
REVIEW

OF THE

INDUSTRIAL POSITION AND PROSPECTS IN
BENGAL IN 1908

WITH

SPECIAL REFERENCE TO THE INDUSTRIAL SURVEY
OF 1890.

[PART II OF SPECIAL REPORT.]

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[PART II OF REPORT OF OFFICER ON SPECIAL DUTY.]

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CHAPTER

INTRODUCTORY.

THE subject of technical education is discussed in a separate review. It is difficult to arrange the industries of the province of Bengal in groups which will not overlap; but the following division, adopted by a distinguished expert in industrial training, is fairly logical:—(1) those involving the use of extensive machinery; (2) those mainly requiring the use of hand tools; (3) those dependent on artistic skill; and (4) agriculture in all its branches. To this list may be added the mining industries. Another expert in Indian manufactures makes the division of—(1) manufactures proper; (2) manipulation or preparation of agricultural, forest or animal produce; and (3) utilisation of minerals. We can have the following groups:—(1) factory industries, (2) mining industries, (3) handicrafts, (4) industrial arts, and (5) industries dealing with economic products. These will be considered in turn; and it is proposed to treat in detail the indigenous manufacturing industries and the indigenous industrial arts. Manufacturing industries cover both factory industries and cottage handicrafts. It is desired to indicate the nature of existing obstacles to development, the possibility of development, and the measures which Government may legitimately take to remove obstacles, or facilitate development. Special investigation has been made in the case of weaving, leather work, brass work and glass making. It is intended also in this review to bring up to date the report on the arts and industries of Bengal, prepared by Mr. E. W. Collin, I.C.S., in 1890, under the instructions of the Government of India issued for all the provinces in 1888.

Twenty years have elapsed since 1888, and now in the newspapers, in magazine articles and in the addresses of Indian publicists it is stated that the country is on the eve of an extensive industrial development. Although fresh factors have been brought into operation within the last two years, yet it will be found that there has been a continuous development. The material condition of the people was reviewed in 1892 and again in 1902. In the former year it was found that, while silk manufactures and hand-loom weaving were decaying, there had been a “redistribution rather than destruction of wealth,” and that the manufactures of Bengal were “more valuable than they were in days when her silks and muslins held every market in Europe.” By 1902 it was stated that there had been an outburst of manufacturing and mining activity, which was converting the metropolitan districts into a vast industrial tract; and even at that time Mr. Shirres, who prepared the memorandum, was able to point to the growth of an industrial middle class. The following figures are sufficiently striking. Within twenty years jute mills have increased from 12 to 42: cotton mills from 6 to 13: the coal output from under two million tons to over ten million tons: the mica output from under 100 tons to over 1,000 tons. The greater part of this development has been due to European capital and enterprise, while the trend of the present movement is for the outlay of Indian capital and the exercise of Indian management. The outlay of capital implies the power of combination and the risking of reserve funds for industrial purposes, and management implies technical skill and business capacity. There is and has been for the last six years a desire amongst the educated classes to take to industrial enterprises,—a desire not unconnected with the blocking by competition of the traditional avenues of livelihood on literary lines. The history of the Indian Industrial Association of Calcutta shows that its promoters were in advance of public opinion in 1893. Those therefore who now earnestly desire this industrial development must continue to call upon their countrymen to use their latent capital, either individually or collectively; and to acquire skill in technique and business management.

One of the chief requisites in Bengal for the development of indigenous industrial enterprise—or “honest *swadeshi*”—is the appointment of a whole-time expert officer of

Government, one possessing primarily engineering and scientific qualifications, and secondarily a knowledge of local conditions, sympathy and acquaintance with business methods. The Bengal Government have taken steps to obtain such an officer. He would be able to give disinterested advice to those who wish to take up industrial enterprises and to exert continuous personal pressure to put into effect the recommendations of Mr. Collin, almost all of which still hold good, and any other recommendations which Government may accept. The next requisite is patience. There is an impatience to achieve in a single year results for which decades would not be too short.

CHAPTER II.

FACTORY INDUSTRIES AND HANDICRAFTS.

SECTION (1)—GENERAL REVIEW OF FACTORY INDUSTRIES.

Government
factories.

THE factories requiring extensive machinery, most of which are worked by European capital and under European supervision, are principally those in the vicinity of Calcutta on both sides of the Hooghly. Government is itself in Bengal a large employer of labour and a manufacturer on a large scale: of arms at Ichapore, of ammunition at Dum-Dum, of shells at Cossipore and Ichapore, of railway plant at Kanohrapara, Balliaghata, Sealdah and Chitpur, of steamers at Kidderpore, of clothing at Alipur, of telegraph stores at Bhawanipore, of opium and opium boxes at Patna, and of canal stores at Dehri-on-Sone, Midnapore, Cuttack and Calcutta.

Private
factories.

It is not realised what an enormous variety of industrial activity exists at present in Bengal, with part of which Indian capital might be more associated than it is. The Department of Commercial Intelligence takes as a standard for statistical purposes any factory which employs 50 workmen or more. Even on this standard we find the totals for Bengal in 1905 as tabulated in the Financial and Commercial Statistics of British India for 1907, under many diverse heads.

I.—*Textiles.*

Ginning mills	...	...	...	...	2
Cotton mills	...	...	...	...	10
Jute mills	...	...	...	...	37
Jute presses	...	...	...	...	22
Rope works	...	...	...	...	8
Silk filatures	...	...	..	...	42

II.—*Minerals.*

Coal mines	...	...	...	...	246
Iron ore mines	...	...	...	...	6
Mica mines	...	...	...	...	205
Mica splitting factories	...	...	...	...	3
Saltpetre refineries	...	...	...	...	2
Iron and brass foundries	...	...	...	...	35

III.—*Transport.*

Dockyards	...	...	...	...	6
Railway workshops	...	...	...	...	22
Tramway works	...	...	...	...	1

IV.—*Miscellaneous.*

Bone crushing	...	...	...	...	2
Cement works	...	...	...	...	1
Chemical works	...	...	...	...	2

IV.—Miscellaneous (continued).

Brewery	...	...	...	...	1
Dairy Farm	...	...	...	...	1
Flour mills	...	...	...	...	4
Ice and aerated water factories	...	...	...	...	4
Sugar factories	...	...	...	...	7
Gas works	...	...	...	...	1
Indigo factories	...	...	...	...	106
Kerosene tin works	...	...	...	...	4
Lac factories	...	...	...	...	34
Oil mills	...	...	...	...	9
Paper works	...	...	...	...	3
Pottery works	...	...	...	...	1
Printing presses	...	...	...	...	22
Soap factory	...	...	...	...	1
Tanneries	...	...	...	...	2
Tile factories	...	...	...	...	3
Miscellaneous private factories	...	...	...	...	27
Government factories	...	...	...	...	18

On the east of the Hooghly are the 24-Parganas district and Calcutta, on the west the Hooghly and Howrah districts. These constitute the metropolitan area. I give below the distribution of private factories within that area in 1906-1907, taking the same standard. There are, of course, many others which employ less than fifty work-people. Factories within the metropolitan area.

In 24-Parganas such factories are :— Lac 2, paper 2, ice 3, soap 1, sugar 1, silk 1, saltpetre 1, stone 1, gas 1, rope 2, flour 1, dairy farm 1, coach-building 1, tannery 1, tramway workshops 3, dockyards 2, iron and brass foundries 13, oil mills 2, oil depôts 3, jute 33, cotton 6, jute presses 11, municipal workshop 1, electric supply 1, chemicals 1.

In Calcutta itself, there are :—Municipal workshops 2, Port Commissioners' workshops 2, ice 1, foundries 5, jute press 2, lac 1, printing presses 21, coach-building 2, electric supply 1, cabinetmaking 1, wood works 1.

In Howrah district there are the following :—Jute 9, rope 3, jute presses 7, engineering works and foundries 9, docks 4, flour 4, cotton 6, railway workshops 3, printing 1, salt 1, lime 1, bone 1, paint 1, oil 1.

And in Hooghly district there are :—Brick-making 11, jute 6, cotton 1, chemicals 1, bone 1, surki 31.

Outside Calcutta and its neighbourhood we find comparatively little industrial enterprise which is not connected with agriculture. I give an analysis on the same standard of fifty work-people per factory. Factories beyond the metropolitan area.

PRESIDENCY DIVISION.

Murshidabad District.—Silk 30.

Jessore District.—Sugar 1.

Nadia District.—Silk 1.

BURDWAN DIVISION.

Burdwan District.—Oil 1, brass 1, weaving 3, pottery 1, paper 1, iron 1 tanning extracts 1, railway workshop 1.

Birbhum District.—Railway workshops 2, silk 3.

Bankura District.—Brass 1.

Midnapore District.—Silk 2, railway workshop 1.

ORISSA DIVISION

Cuttack District.—Tannery 1, printing presses 2.

CHOTA NAGPUR DIVISION.

Ranchi District.—Lao 7.*Manbhum District.*—Lao 44.*Hazaribagh District.*—Railway workshop 1, Lao 2.

BHAGALPUR DIVISION.

Monghyr District.—Railway workshop 1, brick-making 1.*Darjeeling District.*—Railway workshop 1.*Sontha Parganas.*—Lao 2, brick-making 1.

PATNA DIVISION.

Patna District.—Oil and flour 5, darris 1, hides 1.*Gaya District.*—Railway workshop 1, lao 3.*Shahabad District.*—Sugar mill 1, tiles and bobbins 1.*Saran District.*—Saltpetre 1, sugar 2, railway workshop 1.*Champaran District.*—Sugar 3.*Muzaffarpur District.*—Engineering 2, sugar 2.*Darbhanga District.*—Railway workshop 1, sugar 1.

This distribution gives, however, no idea of the extent of the lao industry, for instance. Only seven large factories are shown above in the whole of the Chota Nagpur Division, whereas there are no fewer than 82 small factories in Manbhum district alone. Nor does it give a fair idea of the brass industry in North Midnapore, where some capitalists employ 150 to 300 men. The tendency of the district staff, who prepare the returns of important industries, is, I find, to assume that an "important industry" must use mechanical power.

European enterprise.

Many of the factories in and around Calcutta are those described in Mr. Collin's report as European industries. It is not realised what an enormous amount of European capital is invested in industrial enterprises in Bengal. Take the case of jute; the capital invested in buildings and plant on the banks of the Hooghly is £12,000,000 sterling; and employment is given to 200,000 native operatives, whose wages amount to £3,000,000 or four and a half crores of rupees a year. In the districts too, European capital has within recent years started large factories such as the sugar factory of India Development Limited, at Otter in Muzaffarpur district, and the new factory of the Peninsular Tobacco Co., which is under erection at Monghyr. If, however, there is to be any really indigenous industrial development in the province, Indian capital must come forward, either in joint-stock enterprise or through the small capitalist. A commendable beginning has been made, but an examination of the registration of joint-stock companies will show that Bengal is far behind Bombay in the inauguration of purely indigenous industrial concerns. Bombay provided 49 per cent. of the total nominal capital in 1906-07, and Bengal 24 per cent. In Bengal in 1907-08 there were 80 companies registered with a paid-up capital of 13½ lakhs, but coal companies accounted for more than half of the number and 12½ lakhs of the capital. Indigenous joint-stock enterprise is still in its infancy in Bengal; and the transactions are characterised by an almost excessive, though prudent, amount of caution and shyness. For instance, the Bengal Laxmi Cotton Mills, Limited, took over a working mill, the Laxmi Tulsi Cotton Mills, at Serampore; and the Bengal Hosiery Company, Limited, are taking over the works of the old Kidderpore Hosiery Factory. There have been some interesting developments of joint-stock enterprise for banks and insurance companies, which are so far hopeful signs. But the capital for these new enterprises is not coming from the large capitalists, but from the savings of the middle class. It is the opinion of a leading native merchant that it is much easier to make money by an agency in imported goods, than by investment in industrial enterprise. The large capitalist has still to be persuaded that he can get a good return for his money in manufacture rather than in zamindari or agency, or money lending. There are two good examples in Calcutta of successful indigenous enterprise: the Calcutta Pottery Works, and the Bengal Chemical and Pharmaceutical Works. These are financed by

Indian capital, and managed by Indian brains, which have had a scientific training. These are only nominally companies; they are really private syndicates. These works are commended as good examples of what is required. The essentials are a sufficiently large capital, scientific management, sufficient supply of raw materials, and a remunerative market which is capable of expansion. It is, therefore, by the small capitalist or by small syndicates that progress may be made in the immediate future, either in new lines of business or by improved methods adapted to strictly indigenous work, as for example brass manufacture. The joint-stock company is essential, but its growth will be slow. The Hon'ble Mr. (now Sir Vithaldas Damodar) Thackersey in his presidential address at the Calcutta Industrial Conference of 1906, quoted with approval the words of Mr. (now Sir Thomas) Holland, the Director of the Geological Survey of India, who said that Indians will continue to pay an unnecessary and undesirable tax as long as those in the country who possess money will not risk their reserve fund for industrial purposes.

Essentials for promotion of Indian enterprise.

Apart from the investment of capital, another essential for industrial developments is that the young men who study engineering at Sibpur and elsewhere should acquire more than a superficial knowledge of mechanical engineering. This is dealt with in my other report. In all factories where machine plant is used some knowledge of mechanical engineering is essential; and there is a splendid opening for the middle class youth as foremen if they will only take advantage of it. It is a common complaint of large employers that the Sibpur youth quickly forgets all that he has learned in the workshop. One leading engineering firm says that there is no employee available between a native tindal and a European foreman mechanic. As I have recorded elsewhere, the firms which are financed by European capital and organised under European management prefer to employ European foremen, inasmuch as force of character in managing factory hands is considered an essential as much as technical skill, but still the training at Sibpur contributes not a little to strengthen the character of the students, and it is to be hoped that they may yet wear down the prejudice that the Sibpur youth is afraid of hard work and not suitable for a responsible position, even though his workshop experience and theoretical training may have been of the best. I am glad to find that the East Indian Railway at the Lilloah workshops and the Eastern Bengal State Railway at Kanchrapara are giving every reasonable opportunity for advancement to the literate Indian apprentice.

Mechanical engineering.

SECTION (2)—GENERAL REVIEW OF HANDICRAFTS.

While agriculture occupies over 72 per cent. of the population, the whole of those engaged in the "preparation and supply of material substances," according to the census of 1901, comes up only to 10 per cent.; and amongst these, handloom cotton weavers, though the most important workers in indigenous industries, make up only 1.2 per cent.; workers in precious metals, 0.4 per cent.; potters and iron workers each 0.3 per cent. Hence we see what a small proportion of the population is included under the head of artisans. In 1881, the proportion of those engaged in industrial pursuits was only 8.7 per cent. Mr. Collin stated in 1890 that except in wood work, brassware, mat work and common pottery, the Bengal manufactures had been almost entirely superseded by imports from Europe. In 1894 Mr. Trailokya Nath Mukharji stated in his monograph on brassware that this was perhaps the only important industry which had not suffered from competition. In the memorandum on the material condition of the people of Bengal, Mr. Shirres in 1902 confirmed this view. In Chapter XII on Occupations in the Census of 1901, Mr. Gait pointed out that detailed information as to the industrial organization of a country cannot be obtained by the machinery of the general census. In fact, the elaborate and costly occupation tables tended, he thought, to obscure the main facts which a less elaborate method would have brought out. At the same time it was remarked that there had been a decline in the number of workers in wool and cotton and that machine-made goods were gradually replacing those made by hand in the villages. The *swadeshi* movement of the past two years

Indigenous handicrafts.

Recent developments.

(1906 and 1907) is a new factor stimulating production and creating a demand. I find that this has led to the improvement of the weavers in parts of the Presidency and Burdwan Divisions: that is to say, many weavers who had given up their caste occupation have returned to it. The weavers, however, in the Orissa Division were on the one hand not so affected by the previous competition of imported cloth, and on the other hand not so affected by the revival in favour of country-made cloths. In Bhagalpur and Chota Nagpur Divisions, there is a strong element in the population which prefers the coarse country-made cloth, apart from, and previous to, any *swadeshi* movement. As for the brass industry, there are signs of a double movement—in the districts near Calcutta, the poor people buy the enamelled goods because they are cheap, while better class people are becoming a little ashamed of their previous election of the cheaper ware on the ground of cheapness, and there is a feeling that every Hindu who can afford it should purchase brass and bell-metal ware. The motive for the latter attitude is something more than a desire to encourage indigenous industrialism, and should be respected.

The comparative importance according to the census of 1901 in the leading handicrafts was as follows:—(1) weaving, (2) pottery, (3) carpentry, (4) mat-making, (5) leather manufacture, (6) iron manufacture. These same handicrafts were stated by Mr. Collin to be the principal indigenous industries in 1890. The report of the Industrial Committee, 1903 (Vol. I, p. 87), recommends that all the above should be encouraged in Bengal. The committee appointed by the Bengal Government in 1904 recommended in particular that weaving should be developed. This will be discussed in the next chapter.

Improvement
in indigenous
handicrafts.

After six months' special investigation, during which I have examined industries in twenty-six districts, it appears to me that what is now required is not the teaching of the existing methods in cottage industries, but the teaching of improved methods, and also the assistance of the educated upper-middle classes in a more organized system of production and distribution. Mechanical power, or in some cases, an improved adaptation of human power is required. An acute observer, representing the United States Government, has recently reported to Washington that the *swadeshi* movement must recognize that this is the age of machinery all over the world. The artisan must not be left to himself to obtain his raw materials, to produce an article, and then sell the completed product. Also I hold that industrial schools outside of a commercial atmosphere and without highly qualified teachers are futile, and that enthusiasm without money and business-like methods is vain.

CHAPTER III.

MANUFACTURING INDUSTRIES.

TEXTILE INDUSTRIES.

COTTON SPINNING AND WRAVING.

Spinning mills.

The factory industry has increased considerably since 1890. There are now 14 mills, in nine of which spinning is done. More than half of these fourteen are backed by Indian capital. Mr. Collin said in 1890 that cotton spinning, except as a cottage industry, did not exist.

Bengal produces now only seven per cent. of the total production of spinning mills in India. The Bengal climate appears to favour spinning, and spinning mills appear to have a chance in Bengal, because they can obtain cotton at a nominal freight by steamer from Bombay. The great difficulty is the want of skilled labour. The most recent figures show a falling off in yarns spun in Bengal:—April 1905 to March 1906, 51·2 million pounds; 1906-07, 46·5 million pounds; 1907-08, 41·8 million pounds. During 1907, the average dividend in one hundred selected Lancashire

companies was 15½ per cent., but for 1908 the outlook is not reassuring. In Bengal only two of the mills spin any yarn above 25s. As for factory weaving, it has received an impetus from the *swadeshi* movement. The Bengal Laxmi Cotton Mills started in 1906, and has a paid-up capital of 11½ lakhs. It declared a dividend for the last half of 1907 at the rate of 5 per cent. per annum; but it was admitted that the profit was comparatively less because the goods had to be sold at a much cheaper rate in order to encourage the industrial movement of the country. This is the only mill which weaves *dhoties*. It has passed through four sets of proprietors within ten years, and has over 26,000 ring spindles and 200 looms. There has been an increased local manufacture of T cloths, and there is a probability of further increased local manufacture. The woven goods produced in Bengal mills during the last three years have been as follows:—2·5 million yards in 1905-06, 5·8 million yards in 1906-07, and 7·9 million yards in 1907-08. The first figure is for *greys* alone, the latter two are for all woven goods. On the other hand, the imports of all cotton piece-goods into Calcutta were 1,171 million yards as the average of 1900-1905, 1,336 million yards in 1905-06, and 1,160 million yards in 1906-07. The decrease in 1906-07 was greatest in *greys*. The imports of all cotton piece-goods have mounted up again in 1907-08 to 1,330 million yards, with a record value of 21½ crores of rupees. The position in Bengal shows that there is an opening for the extension of the textile industry more in the Indian market and less in the China and foreign markets, and for the weaving of fine goods.

