of Middlesex Canal to 1819		Percentage which the first dividend bore to the cost
By total assessments	\$592,000	2.02%
*By assessments at simple interest	\$1,156,200	1.03%
*By assessments at compound interest	\$1,620,700	0.74%

* Interest rate 6 per cent. The first of these two items is calculated to Feb. 1, 1819; the second to Dec. 31, 1818. The calculation at simple interest in Eddy: *Historical Sketch of the Middlesex Canal* (1843), contains an error which is rectified in these figures. An account by James F. Baldwin of assessments made up at 6 per cent compounded annually to 1821 is with the Baldwin MSS.

¹⁶ This is viewed as a normal, non-profit yield in reports and letters in the canal records throughout the whole period.

The complete dividend history of the corporation is given in the following table:

DIVIDENDS ON MIDDLESEX CANAL SHARES

	per share		per share
1819	\$15.00	1834	30.00
1820	10.00	1835	30.00
1821	10.00	1836	30.00
1822	20.00	1837	30.00
1823	15.00	1838	20.00
1824	15.00	1839	20.00
1825	12.50	1840	18.00
1826	15.00	1841	10.00
1827	9.00	1842	16.00
1828	9.00	1843	10.00
1829	10.00	** 1844	60.00
1830	8.00	1845	10.00
* 1831		*	
1832	22.00	** 1852	65.00
1833	20.00	** 1853	20.00

* Dividends were passed in 1831, and in the period 1846-1851.

** Return of capital from liquidation of assets. The payment of 1844 arose from the sale of the subsidiary holdings of lands and estates.

The total sum paid by the stockholders on assessment, neglecting interest, was \$740 per share. Their payments were spread over the period from 1794 to 1817. They then received in installments, during the years from 1819 to 1853, a total repayment of \$559.50. The figures indicate the full result. The canal company was a financial failure from the end of the first year of business to the day, fifty years later, when the last boat traversed its nearly abandoned works.¹⁷

The dividends in the early thirties remained low, despite growing receipts, because of heavy expenditures for the renewal of important works. The agent had inspected in 1830 the principal canals and railroads completed or under way in Connecticut, New Jersey, New York, and Pennsylvania, preparatory to recommend-

¹⁷ Referring to the Caledonian Canal, the *Boston Daily Advertiser* of Sept. 21, 1827 stated: ". . . its gross receipts, without any deduction for the cost of repairs and superintendence, are less than three-tenths of one per cent on the capital expended, and the annual charges exceed the annual receipts by more than a thousand pounds. This is worse than the Middlesex Canal."

ing a plan for extensive rebuilding. Even during the years the railroads were under construction and during several years after they were in operation, the progress of replacing wood with stone went forward in the case of nearly all the principal works. When forced by the railroads to discontinue operations, the Middlesex Canal was on the whole more durably constructed than ever before.¹⁸

The unfortunate financial history of the waterway cannot be attributed to inefficient direction. Representatives of the foremost business talent of succeeding generations were regularly found serving on its board of directors.¹⁹ Nor were its agents lacking in ability. The causes for financial failure are to be sought elsewhere.

These causes were in part those incident to canal navigation generally and in part those peculiar to this canal. The seasonal nature of business on most canals, unless there be a complete cessation of trade between the districts they serve, makes necessary the maintenance of a substitute mode of conveyance during the winter months. Except in the case of artificial waterways of great length or of those which are built to bring to market some previously immobile product available in great quantities at the head of navigation, canals could not fully replace land carriage. This diminished their chances of financial success even in the period before the railroads. The inflexibility of a waterway

¹⁸ The period of extensive rebuilding covered the years from 1825 to about 1837.

¹⁹ The directors who served in 1805, in 1814, and the series of directorates from 1830 to 1854 are given in Appendix J. Men owning stock in the Locks and Canals Co., which has been characterized by Morison (*Maritime History*, p. 151, n.) as the corporate overlord of Lowell, were on the board of directors of the Middlesex Canal in 1830. Other shareholders in the Lowell concern were represented on the canal directorate by 1838. These same men seem to have been in the group controlling the railroad. By 1830, 350 of the 800 canal shares were owned by women who had received them mainly through inheritance. A number of shares were held in trust for minors. With the stock lodged in this way, the canal directors may be considered to have occupied more completely than usual a position of trusteeship. The action taken by the board, throughout the period of railroad competition, must be characterized as conservatively correct; the proposals of the agent, who appears to have been loyal to the interests of the stockholders, were supported. The steps taken by the directors to combat the railroad and to urge the vested rights of the canal, however, were marked neither by ingenuity nor by forcefulness. The ownership of stock in the Locks and Canals Company of Lowell, as of 1834, is given in Appendix K, that in the Middlesex Canal, as of 1846, in Appendix L.

severely limits the possibility of supplying direct contact with numerous small centers. To serve a radiate market, therefore, artificial inland navigation requires some supplementary system of transportation and thus actually fosters the development of possible competitors. Previous to the railroad, this substitute form was overland carriage by teams. It is of central importance with reference to the difficulties of early canals as general carriers that, although they might partially replace, they could not eliminate from practical consideration, this alternative mode of conveyance. In the pre-railroad era, the teamster had to provide whatever inland transportation existed during the winter months, and in the remaining eight months he must either accept a subordinate position as a feeder of a canal system, or cease teaming, or compete with the canal.

Canals are, furthermore, frequently subject to inconstant supplies of water. There is danger of damage by low water or by flood. The speed of conveyance does not exceed that of land carriage by teams over good roads. At a roughly equivalent speed, however, a canal bears a much larger tonnage in a single carrier with proportionately much less expenditure of energy. In this lies the advantage of canals over teams. The comparable money costs of land and canal carriage merely express the combined action of such technical determinants, working in relation with the particular circumstances of the trade and of the economic development of the region.

The railroad introduced new considerations. In addition to its greater speed, it possessed in relation to inland waterways two particular advantages. Winter but slightly impaired the efficiency of its operation, and the full year's service quickly effected an orientation of the traders. Of equal importance was the advantage of operation on a strict schedule. The railroad organization allowed far greater coördination of control over its workmen; the easily regulated traffic, the efficiently maintained roadbed offered no such excuses for delay as were frequently alleged by canal employees. The bargeman was captain of his craft. After starting upon his journey, he was confronted along his route with problems demanding discretion. To weave through congested

traffic and to navigate a lock were no simple tasks; and only too convenient were the taverns along the way. If the railroad had to seek technical skill, the canal demanded, in addition, conscientious character. The technical difficulties of early canals thus tended to limit the organization of work to a system comparable to the craft stage, and, unless favored by special circumstances, the waterways necessarily yielded to the coördination and efficiency of the railroads.

Subject to all the general disadvantages, the Middlesex Canal struggled with difficulties of its own. Probably few American canals suffered so directly from the competition of land carriage. Lacking any great staple that would aid it to secure a general advantage over the teamster, by guaranteeing a basic tonnage, it had to compete with him for the carrying of general goods. Until a demand for raw materials for the manufactures had been developed, ship timber and wood products constituted the canal's main source of tonnage. The prosperity of the shipbuilding industry, however, was extremely aleatory. With the growth of the manufactories the situation became favorable to the canal, and the teamster went down to final defeat; but almost immediately the railroad reached forth to garner the trade of the factories and eventually to divert to its cars every ton of traffic formerly relied upon by the Middlesex Canal.

Although deprived of business and lacking in purpose, a corporation created by the public powers requires at its death due formality.²⁰ It must first request permission to die. The proprietors of the Middlesex Canal, meeting December 11, 1850, in the office of their president, Ebenezer Chadwick, at 11½ Tremont Row, stated their case:

²⁰ Corporate Records, Book L. Power to sell the canal, its franchise, or its property at discretion had been annually conferred on the directors from 1848 to 1850. The shares owned in the Hooksett, Bow, and Union canals were sold in 1851 and 1853. Most of the sales of land were consummated before boats ceased to navigate the canal. The attorney-general informed the Supreme Court that the company ceased to maintain the canal on June 1, 1853 (*Commonwealth by Information of Attorney-General v. Proprietors of Middlesex Canal*, Oct. 3, 1859, papers and court decree on file: Middlesex County Court House). See also *Massachusetts Statutes Private and Special*, XI, 109, and Court Docket, Supreme Judicial Court, April Session, 1860, *In re Middlesex Canal*.

Whereas it has become certain that in consequence of sundry acts passed by the legislature of Massachusetts, the franchise of this corporation has not only been rendered worthless, but the attempt to avail of it has for the past year involved the corporation in debt.

[Be it voted]: That the Directors . . . are . . . instructed . . . to ask the grant of such privileges and rights . . . as will enable them . . . to convert their property into such form as to make it distributable among the corporators before it shall be totally sunk by the present discouraging condition of their affairs.

After considerable delay, permission to liquidate their assets seems to have been granted the proprietors, but authority to cease to exist as a corporation seems to have been denied. Several years were consumed before the court and the legislature moved toward final decision; and when at last they spoke, the company had been practically disbanded, the bridges over the waterway had been removed, and the filling up of the trough of the canal had been long in progress. On October 3, 1859, the Supreme Judicial Court of Massachusetts decreed that the proprietors had ceased to enjoy their rights; and on April 4, 1860, the legislature took cognizance of the court's statement and declared the privileges of the corporation seized into the hands of the Commonwealth, forfeited, and annulled. On June 25, 1860, it was ordered that all papers and records of the Middlesex Canal Company should be delivered to the custody of the Clerk of Court of Middlesex County to be guarded indefinitely "for the use and benefit of all parties interested therein." By this act of the Supreme Judicial Court, the history of the Middlesex Canal was at one stroke both completed and preserved.

APPENDIXES

APPENDIX A

LOCATION AND GENERAL FEATURES¹

THE MIDDLESEX CANAL found its source at its summit level in Billerica, Massachusetts. With the exception of a small amount drawn from Horn Pond, water came from the Concord River at Billerica Mill Pond, feeding the course to the southward to Charles River, twenty-two miles distant, and to the northward over a distance of nearly six miles to Merrimack River. The summit was 107 feet above the tidewater at Boston and twenty-seven feet above the Merrimack. The breadth was twenty feet at the bottom and thirty and a half feet at the water line.² The trough was built to carry a depth of three and a half feet; but, owing to silting after completion of the canal, the water was seldom more than three feet deep. General specifications in the early contracts for construction were varied over short distances in several locations where the presence of solid ledges of rock led to a diminution of the width, in some cases to fourteen feet. Occasional basins of much greater extent furnished landing places or havens where boats could congregate. The banks, one foot above the water line, were ten feet wide in general on the towing path side and five feet wide on the other. A specification that the slopes of all banks should be 33° was contained in the general plan outlined by the projectors and was embodied in contracts.³

¹ Much of the information relating to the location of the canal was obtained through the aid and kindness of Mr. Edward B. Carney of Lowell, who has traced the route on foot several times. The writer went over the ground with him on one occasion. Further acknowledgment is made to Mr. Frank H. Kendall, Engineer of Middlesex County, Mr. Moses Whitcher Mann of West Medford, and Mr. Arthur C. Loring of Woburn. In his research Mr. Carney received aid from Mr. A. B. Corthell, Chief Engineer, and Mr. Frank B. Rowell, Research Engineer of the Boston and Maine Railroad, Mr. Edward F. Wyer of Woburn, and "a host of men, women, and children along the route of the canal." (E. B. Carney, "A Modern Ramble along the Middlesex Canal," MS.) This appendix is further based on field books, early surveys, plans, notes, etc., in the Baldwin Manuscripts; also, *Sections of the Middlesex Canal*, 1830, original: Baldwin MSS. *Profile of the Middlesex Canal*, 1830; *Plan and Profile of the Boston and Lowell Railroad*, 1836: Corporate Records; Mr. E. B. Carney's collection of maps and plans. Material has likewise been drawn from the following two books, specific references to which are given in the notes: G. L. Vose, *Notes on Early Transportation in Massachusetts* (1885); *The Official Reports of the Canal Commissioners of the State of New York* (1817). A detailed "Report on the Middlesex Canal, Nov. 1819," found among the records of the corporation, has proved useful.

² Contracts for construction: Baldwin MSS.

³ *Plan and Profile of the Middlesex Canal* (1830).

There were twenty locks, eight aqueducts, and forty-eight bridges, as well as the necessary safety gates, culverts, sluiceways, and waste weirs. The twenty locks included two tide locks on the Charles and two guard locks on the Concord. The latter, by regulating in part the flow of water into the canal, helped to provide against danger to the banks from variations in the level of Concord River. Locks were ten to twelve feet wide and, though of several slightly different lengths, all were large enough to accommodate canalboats fully seventy-five feet long. The highest single lift was about ten feet and the average lift between seven and eight feet. Some of the locks were of stone, others of wood. In the latter, the wooden side walls were enclosed between walls of rough masonry formed a few feet back of the timber work. The timber constituted a compact box for the water; and the masonry, a retaining wall for the earth. Struts of wood braced the two walls apart.⁴

The head of the line was on the Merrimack at Middlesex Village about a mile above the present dam at Lowell. There the entrance was formed by a nearly semicircular basin, measuring about two hundred feet along the shore of the river and extending back from the river about one hundred feet. It was about five feet below the surface of the Merrimack at low water and about ten or twelve feet below the natural surface of the earth.⁵ The basin led to a flight of three locks of durable stone masonry set in trass mortar,⁶ which were the first and best-built locks on the canal. Through these, rafts and luggage boats were lifted to the summit level. The yards and tracks of the Boston and Maine Railroad now cover the ground formerly occupied by the locks.

Passing under the main street at Middlesex Village, the canal crossed Black Brook in a wooden aqueduct near the site occupied, when the canal was completed, by a glass factory. The aqueduct, with abutments 110 feet apart, was supported by ten wooden piers on stone foundations. Its trough, about ten feet above the stream below, was made of timber and plank, with the timber framed together by tenons and mortises and strengthened by braces. Had the construction been with knees and bolts, after the fashion of shipbuilding, it would doubtless have been more durable.⁷

Continuing across what is now Chelmsford Street and then at right angles to the present track of the Lowell-Framingham Railroad, the canal next traversed the Great Swamp, the location of a large portion of the two necessary miles of embankment between the Merrimack and Concord rivers. Carried over River Meadow Brook or Hales Brook in a small aqueduct, it continued to Billerica Mills, where a stone guard

⁴ Vose: *Early Transportation in Massachusetts*, p. 9.

⁵ *Official Reports of the Canal Commissioners of . . . New York* (1817), p. 116.

⁶ *Ibid.*, p. 116.

⁷ *Ibid.*, pp. 111, 112, 116.

lock, excavated in a ledge of rock, formed the entrance into Concord River Mill Pond. Remains of the guard lock may now be traced in the yard of Talbot's Mills.

Some rods below the line of the canal at this point, a dam about a hundred and fifty feet long and eight feet high was thrown across Concord River, creating the mill pond out of which water flowed to supply both arms of the canal. The water feeding the longer line toward Boston passed through a horizontal aperture of six feet by one foot, with a head of two feet of water above the upper part of the aperture.⁸ Waste gates in the dam made it possible to regulate to some extent the height of the water. The fountain head of the canal was crossed by a floating towpath of which a section could be removed to permit logs, timber, or driftwood coming down Concord River to pass through to several sawmills below.⁹ The trunk of the canal left Concord River by another stone guard lock and pushed on through about a half-mile of deep cutting. Some eight hundred feet of this was blasted through hard, granite rock.¹⁰ Today the Billerica Car Shops of the Boston and Maine Railroad are set squarely in its former path, obliterating all traces; but beyond them for nearly a mile the canal is still found in almost navigable form.

Continuing from here the canal, today a dry ditch, reached the site of the famous Shawsheen Aqueduct, which carried it some thirty to thirty-five feet above the Shawsheen River. About 188 feet in length,¹¹ The aqueduct rested on two abutments and three or more central stone piers, all laid without mortar, with a wooden brace or modest type of pier between each outside stone pier and the adjacent abutment. Large horizontal timbers, embedded between the piers at suitable distances, served as supports to the lower ends of the aqueduct braces. From each end of the aqueduct an embankment thirty to thirty-five feet high ran a distance of several hundred feet. As freight and packet boats could only proceed singly over the river, basins on either side allowed them to congregate while awaiting passage. From its height and from the general nature of the surrounding low land, the Shawsheen Aqueduct was one of the imposing sights on the canal.¹²

⁸ *Official Reports of the Canal Commissioners*, pp. 115, 116.

⁹ *Ibid.*, pp. 115, 116.

¹⁰ *Ibid.*, pp. 115, 116.

¹¹ Report, November 1819: Corporate Records.

¹² The difficulty of determining dimensions of features of the Middlesex Canal may here be illustrated. The engineer's original proposal called for an aqueduct 620 feet long, spanning flat, low land for 444 feet of its length. A committee of the directors advised erecting banks on the low land for 442 feet and carrying the aqueduct over 170 feet. (June 17, 1799: Baldwin MSS. The discrepancy in the distance covered by these two reports is not explained.) Vose, writing in 1885, gives the length of this aqueduct as 40 feet, while the Canal Commissioners of the State of New York (1817) mention 140 feet. The length given in the text is that con-

A half-mile south of the Shawsheen came the first drop from the summit level through Nichol's Lock. Slight remains can be today identified. A mile and a half more, fairly evenly divided between excavation and embankment, and containing, over Lubber Brook, a small aqueduct known as Sinking Meadow Aqueduct, brought the canal to Gillis' or Jaques' Lock, the second descent toward Boston Harbor. At the sinking meadow, an embankment of some thirty rods was originally carried across a morass with subsoil of decayed vegetation. The earth and gravel brought on continued, for some years, to sink gradually into the marsh. Estimates of the depth to which the embankment sank vary from thirty-eight to sixty feet. The wall on the east was the first to hold firm; that on the west also ceased to settle, but continued for a time to spread. Material was carried on and impacted until the banks were consolidated.¹³

A house has been built on the ground of the second descending lock, the garden occupying the site of the basin. The old canal tavern still stands, recently occupied by tenants of whom one was a descendant of a tavern-keeper at Gillis' Lock. The towpath from here to Wilmington became the ground bed of a trolley line, which eventually reached a state of decay comparable to that of the canal.

Passing from Gillis' Lock over a small aqueduct, the canal encountered more obstacles some two miles beyond, near the site of the former Wilmington Poor Farm. Here an embankment, some eighty rods long and twenty-five feet high to the top of the towing path,¹⁴ was thrown across Maple Meadow, and an aqueduct constructed over Maple Meadow Brook, a source of the Ipswich River. To avoid further passage through this treacherous meadow, the canal was turned sharply, making an abrupt bend which came to be called the Ox-Bow. The former entrance to the town of Woburn was reached a mile farther south, the route skirting or crossing the present state highway, then paralleling or merging with the roadbed of the Woburn branch of the Boston and Maine, through North Woburn, Central Square, and as far as the grounds of the present Woburn Public Library. A fairly high embankment, originally built during the winter over a sinking meadow in Woburn, caused some difficulty. By the end of the spring thaw, it had settled so that its top was level with the natural height of the ground. Another embankment was raised upon it.¹⁵ In North Woburn the line runs beside the

tained in the report of November 1819, found with the records of the Middlesex Corporation. During the rebuilding of the aqueduct, about 1830, it was shortened by filling. The stone abutments and possibly two or more piers were either removed or buried.

¹³ Report of committee of operations, Oct. 8, 1801: Corporate Records; *ibid.*, October 1802. *Official Reports of the Canal Commissioners*, p. 113.

¹⁴ *Official Reports of the Canal Commissioners*, p. 113.

¹⁵ *Ibid.*, p. 113; reports, committee of operations, Oct. 8, 1801 and October 1802; memo. of superintendent, May 27, 1802: Corporate Records.

Baldwin Mansion, built in part in 1660, before which in a public square stands a statue of Loammi Baldwin, the engineer of the canal.

One of the chief engineering features of the Middlesex Canal, was reached after its passage behind the site of the present Woburn Public Library. Here three sets of double locks, called Stoddard or Horn Pond Locks, accomplished a descent of fifty feet. The middle set of locks was separated from the set above and the one below by basinlike widenings to equalize the draft of water by locking.¹⁶ High above Horn Pond stood a spacious, much frequented canal tavern.

Stone Lock, a nine-foot drop, was situated about a half-mile farther on, at the crossing of Horn Pond Brook. Water was here taken in from Horn Pond, the only source in addition to Concord River. A mile and a half below, just north of the Abbajona River, then called Symmes River, were Gardner's Locks, which were double. The bed of Symmes River formerly occupied part of the Upper Basin of Mystic Lakes; the basin did not then exist. An aqueduct with abutments 127 feet apart and with three intervening stone piers¹⁷ effected the crossing of Symmes River. The remains of piers or abutments are still visible at the point where the Abbajona River connects the Mystic Lakes with the Upper Basin, not far from the bronze tablet, with its historical record of the canal, erected on Mystic Parkway.

Running close along the shore of Mystic Lakes, the line passed through the estate of Peter C. Brooks, where an elliptical stone arch of admirable proportions carried a farm road over the canal.¹⁸ Farther south, about a mile and a half, came Gilson's Lock, followed by an aqueduct, 135 feet long, borne over Mystic River by two stone abutments and three stone piers.¹⁹ Each pier and abutment was twelve feet high, twenty feet long, and about six feet in width.²⁰ The surface of the water in the aqueduct was about ten feet above that in the river at high tide.²¹ One mile beyond, the Medford Branch Canal, about one-quarter mile long, with a lock and basin at the upper end and a lock at the lower, connected the Mystic River with the main canal.²² On the banks of this river, after the coming of the Middlesex Canal, grew the excellent shipyards which

¹⁶ Vose, *Notes on Early Transportation in Massachusetts*, p. 10.

¹⁷ Report, November 1819: Corporate Records. Cf. *Official Reports of the Canal Commissioners*, p. 112.

¹⁸ The arch was built in 1821. (Report, Jan. 16, 1822: Corporate Records.) It is said to have been designed by George Rufford Baldwin. (M. W. Mann, "The Middlesex Canal; An Eighteenth Century Enterprise," *Boston Society Publications*, VI, 69-87.)

¹⁹ Report, November 1819: Corporate Records.

²⁰ Letter of J. L. Sullivan to DeWitt Clinton, March 7, 1817, in *Official Reports of the Canal Commissioners*, pp. 111, 135.

²¹ *Official Reports of the Canal Commissioners*, pp. 111, 135.

²² Survey and Estimate, Medford Branch Canal, February 1804; Plan Medford Branch Canal, 1804, 1805: Baldwin MSS. Contract re Medford Branch Canal, October 1804: Corporate Records.

made the name of Medford famous in the ports of the world; and "Medford-built" became synonymous with the best of finished workmanship.

From the crossing of Mystic River to the end of the line, practically all traces of the canal have disappeared. It passed through land now occupied by the Riverina Mills of the American Woolen Company; then under the present railroad tracks, along West Street, parallel to or in Summer Street, and wound a tortuous course, avoiding the hills on the west and the Mystic Marshes on the east. A little damp pool near Hancock Avenue, in the rear of a brick building, said to have been a hat factory when the canal was in operation, is the last vestige that remains in this populous section.