Mill weaving.

Hand weaving.

The hand-loom weaving industry has existed, as Mr. Collin said in 1890, more or less in every district. The yearly accounts from 1892 were rather dispiriting. In the monograph for 1898, it was stated "that large numbers of weavers have abandoned their looms and have taken to other pursuits," or that the cotton weaving industry was in a decaying condition. In 1899 the industry was stated to be on the decline, but there was no change in the fine muslin of Golnagar and in the coarse cotton cloth in Orissa. By 1901 it was stated that the competition of European piece-goods was lowering the indigenous industry in the Burdwan, Presidency and Patna Divisions, but that the fly-shuttle loom was coming into use in the two former areas. In 1905 it was stated that the coarse country-made cloths were preferred in the Orissa and Chota Nagpur Divisions and in the Sonthal Parganas. By 1906-07, the industry had recovered. In Burdwan district there was an increase in outturn of one-half over that of the previous year. From Bankura there was an export trade. At Bolpur in Birbhum there was considerable manufacture. In Hooghly district the manufactures in Arambagh subdivision rose from 11 lakhs to 14 lakhs. In Howrah the mill outturn decreased; and the hand outturn increased. In Midnapore, Ghatal was the centre of weaving. In the 24-Parganas, the mill market was dull; the hand outturn smartened in Basirhat subdivision. In Jessore there was a considerable manufacture in both coarse and fine cloth; so also in Khulna. In Nadia coarse cloths, bed-sheets and towels were made at Kushtia, Meherpur and Shikarpur. Fine cloths with silk borders were made at Santipur for export. In Patna, both cotton and mixed fabrics were manufactured in Bihar. In Saran district, the *jolahas* wove a coarse cloth for winter use. There was some spinning in the Gopalganj subdivision. In Gaya, there was coarse cloth manufactured. In Darbhanga district there was the special *kolti* cloth woven near Madhubani, and *kanti* cloth at Bharwara and Pandaul. In Shahabad coarse cloth was woven all over the district. In Bhagalpur, coarse cloth was made, but an improvement in texture was made, so also in Monghyr. In the Sonthal Parganas, both *jolahas*, *tantis* and aboriginals did coarse weaving. At Kishanganj in Purnea district, *lungis* and *patanis* were made. Throughout Orissa and Chota Nagpur Divisions coarse cloths were woven, principally for local consumption. A comparison between this account and the earlier accounts shows what a revolution for the time being has been made in the industry by the new factor of an increased local demand. How far this factor will be permanent, it is impossible to say. The contrast is shortly as follows:—Country cloth will last over a year, and

imported cloth seven or eight months. The cost of the latter is Re. 0-11 to Re. 1-3, of the former Re. 1-12 to Rs. 3-0.

Extensions of
the Serampore
pattern hand
loom.

✓ The subject of hand-loom weaving has given rise to much discussion since 1890. There is quite a literature on the subject; some of the leading pamphlets are quoted in the Appendix. (In Bengal, as has been seen, from 1892 to 1902 there was nothing but decadence to record.) From 1902 to 1905, the steps taken towards the improvement of the hand-loom weaving were made in the direction of introducing the Serampore pattern throughout Bengal. Mr. Collin had said in 1890 that the Serampore weavers used an improved hand-loom, and owed the vitality of their trade to that fact. Mr. Banerji in his monograph of 1898 again called attention to this pattern, saying that it was a distinct improvement on the ordinary loom, in so far that it led to a great deal of economy of labour. This was the old English fly-shuttle loom invented by John Kay and introduced more than fifty years in Serampore from Farasdanga (Chandernagore). No attempt had been previously made to introduce this loom outside Serampore.

✓ Mr. Havell, the Principal of the School of Art, Calcutta, took up the matter in 1901. From that time, by lectures, letters and advertisements, Mr. Havell did a great public service in his efforts to extend the use of the Serampore fly-shuttle loom. Government circulated instructions and sketches; District Boards were importuned to send weavers for training at Serampore; a factory for the manufacture of Serampore looms was started at Chinsura, first under Ghosh, Chauduri & Co., then Ghosh, Palit & Co., then under Mr. P. N. De. The progress from year to year was summarised in the District Board reports, and Mr. Havell at one time was persuaded that 10,000 new looms were working; and in February 1908 was of the same opinion. An examination of the correspondence in many of the District Board offices discloses that there was too much amateur work; and recent enquiries show that the new form of loom, notwithstanding the impetus of the *swadeshi* movement, has not been sufficiently attractive to the working weaver. The reasons for the failure are many. The present attitude in the districts is not to worry any further about the fly-shuttle loom, on the ground that the attempts to popularize it have failed. Some who have been corresponding about the loom for years do not even know what a fly-shuttle is. The National Weaving School, which worked at No. 209, Cornwallis Street, Calcutta, is now closed. I was sorry to see lying idle in many places a number of frame looms of the Serampore pattern, which had been introduced by well-to-do people in several districts. I think a fresh start must be made in Bengal.

Objections to
the Serampore
loom.

The fly-shuttle loom contains a string and lever mechanism for pushing the shuttle backwards and forwards across alternate sheddings of the warp threads, along the shuttle run; in the country loom the shuttle is passed by the hands of the weaver between the threads of the warp. I checked the weaving in many places and found that it averaged 65 against 22 picks per minute in the country loom. The complaints were in different places (1) that the whole new frame loom was too expensive; (2) that the weaver had to sit on a bench instead of on the ground; (3) that the threads snapped; (4) that the wheels of the shuttle could not be repaired locally; (5) that the shuttle jumped out off the shuttle run; and (6) that sufficient work could not be prepared to keep up with the rate of weaving. I have given to this matter much personal enquiry and studied all the literature on the subject, and I think that some of the difficulties are due to avoidable causes, principally want of mechanical knowledge. What is wanted for the improvement of the individual weaver in Bengal is a cheap adaptation of the flying-shuttle mechanism to the country loom. The improved sley with the string-picking apparatus is the only essential part of the improved loom. The wooden frame-work and the raised seat are only copies of the original English loom. It is not necessary to give the ordinary weaver a stout wooden frame for his loom, or to ask him not to sit on the floor. The line of least resistance is required for dealing with the most conservative of Indian artisans. Mr. Havell did, it is true, propose the adaptation of the fly-shuttle sley to the country loom at a cost of Rs. 7; but I do not think that the people in the districts realised its advantages

or that the suggested contrivance was mechanically perfect. A good adaptation is that proposed by Mr. Greenway, Supervisor of the Darbhanga District Board, at a cost of Rs. 6-11 (Government Circular No. 15T.M. of the 20th September 1906). The best adaptation which has come to my notice so far, is not the Bengal pattern, but the pit loom pattern of Mr. P. Theagaraya Chettiar in Madras, which costs complete Rs. 10. The Bengal pattern with some little devices could be made to swing more evenly, and could be made less costly. The shuttle box of the Bengal pattern is likely to jam the picker when it is first used. In fact the extension of such a pattern in Bengal was as much a mechanical problem as anything else. Moreover the Serampore men were accustomed to their English frame loom; they could teach "picking" on a duplicate loom, but they had no experience to teach the use of the adapted form of loom. Within recent years many patterns of hand-loom have been publicly tried, at Calcutta in 1906, and at Madras in 1908. The last word on the subject is Mr. Chatterton's memorandum on the Madras weaving competition of 1908, in which he shows the advantages of Mr. D. C. Churchill's model of a pedal loom, the Sayaji Baroda loom, and of Mr. Maxwell's "Triumph" Salvation Army loom. It is necessary to indicate precisely what the problems are. First, the problem of assisting the weaver in his old individualistic ways is one thing; for that, the cheapest form of mechanism which will give an increased outturn is required. This will give an increased power of production. Secondly, the problem of applying generally human labour to work looms is another. This depends upon whether there is a market for the hand product, and whether it can compete successfully with the machine product. But even if these conditions are satisfied, this is not enough. Organised capital is required. The capitalist can either finance the weavers in their own homes in an existing weaver colony, and distribute their goods for them; or he can in a similar colony economise by bringing the weavers and their wives and children to work under one roof, in the manner in which the new Madras hand-loom factories are working. A factory does not necessarily connote mechanical power, or unhygienic surroundings. The Madras hand-loom factories were a revelation to me. Hence in Bengal, the capitalist can either go in for power factories or for simple financing, or for organized hand-power factories. For the last two, he should work at known weaving centres, like Serampur, Biahnupur, Santipur, Bhagalpur, Bihar, Madhubani, and so on. The capitalist should get the most efficient form of human-power loom possible even though it be expensive. Care should be taken to avoid one error: it is of no avail to teach weaving to those outside the weaver castes in a place where there is no demand for the goods.

Problems in hand-loom weaving.

What has happened in Bengal is that in parts of Jessore district and most of Howrah district, in the Sadar and Serampur subdivisions, but not in the Arambagh subdivision of the Hooghly district, and in the Raniganj side of the Burdwan district, the Serampur pattern of hand-loom has extended. But I believe that it was due more to intercommunication among the people themselves than to official efforts to popularize the Serampur fly-shuttle loom. On the other hand, the ordinary weaver throughout the Burdwan and Presidency Divisions has, whether a fly-shuttle worker or not, received a special demand for his wares on account of the movement in favour of local manufactures. And yet I found Serampur weavers themselves wearing by preference and for the sake of cheapness imported cloths, although they are the most prosperous among the weaving population, earning up to Rs. 25 and 30 a month. Improvements are also required in the preliminary warping and sizing. The Serampur weavers have adopted, in the formation of the warp, a simple labour-saving appliance by which 100 threads can be laid simultaneously instead of one or two. An Arrah zamindar has a machine for the same object, though unnecessarily complicated. I do not think that the efficiency of the Bengal method of sizing could be improved upon; but it is time-consuming. The proceedings of the All-India Weaving Conference of Madras showed that there is much to learn under these heads, and the improved methods adopted at the Madras hand-weaving factories could be followed in Bengal. There is room for a complete division of labour

Development of hand-loom weaving.

between warpers and weavers. The Patent List of 1907 show five applications or specifications filed by Bengali inventors for improvements in hand-loom or hand spinning wheels.

Proposed Gov-
ernment weav-
ing institute.

The proposals for the Government Central Weaving Institute at Serampur have been detailed in page 8 of my other report. At present we await the arrival of the two experts whose appointments have been sanctioned. I think that their course of action should be, first to study the literature on the subject, then to study the actual indigenous looms in the districts, and then to consider the problem of how to improve the mechanical efficiency of the native looms in Bengal by small improvements, or the desirability of adopting any of the patterns used in other parts, and also the possibility of saving the labour in the preliminary processes. In other words the objects to be kept in view should be the same as those announced by Mr. Chatterton for the Government factory at Salem in the Madras Presidency—experiment as well as instruction. For the present I am arranging to test the Madras pit loom pattern in three districts, Sambulpur, Bankura, and Darbhanga, and the Inspector-General of Prisons has kindly agreed to replace some of his old looms by the Salvation Army loom and the Churchill loom, and to test their suitability in Bengal. The efficiency of the Serampur looms is greatly increased by the addition of an automatic take-up motion which conduces to evenness of weaving. This has been successfully done by Suresh Chandra Sarkar of Raipur in Birbhum district. The proposed weaving institute and capitalist organization would in time achieve the reforms proposed in the Bengal Monograph on Cotton. Dr. Forbes Watson, the great textile expert, once said that the weaver had no regular system or method of doing business. Mr. Banerjee suggested in his monograph that weavers in the backward district should visit the large weaving centres, and learn to improve the quality and design of their fabrics. He advocated also exhibitions; and the introduction of cheap hand machinery, especially the introduction of the improved hand-loom of Serampore.

Requirements
in Bengal.

The memorandum issued by the Government of India on hand-loom weaving in India in 1907, was circulated throughout Bengal. Opinions were collected from all districts, and they confirm my views that:—(1) a central experimental station is required; (2) the assistance of capitalists is wanted; (3) improvements on preliminary processes are necessary; (4) subdivision of labour must come; (5) exhibition are helpful; and (6) a simple really inexpensive adaptation of the fly-shuttle to the existing looms would be acceptable to the ordinary weaver, if he were convinced that it were remunerative. I do not propose co-operative credit societies for weavers, or industrial advances. Either the weaver should be tempted to improve his outturn by a simple device, or the work should be done on a big scale by capitalists, whereby weavers would be paid at piece-work rates for their outturn. Two separate solutions were proposed at the Madras conference; there is room, I hold for each in Bengal. One was to make a good loom even though it be expensive and put it in the market where its own merits would tell; the other was to overcome the first objection of weavers to expense and intricacy and introduce a cheap and simple article.

REELING AND WEAVING OF MULBERRY SILK.

Healthy
coons.

This is the subject of an elaborate monograph by the well-known expert, the late Mr. N. G. Mukerji, who studied the subject for twenty years in the course of which he visited France and Italy. The industry covers the culture of the worm and the reeling of the silk; and also silk weaving. The former subject has been taken up by the Agricultural Department. The report of the committee appointed by Government in 1906 to enquire into the condition of the silk industry in Bengal should be read along with the monograph published in 1903. These papers are of such a recent date that direct reference to them should be made by those interested in the subject. I give here only the conclusions. It is accepted that the present unsatisfactory conditions are due primarily to disease amongst the worms, and not to defects in reeling or manufacture, or to competition. Definite recommendations for the establishment of nurseries and for other remedial measures have been made, and

the Bengal Silk Committee have already taken steps for the propagation and distribution of good seed. The filatures are principally in the Murshidabad, Midnapore and Birbhum districts, and in the district of Malda and Rajshahi of the Eastern province, and are owned chiefly by the Bengal Silk Company, Ltd., the Berhampore Silk Concern, the Rose Silk Filatures, and Messrs. Louis Payen and Co. The exports of raw silk were 47.4 lakhs average from 1901 to 1906, 55.1 lakhs in 1906-07, and 46.9 lakhs in 1907-08. The upward tendency has been noticeable since 1889. I was informed in Berhampore that what was required was an improved spinning machine in place of the native *ghāi*.

As regards silk weaving, I deal with mulberry silk weaving separately from *tussar* Vicissitudes of weaving and mixed silk weaving. Silk weaving still continues, as Mr. Collin noted, in silk weaving. Murshidabad, Birbhum and Midnapore districts. Mr. Mukerji pointed out in his monograph that while there has been a decline in the foreign export of woven silk, the manufacture of silk fabrics for country use continues as vigorously as ever; for, he said, "the whole rank and file of the Hindu population of Bengal have to use indigenous silks on certain occasions." This is a great advantage. Silk weavers, he also said, are "as a class far more prosperous than cotton weavers." I noticed also myself that the silk weavers seem to have more influential headmen; in fact Mr. Mukerji points out that the leading silk weavers have had the enterprise and influence to introduce improvements to their fellow craftsmen and to supervise colonies of weavers. On the other hand, the financiers of the cotton weavers are as a rule not master weavers; and have not improved the craft in the slightest.

Up till 1901 silk weaving had been declining in Murshidabad; from that date it improved. In Bankura district, there is export from Birsinghpur, Bankura and Bishnupur. At Bishnupur there is a weaver of great merit—Babu Lal Kit—whose weaving took one day for a cubit, and whose 12-foot *sari* sold at Rs. 32. There is a great demand from East Bengal for *vel* silk from Bishnupur. In Birbhum district there is silk weaving at Boswa and Palsa. In the Arambagh subdivision in Hooghly district, there are several centres of silk weaving. At Ballydewanganj in this subdivision, special cloths called "*urna*" and "*pagris*" have been made and exported to the United Provinces and the Panjab since the days of the Moghuls. There is little manufacture in Howrah and the 24-Parganas. In North Midnapore as much as 20,000 lbs. of silk is yearly manufactured. In Murshidabad district there are several well-known names, but they are rather silk merchants than manufacturers. They advertise extensively, and have a business-like connection with Calcutta firms, who put their goods in the market. In other districts principally *tussar* is woven.

The Bengal Silk Mills Company, Limited, at 11, Dhur's Bagan Lane, in Ultadanga, Calcutta, is owned and managed by a Bombay Muhammadan gentleman, Mr. Ariff. He has a European works manager from Macdolesfield. This firm is able to manufacture very fine silks for export all over India and Burma and is successful in producing an almost black dye. It is an object lesson to Bengali capitalists of what can be done by skill and capital. Mr. Ariff informs me that he worked himself in his youth as a journeyman at every part of the processes. As Mr. Mukerji has said in the hand-book on sericulture: "skilled Indian labour guided by English enterprise can produce silks of European excellence and finish." I may mention that the Ecole Supérieure de Commerce de Lyons receives pupils from foreign countries and teaches the entire silk business from the raising of the worm to designing, weaving and commercial methods.

As regards the hand-loom weaving industry, the districts give pessimistic reports, but Mr. Mukerji gives reasons at page 63 of his monograph for thinking that the indigenous weaving industry is flourishing at present. My observation confirms this view. In Ghatal the cost of manufacture has increased on account of the increased price of the silk thread; it used to be Rs. 12 a seer; it had risen in 1908 to Rs. 22 a seer.

The present position is that there is a full demand for local manufacture of the silk thread which is not exported and the silk producers have an increasing demand for export of the raw silk. I do not think that Government help is required in Present position of silk weaving industry.

mulberry silk weaving. At Berhampore an intelligent observer told me that the demand of silk was from people who could pay, and that the *swadeshi* movement did not therefore affect the weaving industry. At the same time the inroads of the Japanese imports should be watched. At a time when so much is said and written about the support of local industries, Bengali ladies of the better class are purchasing *saris* of Chinese silk manufactured in Japan and sold in Calcutta in preference to the Calcutta or the Benares product. The imports of Japanese silk into Calcutta was as follows in thousands of rupees:—

1902-03.	1903-04.	1904-05.	1905-06.	1906-07.
18	29	52	40	42

TUSSAR SILK WEAVING.

Changes in the industry.

In Mr. Collin's account, this is described as prosperous. The details of distribution and of the methods of this industry is given in pages 103-138 of Mr. Mukerji's monograph. In 1898 it was recorded that the manufacture was decaying in the Burdwan Division; in 1900 that it was affected by the increased popularity of machine-made goods; in 1903 that there was a decrease owing to the introduction of cheaper and finer cloths from Bombay, Japan and Assam; in 1905 there was a slight improvement in Burdwan, Manbhum and Bhagalpur districts, owing to the *swadeshi* movement. *Tussar* is worked also in the Hooghly, Midnapore, Birbhum, Bankura and the Sonthal Parganas districts; on the other hand, *tussar* cocoons are reared in the Singhbhum, Ranchi, Hazaribagh and Palamanu districts; and in these no weaving is done, except perhaps a little in Singhbhum district. For instance at Singbazar near Purulia I found that the weavers had to travel by rail and road to Chaibassa to get their cocoons.