Running along the westerly part of the old Mystic Trotting Park, the canal came out at the coal pocket on the Mystic River near the Somerville town line, turning inland once more to the western end of Broadway Park, where a stone monument marks its former path. It then curved around to the base of Mount Benedict — Ploughed Hill of revolutionary times. From here to Dorrance Street in Charlestown the route passes through congested districts. Crossing the old Medford turnpike and the rails of the Boston and Maine, it finally passes up the spur track of a lumber company and meets the high brick wall around the Sullivan Square Terminal of the Boston Elevated, which effectually estops further investigation. Near this was the Malden Road Lock and some six hundred feet farther a lock, 114 feet long,²³ leading to the mill pond. Still another lock, with double gates that might be worked in either direction, according to the state of the tide, let canal boats from the mill pond into Charles River. Today the site of this mill pond is dry land, covered with streets and buildings.

Once in Charles River, the boats might be poled, sculled, or sailed to any part of Boston; but a short branch canal penetrated the city at the present site of the Boston and Maine Railroad Station. Entering at the river front, it crossed Causeway Street and passed inward three city blocks, running between Haverhill and Canal streets and ending at Haymarket Square.²⁴

²³ Report, November 1819: Corporate Records.

²⁴ Map of Boston and Lowell Railroad, 1832 (B. F. Perham).

APPENDIX B

There follow some details in summary form of the achievements and employments of engineers of the Baldwin family,¹ who secured their early training on the Middlesex Canal:

LOAMMI BALDWIN, 2ND, 1780-1838

- 1800- graduated from Harvard College.
- 1802- built for the town of Groton, Mass., a fire engine, "Torrent #1," which threw a stream of water through a $\frac{3}{8}$ -inch nozzle to a height of 75 feet. Its 100 feet of 2-inch hose was first made at a harness shop and sewed with wax thread. The engine was used for more than eighty years.
- 1805-1806 published a memoir of Count Rumford.
- 1806-1807 studied civil engineering in England.
- 1809- published: *Thoughts on the Study of Political Economy As Connected with the Population, Industry, and Paper Currency of the United States* — a creditable although not remarkable pamphlet.
- 1814- designed and erected Fort Strong, Boston Harbor, for the defense of the port in the War of 1812.
- 1816- surveyed for the state a route for a canal from Contoocook River, N. H., through Sunapee Lake and Sugar River to Connecticut River.
- 1817-1820 employed on several internal improvements in Virginia.
- 1819- employed on the Boston and Roxbury Milldam.
- 1821- engineer of the Union Canal in Pennsylvania.
- 1824- inspected public works and manufactures in Europe, in company with Francis C. Lowell.
- 1825- served on the committee of design for the Bunker Hill Monument, Charlestown, Mass. The construction and interior details were done by Baldwin.
- 1825- employed by the state to survey for a canal from Boston to the Connecticut River and thence to the Hudson River. His report is one of the most complete engineering documents of the time. It proposes to tunnel the Hoosac Mountain practically at the site later selected for passage by the railroad.

¹Of the careers of two of the five brothers, sons of Loammi Baldwin, little is known. Cyrus Baldwin managed the Merrimack terminal of the Middlesex Canal and was inspector of gunpowder for a time. B. F. Baldwin was employed on the construction of the Boston and Roxbury Milldam; a number of maps in the Massachusetts archives and the Baldwin Manuscripts testify to his skill as a draftsman.

THE MIDDLESEX CANAL

- 1826— acted as engineer of the Salem Milldam Corporation which was organized for developing water power at Beverly, Mass.
- 1827—1834 planned and built his two greatest works, the government dry docks at Charlestown, Mass., and at Norfolk, Va. These were among the leading engineering structures of their time in the United States. They were designed and executed throughout by Baldwin.
- 1826—1835 engaged at various times on the survey of New York Harbor for the location of a government dry dock.
- 1827— acted as consulting engineer of a government board of examination for the improvement of the navy yards.
- 1827— appointed by the Governor of Massachusetts to secure surveys and an estimate for a railroad from Boston to the Hudson River. [see James F. Baldwin]
- 1834— published an elaborate report on the introduction of pure water into Boston. It amounts to a treatise on the supplying of water to municipalities and contains a comparative treatment of the methods employed in ten European cities and two American cities.
- 1835— surveyed and reported on the possible development of water power in the Androscoggin River, Maine.
- 1836— surveyed and reported on the best means of developing water power for the Amoskeag Manufacturing Company at Manchester, N. H.
- 1836— surveyed for a canal to connect Altamaha River with Brunswick, Georgia, and submitted a report. This canal was commenced but never completed.
- other works — projected a dam across the Kennebec at Augusta, Maine. designed and constructed Holworthy Hall, Harvard College. furnished plans for a marine railway at Pensacola, Fla. acted as consulting engineer for the Louisville and Portland Canal and for the Harrisburg Canal. [see G. L. Vose, *A Sketch of the Life and Works of Loammi Baldwin, Civil Engineer* (Boston, 1885)]

JAMES FOWLE BALDWIN, 1782—1862

- 1827—1829 employed as engineer by Massachusetts for the first survey for a railroad from Boston to Albany.
- 1831—1836 employed as engineer and constructor of the Boston and Lowell Railroad.
- 1837—1838 employed by the city of Boston as a commissioner for introducing soft water from Lake Cochituate.

- 1839- acted as engineer of the Locks and Canals Corporation of Lowell, for the measurement and improvement of water power.
- 1840- employed by Massachusetts to fix the boundaries of Boston Harbor.
- 1841- employed by Massachusetts in designing improvements and planning the repair of the Charles River and Warren bridges.
- 1842- acted as engineer of the Locks and Canals Corporation of Lowell, in further measurement and improvement of water power.
- 1842- employed by the United States War Department to measure water power at Springfield, Mass.
- 1843-18(?) served as engineer of the Locks and Canals Corporation of Lowell.

GEORGE RUMFORD BALDWIN, 1798-1888

[G. R. Baldwin's diaries, with the Baldwin Manuscripts, cover more than fifty years and contain daily entries of his engineering activities. I have consulted them only cursorily.]

G. R. Baldwin was employed by the Boston and Lowell Railroad from 1831 to 1832 to secure technical details and information from England and Scotland. Among his other occupations were the designing and building of the Boston Marine Railway and the waterworks at Quebec. He was employed by Massachusetts on the work on the South Boston flats and on surveys for the Cape Cod Canal. He was consulting engineer for the waterworks at Charlestown, Mass., for the Shubenacadie Canal in Nova Scotia, and for early railroads in New Hampshire, Maine, and Vermont.

APPENDIX C

STATE OF OWNERSHIP OF MIDDLESEX CANAL SHARES AFTER THE 96TH ASSESSMENT OF MAY 1806

Adams, John	13	Gray, William	24	Parkman, Samuel	10
Adams, John Q.	7	Greenough, David S.	5	Payne, William	30
Alexander, Giles	1	Guild, Mrs. Elizabeth	2	Payson, Phillip	1
Allen, James, Jr.	2	Hall, Andrew	1	Phillips, John	2
Allen, Jeremiah	6	Hall, Benjamin	4	Phillips & Holden	1
Amory, Jonathan	8	Hall, Benjamin, Jr.	2	Pomeroy, Samuel W.	2
Andrews, Ebenezer J.	4	Hall, Dudley	1	Prince, John	9
Atkins, Henry	7	Hall, Ebenezer	1	Quincy, Josiah	5
Balch, Nathaniel	3	Hall, Joseph	5	Quincy, Mrs. Anne	2
Baldwin, Cyrus	2	Hall, Mrs. Mary	1	Russell, Miss Sarah	5
Baldwin, Loammi	11	Hall, Nathaniel	2	Sigourney, Andrew	5
Barrell, Joseph	7	Hall, Richard	5	Sigourney, Daniel	1
Barrell, Nathaniel	4	Hartshorn, Oliver	4	Sigourney, Elisha	1
Barrett, John	5	Hazard, Ebenezer	3	Sigourney, John C.	1
Bartlett, George	2	Hill, William	10*	Smith, William	14
Bartlett, Josiah	1	Hitchborn, Benj.	16	Storer, Charles	23
Bigelow, Abraham	1	Homes, William	5	Storer, Ebenezer	20
Bishop, John	10	Howard, Rev. Simeon	4	Sullivan, George	14
Blake, Edward	2	Jackson, Henry	8	Sullivan, James	1
Brattle, Thomas	10	Jackson, John	2	Sullivan, John L.	14
Brooks, Peter C.	6	Jaques, Samuel	1	Temple, Mrs. Elizabeth	3
Codman, John	6	Jones, John C.	20	Temple, Grenville	6
Coolidge, Benj.	3	Joy, Benjamin	70	Thompson, Samuel	1
Coolidge, Joseph	15	Joy, John, Jr.	40	Thompson, Thomas	3
Coolidge, Joseph, Jr.	6	Lambert, William	12	Touro, Abraham	7
Dalton, Peter R.	5	Mackay, Capt. Mungo	20	Tudor, William	5
Derby, Capt. John	15	Mackay, Mrs. Ruth	2	Walley, Thomas	8
Devens, Richard	3	Middlesex Canal Co.	1	Warren, Capt. Isaac	1
Dexter, Aaron	6	Miller, Charles	5	Warren, John	8
Dunn, Samuel	5	Morse, Rev. Jedediah	10	Watson, Marston	4
Durant, Cornelius	10	Oliver, Ebenezer	2	Weld, Benjamin	22
Gore, Christopher	35	Otis, Samuel A.	9	Wendell, Oliver	2
Gore, John	35	Parker, Isaac	1	Winthrop, James	4
Gray, John	6	Parker, John	5		

800 shares See Hill *
101 stockholders

* The number of shares owned by William Hill is doubtful. His account shows 10, 11, and 12 shares with various transfers and illegible notations. The 10 shares here attributed to him may have been owned by others, not listed at this time.

APPENDIX D

THE SUPERINTENDENT'S NOTES ON MEN EMPLOYED AND WAGES 1800 AND 1801 *

"Pocket Memorandum Canal & Other things. October 3, 1799 to
December 1801." (Baldwin MSS)

March 1800

John Chapman, Tewksbury, for 1 mo. from 10 March @ 12. doll.
Reuben Durront, Billerica 7/6
Timo. Hill Jun of Amherst, Carpenter, 16 d. per mo.
Timo. Clough, stone layer, New Salem @ 16
Joseph Pittingill, stone layer, Salem @ 14
Joshua Atwood, Carpenter 17

April 1800

Ezekl Page of Hancock 18
Zachariah Spaulding, Chelmsford, Carpenter 18
John Robbinson of Derry, Carpenter 22
John Austin }
John Austin, Jun. } 20
Edw. Pettie 19
Rich.d Pettie 19
David Pettingill & Man dol. 35; June 6 him alone 24
Henry Dowing 18

May 1800

James Lunds 15
John Austin 20 [see above]
Daniel Allen of Chester 1 week at 12
Aaron Fletcher, Carpenter, asks 20 dol. pr. mo.
James Wilson, Windham, asks 20.
Reuben Johnson to be Blacksmith, Stone work, or any other work @
11 dol. gave some encouragement, if he does well 12 dolls.
George Tufts, Carpenter, 28 dol. & board himself
[4 names in May with no wages stated]

June 1800

Abraham Emerson, Master Stone layer @ 20
Webster 13 dol.
his son 9
Nathaniel Levermore of Shirly, stone layer, 14 doll.
Abel Witherbee of Harvard, stone layer 14
Jonath.n Burnham, blacksmith, stone layer &c 14 dol. or 15
James Baldwin 1 dol. pr. day, his 2 jornemen @ 15½ doll. pr. mo.

July 1800

agreed to give Nath. Levermore 16 doll. pr. mo. for future

* During these years most of the hiring of men was done by Jaques, an overseer.
His accounts are not available.

August 1800

agreed with M. Jarvus [?], Lemingburg [?], a carpenter, from 16 to 18 doll. pr. month with 2 men from N. Concord, one a Stone blower, both will work at Stone work @ 10 doll. pr. mo.

Henry Willard @ 13 doll. Stonework

agreed with worker C. Chamber [?], stone 12

[There follow thirteen names with no statement of wages]

March 1801

agreed with Mr. Whittle @ 7/ p. day

March 7 or 8 — the water let into canal to the west of Concord River — went up in boat to head with Leonard Jarvus — canal all clear of Ice agreed with Elephalet Brown to work for the season at 10 doll. pr. mo.

Jonathan Marbel of Dracutt, carpenter, agreed to work at 18 doll. pr. mo.

Sam'l Noyes of Andover, carpenter, agreed at 19 dolls. per mo, thro season — he wishes to have 20 if he earns it but I do not agree to give

Barnett Hughes of L. Derry, carpenter, @ 19 doll. pr. mo. for season

Phineas Davison of Andover agrees to work in Stone work for the season at 13 or at most 14 doll. pr. month as I shall think right

Asa Winn of Billerica to assist at Stonework @ 11 or 12 doll, pr. mo. for season

William Richardson of Billerica the same as above for the Season to come on Apr. 1.

Mr. Bigelow of Bolton agrees to work in stone blowing & Laying . . . engages for Season @ 12 or 13 doll.

April 1801

Mr. David Tarbell of Nottingham, a carpenter, agrees to work the Season at 19 doll, pr. mo. or at most 20 doll. as I think he may Earn.

Joseph Tarbell of Nottingham, a blacksmith & Stone working to have 13 doll. per mo. & he say that he will earn 14 or 15 doll. perhaps shall give him 14 doll. pr. mo.

Wm. Ayers, stone work, told him should not give him but say 14

Sam'l Sproke Jun of Nottingham, carpenter, asks 18 doll. to come first of May if I send for him at Mr. Pelnams . . . dont expect to give him more than 17 doll.

Edson, Brick layer & Stone layer, at the Fox House on Fast Day, to work for 18 doll. at most pr. mo.

Joseph Kinney to work on Canal or Farm at 10 doll. for season.

Mr. Isaac Hobart of Hollis, Stone layer & master workman engages at 14 doll. pr. mo. at least perhaps I may give him 15, but do not agree to give more than 14 doll. for the season pr. month.

Sam'l Ridcut of Hollis in the Stone work at 12 doll. pr. mo.

Jacob Hobert of Hollis in Stone work at 12 doll, pr. mo.

Jacob Silver of Smithfield, R. I., Master workman in Stone laying Engaged for the Season if he suits us at 14 doll. pr. mo. . . if I think proper, to allow him 15 doll. but under no obligation.

Herbert Thorndeck of Tewksbury Engages in the Stone work & dig.g at lock at 13 doll. pr. mo. — may dig some at the locks &c.

Jeremiah Tyler may work in the Stone work but would not agree to give him more than 12 doll.

May 1801

Levy Leach of New Salem in Mass. engages for the Season in the Stone work at 12 doll. pr. month

David Capen agrees as Leach does above. I may allow them one doll. more if I think fit, but am not to be held.

James Ashley of Shootsbury engages in the Stone work at 12 doll. per month by Season Jarvus [?] Ashley his son @ 8 doll. pr. mo. by Season

Ebenezer Ball of Hollis engages as a blacksmith & Stone worker by Season at 14 doll. pr. mo. to be Regular & keep the tools & shop in good order & secure, to come next Monday or Tuesday — read this to him when he engaged — said that he would suit me

agreed with Mr. John Johnson of Cantaberry to work in Stone at 13½ pr. mo.

Mr. [?] Chase of Northfield, carpenter, agrees to work the season for 16 to 18 doll. as Mr. Hall shall say, but not to be less than 16 nor more than 18.

June 1801

agreed with Mr. John Eaton of Plainfield, N. H., a good Stone layer at 14 doll. pr. month at least, but not more than 15 for Season.

agreed with Mr. Wells to work as carpenter or Stone work or for myself at 13 or 14 doll.s as I shall think he earns, but he say that he expects 14 doll.s

Joe Snow agreed to work at Stone work for the season at 13 or 14

July 1801

agreed with John Weeks for him to work at carpenters business @ 20 Dollars pr. mo. & his man @ 13 doll.s

John Kean agreed to work on Canal at 15 doll. pr. mo. & to exert himself

September 1801

Sam.l Wilder of Lineal agrees to work in the Stone work until the last of October next at 13 doll. pr. mo.

October 1801

agreed with Oliver Fletcher to work at Stone or other work @ 11 doll. pr. month.

agreed with Rich.d Briggs to work at Stone work or other work at 12 doll. & if he shall Exert himself may give him 13 doll.

James Calwell, Nottingham, agrees to work at 10 doll. pr. month

November 1801

James Kelly of Cantabury agrees to work in Stone work at 11 doll. pr. month.

John Bowers agreed to work on Stone at 12 doll. pr. mo. — no time set — he proposed 5 or 6 mo. — I told him it would be according as the Season was

December 1801

John Smalley agreed to work at 8 doll. pr. mo. . . .

APPENDIX E

CARPENTERS' CRAFT RULES IN BOSTON, 1774-1800

The Carpenters' rules of work in the Town of Boston, "formed and published in the year 1774," consisted of a list of the work the members of the craft performed, a description of the manner of finishing, and a statement of the prices to be charged for the several items. These prices, or wages, were largely inoperative; they remained superseded throughout the severe monetary fluctuations during and after the Revolution. The new rules of 1800 state with reference to the rules of 1774:

. . . several have held them up as a direction at this day, not considering that they were calculated upon a scale which bears no proportion to the price of other labor *now*, and which is by no means an equivalent compensation for the service, in reference to the raised price of the necessaries of life; and that, not only the low rate at which they were cast render them a very incompetent guide at present, but that they are besides greatly defective in not specifying one quarter part of the work now in demand. Wherefore, the Carpenters of the Town have met at sundry times to consider the propriety of forming new arrangements, and Rules, more accurate and more complete, and calculated on a scale better adjusted to the means of an honest livelihood in an equitable reward to faithful industry. They chose, accordingly, a large and respectable *COMMITTEE*, out of their number, to form such *RULES*; which, being reported and unanimously approved by the whole body, they now publish for the service of the Craft, — expecting that all work will be measured by them, and executed in the best possible manner.

Items of house carpentering are specified almost exclusively. There is no reference to work on bridges, although Boston had seen numerous carpenters employed on her connecting bridges before the year 1800. The list was, therefore, not coextensive with the work of members of the craft. The prices recommended by the trade doubtless served in the town principally as norms about which actual charges fluctuated. Such craft organization was a minor excrescence on the body of a society essentially individualistic. See *The Rules of Work of the Carpenters in the Town of Boston* (Boston, 1800), pp. iii, iv., Harvard College Library.

APPENDIX F

The following extracts from the Almanac Diaries kept by Loammi Baldwin, 1st, will indicate the nature of these manuscripts, extensively used in this study:

- 1790 — "Linco M said no man was saved because he merited it sought for it or wish.d for it. . . .
- 1793 — Aug. 7 — "Medford — begin surve[y] for Middlesex Canal. . . .
Oct. 8 — "Gov. Hancock died. . . .
Nov. 14 — "Resigned as sheriff . but consented to continue until about 2nd. week in Jan. . . .
- 1794 — Jan. 17 — "Resignation accepted. . . .
Mar. 10 — "Monday about 3 O'clock P.M. Set out for Southern States to ye appointment and at the request of the Directors of the Middlesex Canal to View the Canals Engage an artist in our service & make such further enquiry as shall think proper. . . .
Apr. 16 — "arrived home Woburn 11 P.M. [from southern trip]. . . .
May 12 — "Reported to Directors Middlesex Canal. . . .
June 4 — "at Gen.l Court about Canal acts. . . .
June 13 — "Elected by Gen.l Court a Senator of Middlesex. . . .
June 19 — "took my seat in Senate. . . .
July 21 — "began the survey of the Middlesex Canal by James [sic] Weston, Esq. . . .
July 30 — "ended the survey. . . .
Aug. 11 — Aug. 23 [or to 30] "Buy land for canal. . . .
Sept. 10 — "Brock ground in the Middlesex Canal on the western shore of the Proprietors Millpond I turned or dug the first spade full. . . .
Oct. 30 — "Cambridge, Boston, home — got the Instrument. . . ."

APPENDIX G

THE UNION CANAL LOTTERY¹

The right to raise not more than \$20,000 by lottery was granted by New Hampshire to the Union Canals in 1813. The next year the company secured authority to sell the tickets in Massachusetts. In the latter state the scheme met difficulties in 1818 with the passage of a general act regulating lotteries. Meanwhile the term of the lottery had expired in New Hampshire and a new act, passed December 20, 1820, allowed an extension of six years for drawing the classes yet undrawn. There were then three lotteries authorized in New Hampshire. Each was allowed five months in every fifteen, during which it might conduct a lottery without competition. The first term of the Union lottery, under the extension, commenced in February of 1821. An appeal in 1822 or 1821 to the Massachusetts legislature for a similar increase of time failed of favorable action.²

When matters had reached this point, the directors of the Middlesex Canal, largely interested in the Union Canal, inquired into the affairs of the managers of the lottery and received the news that after six classes had been sold and drawn, the lottery stood in debt \$5,647.07. Instead of profiting, the Union Canal was further burdened. To pay off the debt at once by an assessment on shares was considered unwise for two reasons:

1. The \$60 assessment required would lead many stockholders to abandon their shares.

¹ Lotteries were likewise granted Blodget's or Amoskeag Canal for improvement of the Merrimack River. The original act, Dec. 30, 1799, empowered Blodget to raise \$9,000 in three years. A resolve of the legislature of June 17, 1802, called for the accounts of the managers, and an act of the next day authorized the raising of an additional \$10,000. The term of three years for this act was twice extended (*Laws of New Hampshire*, VI, 622; VII, 101, 122, 438, 749). Similar grants in favor of Blodget were passed by Massachusetts on March 9, 1804, and March 14, 1806. Two years after the last of these acts the managers were called upon to exhibit their accounts, and two years later a commission, composed of John Winslow, Jonathan Hunnewell, and Benjamin Weld, was appointed to examine the accounts over which there had been many disputes (*Massachusetts Statutes Private and Special*, III, 440; IV, 36, 145, 292). This same lottery was still running in 1814 (*ibid.*, IV, 547).

² *Laws of New Hampshire*, VIII, 232, 931. *Massachusetts Statutes Private and Special*, IV, 556. Reports, June 1820, Dec. 21, 1820; June 19, 1821: Corporate Records.

2. If notes should be given and the debt therefore remain for some time unsatisfied, "the Legislature may from motives of fellow feeling be yet inclined to relieve the unfortunate proprietors . . . whereas if the debt is cancelled the reason and necessity of granting further encouragement would not be with some so apparent."⁴

Obligations of the company were given in July 1822, to be paid off over five years; and the income of the Union Canal was reserved for meeting these installments. The mood of the legislature remained obdurate, and the debt was still being paid in 1828. The next year the agent of the Middlesex reported of the Union Canal:

I have now the pleasure to state that this Canal is entirely free from debts, the demands created by lottery speculation are paid to the last dollar with interest. . . .⁴

The managers of this lottery, which did so badly, were Patrick T. Jackson, later President of the Boston and Lowell Railroad, William A. Kent, and Andrew Sigourney, who was succeeded on his death by Joel Stone. They have left their summary accounts. The disproportionate yield of even the best class drawn was characteristic of lotteries generally in America.⁵ Large amounts were paid in prizes, and the amount left in the hands of the beneficiaries was in most instances relatively small. Apparently, in this lottery, the chance in favor of the company was too closely calculated, and failure to sell all the tickets made matters worse. The account⁶ is here duplicated as it appears:

⁴ Report, July 24, 1821: Corporate Records.