Position of workers.

Like practically all the cotton weavers, the *tussar* silk weavers are in the hands of their *mahajans*; but they are probably a little better off, midway between cotton weavers and silk weavers. Mr. Mukerji after his special enquiry of 1904 said that the *tussar* silk industry was declining everywhere owing to *grasserie*, although the demand of *tussar* cloths was on the increase. The district officers did not agree with this conclusion. Mr. Mukerji states that the industry must under any circumstances be a precarious one and urges proposals for the improvement of the seed. This is for the Agricultural Department.

Requirement of the industry.

What the *tussar* weaving industry requires is a fly-shuttle mechanism for working *tussar*, I have tried several dodges myself, but have not been successful. Infructuous efforts to introduce fly-shuttle loom were made at Bhagalpur. One weaver of the Mourbhanj State, Bamdeb Uriya, is asserted to have succeeded; but I could not get this verified. The weavers of Kalipur Kodia in Birbhum district succeeded only with a cotton warp and *tussar* weft. The complaint is that the reeds of the sley fray the threads of the warp. The remedy may be in a device in the loom, or in improved spinning. This is a problem for the new Government weaving institute to solve.

Mixed cotton and silk.

Under the head of *tussar*, can be considered *bafta* or mixed cloths. This is associated with Bhagalpur. A cotton *chadar* costs Re. 0-10 to Rs. 5 and lasts for two years; a *bafta chadar* costs Rs. 3-8 to Rs. 15, and lasts five to six years. In Champanagar I found that the *mahajans* were sweating the local craftsman; about eight annas was the labour return for four days' work. In Bhagalpur itself the Bihar Trading Company under Kabir Ahmad Khan of Mujahidpur is doing good work in advertising and circulating samples, issuing new designs to the weavers, and in financing them without extortion. This is a method which the middle class capitalist might follow with advantage where there is any colony of weavers who are at present following individualistic methods of purchase of yarn and sale of material. The Bihar Trading Company have customers in Bombay and Burma, in Bengal and the Deccan; and they have received orders from Europe. I sent several large samples to a leading, wholesale piece-goods merchant in London; but there was no demand there. From enquiries I believe that there may be a demand in Spain for this class of goods.

WOOLLEN GOODS AND BLANKET MAKING.

The position is the same as in 1890. The blanket weavers are principally to be found in the Bihar districts. The *gareri* colonies in Bengal have migrated from Bihar and the United Provinces. For instance those near Bankura came from Gaya district, those in Midnapore came from the Upper Provinces, those in Jessore came from Arrah. The centres from which most of the good exports are sent to Calcutta are Aurangabad in Gaya districts, and Jangipur sub-division of the Murshidabad district, where the blankets cost from seven to eight rupees each. In the Aurangabad sub-division of the Gaya district the industry is in a flourishing condition. The country-made blanket loses about one-third of its size during the wetting and rubbing process. The best blankets are those made from pure Punjab wool by up-to-date machinery under European supervision in Bhagalpur jail. The bullock transport during the South African war obtained some of these warm coverings from Bhagalpur jail. In Bankura I found that a single worker could turn out a blanket costing one rupee eight annas in a day and-a-half. His labour would be represented by five annas. The weavers usually own their own herds of sheep and do the shearing, scutching, rolling, spinning and weaving themselves. In the monograph of woollen fabrics in Bengal prepared by Mr. N. N. Banerji (1899), detailed information is given regarding the processes of manufacture and in an appendix the distribution is given, thana by thana, of the industry throughout the province. The first suggestion for improvement is obviously that there should be improved breeding of the sheep which produce the wool, but the Bihar districts still wait any improvement in this direction. As regards the improvement in weaving itself, Mr. Banerji stated that the country blanket was cheap, warm and durable and produced at a minimum expense and that, as the trade had no prospect of suffering from outside competition, it might well be allowed to remain untouched. I think, however, that in the production of the superior qualities, such as the 6' x 7' blanket costing from ten or twelve rupees and prepared in the Jangipur and Aurangabad sub-divisions, there is room for the small capitalists who might extend the market for finer qualities and introduce further variety of designs. I learnt that at Nabinagar in Gaya district the *gareri* can only dye red, yellow and brown, and for black they have to depend upon the naturally dark wool of the black sheep. Then again they have to depend for soft wool on the *phagun* cutting. They say that they would like to learn how to make soft blankets. If there were a superintendent of industries, he could arrange to have some men sent to Cawnpur for training. The ordinary *gareri* colonies, whom I found settled in Bengal, were happy, self-reliant and self-contained.

CARPET WEAVING.

In Mr. Collin's report it was stated (paragraph 40) that carpets were made in Patna City, in Obra and Daudnagar in Gaya district, at Sasaram in Shahabad district and in Muzaffarpur district. No recommendations were made under this head. This industry was the subject of the monograph for 1905-06, to which, as it is a recent production, reference should be made by those interested in the subject. The industry does not flourish in Bengal proper, as the climate is not suitable for sheep rearing. The work is still carried on in the Patna Division in Patna, Gaya, Shahabad, Muzaffarpur and Champaran districts.

Mr. N. G. Mukerji, the compiler of the monograph, has pointed out that it is very doubtful whether the industry would have lived at all in its higher branches, but for the encouragement given in jails. I find that in the following jails there is some work:—Arrah, Chapra, Motihari, Chaibassa, Purulia, Hazaribagh, Patna, Bhagalpur. The jails employ new thread, well-made forks, English shears and upright looms in nearly all cases.

The *kalins* and *galichas* are made by knotting in the warp, tuft by tuft, the material of the pattern: in *durris* and *shatrangis*, the pattern is woven in the loom. At Obra, in Gaya district, I found that the good workers were 20 men in four

families. The weavers make, as pot-boilers, cheap and nasty *durrie*, called *asans*, which they sell at from one anna upwards. In these they earn as profit about $3\frac{1}{2}$ annas per rupee. But they can make beautiful carpets, with delicate design, heavy pile, and indigenous colouring, at Rs. 8 or Rs. 8-8 per square yard. Very few except Europeans in South Bihar give them orders or pay them at this high rate. In their second-rate work they use aniline dyes because such dyes are cheap. What they require

Publicity required. is publicity, both in Bihar and in Calcutta. In Calcutta they are judged by the fifth rate articles which they export. As they have no capital, they work on advances and are dilatory. Their daily earnings are two to four annas. If private speculators were to run the whole business, and placed their good workmanship in the market, there would be room for a good profit. In Sasaram, in Shahabad district, the *durri* weaver can earn Rs. 7 and the *kalin* weaver Rs. 12 a month. They are not very prosperous. In Champaran the cotton work is partly done from locally grown cotton. In Muzaffarpur the workers earn about Rs. 3 to Rs. 4 a month. At Sultanganj in Patna City, one Sain Mia, about twenty years ago, conceived the idea of using the ordinary country loom for the manufacture of *durris*. The *karga durri*, as it is called,

The invention of the *karga durri* is now manufactured in large quantities. This is a rare instance of improvement in an industry owing to the ingenuity or enterprise of a worker. The weavers in Patna earn from Rs. 7 to Rs. 12 a month; but they have not been able to raise the selling price of their goods with the general rise of prices. The large *shatrange* is dying out at that place.

Mr. Mukerji has several suggestions; but to my mind nothing much can be done, unless a capitalist works, for example, the whole of the Obra industry. At present the Gaya District Board and the local exhibitions give some assistance: much is due to the patronage of Europeans. The suggestions are as follows:—

Mr. Mukerji's recommendation. (1) There should be show rooms at central places; (2) only the best materials should be used; (3) scholarships at the expense of wealthy zamindars should be given for the study of the superior methods at Bikanir, Mirzapur, Bhawalpur and Warangol; (4) only indigenous dyes should be used; (5) local enterprise should start factories, utilising men trained in jails; (6) the best jail methods should be employed; (7) advertisements and encouragement should be given at the local fairs. Mr. Jvala Pershad, who wrote the monograph for the United Provinces in 1907, pointed out the importance of fairs and exhibitions to take the place of the art of advertisement.

POTTERY AND EARTHENWARE.

No change in country pottery. The potter is proverbially not particularly intelligent: he is parsimonious and self-centred. Hence much improvement cannot be expected from his class. The village manufacture of earthen utensils is much the same as it was in 1890. The works of Messrs. Burn & Co., at Raniganj, in Burdwan district, though employing over 1,100 workmen, have not had any appreciable affect on the work of the potter outside: the boys who are trained in modelling there work on as journeymen. The chief work of the firm is still the manufacture of bricks, tiles and drain-pipes of the annual value of about seven lakhs. Brick burning up to 800 million bricks, in the year, is a leading industry in the Serampore subdivision of Hooghly district. The pottery works at Kaliganj in Khulna, continue to enjoy popularity. A superior quality of water-pots is made at Kanthalia, in Murshidabad district. There is a large export of pottery from the Ghatal subdivision in Midnapore district. In the Bihar districts, pottery is of importance in Sewan, Samastipur and Sasaram subdivisions. The pottery of Sasaram is flourishing; that of Sewan requires a more extensive market. In the south of Sasaram subdivision at Banjari is an up-to-date manufactory, run by electric power, where Messrs. Octavius, Steel & Co. manufacture earthen tiles and wooden bobbins. The industry is prosperous and capable of development. The manufacture of earthen vessels as ordinary household articles, is, of course, carried on everywhere. There is a special development in the manufacture of flower-pots in the south of Calcutta. I have never seen finer firing than that of B. C. Pal & Sons, at 20, Diamond Harbour Road.

The chief development since Mr. Collin's report, is the manufacture of white porcelain from kaolin. Mr. Collin said the difficulty was to find the proper clay. Deposits of decomposed felspar or kaolin have been found at Mangalhat, between the Taljhari and Rajmahal railway stations in the Sonthal Parganas. This was worked privately in 1902-03, but not successfully. It has been taken up again with much success by the Calcutta Pottery Works, 45, Tangra Road, Calcutta, which are the result of the enterprise of Maharaja Manindra Chandra Nandi of Kasimbazar, and Babu Baikantha Nath Sen of Berhampore. This firm is a good example of what is required in Bengal for indigenous development. It has sufficient working capital; it has its own coal and its own raw material; it has a ceramic expert in Mr. S. Deb, who studied at the Higher Institute of Technology in Tokyo, Japan; it has up-to-date German and English machinery, and up-to-date furnaces with the best of Stourbridge fireclay bricks; it has found a local market, as well as an export market, in ink-pots, gallipots, insulators, cups, saucers and plates, and even dolls. It is a curious development to find in Calcutta, as the product of Indian labour, such a western product as a chinaware doll dressed in European clothes. I have shown the firm what are the white porcelain articles which are required by the Medical Store Department at Calcutta and the Pasteur Institute at Kasauli, and have placed the firm in touch with these departments. The firm might be able to manufacture according to these specifications. The Government departments named are willing to purchase locally if the quality and price do not compare unfavourably with the imported articles.

Others have taken up the manufacture of kaolin. The works of the Bengal Pottery Works, Limited, are at Baranagar and the show-room is at 20, Cornwallis Street. This company has only Rs. 5,000 paid up out of Rs. 20,000 advanced capital, and suffers accordingly. A factory which has only six workmen cannot be expected to do very much. Cups, saucers and small china ornaments are made, but I regret to have to say that the workmanship is extremely bad. This firm gets its supply of clay material from the Calcutta Pottery Works and its glazing material from abroad. The work was started by Babu Satya Charan Bose, who is now the managing agent. Another small attempt is the Eureka Porcelain Works, started at Giridih by Mr. M. N. Dutt, under the patronage of Mr. Justice Sharfuddin. Mr. Dutt had first-hand knowledge of such work in South-East China. The material is obtained from Garanji, 36 miles from Giridih, discovered in 1903. Both these enterprises, however, require further outlay of capital, and a defined market for their goods.

Kaolin has also been found in the Orissa Garjats, and in Belaur in Gaya district. It is also called china clay. Sir Thomas Holland, F.R.S., the Director of the Geological Survey, was good enough at my request to depute Mr. Murray Stuart of the Geological Survey to examine locally these kaolin deposits. The experience of the Calcutta Pottery Works is very hopeful for the future of this real *svadeshi* industry. The chief thing is that Mr. Deb has succeeded in producing a glaze. Bengal has previously not had the skill or the appliances for the special form of vitrification required. Sir William O'Shaughnessy as long ago as 1839 investigated the question of the production in India of glazed pottery, sufficient for use in Indian hospitals. He used lime-borate. It would be useful and probably economical if the felspar glazing in the up-to-date kilns of the Calcutta Pottery Works could produce locally an article, which at present has to be imported by scientific departments. Mr. Collin in 1890 wrote that the potters of Bengal did not understand the art of glazing. The difficulty in Bengal is to find clay which will be sufficiently free from iron. Mr. T. N. Mukharji in his Monograph on Pottery in Bengal in 1895 wrote that glazing was all but unknown. In fact, in Bengal, pottery is almost entirely terra cotta, that is, plain unglazed ware.

The kind of articles manufactured and the methods of manufacture are described at pages 5 to 9 of the above monograph. The best potters are those on the banks of the Bhagirathi in the Burdwan district, where the clay is specially suited. The only suggestion I have for indigenous manufacture is the extension in the Bihar districts of the form of potter's wheel used in parts of Bengal. The Bihar wheel, the ancient "rota," is solid; the

improved Bengali wheel has a heavy periphery attached by spokes to the central hub. The latter is mechanically more efficient.

The import trade.

The imports of earthenware and porcelain have risen in the last five years from 9½ lakhs to 14½ lakhs, and the feature of the trade is the increase from Germany and Austro-Hungary and the decrease from Belgium. The United Kingdom supplies over a third of the total.

CARPENTRY.

Decline of the Hindu carpenter in Bengal.

Carpenters are found scattered all over the province, and, except in the case of cabinet and furniture making, carpentry is not a centralized industry. There has not been much change in the disposition of the workmen throughout the province since 1890. There has, however, been a change in the character of the work and in the class of workmen. In Calcutta, Hindu carpenters formerly were in the ascendency; but, owing to the fact that youths of the younger generation are frequently not apprenticed to the trade, but encouraged to be clerks, the Hindu carpenters are giving place to Muhammadan and Chinese carpenters. I find the same complaint from a large private employer like Messrs. Lazarus and Company, as well as from a large Government workshop like the Kidderpore Dock-yard. Mr. John Wallace, the editor of *Indian Textile Journal* in a recent article in *Cassier's Magazine* on the industrial regeneration of India has mentioned that the chief faults of the Indian carpenter are his neglect of accurate measurement, his carelessness with regard to the efficiency of his tools, and his lack of perception of the value of time as a factor in the execution of work. This fault of unpunctuality, I may note, is attributed specially to the carpenter in the people's proverbs. The carpenter's saw, Mr. Wallace adds, is in such a bad order that he cuts tenons as a rule with a mallet and chisel, and his ignorance of gauges renders him unable to make even twenty articles exactly alike; also the carpenter rarely knows what size of nail or screw is required on a given job, whilst his screw is always too small. The carpenter has to be taught to measure accurately, to use sharp tools, and to cut to the mark. In Calcutta under European supervision the workmen of Messrs. Lazarus and Company conform to these axioms and the firm of the Chatterjee Furnishing Company, 52-7, Bowbazar, have an equally high standard, but much of the ordinary bazar work is scamped. There is apparently no inducement for the ordinary worker to follow a high standard. A good carpenter can earn in Calcutta from ten annas to one rupee a day, and on piece-work a good man might earn even as much as Rs. 40 a month. As regards the quality of the work, it is, of course, a question of cost; it depends upon how much people are willing to pay for good articles. At Dinapore the quality of the furniture mentioned by Mr. Collin is still good and the prices are reasonable, but not cheap. At Ghatal I found plain rough carpentry, which was just what was desired and what the people were willing to purchase. Mr. Collin pointed out that the supply of improved tools and the supply of designs were two essentials for improvement. I find that the workmen appreciate good tools when they can afford to pay for them. And the country-made rope bit is as efficient for ordinary work as the more expensive English bit turned by means of a bitstock. The native lathe with its double rope ends should, however, be supplanted by a rope pulley which would work continuously when driven by a large wooden wheel. This kind is to be found outside Bengal, in Cawnpore and in Madras. As for design, much improvement has been made by Europeans in the Bihar districts; they have retained carpenters whom they cause to copy designs and turn out articles with high finish. In Madhupur near the town of Monghyr I found a carpenter who worked from an old catalogue of Messrs. Lazarus and Company, and a catalogue of an English wholesale furniture manufacturer. His work was apparently appreciated by well-to-do Indians. He is bringing up his boy in his business. In a decentralised industry it is difficult to introduce the leaven which will leaven the whole lump. I have, however, suggested in my report on industrial education that there should be good schools of carpentry at Cuttack, Gaya and Bettiah, but the difficulty is to obtain instructors who will be superior to the bazar *mistri*. But I have found that there are carpenters with a high

degree of skill in Cuttack and in the Bihar districts, and such could be recruited if the pay were sufficiently attractive. It must be remembered, however, that it is the workshops under European control which are the real centres of technical instruction. But the men trained in such workshops remain as a rule with their employers, and consequently do not extend their training to their countrymen. Carpentry is the most common form of industrial employment taught by the Missionary agencies. The best results are those obtained by the Oxford Mission Industrial School at Ballyganj in Calcutta and the Hatchapra Church Missionary Society Industrial School at Hatchapra in the Nadia district. The youths trained at these schools are encouraged to earn their livelihood at the craft. Much good can be done by the insistence on the teaching of drawing to scale in all industrial schools. As Mr. Nathan has remarked in his review of the progress of education in India (1898-1902), it is a poor testimony to the efficiency of industrial schools in Bengal that, although carpentry is the principal object of instruction, the native carpenter of Calcutta does not hold his own against his Chinese rival. The Hon'ble Mr. F. A. Larmour in the Bengal Council on the 4th April 1908, stated that the Bengali carpenter gets small wages, but that he earns for his employer even less than he gets, that he takes little or no interest in his work, and if not carefully watched will scamp his job. So the Hon'ble Member emphasized the necessity for some system of training that will improve the status of the Indian mechanic.

This trade furnishes a good opening for middle class capitalists outside Calcutta. They should have some machine plant driven by mechanical power, such as a band saw, planing and morticing machines; they should make use of the services of existing carpenter *mistris* in places like Burdwan, Cuttack, Gaya, Monghyr, Bettiah, Muzaffarpur; they should insist on good quality and should advertise, as the successful shops in Bowbazar, Calcutta, have done. But a master-carpenter should also have skill and knowledge, which is best acquired by the unpalatable drudgery of a regular apprenticeship. I have tried without success to get middle class youths apprenticed to the carpentry trade.