⁴ Report, Jan. 26, 1829: Corporate Records.

⁵ A. R. Spofford, "Lotteries in American History," *American Historical Association, Annual Report* (1892), pp. 173-195.

⁶ Corporate Records.

UNION CANAL LOTTERY*

	Dolls Ct		Loss	Gain	Bad Debts
1st Class 13500 Tickets in all @ 10.00 each					
6935 " Sold amounting to	71,555.00	a			
amt. of Prizes paid & charges	<u>81,863.47</u>	Bal. Loss.	10308.47		2058.72
2d Class Suspended—					
3 Class 20,000 Tickets @ 3.00					
16,167 Sold amt'g to	49,498.00				
Prizes & Charges	<u>47,879.72</u>	Bal. Gain		1618.28	1768.51
4b Class 25000 Tickets @ 4.00					
18609 Sold amt'g to	76,564.00				
Prizes & Charges	<u>65,940.00</u>	Balance Gain		10,623.85	*9012.90
5b Class 25000 Tickets @ 5.00					
12013 Sold amt to	61650.00				
Prizes & Charges	<u>44524.00</u>	Balance Gain		17,125.13	684.80
6 Class 25000 Tickets					
23623 Sold amt'g to	159,211.00				
Prizes &c Paid	<u>159,306.03</u>	Balance Loss	95.03		*10645.30
2d Class 10000 Tickets @					
9721 " Sold amt to	48850.00				
Prizes & Charges	<u>45902.---</u>	Balance Gain		2948.00	
Gain ... 32315.26					
Loss ... 10403.50			<u>\$10403.50</u>	<u>\$32315.26</u>	<u>\$24794.94</u>
	<u>21911.76</u>				
Bad Debts .. 24794.94					
Int paid 2763.89					
	<u>27558.83</u>				
Aggregate Loss \$ 5647.07					

* The mathematical errors in this table are unexplained.

* 6064.80 of this sum was due fr. T. Kidder
 ° 6316.00 " " " B. Eaton

APPENDIX H

STATISTICS OF LOWELL MANUFACTURES.

JANUARY 1, 1835.

CORPORATIONS,	<i>Locks & Con's</i>	<i>Merrimach</i>	<i>Hamilton.</i>	<i>Appleton.</i>	<i>Lowell.</i>	<i>Suffolk.</i>	<i>Tyromst.</i>	<i>Lawrence.</i>	<i>Middlesex.</i>	<i>Total.</i>
Capital Stock,	600,000	1,500,000	900,000	500,000	500,000	450,000	500,000	1,100,000	500,000	6,650,000
Number of Mills,	1	Print Works and 3	Print Works and 3	2	Cotton and Carpet Mill in one building.	1	2	4, another & Bleachery preparing	2	22 Mills, beside Print Works, &c.
Spindles,		34,432	18,944	10,240	4,500 Cotton besides Woolen.	10,240	11,136	24,192	3,120	116,804
Looms,		1,253	560	350	140 Cotton 68 Carpet.	350	404	710	98	3,933
Females employed,		1,321	780	475	325	460	450	1,000	240	5,051
Males "	200	437	200	70	150	70	80	160	145	1,512
Yards made per week,		172,000	78,000	80,000	43,270	90,000	120,000	164,000	6,000	753,270
Bales Cotton used in do.,		110	70	86	76	86	86	156	None.	670
Pounds Cotton wrought in do.,		40,000	25,500	30,000	15,600	30,000	30,000	54,600	470,000 wool per an. and 1,500,000 cotton teasls.	235,700 cotton
Yards dyed and printed do.,		150,000	70,000	None.	None.	None.	None.	None.	6,000	226,000
Kinds of Goods made,	{ Machinery, Carak,Engin's for Railroads, }	Prints & Sheetings No. 22 to 40	Prints & Drillings, No. 14 to 40.	Sheetings & Shirtings, No. 14	Carpet, Rugs and Negro Cloth.	Drillings, No. 14.	Sheetings & Shirtings, No. 14.	Sheetings & Shirtings, No. 14 to 30, and Casi- mires, 37 to 41 inch. wide.	Broadcloths and Casi- mires.	
Tons Anthracite Coal expended per annum,		4,696	2,000	300	180	294	329	500	240	11,239 *

* Unexplained error in total.

APPENDIX H (continued)

CORPORATIONS,	Locks & Canals	Merrimack	Hamilton.	Appleton.	Lowell.	Suffolk.	Tremont.	Lawrence.	Middlesex.	Total.
Cords of Wood per annum,		1,400	1,500	100	500	70	60	120	1,000	4,750
Gallons of Oil, "		6,800	6,000	3,500	Olive 3,000 Sperm 4,500	3,840	3,692	6,217	Olive 10,500 Sperm 2,500	50,549
Diameter of Water Wheels,		30	13	13	13	13	13	17		
Length of do. for each Mill,		24	42	42	60	42	42	60		
Incorporated,		1822	1825	1828	1828	1830	1830	1830	1830	
Commenced operations,		1823	1825	1828	1828	1832	1832	1833-4	1833	
How warmed,		Hot Air Furnace.	Hot Air Furnace.	Hot Air Furnace.	Hot Air Furnace.	Hot Air Furnace.	Hot Air Furnace.	Steam.	Wakefield Furnace & Steam.	

REMARKS.

<p>Yards Cloth made per annum, 39,170,040</p> <p>Pounds Cotton consumed, 12,256,400</p> <p>Assuming half to be Upland, and half N. Orleans and Alabama, the consumption in bales, is 34,800</p> <p>A pound of Cotton averaging 3 2-10th yds. 100 pounds Cotton will produce 89 pounds Cloth.</p> <p>As regards the health of persons employed, great numbers have been interrogated, and the result shows, that 6 of the females out of 10 enjoy better health than before being employed in the mills, — of males, one half derive the same advantage.</p> <p>As regards their moral condition and character, they are not inferior to any portion of the community.</p>	<p>Average wages of Females, clear of board, \$1.90 per week.</p> <p>" " of Males, clear of board, 80 cts. per day.</p> <p>Medium produce of a Loom on No. 14, Yarn, 38 to 49 yds per day.</p> <p>" " No. 30, 25 to 30</p> <p>Average per Spindle 1 1-10th yard per day.</p> <p>Persons employed by the Companies are paid at the close of each month.</p> <p>The average amount of wages paid per month, \$80,000</p> <p>A very considerable portion of the wages is deposited in the Savings Bank.</p> <p>Consumption of Starch per annum, 310,000 lbs.</p> <p>" of Flour for do. in Mills, Print Works & Bleachery, 3,800 bbls.</p> <p>" per ann. 3,800 bbls.</p> <p>" of Charcoal, per annum, 500,000 bushels.</p>
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To the above named principal establishments, may be added, the extensive Powder Mills, of O. M. Whipple, Esq; The Lowell Bleachery; Flannel Mills; Card and Whip Factory; Planing Machine; Reed Machine; Grist & Saw Mills, together employing about 300 hands, and a capital of \$300,000. Also, in the immediate vicinity, Glass Works, and a Furnace, supplying every description of Castings.

On the 1st. June next, the Middlesex Company will manufacture 300 yards of Sattinet per day, in addition to the above, and the consumption of Wool will then be 2000 lbs per day in their establishment. The Locks & Canals Machine Shop, included among the 22 Mills, can furnish machinery complete for a Mill of 3000 Spindles in 4 months, and lumber and materials are always at command, with which to build or rebuild a Mill in that time, if required.

APPENDIX I

I

RATE OF TOLL

ON THE

MIDDLESEX CANAL.....UNTIL FURTHER NOTICE.

APRIL 4, 1808.

ON all articles (excepting those which follow) by weight at 6½ cents a ton, each and every mile, the whole distance being 27 miles		Dolls. Cts.
Timber { Oak—per mile, 6½ cents a ton	- - -	1,68½
Timber { Pine—per mile, 4 cents	- - -	1,08
Pine Boards	} 6½ cents	
Pine Plank, reduced to board measure		1,68½
Clapboards—4 cents a thousand	- - -	1,08
do. freight in the Proprietors' Boats—64 cents a thousand	- - -	
Shingles—1 cent a thousand	- - -	
Oak Plank, 2½ inch—6½ cents for 600 feet board measure	- - -	1,68½
Ash Plank, 2½ inch—6½ cents for 700 feet board measure	- - -	1,68½
Staves, Barrel—6 cents per thousand	- - -	1,62
do. Hoghead—12 cents	- - -	3,24
do. Pipe—18 cents	- - -	4,86
do. Butt—25 cents	- - -	6,75
Hoops, Hoghead—8 cents per thousand	- - -	2,16
do. Barrel—4 cents	- - -	1,08
do. Half-Barrel—3 cents	- - -	,81
Hoop-Poles, Hoghead—18 cents per thousand	- - -	4,80
do. Barrel—9 cents	- - -	2,40
Shucks, 40 to be rated as one ton—6½ cents	- - -	1,68½
do. with heads, 40 to be rated as one and an half ton, or 27 a ton—6½ cents	- - -	1,68½
Hogheads, empty, 20 to be rated as a ton, or at 8½ cents each	- - -	1,68½
Barrels, empty, 50 to a ton	- - -	1,68½
Half-Barrels, empty, 80 to a ton	- - -	1,68½
Corn { 40 bushels to a ton, or 4 cents, 2 milles a bushel	- - -	1,68½
Rye { 40 bushels to a ton, or 2 cents, 1 mille a bushel	- - -	1,68½
Oats, 80 bushels to a ton, or 2 cents, 1 mille a bushel	- - -	1,68½
Rock Salt, 28 bushels to a ton	- - -	
Coarse Salt, 30 bushels to a ton	- - -	
Coarse Fine Salt, 34 bushels to a ton	- - -	
Fine Salt, 40 bushels to a ton	- - -	
Oars, for 1000 feet—4 cents a mile	- - -	
Wood and Bark per cord, whole distance 27 miles, or from above Concord River	- - -	1,17
	to Medford, 22 miles	1,00
ditto	from between Hopkins's Lock and Concord River, to Medford, 19 miles	,90
	to Charlestown, 22 miles	1,00
ditto	from between Wilmington Lock and Hopkins's Lock, to Medford, 14 miles	,65
	to Charlestown, 17 miles	,75
ditto	from between Horn-Pond Lock and Wilmington Lock, to Medford, 12 miles	,60
	to Charlestown, 15 miles	,70
ditto	from between Medford-Pond Lock and Horn-Pond Lock, to Medford, 7 miles	,40
	to Charlestown, 10	,50

APPENDIX I

2

RATE OF
Dockage, Wharfage, and Storage,
AT THE LANDING-PLACES OF THE MIDDLESEX CANAL.....1809.

At the Boston Landing.

WHARFAGE.	
<i>On Articles brought down or going up the Canal.</i>	HALF-CHESTS of BOHEA or HYSON TEA— 3 cents each.
WOOD and BARK—per cord, 10 cents for landing and the first month; and then 5 cents a month from April to September inclusive, and 10 cents a month from October to March inclusive.	GRAIN—1 cent per bushel.
TIMBER—per ton or per 100 feet ranging, 10 cents for landing and the first month, and 5 cents for every month after.	HALF-BARRELS, FIRKINS, KEGS, and SMALL PACKAGES—1 cent each.
BOARDS, PLANK, JOIST, STAVES, HOOPS, and CLAPBOARDS—12 cents per thousand for landing and the first month; 6 cents per thousand from April to September inclusive, and 10 cents from October to March.	HOGSHEADS and PIPES—6 cents each.
SHINGLES—3 cents per thousand for landing and the first month, and 2 cents per thousand for every subsequent month.	BARRELS—3 cents each.
SHOOK HOGSHEADS—1 cent per thousand for landing and the first month.	IRON—10 cents per ton.
BALES of COTTON, BAGS of HOPS, BALES, CRATES, TRUNKS, BOXES—5 cents each.	NAILS—2 cents per cask.
BOXES of LEMONS, OIL, GLASS—1 cent each.	SALT—3 cents per hogshead.
CHESTS of BOHEA TEA—6 cents each.	
	STORAGE.
	BALES of COTTON, BAGS of HOPS, BALES, CASES, CRATES, and TRUNKS—12 cents a month.
	HOGSHEADS—12 cents.
	BARRELS—5 cents.
	CHESTS of BOHEA TEA—12 cents.
	GRAIN—2 cents a bushel.
	IRON—20 cents a ton.
	If put into Store for any term less than a week <i>one third</i> the above rates.

In Charlestown, at the 1st and 2d Landings.

DOCKAGE.	
TIMBER put into the Booms—5 cents a month a ton or 100 feet ranging.	STORAGE.
N.B. All Timber must be put into the Booms, if not going immediately out of the Pond.	<i>(The same as at the Boston Landing.)</i>
	BALES of COTTON, BAGS of HOPS, BALES, CASES, CRATES, and TRUNKS—12 cents a month.
WHARFAGE.	HOGSHEADS—12 cents.
WOOD and BARK—5 cents per cord a month; 20 cents a month, if left within 20 feet of the water.	BARRELS—5 cents.
BOARDS, PLANK, JOIST, STAVES, HOOPS, CLAPBOARDS—6 cents per thousand a month.	CHESTS of BOHEA TEA—12 cents.
SHINGLES—2 cents per thousand a month.	GRAIN—2 cents a bushel.
TIMBER—6 cents a ton or 100 feet ranging.	IRON—20 cents a ton.
	If put into Store for any time less than a week, <i>one third</i> the above rates.

Articles loaded on or landed from Vessels other than the Canal Boats, to pay the customary wharfage.

Boats and Rafts may proceed to the Boston Landing, and pay toll there.
When a Boat, loaded with Wood or other articles, is to go to the Boston Landing, the Conductor must present his Passport to the Collector at Charlestown, and sign a copy of it, which the Collector will make in a book kept for that purpose. He must then take his Passport with him to the Boston Landing. And on the return of the Boat, the Conductor must bring a Certificate from the Collector at the Boston Landing, that his loading has been received there; otherwise such Boat cannot have a Passport to go up the Canal.

When a Raft is to go to the Boston Landing, the same rule is to be observed.
JOHN L. SULLIVAN,
Agent of the Middlesex Canal Corporation.

RATES OF TOLL ON THE MIDDLESEX AND RIVER CANALS.....1821.

Articles.	Bow.		Hooksset.		Amoskeig.			Union and Cromwell's						Total at U. & C.		Wicassee		Middlesex.		Remarks.	
	Dollars.	Cents.	Dollars.	Cents.	Dollars.	Cents.		M.	G.	B.	O.	C.	M.	C.	Dollars.	Cents.	Dollars.	Cents.	Dollars.		Cents.
Timber, Oak, per ton,	15	10	13	8	37	1/2	4	4	4	6	4	10	8	40	17	1	68	1	68		
Pine,	10	15	12	12	30		4	2 1/2	3 1/2	4	2 1/2	6	4	20	9		90		90		
Masts and Bowsprits, three tons each and over,	25	12	12	12	30		4	4	4	6	4	10	8	40	12	1	40	1	40		
under three tons each,	12	12	12	12	30		4	4	4	6	4	10	8	40	12	1	25	1	25		
Lumber, Pine, per m. board measurement,	14	18	18	18	50		4	4	4	8	3	12	10	50	17	1	65	1	65		
Oak Plank and Boards, per m. inch,	14	18	18	18	50		4	4	4	8	3	12	10	50	17	1	65	1	65		
Ash and other hard stuff not enumerated,	16	18	18	18	50		4	4	4	8	3	12	10	50	17	1	65	1	65		
per m. board measurement,	16	18	18	18	50		4	4	4	8	3	12	10	50	17	1	65	1	65		
Staves, Pipe, per m.	50	28	1	00	1	00	8	7	8	12	7	18	15	75	21	1	10	1	10		
Hogshead, W. O. and R. O. per m.	80	42	1	25	1	25	7	7	7	8	7	11	7	54	22	1	83	1	83		
Barrel,	60	32	1	00	1	00	5	5	5	6	5	9	5	40	18	1	80	1	80		
Hoops, Hogshead,	40	18	50	50	50		3	3	3	4	3	6	3	25	13	1	00	1	00		
Barrel,	16	12	50	50	50		3	3	3	4	3	6	3	25	13	1	00	1	00		
Hoop Poles, Hogshead,	8	6	33	33	33		2 1/2	2 1/2	2 1/2	3 1/2	2 1/2	5	4	22 1/2	8 1/2	1	75	1	75		
Barrel,	32	24	1	00	1	00	10	10	10	14	10	20	16	90	34	3	50	3	50		
Hoop Poles,	16	12	50	50	50		5	5	5	7	5	10	8	45	17	1	75	1	75		
Shooks, with Heads, 55 to a ton,																					
without Heads, 40 to a ton,																					
Hogsheads, empty, 50 to a ton,						each.	8	8	9	9	8	14	16	72	20	1	50	1	50		
Barrels, Beef and Rum, 50 to a ton,	48	23	1	3	1	3															
Fish, 60 to a ton,						"															
Half, 80 to a ton,						"															
Shingles, per m.	3	2	6	6	6		1	1	1	1	1	2	1	8	2		27		27		
Clapboards, "	15	10	10	10	30		5	5	5	5	5	10	8	40	10	1	05	1	05		
Stone, Hammered, per ton, (of 14 cubic feet.)	25	12	30	30			4	4	4	4	4	7	8	35	5		75		75		
Rough,	13	6					2	2	2	2	2	4	4	18	3		40		40		
Merchandise, per ton,	48	25					8	8	8	9	8	14	10	72	20	1	50	1	50		
Salt, Lime and Plaster, per ton,	20	13					6	6	6	7	7	10	13	56	9		35		35		
Iron Ore, same as Plaster, per ton,	20	13					6	6	6	7	7	10	13	56	9		35		35		
Oats, 75 bushels to a ton,						per bu.	8	8	9	9	8	14	16	72	20	1	50	1	50		
Corn and Rye, 40 bushels to a ton,	48	25	1	1	1	1															
Potatoes,	40		1	1	1	1															
Wood, Hard, per cord,	10	6	25	25			2	2	2	3	2	5	5	21	8		83		83	} delivered in Charles-town or Medford. 1-6 of value.	
Pine,	6	4	20	20			1	1	1	2	1	4	4	15	6		63		63		
Posts and Rails, split and sawed, per 100,	10	6	13	13			2	2	2	3	2	5	5	21	8		83		83		
Charcoal, per 100 bushels,	15	9					2	2	2	3	2	5	7	31	12	1	50	1	50		
Treennils, per ton,	48	25					8	8	9	9	8	14	16	72	20	1	50	1	50		
Bricks, per 100, same as Plaster,	20	13					6	6	6	7	7	10	13	56	9		35		35		
Manure, per boat load,							6	6	6	7	7	10	13	56	9		35		35		
Hay, per ton, Screwed,	36	16					6	5	6	6	5	10	10	48	18	1	00	1	00		
Bark, per cord,	10	6					2	2	2	3	2	5	5	21	8		83		83		
Hoop Poles, per 100,	5	3					1	1	1	1	1	2	1	4	2		20		20		

* Each Boat passing Amoskeig Canal pays \$2. or 24 cents per ton on its capacity, whether loaded or empty; and the articles it contains pay no other Toll

APPENDIX I

4

RATES OF TOLL ON THE MIDDLESEX AND RIVER CANALS.....1825.

Articles.	Bow.		Hooksett.		Amoskeig.		Union and Cromwell's.						Total at U & C.		Wicasset.		Middlesex.		Remarks.	
	Dollars.	Cents.	Dollars.	Cents.	Dollars.	Cents.	M.	C.	S.	G.	C.	M.	C.	Dollars.	Cents.	Dollars.	Cents.	Dollars.		Cents.
	Timber White Oak, per ton,	25		13		37		4	4	4	6	4	10	8	40		17			1	68
" Red Oak, rough hewn, per ton,	12		7		17		2	2	2	3	3	5	4	20		9			85	
" Pine,	16		8		20		2	3	2	4	2	6	5	26		9			90	
" Rough Spruce & Hemlock, per ton,	8		4		10		1	2	1	2	1	3	2	14		5			45	
Masts and Bowsprits, three tons each & over, under three tons each,	25		13		30		4	4	4	6	4	10	8	40		24		1	40	
Lumber, Pine, per m. board measurement,	25		13		30		4	4	4	6	4	10	8	40		24		1	25	
Oak Plank, and Boards, per m. inch,	25		13		30		5	5	5	8	5	12	10	50		27		1	63	
Ash and other hard stuff not enumerated, per m. board measurement,	34		18		30		10	10	10	16	10	24	20	100		18		2	81	
Staves, Pipe, per m.	50		28		100		8	7	8	12	7	18	15	75		21		2	10	
" Hogshead, W. O. per m.	80		42		100		7	7	7	8	7	11	7	54		22		2	25	
" R. O.	60		32		90		5	5	5	6	5	9	5	40		18		2	20	
" Barrel, W. O.	40		21		60		3	3	3	4	3	6	3	27		12		2	10	
" R. O.	40		18		50		3	3	3	4	3	6	3	25		13		2	00	
Hoops, Hogshead,	27		12		35		2	2	2	3	2	4	2	17		9			67	
" Barrel,	16		12		50		5	5	5	7	5	10	8	45		17		1	75	
Hoop Poles, Hogshead,	8		6		33		2	2	2	3	2	5	4	22		8			87	
" Barrel,	32		24		100		10	10	10	14	10	20	16	90		34		3	50	
Shooks, with Heads, 25 to a ton,	16		12		50		5	5	5	7	5	10	8	45		17		1	75	
" without Heads, 40 to a ton,																				
Hogsheads, empty, 20 to a ton,																				
Barrels, Beef and Rum, 50 to a ton,	48		25		3	each.	8	8	9	9	8	14	16	72		20		1	50	
" Fish, 60 to a ton,					3															
" Hall, 80 to a ton,					2															
Shingles, per m.	3		2		6		1	1	1	1	1	2	1	8		2			27	
Clapboards,	18		12		50		5	5	5	8	5	12	10	50		17		1	62	
Stone, Hammered, per ton, (of 14 cubic feet),	25		12				4	4	4	4	4	7	8	35		5			75	
" Rough,	13		6				2	2	2	2	2	4	4	20		3			40	
Merchandise, per ton,	20		10		12		6	6	6	6	6	9	9	48		10		1	00	
Salt, Lime, Plaster, Bar Iron, and Iron Castings, per ton,	15		7		11		3	3	4	4	4	6	7	31		6			80	

RATES OF TOLL ON THE MIDDLESEX AND RIVER CANALS.

Eighteen Hundred and Thirty.