MAT-MAKING AND BASKET WARE.

The details given in paragraph 22 of Mr. Collin's report still hold good. If there has been any change, it is in the improved exports in the Kishanganj sub-division of the Purnea district, by the opening of the Barsoi Extension. Mats and palm-leaf braids are manufactured at Falta and Diamond Harbour in the 24-Parganas district and are exported to Calcutta for sale. There is some centralised mat-making in Jessore district, Nuddea district, Sitamarhi sub-division and throughout Orissa. The industry in the Sabang and Panskura thanas of Midnapore district gives employment to about a thousand workers; as much as one thousand to two thousand rupees is paid on each *hat* day at each of the four recognised local markets. There have been increased exports, but the profits have not correspondingly increased on account of the increase in the prices of jute string and of the *mandari* reeds. The industry is a flourishing one. The workers have a steady cash market close to their own homes. There are four leading dealers who export goods to Postabazar in Calcutta. The workers told me that they were quite ready to adopt new designs, but they asked what pecuniary benefit this would be to them. Mr. Collin suggested in paragraph 78 that this was one of the special home industries which might be assisted by the establishment of classes, and he specially suggested the above mentioned localities in South Midnapore. He said, however, that the subject was one perhaps for private enterprise. I agree with Mr. Collin that there is no reason why India should not export a large quantity of fancy and useful basket ware. But I do not think that we can do more than call the attention of private enterprise to the possibility in this direction.

OURING, TANNING AND LEATHER WORK.

In 1890, Mr. Collin drew attention to the ouing of leather in a few factories in Calcutta, and to the small manufacturing work done in Calcutta, Patna and Darbhanga.

Since then, there have been phenomenal exports of hides and skins from Bengal. There was till 1907 an extraordinary world demand for leather, and so the Indian market was exploited to the full. Motor cars, change of taste in boot leather, and the boom in the cotton industry, all contributed as causes. In December 1906, an expert called attention to the scarcity of hides. In 1907 there has been a strong reaction.

Exports.

The exports from Calcutta are instructive:—

	1900-05. Average.	1905-06.	1906-07.	1907-08.
Raw hides	311	448	554	380
Raw skins	192	327	255	176
	503	775	809	556 lakhs.

The prohibitive rates against tanned goods on the Continent and America prevent any export. England is the only country to which there is an export of tanned goods.

Imports.

The imports of boots and shoes from abroad into Calcutta were as follows:—

1902-03.	1903-04.	1904-05.	1905-06.	1906-07.	1907-08.
9.1	9.56	12.86	10.93	6.41	9.40 lakhs.

The "boycott" movement contributed to the fall in 1906-07. The imports of leather other than boots and shoes consist of unwrought leather, saddlery and harness, and other sorts. There was a decrease in imported saddlery also:—

IMPORTS (IN LAKHS) OF—	1902-03.	1903-04.	1904-05.	1905-06.	1906-07.
Unwrought leather	2.66	2.08	2.29	2.21	2.42
Saddlery	2.13	2.35	2.19	1.94	1.67
Other sorts	2.94	3.36	3.23	3.24	3.34

The present moment is propitious in Bengal for the increased local manufacture of leather goods for local consumption, not for export; and this consumption includes both country shoes and shoes of European pattern.

Special enquiry
directed by
Government in
1907.

The committee appointed by the Government of Bengal in 1904 to consider industrial education in Bengal, resolved that the fact that there was a large export of uncured hides should be brought to the notice of Government, so that enquiries might be instituted. In consequence of this Mr. E. R. Watson, M.A., F.C.S., Indian Educational Service, has recently prepared two valuable reports in connection with the leather industry, one concerning the curing, the other concerning the tanning of hides. These reports have been circulated to many associations and individuals who are likely to be interested in the industry. These reports are full and suggestive. I give below my own views.

Curing of
hides.

As regards curing, Mr. Watson's proposals are two-fold, to give publicity to the artificial state of the Calcutta hide-trade, in which the advantage to the seller is almost in favour of badly cured hides, and to set a good example by starting a demonstration curing department under Government auspices. For the first object the Calcutta hide merchants are to be asked through the Bengal Chamber of Commerce to form an association of hide buyers. This I think should be done; such an association would be analogous to the associations recognised by the Bengal Chamber of Commerce (see page 95, Report of 1906, Vol. I), such as the Jute Fabrics Shippers' Association and so on. Still the

proposal has been mooted before without success, and all the hide buyers are not enthusiastic. And next, the principal associations of tanners in Europe and America, it is proposed, should be addressed in order that the requirements of the tanning trade might be more carefully attended to by the collecting and distributing trade. On this I would suggest that the Bengal Chamber of Commerce might be requested to make this reference, rather than that Government should do so itself.

As regards a demonstration department at Tangra on the east of Calcutta, which would be the means of the second object—to show the correct method of curing—I think that this is feasible; but I suggest that it would be better if the actual work of buying, curing and selling were done by a private firm with the help and under the advice of the expert appointed by Government. I have sounded the firm who have the lease of the *bhagar* under the Cossipore-Chitpur Municipality. Sheikh Nabi Buksh was a sorter for Messrs. Thomson, Lehzen & Co., and Munshi Ramzan Ali, his brother, was a buyer for Messrs. Cohn Brothers and Fuchs. These are practical men. I suggest, as Mr. Watson does, that Government should acquire a site, and erect sheds, and appoint and pay a superintendent; but that an agreement should be made with this firm, that they should try and sell, but that the flaying and curing should be done under the advice of a Government superintendent. The methods proposed by Mr. Watson could be adopted; to flay without scoring, and to cure with Madras sea salt. The firm have told me that they would work under these conditions. Mr. Watson thinks no butcher or *chamar* would allow a Government instructor to interfere in the curing of hides, which were the butcher's or *chamar's* own property. Perhaps not in the case of small men; but these men are not small men. The advantage is, if the scheme could be worked, that the proof of commercial success is at once apparent, whereas if Government financed the buying and selling, it might be not so practical a demonstration. If Tangra be not considered a suitable site, it might be possible to start such a demonstration curing department at a local centre of the hide trade, such as Patna.

After further personal enquiries in Darbhanga district, I do not favour the proposal of Mr. Watson to start a hide collecting agency in the north of Darbhanga district directly under Government control. The improvement in curing, I consider, must be made by the insistence on a better cure by the large firms acting through their multifarious agencies. Messrs. Schröder, Smidt & Co. have improved curing in this way, and Messrs. Ralli Brothers, who have recently taken up Muzaffarpur district, might do the same. It is a matter which concerns the self-interest of the exporters. The Collector of Customs has reported that during 1907-08 there were complaints on the part of German and Austro-Hungarian tanners regarding the systematic manner in which some Calcutta trade shippers have been lowering the standard of their assortments.

Turning now to the tanning of hides, I find that Mr. Watson's recommendation completely tally with the results of my own enquiries. There has always been some hides Tanning of tanning done in Calcutta and the suburbs—perhaps up to five lakhs a year. The oldest firm is Messrs. J. Teil & Co., of Kidderpore. There are a few places outside of Calcutta where tanning has been taken up in recent years. Mr. Madhu Sudan Das, C.I.E., has the Utkal Tannery at Cuttack, which has a retail depôt in College Street, Calcutta. He gets the hides principally from the Orissa Tributary States, has a German tanning expert, and a English practical boot-maker from Messrs. Cooper, Allen & Co., Cawnpore, and lately was turning out about 400 or 500 pairs a month. Mr. Bipra Das Pal Chaudhuri, who has in other things shown enterprise in advance of his countrymen, has a small factory at Maheshgunj, Nadia district, with a local agency at 7, Mirzapur Street, Calcutta; has as manager, Babu Sisir Bose, who studied for a time under Mr. Chatterton in Madras; and makes a speciality of chrome-tanning. Dr. Nil Ratan Sircar has the National Tannery,—a small chrome-tanning business, near No. 4 Bridge, in Beliaghata, with a retail shop at 66-2, Harrison Road. This place is to be used as a training ground for students of the Bengal Technical Institute. All these three gentlemen are directors of a new Boot and Equipment Factory Company, Limited, which has been started at Agra in the United Provinces by amalgamation with the Steuart Factory Company of Pandit Mehan Krishna

Dhar. It was at first proposed that the new company should acquire the factories at Cuttack and Maheshganj, but this idea has been since dropped. This company have engaged Mr. P. A. Taher, B.A., a young Muhammadan of Hooghly district, who has had a specialised training on tanning and leather work in America. It would therefore appear that the advice of Mr. Watson, namely, to make known the desirability of establishing tanneries in Bengal, would be taken if it were published. At Bankura, Ranchi and Muzaffarpur I have suggested to local people that there is a hopeful future for tanneries and factories if they be started where there are

Requisite for
tanning in Ben-
gal.

(1) a hide market, (2) a supply of the raw material for tanning, (3) good water, (4) a cheap supply of labour and (5) local colony of *chamars* or *muchs*. At the same time I fully recognise the prejudices which must necessarily exist amongst the Hindu community against this industry. And my efforts to bring capitalist and expert together, for instance, at Bankura, have not been so far successful. But I fully approve Mr. Watson's recommendations that the Government of India should be asked to establish a branch Army Supply Harness and Saddlery Factory in Bengal, that the establishment of local tanneries be encouraged, that the patronage of the Bengal Government, say for example, in foot-wear for constables and warders, should be given to local factories, and that scholarships be given by Government to youths desirous of studying at Madras or at Cawnpore, or, I would add, of going abroad under the auspices of the Association for the Advancement of Scientific and Industrial Education of Indians. For such scholarships I would suggest Rs. 50 a month, for two years at Cawnpore, or for one year at Madras; and Rs. 50 a month for two years in Europe or America.

Tanning mate-
rials.

The difficulty about curing may right itself with the help of a little practical instruction from Government. But the chief difficulty about tanning is in the supply of a cheap and plentiful tanning material. The chief material used in Bengal and Upper India is the *babul* bark (*acacia arabica*). The Cawnpore manufacturers complain that they have to go further afield for their bark: the President of the Upper India Chamber of Commerce has suggested that the bark used in Madras known as the tanner's cassia (*cassia auriculata*) should be cultivated in Upper India. The myrobalan plant (*terminalia chebula*) is found in Chota Nagpur districts. An extract from the fruits is prepared by the Bengal Tanners and Dyers Extract Co. of Raniganj and exported. The Nadia Tannery at Maheshganj uses myrobalan fruits and Madras bark, as well as chrome salts. The Cuttack tanuery uses vegetable bark, and so do all the Calcutta tanners. Mr. Hooper, F.I.C., F.C.S., of the Indian Museum, suggests that in Bengal the Australian wattle bark (*acacia decurrens*) should be cultivated. *Babul* bark gives only 16 per cent. of tannin, while the *cassia auriculata* gives 23 per cent., *terminalia chebula* 28 per cent. and *acacia decurrens* 33 per cent. The present problem is, however, not the cultivation of tannin for export; the English and Continental tanners will not change their tanning agents readily. The problem is the tanning of some of the hides for local leather manufacture, and the simplest course is to increase the quantity of the tanning materials which are locally procurable. The *babul* tree unfortunately is destroyed after use, whereas the South Indian agent, the *cassia auriculata*, gives a perennial crop. Doctor McCann's Monograph on the Dyes and Tans of Bengal was prepared as long ago as 1883; neither that work nor Mr. Hooper's monograph of 1902 on tanning materials, nor the Bengal Monograph of 1904, Chapter VI on tanning materials, furnish the information which a practical tanner in Bengal wants, namely, a full and accurate account of the habitat of the *babul* and other local tanning agents. It is desirable that the Bengal Agricultural Department should make this enquiry, and should experiment in growing the trees which have been suggested. The Agricultural Ledger No. 9 of 1896 tells us that the *babul* is not a forest tree in Bengal, but a roadside and village tree.

Chrome-tan-
ning.

As regards chrome-tanning, it is more independent of local conditions. The potassium chrome alum can be prepared by chemical manufactories in Bengal by the addition of sulphuric acid to a solution of potassium dichromate and by passing sulphur dioxide through the liquid. I visited the Government chrome-tannery in Madras. It has quite recently been enlarged, and those who wish to take up the industry,

should study there. Chrome-tanning is successful at the new Agra factory. Some good chrome-tanning was recently done in Muzaffarpur, and exhibited at the Bankipore Exhibition in January 1908. From all I can gather, there appears to be a good future for chrome-tanning in Bengal.

At Bankura I came across a colony of leather workers, who supplied work to A. C. Roy, of Faujdari Balakhana, Tiretta Bazar, Calcutta, under the name of the Bankura Boot and Shoe Factory. The leather they received from the Bengal Tannery, Chowson Tannery and other firms in Calcutta. This business might be better organised, and they could do better work if they possessed wooden or metal lasts on which to work. I suggested to them an inexpensive expedient to take the place of a metal last. There is also a good opening for a leather factory at Dumka, where the craftsmen have some enterprise.

Mr. Rowland Chandra, who wrote the Bengal Monograph in 1904 has several recommendations. His remarks at pages 24-26 should be studied by capitalists and others interested in the subject. I am sorry to find that the existence of this monograph was not even known to one who was in charge of a Bengal tannery. Mr. Chandra suggested amongst other things that young men should study abroad. Six have been sent by the Scientific Association in Calcutta, and the industry was the second selection of the Bengal Government for the State technical scholarship in 1908.

IRON AND STEEL WORK.

Iron and steel work is the subject of the Provincial Monograph prescribed for 1907. It was prepared by Mr. E. R. Watson, M.A., F.C.S., of the Indian Educational Service, and is still under issue. Mr. Watson has stated that the art of working in iron and steel in Bengal has from very remote times been indebted to the outside world for assistance, not only by ideas but by actual supervision and control of the workers by foreign experts, so that it becomes almost a question whether any part of the industry can be called indigenous. Machinery and engineering workshops are concentrated in Howrah and Calcutta. Iron foundries are in the same neighbourhood and in the Burdwan district. Practically all indigenous workers are Hindus, while the Mussalman workers in iron and steel are almost all confined to factories conducted on European lines. Mr. Watson's report is very full and interesting; and as it is quite up-to-date, those who desire detailed information, especially regarding statistics, should refer to it. As regards the outturn of indigenous work the country blacksmith is not capable of much improvement. He supplies cheap plain articles for which there is a local demand. A small beginning in improvement has been made by the extension of village schools in the Chota Nagpur districts, specially in Hazaribagh. At Jhalda in Manbhum district I found that the workers were capable of doing much better work than they were doing. They require an extended market for their manufactures. A small capitalist might do a good business there. I tried to interest a local capitalist in this work. They should be induced to take up the manufacture of knives and scissors, instead of sword-sticks, the export of which has been stopped.

Insignificance
of indigenous
work.

There has been, I think, an extension of the manufacture of cutlery since 1890. I found Prem Chand Mistri whom Mr. Collin visited, still working at Kanchannagar near Burdwan. He has shown his enterprise by obtaining a small size oil engine for working his lathes. He is bringing up his son to follow him, and some of his workmen have been able to start for themselves. There is also good cutlery made at Shaspur, thirty miles from Bishnupur in Bankura district. One Makhan Kamar has taken to the use of an iron pedal lathe on the model of the sewing machine. A good workman can earn up to one rupee a day. I found that the best cutlery was made from old cast-off English files. Babu N. M. Bose, an educated young man in Muzaffarpur, has taken up the manufacture of surgical cutlery. Bechu Mistri and his son of Jagadipur in Shahabad district turn out work of the highest quality. I find cutlery taken up specially in Birbhum, Bankura, 24-Parganas, Khulna and Nadia. Superior nut-crackers (*jantis*) are made in Jangipur subdivision in Murshidabad, and in Satkhira subdivision in Khulna. Messrs. Khan & Co., of Sooke's Street, Calcutta, have a high reputation.

Cutlery.

This cutlery trade furnishes an opening for the small capitalist. Improved mechanical appliances for filing and polishing are required, and a system of distribution of the completed product at a central place is essential.

Rice bowls.

The figures regarding the import of rice bowls from the United Kingdom into Calcutta should afford reflection.

1902-03.	1903-04.	1904-05.	1905-06.	1906-07.
7	7.9	8.6	8	8 lakhs.

These cast-iron rice-bowls are universally used, yet not one is made in Bengal. The people prefer them to the old wrought iron *karahis*, which are also more expensive. Only one private attempt has to my knowledge been made in Bengal to manufacture these thin globular castings. The Principal of the Sibpur College, Mr. B. Heaton, suggests that the problem of making these thin castings in this country should be attempted to be solved by experiment in the workshop of the Sibpur College.

Steel trunks.

The manufacture of steel trunks has become very popular within the last three or four years. It owed its birth in Patna six years ago to Muhammadans from Allahabad. Mansudan Brothers started the Bihar Trunk Works in 1904 at Bhagalpur; and a man who learnt the art in a Calcutta shop has started in Khagra, at Berhampore. Murshidabad district has four factories altogether. These small factories are doing well and the prices are cheaper than those of English-made goods. The Berhampore man has agencies both in Rampur Boalia and in Calcutta. Although the sheet metal has to be imported, yet this is an industry which might be taken up by small capitalists in the same way as has been done by the Berhampore man. He has good material, good workmanship and good distribution. The Arya Factory of 107, Machua Bazar Road, Calcutta, turns out good articles. Importers such as Messrs. Alexander Young & Co. are now putting in the market ready-made corner pieces. This is a convenience as the machinery for stamping dies locally would be rather expensive. Manufacturers can obtain the plant for ridging the steel sheets from Messrs. T. Rhodes and Son of Wakefield, England. I found that neither the Patna nor the Bhagalpur manufacturers were reaching the market which exists at their own doors. A dealer at Madhubani in Darbhanga district was obtaining his goods from Allahabad. The reason was that the Patna goods were not sufficiently well finished. I advised the Bhagalpur firm to make their hinges and locks stronger. Another word of warning is that these manufacturers should resist the temptation to produce inferior articles. Since the industry started, some manufacturers have been using sheets of a 102-lbs. to the bundle instead of 112.

Iron-safes.

Another form of iron industry is open to the small capitalist, viz., the manufacture of iron-safes. There is one enterprising blacksmith in village Lohani, thana Kuahtia, who since 1905 has been manufacturing iron-safes at a cost of fifty rupees to one hundred rupees. Messrs. Das & Co., Chitpur, have had for some time a reputation in this class of work.

Guns.