Articles.	Bow Canal.	Hooksett.	Amoskeig.	Union Locks and Canals.							Total Union	Wicwasee.	Middlesex Canal.	Total.	Remarks.
				Merrill's.	Griffin's.	Short	God's.	Cook's.	Moore's.	Cronwell's.					
Merchandise, per ton,	13	10	18	1	1	1	1	1	1	1					
Corn and Rye, 40 bushels to a ton,	13	10	18	1	1	1	1	1	1	1	2	1	00		
Oats, 75 bushels to a ton,															
Potatoes, 40 bushels to a ton,	14	10	18	6	6	6	6	6	6	9	9	48	10	1	00
Shooks, with heads, 25 to a ton,															
" without heads, 40 to a ton,	14	10	18	6	6	6	6	6	6	9	9	48	10	1	00
Hogsheads, empty, 20 to a ton,															
Barrels, beef and rum, 50 to a ton,	14	10	18	6	6	6	6	6	6	9	9	48	10	1	00
" " 80 to a ton,															
" fish, 60 to a ton,	10	7	15	1	1	1	1	1	1	1	1	1	1		
" " 120 to a ton,															
Charcoal, 100 bushels to a ton,	10			1	1	1	1	1	1	1					
Salt, Lime, Plaster, Bar Iron, Pig Iron,	11	7	15	3	3	4	4	4	6	7	31	6	80		
and Iron Castings, per ton,															
Factory Cotton Cloths, downward,	12	10	20	1	1	1	1	1	1	1	45	1	50		
Sea Coal, (bituminous) per chaldron,	10	6	12	1	1	1	1	1	1	1	17	5	80		Upward, same as Merchandize.
Lehigh and Schuylkill Coal, per ton,	4	3	7								7	5	50		
Copperass, (downward,)	5	4	9								18	4	50		
Iron Ore, per ton,	7	4	11								37	5	37		Upward, same as Merchandize.
Stone, hammered, 14 cubic feet per ton,	8	5	13	3	3	3	3	3	4	5	24	5	50		
" rough,	8	5	13	3	3	3	3	3	4	5	24	5	40		
Bricks, common, per M,	2	1	3								7	2	14		
" furnace	13	13	25	6	6	7	7	7	10	13	50	9	50		
Sand and Clay, for glass houses, per ton,	20	13	25								33	9	100		
Manure, per boat load, per mile,	7	5	9								24	5	50		
Hay, screwed, per ton,													13		
Cotton	13	10	18	2	2	2	2	2	6	6	26	10	100		
												4	67		

TIMBER LUMBER, &c.

Timber, Oak, per ton,	25	13	37	4	4	4	6	4	10	8	40	17	1 68
Red Oak, rough hewn, for	12	7	17	2	2	2	3	2	5	4	20	9	85
posts and piles, per ton,	16	8	20	2	3	3	4	3	6	5	26	9	90
" Pine, per ton,	8	4	10	1	2	2	2	2	3	2	14	5	45
Rough Spruce and Hemlock, per ton,	25	12	30	4	4	4	6	4	10	8	40	14	1 40
Masts and Bowsprits, 3 t'ns, each, & over,	25	12	30	4	4	4	6	4	10	8	40	12	1 25
Under 3 tons, each	34	18	50	5	5	5	8	5	12	10	50	17	1 63
Lumber, Pine per M, board measurement,	68	36	100	10	10	10	16	10	24	20	100	28	2 81
Oak Plank and Boards, per M, do do	50	28	100	8	7	8	12	7	18	15	75	21	2 10
Ash, and other hard stuff, not enumerated per M, board measurement,	3	2	6	1	1	1	1	1	2	1	8	2	10
Shingles, per M,	17	9	25	3	2	2	4	3	7	4	25	4	80
Clapboards, per M,	—	—	—	—	—	—	—	—	—	—	—	—	—
Posts & Rails, split & sawed, 100 pr. ton,	—	—	—	—	—	—	—	—	—	—	—	—	—
Treenails, per M,	5	3	5	1	1	1	1	1	1	1	4	2 1/2	20
Hop Poles, per 100,	2	1	3	1	1	1	1	1	1	1	4	1	10
Laths, per M,	10	6	15	1	1	1	3	1	5	3	15	5	83
Wood, hard, per cord,	6	4	10	1	1	1	1	1	3	1	10	7	65
pine,	10	6	14	1	1	1	3	1	5	3	15	8	1 00
Bark, per cord,	75	37	100	2	2	3	4	2	10	7	30	11	1 50
Staves, Pipe, per M, White Oak,	40	25	75	—	—	—	—	—	—	—	20	7	1 33
Hhd. " Red Oak,	30	20	50	—	—	—	—	—	—	—	14	6	1 00
" Barrel, " White Oak,	30	15	45	—	—	—	—	—	—	—	15	10	85
" Barrel, " Red Oak,	20	12	30	—	—	—	—	—	—	—	14	7	50
Hoops, Hogshead, per M,	16	12	50	—	—	—	—	—	—	—	45	17	1 75
Barrel, per M,	10	6	17	—	—	—	—	—	—	—	22	8	87
Hoop Poles, Hogshead, per M,	35	20	60	—	—	—	—	—	—	—	65	20	3 50
" Barrel, per M,	16	12	35	—	—	—	—	—	—	—	45	17	1 75
Empty Boats,	50	25	75	—	—	—	—	—	—	—	25	25	25

Same as Merchandise.
Same as W. O. Bbl. Staves.

RATES OF TOLL ON THE MIDDLESEX AND RIVER CANALS.

Eighteen Hundred and Thirty-Five.

ARTICLES.	BOW CANAL.	HOOKSETT.	AMOSKEG.	UNION LOCKS AND CANALS.						TOTAL UNION.	MIDDLESEX CANAL.	BILLERICA LOCK.	REMARKS.	
				MERRILL'S.	GRIFFIN'S.	SHORT.	GOTT'S.	COOS.	MOOR'S.					CROWWELL'S.
Merchandise, per ton,														
Corn and Rye, 40 bushels to a ton,														
Oats, 75 bushels to a ton,														
Potatoes, 40 bushels to a ton,														
Shooks, with heads, 25 to a ton,														
" without heads, 40 to a ton,														
Hogsheads, empty, 20 to a ton,	14	10	18	6	6	6	6	6	6	48	1	0.10		
Barrels, beef and rum, 50 to a ton,														
" " 80 to a ton,														
" fish, 60 to a ton,														
" " 120 to a ton,														
Charcoal, 100 bushels to a ton,														
Salt, Lime, Plaster, Bar Iron, Pig Iron, Iron Castings, and Slate, per ton,	10	7	15	2	2	3	3	3	6	25	75	0.10		
Factory Cotton Cloths, (downward),	10	8	12							20	50	0.10	Upward, same as Merchandise.	
Sea Coal, (bituminous) per chaldron,	10	8	12	1	1	1	1	1	7	20	50	5		
Lehigh and Schuylkill Coal, per ton,	5	3	8	1	1	1	1	1	3	9	35	4		
Copperas, (downward),	4	3	6	1	1	1	1	1	1	12	25	10	Upward, same as Merchandise.	
Iron Ore, per ton,	7	5	9	3	3	3	3	4	5	24	50	5		
Stone, hammered, 14 cubic feet per ton, " rough,	6	4	10	1	1	1	1	1	3	10	40	5		
Bricks, common, per M,	14	10	20	6	6	7	7	7	10	56	14	5		
" furnace,	20	13	25							52	50	10		
Sand and Clay, for glass houses, per ton,	7	5	9							24	1	50		
Manure, per boat load, per mile,											1	1.00		
Hay, screwed, per ton,											1			
Oyster Shells,											1			

TIMBER, LUMBER, &c.

Timber, Oak, per ton,	85	13	37	4	4	4	6	4	10	8	40	1	68	0.10	
" Red Oak, rough hewn, for posts and piles, per ton,	12	7	17	2	2	2	3	2	2	4	20		85	0.8	
" Pine, per ton,	16	8	20	2	3	3	4	3	6	3	26		90	0.6	
Rough Spruce and Hemlock, per ton,	8	4	10	1	2	2	2	2	3	2	14		45	0.3	
Masts and Bowsprits, 3 t'ns, each, & over,	25	12	30	4	4	4	6	4	10	8	40		1	40	0.14
Under 3 tons, each	25	12	30	4	4	4	6	4	10	8	40		1	25	0.12
Lumber, Pine, per M, board measurement,	34	18	50	5	5	5	8	5	12	10	30		1	63	0.12
Oak Plank and Boards, per M, do do	68	36	100	10	10	10	16	10	24	20	100		2	81	0.20
Ash, and other hard stuff, not enumer- ated, per M, board measurement,	50	28	100	8	7	8	12	7	18	15	75		2	10	0.16
Shingles, per M,	3	2	6	1	1	1	1	1	1	1	8		1	10	0.4
Clapboards, per M,	17	9	25	3	2	2	4	3	7	4	25		1	80	0.10
Posts & rails, split & sawed, 100 per ton,															
Treenails, per M,															
Hop Poles, per 100,	8	3	5						1	1	4		1	20	
Laths, per M,	2	1	3	1	1	1	1	1	1	1	1		1	10	0.2
Wood, hard, per cord, and Bark, pine,	6	4	10	1	1	1	3	1	7	8	22		1	83	0.8
" " " Red Oak,	4	3	8	1	1	1	1	1	4	5	15		1	60	0.6
Staves, Pipe, per M, White Oak,	75	37	100	2	2	3	4	2	10	7	30		1	50	
" Hhd.	40	25	75								20		1	33	
" " " Red Oak,	30	20	50								14		1	14	
" Barrell, " White Oak,	30	15	45								15		1	85	
" " Red Oak,	20	12	30								14		1	50	
Hoops, Hogshead, per M,	16	12	50								45		1	75	
" Barrel, per M,	10	6	17								12		1	87	
Hoop Poles, Hogshead, per M,	35	20	60								65		3	50	
" Barrel, per M,	16	12	35								45		1	75	
Empty Boats,	50	25	75							25	25		1		0.25

Upward, one dollar per M.

Same as Merchandise.
Same as W. O. Bbl. Staves

M

RATES OF TOLL

ON THE

MIDDLESEX AND RIVER CANALS.

Eighteen Hundred and Forty-Three.

ARTICLES.	BOW CANAL.		ROOSEVT.	UNION LOCKS AND CANALS.						TOTAL UNION.		MIDDLESEX CANAL.	TOTAL.	REMARKS.	
				MERRILL'S.	CRIFPIN'S.	SHORT.	COFF'S.	COOS.	MOOR'S.						CHOMWELL'S.
Merchandise, per ton,															
Corn and Rye, 40 bushels to a ton,															
Oats, 75 bushels to a ton,															
Potatoes, 40 bushels to a ton,															
Shooks, with heads, 25 to a ton,															
" without heads, 40 to a ton,															
Hogsheads, empty, 20 to a ton,															
Barrels, beef and rum, 30 to a ton,															
" fish, 60 to a ton,															
" 120 to a ton,															
Charcoal, 100 bushels to a ton,															
Salt, Plaster, Bar Iron, Pig Iron, Iron Castings, and Slate, per ton,	7	..	5	..	1	1	1	2	2	3	3	13	..	40	65
Lime, 8 casks to a ton,	7	..	5	..	1	1	1	2	2	3	3	13	..	25	50
Sea Coal (bituminous) per chaldron,	6	..	4	..	1	1	1	1	1	5	5	15	..	25	50
Lehigh and Schuylkill Coal, per ton,	5	..	3	..	1	1	2	2	2	2	2	12	..	20	40
Copperas, (downward,)	3	..	2	..	1	1	1	1	1	2	3	10	..	25	40
Iron Ore, per ton,	7	..	5	..	1	1	2	2	2	2	3	13	..	25	50
Stone, hammered, 14 cubic feet per ton,	3	..	2	..	1	1	1	1	1	2	3	10	..	25	40
" rough,	2	..	1	..	1	1	1	1	1	1	1	7	..	14	28
Bricks, common, per M,	12	..	8	..	4	4	6	6	7	10	10	50	..	25	70
Sand and Clay, for glass houses, per ton,	5	..	3	..	1	1	1	1	1	3	4	12	..	25	45
Manure, per boat load, per mile,	..	..	..	..	..	..	..	..	..	..	..	..	..	13	26
Hay, screwed, per ton,	7	..	5	..	1	1	1	1	1	3	3	12	..	50	75
Oyster Shells, per ton,	2	..	1	..	1	1	1	1	1	2	2	8	..	20	40

TIMBER, LUMBER, &c.