Mr. Collin gave a full account of the manufacture of guns at Monghyr. The industry still thrives in Cossimbazar, Monghyr, so called after the Nawab who brought a carpenter from Delhi for making gun stocks, from which small beginning this gun industry arose. There used to be 22 shops, but there are now only 13. The annual outturn of guns and pistols rose from two thousand in 1890 to three thousand in 1897. At present the number manufactured annually is about eight hundred. It is really wonderful what fine results can be obtained by means of the crudest of methods and the simplest of appliances. The gunsmiths complained of loss of custom; but they appear to be sweated by the wholesale Indian firms in Calcutta, about six in number, who buy their guns at eight to ten rupees for a

single-barrel and fifteen to twenty rupees for a double-barrel gun. The guns made to order fetch higher values according to their quality. A single-barrel breech-loader costs locally thirty rupees, a double-barrel breech-loader fifty rupees. A good workman can earn as much as thirty rupees a month. Sudarsan Mistry has sometimes as many as 20 workmen. Mr. Collin suggested that the gun barrels should be tested before they were sold and pointed out that there could have been no difficulty in testing them in the same way as the water tubes of boilers are tested. This suggestion, however, was not accepted by the then Commissioner of Bhagalpur on the ground that it would be a needless interference with the industry. But I may be permitted to point out that the workmen themselves asked that an inspector be appointed. However, it has not been brought into notice in recent years that the bursting of Monghyr barrels has been so marked as to necessitate Government interference. Similar guns, but inferior in quality, are made at Jhalda in Manbhum district. The Government rifle factory at Ichapur is silently effecting a revolution in the teaching of Indian workmen. The most callow of labour material is being induced under skilled supervision and guidance to turn out the highest class of work in which accuracy is required.

But the real future of the iron industry in Bengal depends upon the local manufacture of steel, and in Mr. Watson's words "the only pleasing side of the industry in this province is what we may call the 'modern industry,' namely, iron and steel work carried on in large works according to European methods." Mr. Watson proceeds to state:—"This industry is, of course, quite small, but it has developed very greatly within recent years, and its condition and future prospects appear very hopeful. And although there are only a few such, this province can boast of engineering works which in size and equipment compare very favourably with all but the largest works in England; and the Bengal Iron and Steel Works produce pig-iron in blast furnaces of the most up-to-date pattern." In fact it is the only province in which pig-iron is produced. As regards the manufacture of steel it is a melancholy sight to see plant to the value of a hundred thousand pounds sterling lying idle at Barakar. In the case of the Bengal Iron and Steel Works a subsidy to the extent of Rs. 45,000 a year, was granted by the Secretary of State in 1903, coupled with the provision that the material sold to Government should be three per cent. under normal prices. But no definite standing order for material was given. Government, however, is prepared to subsidise the Tata Iron and Steel Company, which has arranged to start operation in Bengal at Kalimati on the Bengal-Nagpur Railway, to the extent of a standing order of twenty thousand tons of steel per year for ten years. The latter firm selected its site in Bengal after making the most detailed scientific preliminary enquiries. The Bengal Iron and Steel Company in 1903-04 laid down plant for the outturn of twenty thousand tons of steel per year; but in two years the total amount of orders from Government was only for six hundred tons altogether, requiring no fewer than seventy rolling sections and representing less than three tons per order. It is a matter for regret that in the case of the local firm the good will of Government was not converted into a tangible standing order. As Mr. Watson has stated, the production of steel from country pig appears to be the advance which above all others is now required in the local industry. In the manufacture of pig-iron there is surely something wrong when Indian requirements are met by orders from England, while the Bengal Iron and Steel Company have to seek a market outside of India in Australia. In 1906-07, 1,996 tons were sent abroad from Bengal, principally to Australia. The total production of pig at the works in that year was 39,246 tons. The proposed new works of the Tata Iron and Steel Company, at Kalimati are not noticed by Mr. Watson in his monograph. The works will have far reaching influences in Bengal. Coal in the Jherria field, iron in Gurumishini in Mourbhanj, manganese and limestone quarries in the Central Provinces have all been acquired. It is anticipated that at Kalimati will be prepared not only iron but steel joists and structural shapes, and all sizes and shapes of steel bars; and that within five years work will be available for 20,000 people. The meaning of this is apparent when it is stated that all the existing iron and steel and

Future progress
in the manufac-
ture of steel.

engineering works in Bengal are estimated to give employment at present to only 40,000 men.

WORK IN BRASS, BELL METAL AND OTHER ALLOYS.

Stability of the industry.

This industry I have examined in considerable detail, and am able to say that there has been no decline; in fact it has, if anything, improved within the last ten years. Yet, although the industry is flourishing, I think much could be done in cheapening the cost of production. The monograph on brass was written by Mr. T. N. Mukharji in 1894. He gives an exhaustive list of places, showing the distribution of the industry throughout the province, (and its concentration in the Burdwan Division. Mr. Mukharji, who has retired for several years, and who was the main spring of the Indian Industrial Association, tells me that he had not time for much local enquiry, and compiled most of his monograph from district reports. He has, however, kept in touch with industrial matters, and his present views are, therefore, of interest. These are:—(1) The industry is not on the decline. (2) The enamelled ware has not been an altogether successful competitor, owing to the defects of the ware, the *swadeshi* movement, and the views of orthodox Hindus about the use of iron as well as to the fact that old brass ware has always a market value. (3) But the industry might have been developed further; the high price of copper was one of the obstacles. The following figures are instructive:—

	1902-03.	1903-04.	1904-05.	1905-06.	1906-07.
Imports of enamelled ironware into Calcutta in lakhs.	1.38	4.15	3.59	3.26	3.10
Imports of wrought brass into Calcutta in lakhs.	2.00	1.60	1.53	2.05	2.03

I find that the district reports of 1894 reported a decline owing to the import and use of enamelled ware and other ware made of zinc and tin. In 1898, the rise in the cost of living had affected the outturn. There was a strong fillip to the manufacture in 1905, but early in 1907 the price of the raw materials, especially copper, led either to dull trade or to an increase in the prices of the local products.

The industry is of importance in the following places:—

Centres of manufacture.

Calcutta.—Kansaripara, Chitpur, Bhawanipur.
Burdwan.—Kamarpara (Bonpas), Dainhat, Purbasthali, Matiari.
Bankura.—Bankura, Bishnupur, Patrasayer.
Birbhun.—Dubrajpur, Nalhati.
Hooghly.—Bansberia, Khamarpara.
Midnapore.—Chandrakona, Kharar, Ghatal, Ramjibanpur.
Nadia.—Ranaghat, Santipur.
Murshidabad.—Khagra, Jangipur.
Patna.—Patna.
Gaya.—Nabinagar, Daudnagar, Manpur.
Saran.—Sewan.
Darbhanga.—Jhanjharpur.
Monghyr.—Gidhaur.
Purnea.—Kishenganj.
Cuttack.—Cuttaok.
Puri.—Balkati, Rathijima.
Balasore.—Balasore, Ramna.

Wages organization and in Bengal.

A perusal of the Provincial Monographs in brassware (written by Mr. Dampier for the United Provinces, Mr. Johnstone for the Panjab, and by Mr. Mahon for the Central Provinces) reveals a similarity to the conditions in Bengal, and specially the fact that the industry is not confined to *kansaris* or *thatheras*. All castes appear to

work at it. I found a *kayestha* fashioning a copper dish in North Calcutta; a *teli* manufacturing the well known Chandrakona horn; and in Berhampur I found *bagdis* and *kaiwarttas* handling bell-metal. The workmen are paid in most places at piece-rates per seer and per maund, and can earn from Rs. 15 to Rs. 19 a month in Bengal, and Rs. 10 to Rs. 15 in Bihar; and one hard worker in Bhawanipur, Calcutta, was getting up to Rs. 30. Labour rates vary from $1\frac{1}{2}$ to 5 annas for beaten brass per seer, and 7 to 9 annas for cast metal. From some old figures of 1876, I find the master's return on his outlay for material and labour was 15 per cent. The figures given to me in 1907 in respect of plain beaten brass work showed a return of 20 per cent., but rent had to be paid out of that. This industry is better organized than any other in the province; and it is most highly organized at Ghatal and Kharar in Midnapore district. The masters there are enterprising and wealthy; they obtain the material in economically large quantities, tin from Straits Settlements and copper from Japan and so on; they distribute the labour; they pay by piece-work, and they have a steady demand from Bara Bazar in Calcutta. Krishnamani Paramanik and some others have more than 100 men in their factories. They told me that 4,000 at Kharar out of a population of 9,000 were metal-workers; the whole village resounds with the beat of the hammer on the bell-metal. In Mr. Collin's report, paragraph 13, are mentioned the specialities of various places. To that list may be added Kharar for bell-metal *thalis*; Ghatal for *garhus*; and Kansaripara, Calcutta, for large brass vessels.

Mr. Collin in the Industrial Survey, 1890, recommended: (1) the use of dies for stamping out the metal, (2) better hand lathes, and (3) plate moulding. His view then was, and it is mine:—"Existing processes are costly, and a great saving of hand labour might be effected by machinery." Mr. Bipra Das Pal Chaudhuri of Moheahganj and Calcutta, who studied mechanical engineering at Middlesborough, England, and has had practical experience of brass manufacture, has assured me that there is an opening in brass manufacture for the educated capitalist; for, on the one hand, the cost of raw material is falling, and on the other hand, there is an increased demand for good ware from those who can afford to pay for it. It should be remembered, however, that the copper trade is subject to fluctuations; at present, the American mines have outstripped the demand, and Europe has become "gorged" with copper.

It seems to me that there is room for improvement in the (1) moulding, (2) hammering and (3) lathe work. In moulding, there are three methods for the manufacture of the ordinary *lota*. In Balasore, a layer of wax is placed over an inner core, and an earthen mould over the wax. The wax is melted out and leaves a hollow space. In Bengal proper and at Mirzapur, United Provinces, the outer mould is made first in earth upon any old metal vessel; this mould is divided vertically in two halves, and the imprisoned pattern is then released and the parts joined again. Then the inner core is made by ramming earth inside the earthen outer mould. This core is taken out, scraped and dried, so that there is a space left for the casting. (Compare page 24, Brass Founder's Manual, Weale's Scientific Series.) In Bihar, a reverse method is followed: first, the inner core is laboriously made by additions of earth, and the core turned on an improvised lathe so as to take the shape required: next, the outer mould is made by plastering earth round the core, and the core is thinned again. The Bihar method has the merit that the artificer can make any shape he likes; but that is unnecessary, if articles of standard form are being turned out commercially. When I visited Madras, I found that method which is at present followed in Bihar was formerly followed there, but that it is now considered antiquated. The Orissa method is scientific, but expensive. The wax method is used also in making little models in Sambalpur and Gaya. In Bihar district the inner and outer moulds are kept apart by little nail heads, except at Jamui and Gaya. There is also the method of making models, by making two matrices from a solid pattern, and placing the two together again. This is done at Gaya and Sambalpur.

Now I found only one man in the whole province who was making moulds from a special pattern, and even his next door neighbour was unaware of its merits. This man in Midnapore town had a very thin copper pattern made up of four pieces

Moul.....

which fitted into one another. This he had been using for twenty years, making both the core and the outer mould from the same pattern. This ensured accuracy and saved much time. In Madras I found that aluminium vessels were being cast from a pattern vessel, made in two vertical pieces. From this suggestion I had a pattern *lota* experimentally made for me at Alipur Central Jail. It consists of an ordinary *lota* cut into two vertical halves, the pieces being kept together by four small friction clutches. The Patna braziers admitted to me that this method would be better for them, and I am endeavouring to circulate this pattern.

Stamping from dies.

The next improvement is in the stamping from dies instead of hammering. A hydraulic press worked by hand power, costing about Rs. 300, can give a pressure of 10 tons per square inches and press plates, *thalis* or *rekabis*, up to 9 inches in breadth. I have asked an agent of a firm importing these articles, to show them to the leading manufacturers in Kharar and North Midnapore. The bottom portion of the large *gagras* in Kansaripara, Calcutta, could also perhaps be stamped out by this method. Mr. Bipra Das Pal Chaudhuri and Babu Tarakali Chatterjee started the use of dies many years ago, but gave them up. Dies should be tried again. There will not now be the same prejudice against them.

Lathe work.

In lathe work, it is not necessary that an improvement should necessarily mean steam power. In fact what can be tried first is an improvement on the hand lathe. At present one coolie, pulling a double-ended rope, gives a reciprocating movement to the axle, and there is thus waste of power at every reverse pull. What is used in Madras, might be copied in Bengal as a beginning. A large wooden wheel about the size of a cart wheel is propelled by a coolie holding a crank handle, and by means of a rope passing round the shaft of the lathe, communicates a continuous rotary motion. There is not only saving of time from the omission of the reverse pull, but by this device one coolie can work two lathes. This might be adopted at once in all the places where polishing is done on a factory system such as Khagra, Ghatal and Bankura. There is a further development, on which I am experimenting, in the use of a Romayne punkah machine for working this wheel.

If I had had more opportunity, I would have introduced these myself; I have circulated the ideas amongst many who are actually at work. The officer who may become Superintendent of Industries might very well push these methods by practical example. This will be more satisfactory than any system of teaching. I recommend that the big factories in Kharar, Kamarpara, Dainhat, and at Khagra should adopt power machinery, and that the smaller works should adopt improved hand methods.

Alloy.

In the making of alloys, we have nothing to teach the people, and they are themselves capable of adopting new ideas. For instance, about eight years ago at Bankura, they started making a nickel ware (1 part nickel, $\frac{1}{4}$ or $\frac{1}{2}$ zinc) which has a very fine polish; it is circulated in the neighbouring districts. But there is a want of enterprise in pushing wares in Bengal. Inferior Benares ware was being hawked about on the platform of Asansol station, in a district in which first class ware is produced. Where the work is organized, as at Kharar, the master workers should be induced to take up mechanical power; and at Sewan, at Patna and at Gaya, where the work is not organized, there is an opportunity for educated capitalists to organize the industry. It is not creditable to Bihar districts that there should be so large imports of Mirzapur ware.

Brass locks and telescopes.

Under the head of brass, I should like to notice the exceedingly good workmanship on brass locks turned out by the few families still left at Nataghar, near Sodepur, 24-Parganas, and in the manufacture of Newtonian telescopes carried out by Messrs. S. K. Dhar and Brothers, Hooghly. The present manager is Babu Gokul Nath Dhar. The first are artisans of the blacksmith class, who have once learnt in a European shop accuracy and neat finish and have never forgotten their training, and the other is a member of the educated middle class, who combines scientific knowledge with mechanical skill.

GLASS MAKING.

The constituents of glass are silica and alkali; both of these are obtainable in India, and the fire-clays for the furnaces and fuel are obtainable in this province, yet in spite of these advantages the manufacture of glass has not advanced beyond the rudest stages. The imports from the United Kingdom have remained almost stationary, whereas the imports from foreign countries, especially from Austria-Hungary have steadily been increasing, until in 1906-07 the imports of glass-ware from that country into Calcutta were valued at Rs. 11.8 lakhs out of total glass imports of Rs. 38.2 lakhs. No real progress in glass manufacture.

In 1890 it was recorded that glass-ware was made in Patna, Bhagalpur and in Calcutta. Simple vessels were made in the former place, and glass bangles at Bhagalpur and Patna. The material was river sand and impure carbonate of soda. In 1908 there is practically no manufacture of glass in the province. A few Muhammadans in Harrison Road, Calcutta, and in Lodikatra in Patna City, fashion simple articles by melting down broken glass. In Calcutta coarse pressed ware in the shape of ink bottles, medicine phials and small lamps are turned out by the thousands. The methods and patterns are of the simplest character.

In Upper India, the manufacture of glass on a commercial scale has been attempted with some success at Rajpur, near Dehra Dun; at Ambala City; at Sekendra, Aligarh district; at Ahmedabad; and at Firozabad in Agra district. The Upper India Glass Works of Ambala City have a sample room in Harrison Road, Calcutta, and the factories of Rajpur, Sekendra and Ambala, as well as the Patna workmen sent exhibits to the Calcutta Exhibition of 1906. Now in Bengal proper there have been the Pioneer Glass Manufacturing Company, Limited, of Titagarh which worked from 1890 to 1899, and the works of the Indian Glass Company and later of the Bengal Glass Company at Sodepur from 1898 to 1902, both in the 24-Parganas district. I have visited the buildings of these two factories, now shut down, and have enquired regarding the cause of their failures, whereby several lakhs of rupees have apparently been spent to no purpose. The installation at Sodepur was found to have been most elaborate, while that at Titagarh was plainer but extensive. There were many minor causes; but the difficulty common to both was the supply of skilled labour for glass blowing in the climate of Bengal in the vicinity of Calcutta. For instance, it seems unfortunate that it should have been at the beginning of the hot weather in the valley of the Hooghly that the freshly imported European craftsmen should have started in a tropical country the trying occupation of glass blowing. It will be seen later that the Bombay expert, Mr. Wagle, has given his views regarding the difficulties and failures in Bengal and Upper India, and has held that many of the failures were preventable. The same has been said in Mr. Dobb's Monograph for the United Provinces (1895) as regards the experiments made at Jhelum (1877), Alipur (1879) and Bhagalpur (1882), all in Upper India. Attempts in Upper India.

In 1900 the Bengal Government sent round samples of sand from the south of France and enquired whether similar sand for glass manufacture was available in Bengal. The Rajmahal sand mixed with potter's clay was found similar. Then in 1901 Sir Cecil Stevens suggested that the question of glass-making in Bengal might be investigated. Mr. N. B. Wagle, B.A. of Bombay, who had spent four years in Europe in practical glass-making, having worked as a journeyman in Blackfriars Glass Works in London and having studied at the University College, and at Newcastle, was appointed to prepare a report and to submit proposals for starting glass manufacture in Bengal. He had asked for Government assistance to tide over the interval of experience and research. His deputation extended from January to May 1904; but he did not submit his report until Government took strong measures. It was received two years afterwards, in February 1906. In the meantime Mr. Wagle had taken to other industries in the Gwalior State. I made an attempt to communicate with Mr. Wagle, but was informed from Gwalior that he had left India; and so his proposals for floating a joint-stock company could not be discussed with him. Nothing definite has yet been done on the basis of Mr. Wagle's report, but the Mr. Wagle's enquiries in Bengal in 1904.

subject came before a conference which was held in March 1906 to consider a proposal for a technical college in Bengal. Raja Pyari Mohan Mukharji thought that there should be a class for glass-making, preferably at Barakar. The conference recommended that the industry should be encouraged and that Government grants be offered to persons already engaged in it to enable them to proceed to Europe or America to improve their knowledge and skill and that assistance be given to them for finding a market for the sale of their manufactures. [Mr. Oldham's letter dated 2nd April 1906, paragraphs 10 and 16 (iii).] These are my own independent recommendations, as will appear below.

- Mr. Wagle's report. Mr. Wagle's report is full and interesting ; but, as far as Bengal is concerned, the prospects of glass manufacture do not seem hopeful. The report should be read by itself, but for the present purpose it may be summarised as follows :—raw material,—available in Bengal ; labour,—difficult to procure ; previous attempts,—unsuccessful, but failures due to preventable causes ; market,—local productions should be only plain and simple, as they would have to compete with the cost-price dumpings of the Belgium and Austrian manufactures. My own enquiries confirm these conclusions.
- Raw materials. Quartz sand is available at Rajmahal with over 90 per cent. of silicic acid, and at Barakar, at Giridih and at Titagarh with over 80 per cent. of silicic acid. The Titagarh factory used Hooghly river sand, but it has over 3 per cent. of oxide of iron. The Sodepur factory imported Belgium sand with 98 per cent. of silicic acid and obtained quartz from near Sini with 97 per cent. of silicic acid. The perfect sand must be fine, uniform, angular and white. Alkalis have to be purchased in Bengal proper. In the United Provinces the existence of *reh* in the soil is more convenient, but the enquiry made by the Government of India about 1890 disclosed the fact that *reh* could not give pure glass, yet that in a good furnace it could give superior bottle glass. (See Agricultural Ledger No. 5 of 1902 regarding Alkali Compounds).
- Labour. The supply of labour is really the most important item ; a sufficient number of skilled hands and foremen from the old factories could be collected for a new factory ; but experience has shown that the climate of the plains of Bengal handicaps the workmen. The up-country men are stronger than Bengali workmen, but not so good.
- Items of manufacture. As for manufacture, the Sodepur firm selected soda-water bottles ; the Titagarh firm undertook tumblers and bottles, at one time making in a day 10,000 bottles of all sorts. As Mr. Wagle has explained, the pressed ware is the kind which requires least skilled labour and this should be taken up by any new factory, though it has to meet the competition of the articles of third quality which are exported at nearly cost price from Austria and Belgium. This is the real difficulty to which Mr. Wagle alludes in pages 23-24 of his report. Government in the Medical Store Department import a considerable quantity of plain glassware, which could be made in India, and, if the Indian article be, quality for quality, the more favourable in price, the Director would prefer to buy, and has authority to buy, the locally made articles. New American machines can, however, turn out twelve bottles a minute ; and can press glass with great economy in portable hinged moulds.
- Proposals in Bengal. Babu Bihari Lal Pain of 71, Phear Lane, Calcutta, who was one of the Directors of the Pioneer Glass Company at Titagarh, says he would be prepared to start again if Government would assist him to obtain an expert, and if Government give him patronage in the demand of Government stores. Messrs. F. W. Heilgers & Co., Calcutta, have no present intention of making a fresh start with the Sodepur factory. Mr. Saligram Singh, of Ghaighat, Benares City, who has studied glassware in Tokyo, Japan, is trying to float a company to start a glass manufactory near Barakar to prepare block glass for bangle-making and to prepare bottles and phials. This Barakar was the site which Mr. Wagle had proposed when considering the opening of a glass factory in Bengal. From the monographs on the subject we can glean some items of information for comparison's sake. Mr. T. N. Mukharji (1895) said that glass-ware in Bengal was made only from English imported glass. In the Panjab, Mr. C. J. Hallifax (1892) wrote that only *churis* and bottles and chimneys
- Suggestions from various reports.

were made from glass which was locally manufactured, but that only broken glass was used; and that it was an unimportant industry which could only be effectively and economically improved by manufacture on a large and permanent scale, but that it would continue as long as there was a demand for native-made *churis*. The story is the same in the Central Provinces (1905): only *churis* are made, and made from material obtained from the United Provinces. Mr. Dobb's monograph for the United Provinces (1895) suggested that what is wanted is that two practical glass blowers should proceed to a glass factory in England and in Wurtemberg, should return with a complete set of tools and appliances, and should be set up by Government as instructors. These views may be considered along with the recommendations of Mr. Wagle, which were: (1) imposition of a protective duty on glass imports; and (2) the buying over of one of the old concerns and its management under State guidance until it could be handed over to a private company. He also proposed: (a) certain concessions in railway freight; (b) Government patronage of products; and (c) free use of Government land.

In India people are accustomed to get much done for them by Government; there is a fair cleavage of opinion as to whether Government should pioneer at all. But if Government is to pioneer at all, on full consideration I do not think that Government is justified in selecting this subject of glass. Compared with leather, for instance, it is less important. India cannot hope to make plate glass: and the market for articles for domestic ware is not so wide as in Europe, as brass and earthen vessels are the vessels for which the people generally have an affection. Mr. Wagle's expectation that glass-ware will supplant metal ware (page 25) is, I am afraid, not likely to be realized. But though Government should not pioneer, and admittedly the previous failures in private enterprise are discouraging, yet the private capitalist even in Bengal has an opening. It is possible to make glass in Bengal, and there is a market for a certain quality; but the real difficulty is in the acquisition of skilled labour. If an arrangement could be made with the syndicate who control the use of the Owen's bottle-blowing machine, this difficulty could be overcome to some extent. I have consulted both those who started the original Pioneer Glass Factory and those who use glass commercially; they assure me that a glass factory should pay, that a little skilled labour from the Continent is necessary for a short time, and that bottles and pressed goods could be turned out at a profit. Hence this industry is recommended to capitalists. Mr. Alakh Dhari, the Secretary of the Ambala Works, in his paper before the Industrial Conference of 1906, emphasized the study of the business and commercial aspects of the industry. In the first place, the neighbourhood of Barakar, which Mr. S. N. Singh has selected, is probably as good as could be selected in Bengal. The climate is not as trying as in the neighbourhood of Calcutta, and Sini quartz, Damodar sand, and coal are obtainable. At the same time, Titagarh has its advantages, as it is close to the great distributing centre. As for the alkalis, both carbonate of soda and carbonate of potash are found in India, and the suggestion of utilising waste products from gas works and from the increasing number of soap factories deserves separate research. In the second place, Mr. S. N. Singh has had an expert's training, and his services should be utilized by some of his countrymen. It is not likely that amongst the new subjects to be selected for the Government of India technical scholarships, the art of glass-making may be included; but the Association for the Advancement of Scientific and Industrial Education of Indians might very well select glass-making as a subject. The record of the work of the Association is such (Special Report, Part I, Chapter V) that the Bengal Government might make a grant to the Association for this purpose, in furtherance of the proposals of the conference of March 1906; e.g., Rs. 50 per month for two years. Out of the first 48 names in their list from 1905 to 1907 there is only one, Mr. W. N. Chaudhuri, who has taken up glass as a special subject, and that at the Cothen Polytechnic in Germany. He will probably return to India in 1909. Amongst the next list of 80 names for 1908 is one Upendra Nath Roy, of Chittagong, who has taken up the subject of glass manufacture. In the third place, the requirements of Government in the Medical Store and Telegraph Departments, and possibly in other departments, such as State Railways, could be met from locally-made articles. The management of the factory should ascertain the precise specification

Recommendations.

required by these departments, and thus give quotations for each class of article landed in Calcutta. For example, I have learnt from the Director of Medical Stores that he would gladly give orders locally; and that he has an allotment for local purchases. There seems to be in India a market for 4, 6, and 8 oz. medicine bottles round and octagonal and for larger bottles 20 and 26 oz. If the local factory would supply the requirements of the Director of Medical Stores at rates which were no greater than the rates for imported goods, Government should be prepared to insist that the local goods were purchased. Government patronage cannot, however, very well go beyond this. A business-like local factory, which made articles within its capacity, should however expect in addition the patronage of wholesale chemists and should be able to find a market for the ware amongst the Muhammadan population. Finally, I think that it is a pity that greater publicity is not given to information such as Mr. Wagle's report: it is even now not directly available to the private capitalist. It has been suggested to me that further experiments should be made; but I do not think this necessary. Such experiments would not cost less than Rs. 15,000: the result would be intelligible only to chemical experts. On the other hand, there seems to be no doubt that, given good material and suitable furnaces and annealing chambers, glass can be made in Bengal. As to whether it can be made at a commercial profit has not yet been properly tested, for neither the methods used nor the product selected have been appropriate.

I do not recommend a protective duty or pioneering in the case of the glass industry; but I suggest that encouragement in the way of Government patronage be fully given to any manufactory in Bengal which can make up to specification. I have endeavoured to explain to those concerned what material can be made in Bengal, and what are the requirements of Government departments, and to bring together expert and capitalist.

CHEMICAL INDUSTRIES.

Local manufacturing firms.

I have long thought that in analytical chemistry there is an opening for educated Bengal, provided accuracy could be obtained; and also in the manufacture of chemicals, if business enterprise accompany knowledge. There are no local manufacturers of chemicals beyond Messrs. D. Waldie & Co., of Konnagar, the Indian Pharmaceutical Works, 13, Upper Circular Road, and the Bengal Chemical and Pharmaceutical Works, Limited, 91, Upper Circular Road, Calcutta. The first well-known firm is mentioned by Mr. Collin as a manufacturer of acids, which it still is. The sulphur for the sulphuric acid has however to come all the way from Sicily. The firm also manufactures various salts, sulphates, manures, disinfectants and general chemicals. The factory was formerly in Chitpur: for 13 years it has been at Konnagar; although it is what might be called a *swadeshi* factory, yet it suffers from the lack of many items. Wooden barrels cannot be made out here and iron drums are indifferently made: bottles have to be imported: the only acid-proof jars are those that come from Doulton & Co., of Lambeth. Local enterprise might practice on these items: the firm would gladly take local glass bottles and local acid-proof jars if they could be made. The Indian Pharmaceutical Works make drugs from indigenous articles by means of hand machines.

The Bengal Chemical and Pharmaceutical Works, Limited, is one of the most go-ahead young enterprises in Bengal. Dr. Parfulla Chandra Ray, D.Sc., F.C.S., started it as a small private concern in Lower Circular Road about 15 years ago and made drugs from indigenous materials. About six years ago it was made into a limited liability company, with a capital of two lakhs. Many of the leading chemists in Calcutta are share-holders. It has now a well-thought-out and well-managed factory with about 70 workmen, at 82, Maniktola Main Road. Babu Rajshekhhar Bose, the manager, is an M. A. in chemistry. The variety of manufactures is considerable. Besides the manufacture of drugs and acids, the manufacture of laboratory apparatus, which requires skilled craftsmen in wood and metal, has been taken up. The latest development is in perfumes. The enterprise shows

sign of resourcefulness and business capacity, which should be an object lesson to capitalists of this province.

The great difficulty with which the chemical industry has to contend is in Industrial alcohol connection with industrial alcohol. It is occasionally mentioned in the press that the manufacture of crude alcohol for industrial purposes under proper Government regulations would be a fine *swadeshi* industry. Alcohol is required: (a) for chemical transformation, as in the manufacture of iodoform; (b) as a solvent or precipitant, as in the case of papain; (c) for burning; and (d) for the finished product, as in the case of liquid extracts, tinctures, essences and liniments. Section V of the Board's Rules in the Excise Manual is prepared on the assumption that spirit prepared after the English fashion is for direct human consumption. Section IX deals with the making of spirit unfit for human consumption by the admixture either of caoutchine or of naphtha. Messrs. D. Waldie & Co. have a private distillery at Konnagar. The Bengal Chemical and Pharmaceutical Company at Maniktola purchase imported spirits 68° over proof at Re. 1-10 per gallon, which becomes Rs. 13-4 after duty has been paid: so the duty is nearly eight times the prime cost. This spirit is used in preparing tinctures, extracts and ether. At present the Government is willing to allow the spirit to be manufactured or stored in a bonded warehouse: full duty to be paid when it is removed to the factory, and refund to be granted of the duty of the amount lost in course of manufacture, after keeping only 5 per cent. *ad valorem* duty. The Bengal Chemical and Pharmaceutical Company ask that they be allowed to manufacture in a bonded factory under supervision of excise officers, and to pay after manufacture the full duty on the spirit contained in the preparation, and 5 per cent. *ad valorem* on the amount of spirit lost. If it is the fact, as is asserted, that this concession is allowed to manufacturers in Europe, it is for consideration whether it may be allowed here. Government does not gain interest on the excess temporarily handled, whereas the private company feels the loss of the capital locked up in duty. From my enquiries in the Excise Department, I learn, however, that the request of the firm goes beyond what is allowed in Europe.

I think that special concessions are required for the use of industrial alcohol in the lac trade. This will be mentioned later.

I find that Indian analysts are employed in the Konnagar works and in Analytical chemical laboratories. There is the patient drudge who cannot get more than a clerk's pay. There are also highly skilled experts, who can command high salaries. Still in the best laboratories in Calcutta, the Bengali analyst is not yet more than second rate. The graduates in chemistry should take up this work instead of becoming, as so many do, teachers in chemistry.

Mr. Puran Chand in the paper at the Benares Industrial Conference in 1905 urged the necessity of experiments in industrial chemistry. I trust that the objections to the industrial chemistry classes which the Bengal Government are desirous of opening at Sibpur College, may be overcome and that these classes furnish the nucleus of a technological institute in Calcutta. I have dealt with this subject in pages 10 and 31 of Part I of this Special Report.

DYEING AND PRINTING.

In 1883 Dr. McCann published an account of the dyes and tans of Bengal, the history of which goes back to 1875, when the Secretary of State at the instance of Mr. Thomas Wardle ordered an enquiry into dye stuffs of Indian growth and production. The memorandum prepared in accordance with those orders by Mr. Liotard in 1880 excluded Bengal. The report for Bengal was not issued till 1883, but unfortunately recited only information collected in 1875-77. There is, however, a wealth of practical information about dyeing as well as about dyes in Dr. McCann's memoir. There is a tendency to depreciate these old compilations simply because they

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are old. The Provincial Monograph on dyes was written in 1896, by Mr. N. N. Banerjei, whose instructions were to deal with indigenous processes, rather than with products and materials. Mr. Collin in 1890 had stated that the use of vegetable dyes was becoming uncommon. In 1896 it was stated that the importation of cheap European goods and European aniline dyes was proving fatal to the indigenous industry. At the same time Mr. Banerjei pointed out the want of ingenuity in the production of colours and the want of assistance from capitalists. In 1908 the only place where I found the industry flourishing was in the Serampore subdivision; and to a lesser extent in Patna, in Saran, and in Bhagalpur. Mr. Banerjei said that the industry had become extinct in Northern and Eastern Bengal and in Orissa. The imports of aniline dyes from Belgium ports to Calcutta have increased steadily as follows:—

1902-03.	1903-04.	1904-05.	1905-06.	1906-07.
1.69	2.26	3.79	3.73	6.70 lakhs.

On the other side of the picture is the following interesting record of Calcutta's export of indigenous dyes—the figures are in lakhs of rupees:—

	1902-03.	1903-04.	1904-05.	1905-06.	1906-07.
Indigo ...	65.97	60.13	56.07	41.03	45.07
Myrobalans ...	2.95	4.76	6.85	13.67	11.75
Safflower ...	0.55	0.66	0.32	0.30	0.50
Turmeric ...	1.32	0.68	0.59	1.21	1.17

In Bihar districts I have found a desire on the part of the country dyer to take up natural indigo; the indigo now produced is finding a local market at about Rs. 120 a maund for its inferior qualities. The decrease in the number of factories has diminished the amount which filtered to the bazar through petty pilfering. The country dyer is content with a quality which the Calcutta broker would despise.

Prospects for
future enterprise.

Even in the dyeing of foreign materials there is room for the capitalist in Bengal. Bengal imported in 1906-07, 204 lakhs of coloured piece-goods. The Bengal Laxmi Cotton Mills consume Rs. 3,000 of dyed yarns monthly. It is calculated that there is a profit of two annas a pound in the dyeing of yarn. Bengal has, moreover, many dyeing materials; Dr. McCann's book names 18 giving red dyes, 21 giving yellow dyes, 2 giving blue dyes, 20 giving brown and 4 giving green dyes. Mr. Banerjei's monograph mentions 53 indigenous dye-producing plants. There is a prospect of the capitalist succeeding in dyeing piece-goods by means of indigenous materials, if up-to-date methods are used. It is unfortunate that the Bengal Dye Works, Limited, was not floated. It was to have engaged the services of Mr. G. C. Sen, an expert in dyeing and colour chemistry, who returned in 1907 after study in Leeds and in Germany.

Fastness
of
dyes.

Regarding the fastness of indigenous and imported dyes, Mr. E. R. Watson, F.C.S., has made scientific experiments from which it will appear that bakam (*cassalpinia sappan*) manjista (*rubia cordifolia*) and catechu (*acacia catechu*) compare very favourably with the great majority of the synthetic products; but that, contrary to accepted opinions, the majority of indigenous dyes give fugitive dyeings. Other information about catechu is to be found in the Agriculture Ledgers No. 1 of 1895 and No. 35 of 1896. It is well known that any after-treatment of copper sulphate will increase fastness in certain cases; and there is a new German patent for adding the copper to the printing colour itself in the form of an-alkaline solution. These facts are worthy of attention. I found that even in the mixing of the European chemical powders, the indigenous dyer is careless and wasteful, because he uses more than he need do if he carefully followed the instruction

on the tin boxes. In Bihar districts I found that the tins bore the name of Bombay importing firms. The use of the lac dye had become unprofitable even in 1890.

The colour printer is even more elusive than the dyer. He is fairly prosperous at Serampur, where he prepares handkerchiefs which are exported, as Mr. Collin said, to Rangoon, Madras, and Mauritius. At Madhubani on the other hand there was only one printer in the whole bazar. The calico printing is also done in North Calcutta and at Hajipur. As a rule dyers and printers simply colour the articles given to them: the Serampur printers are an exception. The wooden blocks for printing are made at Nawabganj near Barrackpore, at Patna, Benares, and at Samagaddi in the Nepal Terai.

There is an opening here for the Indian capitalist who would organise the business in Serampur or in the Bihar districts.

PENCIL AND BUTTON MANUFACTURE.

This is to be taken up by the Small Industries Development Company, under two of the students who were sent abroad by the Scientific and Industrial Advancement Association (see *Industrial India*, Volume III, February 1906). The Bengal Button Factory has been started at 130, Bagmari Road, Calcutta, under one who has studied the industry in Osaka, Japan. A new industry.

INK MANUFACTURE.

Since 1890 considerable improvement has been made and there are several manufactories of writing ink in Calcutta. It is an industry which requires little capital. Mr. J. P. Bose studied the manufacture of printing ink in Japan, and has now a manufactory in Ultadanga financed by a Mymensingh capitalist. Development since 1890.

Babu Srish Chandra Dutta, joint-secretary of the Indian Industrial Association lectured in 1894 on printing ink manufacture from lampblack and linseed oil varnish. He was perhaps the first Indian manufacturing chemist (see proceedings of Indian Industrial Association for the year 1896).

PAPER MAKING.

There has been a further decadence since 1890 in the indigenous manufacture. Hand-made paper is still produced at Hooghly district, principally at Mahanad Gosainmalpara, Neala and Ballidewanganj by a class of Muhammadans known as *kagjis*. They are fast dying out. Their paper has a market at Rs. 10 per 100 sheets amongst Calcutta traders for account books. The same class is found at Mainan in Howrah district and at Krishtopore and Srirampore in the Jangipur subdivision of the Murshidabad district. The manufacture ceased five years ago at Naariganj in Shahabad, and in Cuttaok it has practically ceased. (See the notes on *champat* paper in Banerjei's Report on the District of Cuttaok, page 171, Calcutta, 1893, and O'Malley's Gazetteer of Cuttaok District, page 134; also on *basota* paper, O'Malley's Gazetteer of Shahabad, page 93). The indigenous industry.

A practical manufacturer writing in May 1907, said that Indian mills could make profitably a large proportion of imported paper, if new up-to-date mills were furnished with the most modern plant for effecting economy in manufacture. The Maharaja of Mourbhanj is anxious to lay down such a mill. The prospectus for the Mourbhanj Paper Mills Company with a capital of 16 lakhs has been issued, of which the Maharaja will subscribe one-third. The works are to be at Baripada on the river Boorabolang. The material is to be *sabai* grass, which can be obtained locally. In Bengal the only paper mills are the Titaghar Paper Mills Company, Limited, which has acquired the Imperial Paper Mills and the Bally Paper Mills, and the Bengal Paper Mills Company, Limited, of Raniganj. The former gave a dividend of 2½ per cent. on the second half year of 1907. I am informed that a leading Indian publisher complains of the quality of the Indian paper for publishing purposes. In The factory industry.