Timber, Oak, per ton,	20	..	13	..	4	4	4	6	4	10	8	40	..	1 25	1 85
" Red Oak, rough hewn, for posts and piles, per ton,	15	..	10	..	2	2	2	3	2	5	4	20	..	80	1 25
" Pine and Chestnut, per ton,	12	..	8	..	2	2	2	3	2	3	4	20	..	70	1 10
Rough Spruce and Hemlock, per ton,	7	..	4	..	1	2	2	2	2	3	2	14	..	45	70
Masts and Bowsprits, 3 tons, each, and over, Under 3 tons each,	25	..	15	..	4	4	4	6	4	10	8	40	..	1 40	..
Norway Pine Masts,	15	..	10	..	2	2	2	3	2	5	4	20	..	1 00	1 50
Lumber, Pine, per M, board measurement,	25	..	20	..	3	3	3	5	3	10	8	35	..	1 00	1 80
Oak Plank and Boards per M, do. do.,	30	..	20	..	5	3	5	8	5	12	10	50	..	1 50	2 50
Ash, and other hard stuff, not enumerated, per M, board measurement,	25	..	15	..	4	4	4	7	4	10	7	40	..	1 20	2 00
Shingles, per M,	4	..	3	..	1	1	1	1	1	2	1	8	..	10	25
Clapboards, per M,	12	..	8	..	1	1	1	2	1	2	2	10	..	50	80
Posts and Rails, split and sawed, 100 per ton, . . . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Treenails, per M, . . . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hop Poles, per 100,	5	..	3	..	1	1	1	1	1	1	1	4	..	20	..
Laths, per M,	2	..	1	..	1	1	1	1	1	1	1	3	..	10	..
Wood, hard, per cord, and bark, pane,	4	..	3	..	1	1	1	1	1	1	1	13	..	60	0 80
Staves, Pipe, per M, White Oak,	40	..	20	..	2	2	2	2	2	6	4	20	..	1 00	1 80
" Hhd. " Red Oak,	20	..	12	..	1	1	1	2	2	3	3	13	..	75	1 20
" Barrel, " White Oak,	15	..	10	..	1	1	1	1	1	1	1	8	..	60	03
" Barrel, " Red Oak,	11	..	6	..	1	1	1	1	1	2	2	9	..	50	80
Hoops, Hogshead, per M,	10	..	5	..	1	1	1	1	1	2	2	9	..	25	50
" Barrel, per M,	5	..	3	..	1	1	1	1	1	3	2	12	..	50	70
Hoop Poles, Hogshead, per M,	15	..	10	..	4	4	4	7	4	10	7	40	..	2 00	2 65
" Barrel, per M,	10	..	5	..	2	2	2	6	5	5	3	25	..	1 25	1 65
Empty Boats, . . . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Railroad Sleepers, per hundred,	12	..	8	..	2	2	2	4	4	6	10	30	..	1 00	1 50

.. Upwards 50 c., Midd'x.

Same as Merchandise.
Same as W. O. Bbl. Staves.

APPENDIX J

PERSONNEL

MIDDLESEX CANAL COMPANY

PRESIDENTS

James Sullivan	1793-1808
Aaron Dexter	1809- ?
Benjamin Guild	? -1830
Peter O. Thatcher	1831-1840
Abbot Lawrence	1841-1849
Ebenezer Chadwick	1850-1853
Abbot Lawrence	1854- ?

STANDING COMMITTEE 1830-1839

William Appleton, succeeded by George Hallett in 1835
Ebenezer Chadwick
William Sullivan

STANDING COMMITTEE 1840-1846

Charles Francis Adams, succeeded by Amos A. Lawrence
in 1843
Ebenezer Chadwick
George Hallett
(The Standing Committee was abolished in 1846)

SUPERINTENDENTS OR AGENTS

Loammi Baldwin	1794-1805
Samuel Jaques	1806-1807
John Langdon Sullivan	1808-1820
James F. Baldwin	1821-1824
Caleb Eddy	1825-1845
Richard Frothingham	1846-1854

DIRECTORS

1805

Joseph Coolidge
Aaron Dexter
Christopher Gore
Benjamin Hall
John Coffin Jones
Benjamin Joy

Mungo Mackay
 Ebenezer Oliver
 William Payne
 James Sullivan
 James Winthrop

1814

Ebenezer T. Andrews
 Jonathan Amory
 James F. Baldwin
 Joseph Coolidge
 Edward Cruft
 Aaron Dexter
 Benjamin Guild
 Dudley Hall
 Benjamin Joy
 William Payne
 William Sullivan
 Abraham Touro

1830-1837

Charles Francis Adams
 Ebenezer T. Andrews
 William Appleton, succeeded by George H. Kuhn
 in 1837
 James F. Baldwin
 Ebenezer Chadwick
 Joseph Coolidge
 Benjamin Guild
 Dudley Hall
 George Hallett
 Joseph B. Joy, succeeded by Abbot Lawrence in 1834
 Thomas W. Phillips
 William Sullivan
 Peter O. Thatcher
 (The Board was reduced to seven in 1838)

1838-1839

Charles Francis Adams
 Ebenezer Chadwick
 George Hallett
 Abbot Lawrence
 Luther Lawrence
 William Sullivan
 Peter O. Thatcher
 (The Board was reduced to five in 1840)

1840-1850

Charles Francis Adams

Ebenezer Chadwick

George Hallett, succeeded by William Sturgis in 1846

Abbot Lawrence, succeeded by William Appleton in 1850

Peter O. Thatcher, succeeded by Amos A. Lawrence
in 1841

1851-1854

*Charles Francis Adams

William Appleton

Ebenezer Chadwick

William R. Lawrence, succeeded by Amos A. Lawrence
in 1854

William Sturgis

* Succeeded by George H. Kuhn in 1852, who was in turn succeeded by Abbot Lawrence in 1853.

APPENDIX K

PROPRIETORS OF THE LOCKS AND CANALS, LOWELL,

OCTOBER 8TH 1834

Appleton, Nathan	60	Jackson, P. T.	80
" Samuel	12	" Charles	30
Amory, Hannah R.	20	" James	30
Andrews, Henry	2	" P. T. & Lee (Trustees)	10
Ames, Francis	4	Kuhn, Geo. H.	10
Appleton, William	5	Lowell, J. A., & Trustee	53
Bigelow, Tyler	1	" John Jr.	20
Boott, Kirk	5	Lee, Jeremiah	4
Borden, Isaac	4	" Thomas Trustee	3
Bigelow, I.	4	" Thomas	12
Budlong, Thomas	6	Lawrence, Amos	20
Blake, Joshua	17	" Abbot	20
Brooks, Peter C.	28	Lyman, Geo. W.	51
Boott, J. W., Trustee & Guar ^o .	8	" Theodore Jr.	40
Bryant & Sturgis	23	Lee, George	12
Boott, Moody & William (Trustees)	3	" John C.	2
Belknap, John	10	Lawrence, Luther	1
Cabot, Frederick, 5; E. Clark, 9	14	Lee, Henry Jr.	1
Cabot, Lucy	12	" Elizabeth C.	1
" Samuel, 10; R. A. Crafts, 5	15	" Francis L.	1
" Henry	40	" Harriet J.	1
" Henry & Lee (Trustees)	4	" Joseph	4
Channing, Susan	4	" Thomas & Henry (Trustees)	1
Carey, Thomas G.	10	Motley, Thomas	15
Cushing, John P.	15	Mason, William P.	11
Chadwick, Eben ^r .	5	Manufac ^r . Insurance Office	8
Dutton, Warren	10	Moody, Susan M.	3
Deveraux, Humphrey	6	" David Guar ^o	6
Draper, W. B.	12	Mason, W. P. (Trustee)	12
Emmons, Nathl H.	3	Moody, W. H.	3
Foster, Chas. W.	10	Nichols, B. R. Guar.	12
Fiske, Isaac	2	Ocean Bank at N. Port.	1
" Augustus H.	1	Prescott, William	10
Gray, John C.	22	Perkins, Thomas H.	20
Green, Simon E.	6	Pickman, D. L.	10
Gardiner, Wm. H., & Trustee	6	Perkins, T. H., S. G. & Gardiner (Trustees)	13
Hobbs, Ebenezer Jr.	2	Parkers, Jno.	20
" Sarah	2	Perkins, Thos H. Jr.	18
Higginson, Susan C.	1	Paine, Chas. C.	4
" J. P. (Trustee)	1	Pratt, Geo. W.	2
" Stephen & Cross (Trustees)	2	Quincy, Josiah, Jr., Guar ⁿ .	12
" Louisa	6	Rogers, Wm. S.	8
Hallett, George	2	Rollins, Eben ^r .	10

THE MIDDLESEX CANAL

Rand, Benjamin	1	Warren, John C.	14
Stanton, Francis	6	Whitwell Bond & Co.	3
Thorndike, Israel	50	Wales, Thomas B.	15
" Augustus	35	Williams, Timothy	17
Tilden, Joseph	28	" John	1
Thorndike, Mary M.	12		
" Charles & Loring		98 Subscribers	•
(Trustees) 5		1200 Shares	

APPENDIX L

STOCKHOLDERS OF MIDDLESEX CANAL COMPANY, NOVEMBER 17, 1846

Adams, Charles Francis	2	Lawrence, Lucy	5
Adams, John Quincy	43	Lering [?], Elizabeth	6
Andrews, Ebenezer T.	4	Lodge, Giles	1
Appleton, William	21	Lyman, Mrs. S. B.	8
" " (Trustee)	5	Middlesex Canal	1
Atkinson, George	3	Miller, Charles E.	1
" J. and F. [?]	23	Miller, Hannah	1
Baldwin, George R.	2	Packard, Asa	1
" James F.	6	Parker, Peter	5
Bassett, Francis	2	Parsons, Lydia E.	3
Blake, Sarah	12	Phillips, Sally	6
Boston Episcopal Charity Society	1	Porter, G. W.	1
Brooks, Peter C.	6	Prince, Harriet	2
Chadwick, Ebenezer	29	Oliver, Ebenezer	2
Coles, Isaac U. [?]	20	Quincy, Josiah	7
Davis, John W.	5	Seaver, Anna M. [?]	5
Dexter, George M.	3	Shattuck, Amelia H.	1
" John C.	3	Shattuck, George C.	1
Farley, Robert	8	Sohier [?], E. A.	3
Gorham, B. (and wife)	11	Schier [?], William D.	5
Greenough, Maria	5	Standish, Hannah	1
Guild, Benjamin	1	Storer, Ann W.	1
Guild, Elizabeth	14	" Susan	2
Hall, Dudley	2	Sturgis, William	7
Hall, Joseph	15	Sullivan, William (heirs of)	40
Hallett, Elizabeth	10	Sweet, Elizabeth B.	7
Harvard College	60	Thatcher, Peter O. (Estate of)	5
Hazard, Ebenezer	3	Thayer, Charles L. (Children of)	2
Howard, Catharine H.	1	Touro, Judah	22
Howard, Elizabeth	16	Warren, Edward	4
Howard, John C.	1	Watson, Almira	1
Hayward, James	5	" B. M.	2
Johnson, Mary	5	" Laura A.	1
Jones, Anna P.	20	Wendell, Oliver	2
Joy, Joseph G.	20	Whetmore, Thomas	7
Joy, Nabby [?]	15		
Kuhn, George H.	2		
Lawrence, Abbot	137		
" Amos A.	90		
		74 Stockholders	
		800 Shares	

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- D. Alphabetical Index of Stockholders
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1808-1811
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1811

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