1906-07, the Government of Bengal purchased 5½ lakhs of paper in India. This may be compared with the local purchases in lakhs for each of the previous ten years since 1896-97:—4·55, 5·11, 5·41, 4·42, 4·97, 5·59, 6·08, 4·51, 4·54 and 4·52 lakhs. The imports by sea into Calcutta were in 1906-07:—printing paper, 8 lakhs; writing paper, 5½ lakhs; other kinds, 4½ lakhs. The Bengal Paper Mills of Raniganj employed over one thousand work-people, and turned out 11½ lakhs in 1905-06, and over 17 lakhs in 1906-07. The two mills at Titagarh and Kankinara under the Titagarh Paper Mills Company, turned out 28½ lakhs in 1905-06 and 30 lakhs in 1906-07. These mills manufacture white printing, *badami*, coloured printing, cartridge, blotting paper and foolscap out of rags, grass, straw, jute, old gunnies, hemp baggings, ropes and waste paper. The wood pulp used abroad gives a better finish than these materials. *Sabai* grass for the mills comes principally from Sahebganj in Rajmahal subdivision at an average rate of Re. 1-4 a maund.

MATCH MANUFACTURE.

New factories.

About eight years ago there was an attempt made to start the local manufacture of matches in Bengal. Factories have been started at Ahmedabad, Kotah, and in the Punjab. There is now one manufactory working in Bengal since January 1907, the Bande Mataram Factory at 38, Russa Road, Tollyganj, belonging to Dr. Rash Behari Ghosh and Babu Sailendra Kumar Mitra. The assistants are Messrs. P. C. Roy and A. P. Ghose, who have returned from Japan. The wood used is the Sundarbans "genwa" (*Excoecoria Agallocha*), a soft wood used for cheap house furniture in Calcutta. They tell me that they had previously experimented with many others. After examining their machinery, I think that the unevenness of the match splints is due to the wood and not to the machinery. The dipping machines are made by Babu Charu Chandra Mullik of Bankipur. Rai Sahib Upendranath Kanjilal, F.L.S., read a paper on the Indian woods suitable for match-making at the Calcutta Industrial Conference of 1906; and an account of the manufacture of matches compiled by Babu Hari Das Chatterjee is given in *Industrial India*, Vol. III, April 1906. Another factory has not yet started: the Oriental Match Manufacturing Company, of 124, Gunning Street, Calcutta, with a nominal capital of one lakh. A match factory is being started at Tarikere in Mysore by Mr. V. G. Joshi of Poona. The Berar Match Manufacturing Company of Ellichpur, Central Provinces, with a capital of one lakh, is using *salai* and *maharuk* woods (see Mr. C. E. Low's Note on the Match Industry).

SOAP MANUFACTURE.

An attractive industry.

The manufacture of soap has recently advanced and is attractive to Indian capitalists. The example of the North-West Soap Company of Meerut, who started at Garden Reach, Calcutta, under European supervision was helpful. At the Calcutta exhibition of 1906 there were exhibits from four Bengal companies; there are now only three besides the English company, namely, the Bengal Soap Company, 54-1 Mechua-bazar Street; the Oriental Soap Factory, Goabagan, and Dr. Nil Ratan Sircar's National Soap Factory, 92, Upper Circular Road, Calcutta. They have all taken to highly scented, highly coloured toilet soaps, for which I find there is a large and expanding demand. The Bihar Pioneer Soap Manufacturing Company, of Dinapore exhibited at the Bankipore exhibition of 1908. Babu Kamlanand Singh of Srinagar started a factory at Purnea, but it was closed in 1906. Mr. E. R. Watson, F.C.S., has made an analysis of the *svadeshi* soaps (*Statesman*, February 5th, 1907). European soap of the highest quality has 93 per cent. of pure soap. Six samples of *svadeshi* soap showed proportions varying from 66 per cent. to 91 per cent. Three were classed very good, but one was found to be grossly adulterated with 20 per cent. of starchy matter.

There would appear to be an opening for the commercial manufacture of the common *dhobi's* soap, but one of the ingredients is dear, because it is used as an adulterant of *ghi*. Indigenous soap manufacture is nowhere done on a factory scale.

Patna soap was formerly used all over Bengal. The ingredients are given in Dr. Buchanan Hamilton's Account of Patna District (Martin's Eastern India, Vol. I, page 329).

BRUSH MAKING.

Mr. Collin said that this was a new trade, and that the demand was increasing. Brushes continue to be manufactured at Khurda, Panihati and Sukohar.

PERFUMERY.

Much has been written lately about the prospects of perfume manufacture in India. The local manufacture of an expressed oil impregnated with the odour of the *chambeli* flower has been carried on at Fatwah in the Barh subdivision of Patna district for over a century. There are now only twelve families, and the industry is decaying. Mr. D. Hooper, F.C.S., of the Indian Museum, gave a paper on Indian essential oils at the Calcutta Industrial Conference, 1906, which gives information for those desirous of starting in Bengal. Mr. J. N. Banerjee stated at the same conference that in Bengal there are grasses from which the essence of lemon and peppermint are extracted. This subject deserves more attention and enquiry in Bengal; for other provinces seem to be more fortunate in possessing the raw materials. I find it on record, however, that there is a good opening for a perfume factory equipped with up-to-date machinery (see *The Indian Age*, March 1908, page 18). Moreover, if there is to be any export (at present only $\frac{1}{2}$ lakh is exported), the scents for export must be made less heavy, by the use of some other than gingelli oil. Further development possible.

OTHER INDUSTRIES.

No special remarks beyond those of Mr. Collin are required on the following:— Boat-building, book-binding, electro-plating, fishing-hooks, gilding, masonry work, musical instruments, tape-making, tin-foil, watch-repairing.

CHAPTER IV.

MINING INDUSTRIES.

Mining industries are principally in the Burdwan and Chota Nagpur Divisions.

COAL.

The industry of coal mining has advanced with enormous strides since 1890. In that year Mr. Collin described the industry as still in its infancy and as growing. The output of coal in Bengal has risen from 1½ million tons in 1887 to 8½ million tons in 1906 and over 10 million tons in 1907. At the end of the year 1907 there were 81 companies, with a nominal capital of 411 lakhs; of these companies, 38 were floated in 1907; none pay less than 10 per cent. and some very much more. The average number of workpeople employed in the Giridih, Jherriah, Asansol and Ranigunge fields was nearly 120,000 in 1907. Another field is being opened in the Palamau district, and the industry has got great possibilities in Birbham district. There has been an increased expenditure of native capital in the development of mining. It is a matter of common knowledge that the supply has not been able to cope with the demand both for local consumption and for export, notwithstanding the great extension of the industry. It is the view of the Bengal Chamber of Commerce that the position of the coal industry is so strong and the prospects are so good, that it seems to be likely to be by far the best and most lucrative opening for young Indian students. The Superintendent of the Bengal Coal Company, Limited, Mr. H. H. Macleod, has stated that it is the finest of all the Enormous increase in output and consumption.

svadeshi industries, and that it has a magnificent future before it. The attention, therefore, of the middle class youth is directed to the opportunities which exist at Sibpur and in the mining districts, as detailed on page 14 of the report on technical education, for obtaining skilled knowledge in practical and theoretical mining and to the probability of obtaining employment in the mining industry. The actual labourers earn four annas to ten annas a day. They are in the fortunate position that the demand is in excess of the supply. It is not improbable that this may lead to the introduction of mechanical plant for coal cutting. A system of mechanical sifting has already been introduced at one of the East Indian Railway Company pits in the Giridih field.

MICA.

A monopoly of Bengal. Mica is worked principally in the districts of Gaya, Hazaribagh and Monghyr. The output has increased from 87 tons in 1887 to 2,018 tons in 1908. The export has reached to 23 lakhs, more than half of which is sent to England. Bengal is reaping the advantage from the fact that mica is the best non-conductor of electricity known. There was a recent fall through the American collapse, but still there is a firm demand owing to increased requirements. In the Hazaribagh district, in the vicinity of Koderma, mica gives employment to more than 6,000 people. In mica mining there used to be a great deal of wastage, but an invention for compressing broken mica into block form, called micanite, has been of great service. In this industry also there is an opening for Indian youths who will combine scientific training with practical experience. One producer informed me that the industry suffered from the want of accurate knowledge of the requirements of the European and American manufacturers. There is evidently some doubt on the subject as will appear from the interesting correspondence published in the Agricultural Ledger No. 24 of 1900.

OTHER MINERALS.

In parts of Manbhum, Singhbhum and Ranohi districts, plates, bowls and the like are manufactured on a small scale from soap-stone. The quarries give employment to about 200 labourers in Manbhum and to a similar number in the Singhbhum district. Iron stone is worked in Dhalbhum within the Singhbhum district by the Bengal Iron and Steel Company. The outturn was over 7,000 tons in 1906. In Hazaribagh the industry is insignificant. Sambalpur district turns out varying amounts of iron ore; in 1907 the amount was 800 tons. The smelting of iron for local use is carried on to a small extent in few places in the Sonthal Parganas. The Tata Iron and Steel Company have secured the rights to iron ore within Mourbhanj, one of the Orissa Tributary States. Messrs. Ambler & Co. turned out in 1906-07 as much as 200 tons from their slate concerns in Monghyr district. Manganese has been worked in the Singhbhum district.

Requisites for any improvement. The first requisite for the indigenous development of the mineral industries is patient and scientific prospecting. This requires the bold outlay of capital, of which there may be no prospect of immediate return. The next is that there must be as greater bias on the part of under-graduates to the study of the sciences concerned, such as geology and metallurgy. In March 1908, 1,200 students appeared for the examination of the Calcutta University for the B. A. degree, and only 38 for the B. Sc. degree.

CHAPTER V.

INDUSTRIAL ARTS.

Position and possibilities of industrial arts in Bengal. THE artistic industries of Bengal province are not supported as they ought to be. Much of the patronage whereby some of the arts have been kept alive is from the European residents. As Mr. Collin said, Indian noblemen appear to be more inclined to patronise foreign productions than the arts of the country. Although the fact may

be deplored, yet it is only natural that each community should be attracted by the arts of the other. Indigenous artistic industries at present suffer from want of patronage and want of publicity; and any real encouragement must consist in providing publicity and a ready sale for the articles of the best type. The Indian Museum in Calcutta is imperial; Bengal has no provincial museum similar to those in Lahore, Lucknow and Madras. At the museum of the School of Art there should be an art depôt, where should be exhibited samples of the best work of Bengal craftsmen, with the names and addresses of the makers and the market price. If Government are not prepared to subsidize a private art-ware depôt in Calcutta, I recommend that Government itself should maintain at the School of Art a model art-ware depôt. This is done with success in Lahore and Lucknow. Moreover, if similar depôts were started at divisional head-quarters under the auspices of local enthusiasts, some good might be done. At my request, grants have been given to local bodies at Bankura and Bankipore. The subject has also been discussed in pages 19 and 31 of my report on technical education.

GOLD AND SILVER WORK.

The monograph on gold and silver work in the Bengal Presidency by Mr. D. N. Mookerji (1905) describes the articles made in Cuttack, Dacca, Murshidabad, Patna and Monghyr districts. Mr. Collin said that native jewellery, so long as it was kept to country designs, was of great merit, but there was a tendency to imitate English designs. This tendency has not diminished, but indigenous ornamentation is being placed on articles meant for European use. Such for example is the work turned out by Girish Chandra Dutt & Sons, of Bhawanipur, Calcutta. This firm is enterprising in that it uses Canning's polishing calico mops attached to the boss of an electrically driven motor lathe. The Cuttack silver ware is known outside Bengal principally for the delicate filigree work, which however is only carried on in the Cuttack town itself. This form of the art received considerable development from the Orissa Art Union Factory started by Mr. Madhusudan Das, C.I.E., who has organized on a factory basis with subdivision of labour the hereditary skill of the native craftsman. Mr. Das told me that he was anxious to give up his factory as it was not a commercial success. The number of his employees has diminished and he has given up the Calcutta agencies. Mr. Das lamented the deterioration in quality of the work in precious metals, and the difficulty of obtaining a market for the produce. But some central sale emporium in Calcutta and the issue of catalogues are necessary for maintaining and increasing the market for such wares. Articles of personal adornment of traditional design, as well as articles of European pattern, like picture frames and card cases, are prepared at Cuttack.

Degradation of indigenous design.

In the matter of designs Mr. Das has recruited a man from the School of Art in Madras, but as some of the latter's designs include in one piece of work a cherub with wings, a peacock and a Greek god, his skill as a teacher of oriental designs may be open to question. If Mr. Das had a show-room in Calcutta in addition to the one in Cuttack, his goods would obtain the patronage which they deserve. As regards the other places, the Kharagpur fish made of overlapping thinly beaten-out ovals is, of course, well known; but the number of workers in Monghyr district is decreasing. In Murshidabad the Nawab Bahadur informed me that malaria was playing sad havoc with such industries as still do exist. The centres of the craft are at Khagra, Kandi, Pulinda and Bhagirathpore.

Gold and silver smiths are extensively found in the Patna district. Generally we find that the traditional types of Indian jewellery are giving way to the jewellery of European patterns amongst the better classes. Mr. Mookerji had no suggestions to make for the improvement of this art.

IVORY CARVING.

This art was practised at Barabari in Rangpur district and in Kendrapara in Cuttack district, as well as in Murshidabad, according to Mr. Collin's report.

A dying art.

Mr. G. C. Dutt in his monograph of 1901 stated that the industry had disappeared at the former place in Rangpur district, and from enquiry I learn that it no longer exists in Cuttack district. The Chiefs of the Orissa Tributary States appear to have retained carvers who reached a high standard of proficiency: beautiful examples, fifty years old, were sent by the Chief of the Nayagarh State to the Delhi Exhibition of 1903. There is a little unpretentious work in ivory done in Harkata Lane, off Bowbazar, in Calcutta. The ivory is obtained from the Orissa Tributary States. Thirty-five years ago there were no fewer than fifty families of carvers at Mathra, one of the several centres, in the Murshidabad district, but now there are not more than twenty carvers in the whole district, the best of whom are working at Khagra. The Bhaskars of Murshidabad are professional image makers, who during the declining days of the Nawab took to ivory carving. In 1888 the Murshidabad workers were declared to be perhaps the best in India, "fully displaying the finish, minuteness and ingenuity characteristic of all true Indian art." According to Sir George Watt they met a local demand for certain representations of the gods, but for some years past they have produced an assortment of table ornaments mainly for the European market. Murshidabad ivory work is remarkable for the absence of joins. In Royle's Lecture on the Arts and Manufactures of India, 1852, it is stated, concerning the ivory carvers of Berhampore, that their representations of the elephant and other animals, which were sent to the London Exhibition of 1851, were so true to nature that they might be considered the works of real artists. Mr. Dutt is not without hope of effecting an improvement in the industry, notwithstanding the absence of the support of the wealthy noblemen which the carvers formerly had. The establishment of the Murshidabad Art Agency is a step in the right direction for advertising and exhibiting specimens of the art. But it suffers from the fact that it has no outlet for sale in Calcutta. The workmanship of the existing craftsmen could be much more exploited than it is, if firms or individual capitalists would, as Mr. Dutt suggests, supply the Bhaskars with good ivory, purchase from them their products, suggest new designs, exhibit their specimens and advertise for them.

Manner of possible revival.

METAL-INLAYING (BIDRI WARE).

An art now moribund.

The art of inlaying pewter with silver, called after Bidar in the Déocan, whence the industry was introduced, prevails only in Purnea and Murshidabad. It has further degenerated since 1890. The Murshidabad Art Agency attempts by exhibiting specimens and by advertising in Calcutta newspapers to keep the industry alive. The art is explained at pages 46 and 47 of Watt's Indian Art at Delhi, at page 164 of Birdwood's Industrial Arts of India and in Mr. R. J. Hirst's article in the Proceedings of the Asiatic Society of Bengal for July 1907. In Purnea district Bidri ware is a dying craft and only one man, Mohan Sonar, is left with a fertile invention in designs. It is curious that in such a small art the engravers should be wholly dependent upon others who prepare the amalgum. These are Satua Kanseri and Manju Kanseri of Belauri and Udhu Sau Kanseri of Katihar. Unless their art is studied and communicated, the industry will cease. Some students of the School of Art, Calcutta, which it is proposed, will in future have more direct connection with industrial art, should therefore be sent to study the processes, which should be repeated in the Calcutta school.

CLAY MODELLING.

A characteristic Indian art.

The clay models of Krishnagar have obtained considerable celebrity. In 1888 it was stated that the figures were instinct with life and expression, and that their pose and action were excellent. Mr. Collin expressed a regret that so much skill in modelling should be wasted on ephemeral works of art, as the material used was unbaked clay. As is natural to assume, the industry started from the making of idols for worship, from which grew the manufacture of toys and miniature figures. Sir George Birdwood said in 1880 that Indians had failed to develop the art of figure sculpture, and it was only because their ivory and clay and stone figures of men and animals were on so minute a scale that they excite admiration.

By 1903 Sir George Watt remarked that the Krishnagar modellers had failed to advance above the preparation of toys dressed in real clothes and had steadily raised their prices to a prohibitive extent. On visiting the centre of the industry, Ghurni near Krishnagar, I was prepared to be disappointed and I was sadly disappointed. There are five families left amongst whom the principal workers are, Rakhai Das Pal, O. C. Pal, Nibaran Chandra Pal, Bakeshwar Pal and Jadu Nuth Pal. The first two have price lists printed in English, but they have no agency in Calcutta and not even one in Krishnagar. They are content to live on orders which they obtain indirectly. They have given up almost entirely the preparation of minute models in which they gained their reputation and have taken to relief of minute modelling. work and to statues and busts on European models. The workers have strongly developed artistic talents, and it is a pity that they should use their talents on such unsuitable objects. They are, however, so very self-willed that it is hopeless to do anything with them. Mr. C. A. Radice, I.C.S., when Collector of Krishnagar, did his best to get them to prepare glazed figures which would stand exposure.

ORNAMENTAL GLASS WARE.

In 1888 it was stated that the glass-ware of Patna had acquired a reputation for graceful shapes and beautiful colours, and *The Journal of Indian Art* stated that Patna glass-ware had curiously coloured specimens of considerable excellence. But when specimens were sent to the Indian Art Exhibition in Delhi in 1903 some of them were declared to be artistic and in good taste, but a large percentage was declared to be a miserable imitation of English ware, in bad taste and worse execution. The amber colour which frequently occurs in this ware is obtained from a mixture of the Sone river sand. The Patna ware is made from broken glass melted down. Ahmad Hussain and Zakir Mia are the only two workmen now left. The development of the glass industry must be sought for, as has been shown in Chapter III, on its industrial, and not on its artistic side.

STONE CARVING.

Stone carving was the subject of the monograph for 1904-05, and the Bengal Monograph was written by Mr. Havell, the Principal of the School of Art in Calcutta. A schedule attached to the monograph gives full details of the distribution of the art in the province. Stone-carving is usually associated with Gaya, but Mr. Havell states that the carvers of Orissa acquired the most extraordinary technical skill in architectural decoration which Hindu art has known. As late as 1902-03, the Director-General of Archaeology declared that the work of a modern stone-mason of Bhubaneswar did not fall much behind the old work. I found in Gaya that the stone-work for the new *dharma-sala*, which is being erected by Rai Surja Mull Bahadur, was being carved by stone workers imported from Mirzapore and Hathras. It is unfortunate that the skill of the carvers, who were originally imported from Jaypur in Rajputana to build the great Bishnupada temple, should be allowed to become atrophied from want of practice. There is now in Gaya only one man who does regular figure carving. The best bowls carved from Pathalkatti black stone are sold at one rupee eight annas, the bowls made from a medium kind of gray stone at ten annas; and there is an adulterated form of blackstone made from the slate stone of Dharhara in Monghyr district which is polished and blackened. There are also some stone carving done in parts of the Ranchi district. Mr. Havell states that about seventy or eighty families prepare cheap stone utensils, which are used by colliery coolies at Raniganj. The earnings of carvers are from four annas to eight annas a day. Mr. Havell also states that the almost total extinction of the art is due to—(1) the exclusive use of European styles in public building; (2) the neglect of the study of Indian architecture in Indian colleges of engineering, and (3) the want of discrimination in public taste. The definite suggestion which he made in the monograph was that two of the inside doorways in the new Art Gallery, which is being erected on the Chowringhee Road in Calcutta

Suggestion for should be carved by the best men obtainable from Orissa. I regret, however, to find encouragement of that nothing has been done on this suggestion. the art.

WOOD CARVING.

Decline of the art A monograph was written in 1903 by Chevalier O. Ghilardi, who was then officiating Principal of the School of Art, Calcutta. The art is found in Monghyr, Bhagalpur, Patna, Gaya and Cuttack. Mention of wood-carving in the Bishnupur subdivision of Bankura District is made in the Annual Administration Report of 1903-04. Patna has instances of pure Hindu work; Gaya has the characteristics of Burmese work. The Patna carvers have to content themselves now with making blocks for cotton printing. The wood inlaying in Monghyr was an industry brought in with the gun manufacturer. The Chevalier tried to persuade the worker to produce better work. The man's reply was that the people did not care to pay for it. I found at Monghyr that this worker obtains ebony from Jamui subdivision, and uses deer horns for inlaying. He took periodically a consignment to Calcutta and hawked his goods about the curio shops in Chowringhee. The conclusion of the writer of the monograph is that what is required is more the restoration to Indian art of all that was admirable in its earlier forms rather than a change in the classic traditions of artistic industries. The Calcutta School of Art must take its share in this work. The carpenters of North Bihar, as Mr. Collin pointed out, are still able to do any kind of ornamental wood-work.

SHELL ORNAMENTS.

Shell bracelets are made at Dacca; but in Bengal proper only in Bankura and Birbhum districts, especially at Bishnupur in the former districts and at Karidha in the latter. The Sankaris of Karidha, it is said, have attained perfection in the art.

EMBROIDERY.

An art capable of expansion.

The gold and silver embroidery of Patna is still well-known. Murshidabad and Patna have still skilled embroiderers. The embroidered caps of Patna and Bihar town are frequently seen worn in the Bihar districts. There are two kinds—*kamdani* and *zardoshi* for caps and the trappings of horses and elephants. The work, however, has not the reputation of the Lucknow or Benares work. Chikan work is still thriving. This is carried on in Calcutta, and in the Barasat subdivision. Mr. Collin indicated the business-like method of export. In Madras I found that it paid Belfast linen merchants to send their goods to Madras to be embroidered, principally by female labour. There is drawn-thread work done by the girls of the Bankura Wesleyan Mission; it is all exported.

SOAP-STONE CARVING.

Plates, bowls, tumblers, images and the like are manufactured in thanas Chandil and Manbazar in Manbhum district, in pargana Dhalbhum in Singhbhum district and in the south-west of Ranchi district.

HORN CARVING.

Horn carving is carried on commercially at Tirhetta Bazar, off Bow Bazar, Calcutta. A Mr. Lucy proposes to start a factory at Cuttack.

LAC WORK.

As Mr. Collin said, lac bangles are made all over the country. There are still 40 families working at Liambazar in Bolpur thana in Birbhum district. Only three families are working at toys, the women of the other families dye cotton with shellac dye. The other centres for lac turnery are Patna and Murshidabad.

LACE MAKING.

This is an exotic industry in India, introduced by the missionaries, but Sir George Watt has stated that it has become at Quilon and other places in Southern India a popular industry. Fifteen years ago lace making by hand was an extinct handicraft in England; but to-day it is a recognized industry. Mr. Collin in 1890 recommended that it be taught to native ladies, as was done in the Nazareth Convent in Madras. Dr. J. A. Graham of Kalimpong started in 1905 a lace school at Kalimpong, where the hill girls, already adepts at knitting, have taken kindly to the industry under the teaching of an English lady expert. There are 124 girls working either at their homes or at the school in connection with it. Government has assisted by Rs. 600 down, and Rs. 89-8 a month for three years. Dr. Graham's proposals for the development of a scheme for making at Kalimpong a central school, where teachers might be trained for all parts of Bengal, is at present under the consideration of Government. Up to the present, pupils from Kalimpong have become teachers for the German Lutheran Mission at Ranchi and for the Mahila Shilpasram in Calcutta. Four other missionary agencies at Chaibassa, Jessore, Ballyganj and Calcutta have asked that students be trained at Kalimpong. I have seen the lace factories at Ranchi, Chaibassa and Krishnagar. That of the German Evangelical Lutheran Mission started in August 1907 as an offshoot of Kalimpong, has 32 pupils, who can earn from Rs. 2 to Rs. 6 a month. The patterns and thread are sent from Kalimpong. The Government grant is Rs. 77 a month. The Roman Catholic Mission at Ranchi is independent of Kalimpong. The Ursuline Convent have started lace making since August 1906. There are 60 girls making torchon lace under a European lady expert. The girls, who are aboriginal Kols, can earn as much as Rs. 8 a month. The Government grant is Rs. 50 a month. The work is done in a lofty and roomy building, and the conditions of hours of labour and of discipline have been carefully considered. At the Krishnagar convent there are 57 girls under training. The school deserves encouragement. The defect at present is that the market in all cases is a catch market. It is a good thing to introduce such pleasant, remunerative employment among native women. But a fixed market is wanted, similar to that furnished by the Irish Lace Depot established in Dublin by the late Mr. Ben Lindsey for the cottage lace industry in Ireland; or the commercial methods of the Nagrocoil School in Madras should be followed. But a commercial outlet required.

TOY MAKING.

Rude articles are still made in Patna and Kalighat; lacquered toys at Ilambazar.

WOOD-ENGRAVING AND LITHOGRAPHY.

There is an increased demand for engravers in Calcutta: the art is taught in the Government School of Art and in private schools.

CHAPTER VI.

INDUSTRIES DEALING WITH ECONOMIC PRODUCTS.

This head covers many industries which are under the special observation of the Agricultural Department, such as indigo and sugar. I propose to deal only with the lac, tobacco, oil and the alkali industries.

LAC.

The culture of the lac insect and the manufacture of shellac were not treated in detail by Mr. Collin. I have examined some of the factories in Chota Nagpur, and the literature on the subject, and venture to think that, as Mr. Piran industry. A helpful and progressive industry.

Improvements
suggested.

Chand said at the Benares Industrial Conference in December 1905, the methods of working are crude. I suggest therefore more mechanical power. The new factories starting at Purulia are better fitted than the old factories. In the second place, the twisted cloth bags from which the heated exudation is scraped, contain some resinous matter, and under present methods the bags are boiled in alkali to remove the residuary matter. This residue would be removed more effectively by a spirit, and hence there is the necessity of obtaining industrial alcohol to which reference has been made under "Chemical Manufactures." In the Chota Nagpur tract the spirit which could be obtained would be that of the *mahuwa* flower, from which country spirit is distilled at present. In the third place, it should be realised that the lac is not now gathered for the dye, but that it is gathered for its resinous properties. This has been pointed out in Mr. Stebbing's recently published note on the lac insect. But the old process of manufacture continues, and at present there is much time and trouble taken in removing the dye from stick-lac. Hence it is a matter for further enquiry as to the exact state in which the lac should be collected; for the lac from which the insects have swarmed contains less colouring matter. In the fourth place, I found that the District Officers were taking active steps to remove the nuisance which the washings create round lac factories. Now Mr. D. Hooper, F.I.C., F.C.S., at page 305 of the Monograph on Lac (Agricultural Ledger No. 9 of 1901) states that dye liquor is a rich source of nitrogen, and would constitute a valuable manure. At Ranchi I found that it had been so employed with considerable success: and I have advised elsewhere that the dye liquor be spread out on neighbouring cultivated fields; whereby the nuisance might be removed and at the same time the fields benefited. There is an example in the similar use of indigo washings. I am informed that it would not pay to consolidate the dye washings into poudrette cakes. There is a sufficient number of cheap manures in the market already.

One manufacturer told me that, comprehensive as Sir George Watt's monograph is, there is still much more that a practical maker of shellac ought to know. The industry is a good one in that it affords remunerative employment at many scattered centres to the working population, and is a complete antidote to the failure of agricultural crops. Certain Marwaris have within the last two years started manufacture in the Pakaur subdivision in the Sonthal Parganas: people flock in for labour, and earn four annas to twelve annas a day. At Jhalda in the Manbhum district I found that the factories had increased in ten years from 10 to over 30, employing about 1,500 people. In the whole district in 1907 there were 5,056 people employed in 122 factories, small and large.

The market is a sensitive one. It was affected by the American crisis of 1907 and by a strike in the hat manufacturing districts in England. (Reynolds and Sellers' Review of the Shellac Trade in 1907.)

The trade both in stick-lac and in shellac and button lac is an enormous one, as the following figures show:—

Exports from Calcutta in lakhs.	1902-03.	1903-04.	1904-05.	1905-06.	1906-07.
Stick-lac ...	1.19	1.07	3.14	4.54	8.86
Shellac ...	157.15	217.49	258.37	264.52	289.60
Button lac ...	23.38	49.25	38.64	44.38	44.43

The industry has had one curious result. It has increased disputes about trees in Chota Nagpur and the Sonthal Parganas.

TOBACCO.

Many years ago endeavours were made by Messrs. Begg, Dunlop & Co. to establish at Pusa in Darbhanga district tobacco growing and manufacture for the European market. The increased local demand for cigarettes has altered the situation. The Peninsular Tobacco Company, financed by an Anglo-American syndicate, who already have a factory at Karachi, have been building a large manufactory in the vicinity of Monghyr to make cigarettes for the million. Since May 1908 it is in working order. The Collector (Mr. Hugh McPherson) wrote in 1907:—
 “The new industry will increase the importance of Monghyr as a manufacturing and trading centre, there will be a considerable addition to the demand for labour, and the cultivators of the plant will get better prices for their crops and be stimulated to improve its quality. Tobacco is at present grown over 12,000 acres of land, mainly in Beguserai, and the area may be expected to increase considerably in the near future.”

The develop-
ment of cigarette
manufacture.

In Jessore district, tobacco curing was started by Mr. McLeod of Kotechandpore but was given up in 1907.

In the Rangpur district in the Eastern Province, the Rangpur Tobacco Company with a capital of one lakh is being floated.

The habit of cigarette smoking is spreading amongst all classes, and in Calcutta the manufacture of cigarettes is being undertaken with vigour. There are the Globe Cigarette Company at 20, Tangra Road, the East India Cigarette Company at 17, Baliaghatta Road, and the Bengal Cigarette Manufacturing Company, at 42, Shampukur Street. These firms have been importing cigarette making machinery, and have a well organized system of distribution. Ten cigarettes of the cheapest quality are being sold for a pice. It would have been better if indigenous manufacturing activities had been diverted into a more productive channel.

OIL MANUFACTURE.

Outside the metropolitan area, within which are large mills like those of the Howrah Oil Mills Company, Limited, of Ramkristopore, and the Gouripore Company, Limited, of Naihati, there are very few oil mills in the province. I found one worked under European supervision at Berhampore, one in Nadia district, two under Marwaris and Bengalis in Patna district, two in Bhagalpur district, and nine in Burdwan district, the best of which is worked by Marwaris. The mills in Burdwan and Berhampore were working with imported seed: in one case the seed came all the way from Hathras. Hence the industry might be more developed in the Bihar districts, where seed is locally procurable. The total quantity of linseed which came into Calcutta from Bengal districts in 1906-07 was 128.7 lakhs. It is not necessary that there should be antagonism with the local *teli*. I found the following plant in different places:—a 20 horse-power engine working 54 mills; a 20 horse-power engine working 42 mills; a 16 horse-power engine working 32 mills; another 16 horse-power engine working 26 mills, and 12 mills worked by an oil engine. The Victoria Mills Company of Bhagalpur was started by Babu Kirtti Chandra Chatterjea, a retired pleader; and after some vicissitudes it is now expanding to 50 mills. Some are worked in conjunction with other industries, such as flour grinding, rice husking, timber cutting and *surki* making. Babu Baij Nath Goenka of Monghyr has shown considerable enterprise in erecting a combined mill—a Stamford's corn-grinding mill, a timber-cutting machine, a Carter's disintegrator, and an Empire oil mill. I think that at all the district and subdivisional headquarters, in the *rabi*-producing areas of the Bihar districts, there is room for combined flour and oil mills. There is a constant demand for good oil. The jails produce pure mustard oil, and can sell it above the local market rate. In some parts *sarguja* (*Guizotia abyssynica*, niger seed) is used with mustard seed in the proportion of 1 to 20, partly to assist the expression of the oil on account of its gritty nature, partly as an adulterant. In Calcutta besides the oil of the niger seed,

the oil of the poppy, sesamum, and cotton seeds are mixed with mustard oil; these, however, are considered by the Health Officer as not injurious to health.

It is desirable that the oil-cake should not leave the country. In Dr. Voelcher's words (Report on Indian Agriculture, paragraph 127) "the oil having itself no manurial properties, and being derived from the atmosphere and not from the soil, is a fitting object for export, but to send away the entire seed, or the refuse after the removal of the oil, is to send away the valuable manurial constituents contained in the seed; in brief, to export them is to export the soil's fertility." The following figures are relevant to these remarks:—

		Export from Calcutta in lakhs.	1905-06.	1906-07.
Suitable for export	...	Vegetable oils	25·6	28·5
Unsuitable for export	...	{ Oil-seeds	228·4	220·7
		{ Oil-cake manure	6·3	13·6
		Total	234·7	234·3

In the matter of castor oil I found at the hand-mill in Sewan considerable waste of power and material. There is room for the introduction of more economical devices, and capitalists have an opening here. I find that oil mills with mechanical power will pay in the Bihar districts, if the cost of supervision be not too high. The recently invented American Continuous Extracting Press requires an engine of 40 horse-power and can crush 25 maunds of vegetable oil-seed per hour. The remarks of Mr. K. N. Ramanujachari in *The Indian Review* for March 1908, on the Oil Trade of India indicate the number of subsidiary advantages arising from the increase in the local expression of oils; the increase in lubricants for increased machinery, and the application of oils for medicine, paints, varnishes and soap manufacture.

ALKALIS.

The imports of caustic soda.

It has been laid down by Sir George Watt that the industrial progress of a country can be judged of by the extent to which it produces the alkalis required by its own industries. Such industries as India possesses are, he continues, a century behind the times. Among alkalis there are ammonia and its salts, potassium and its salts, sodium and its compounds. One of the last, caustic soda, is required in many of the nascent manufacturing industries, and it is at present imported. It was hoped that it would be possible to obtain it by decomposition from common salt, sodium chloride, which India has in abundance. Sir George Watt, however, pointed out (Indian Alkalis, 1902) that the possibility of under-selling the product of the chemical works of Europe was doubtful.

CHAPTER VII.

MR. COLLIN'S PROPOSALS AND THE FUTURE DEVELOPMENT OF ARTS AND INDUSTRIES IN BENGAL.

THE text of Part I of this Special Report dealing with industrial instruction was, that it should be kept in view that the instruction which is given should enable pupils to earn a livelihood, and that the central institutions should be kept in the highest possible state of efficiency. In this Part II, dealing with industries and industrial arts, the text is that under present conditions it is for the small capitalist to take up in a business-like way the manufacture of articles for which there is a demand and the raw material of which exists in the country; and, in the case of industrial arts that what is required is greater publicity and an extended market.

Mr. Collin's chief proposals relating to industries were six in number. They were—

- (1) the stimulation of native industries by the preparation or purchase of materials of public works in India, and not in England;
- (2) the establishment of a school for drawing and design for industrial purposes and the circulation of designs amongst native workers;
- (3) the circulation of practical instructions among leading braziers regarding moulding and working in dies;
- (4) the introduction of schools for mat and basket work in localities where the business is carried on; **
- (5) the improvement of ornamental pottery; and
- (6) the establishment of a weaving school at Berhampore in connection with silk and cotton weaving.

The principles of these proposals I repeat and support. The first will be considered below amongst my general recommendations. The second has been discussed under the subject of the Government School of Art in Part I and under the head of "Industrial Arts" in Part II. The third has been considered under the head of "Brassware" in Chapter III of Part II. So also the fourth proposal under the head of "Mat ware" in the same chapter. The fifth proposal is included in the general remarks under Chapter V of Part II, and the sixth proposal in connection with the improvement of the weaving of textiles has crystallised in the scheme for a central weaving institute at Serampore, which has been considered in Chapter III of this part and also in the summary in Chapter I of Part I.

There are certain general recommendations which I desire to make as to the manner in which Government may foster industrial development in this province.

1. One means of stimulating native industries lies in the preparation or purchase, as far as possible, of materials for public works in India, and not in England. This is accepted in principle by Government; the desirability of translating good will into tangible orders for material is shown under the head of "Ironwork." The public still await the report of the Stores Committee. The value of Government stores imported into Calcutta for each of the last five years to 1907 has been:—3·22, 3·73, 2·67, 3·61, and 3·00 crores respectively.

2. It is advisable, if not absolutely essential, to have an expert Superintendent of Industries, or Director of Industrial Enquiries, as the appointment is called in the Bombay and Madras Presidencies. On the one hand there is required the sympathetic enthusiasm of one man rather than any elaborate scheme, if anything practicable is to be done. On the other hand it is not the fault of many would-be industrialists, but of their traditions and environment, that they lack initiative, co-operation of capital, business capacity and organization. The feature of the present position is that it is not the Indian commercial classes who wish to engage in industrial enterprise,—commerce pays them better; but it is principally classes in whom the commercial instinct is not fully developed and who are finding that the pressure for existence in literary lines is too great. There are other reasons—some of which, but not all, are praiseworthy,—for the movement towards industrial development; but the fact remains that it is not the business heads in the Indian community who are being attracted to manufacture, but the professional and landholding classes. The real difficulty is to find an expert officer who would combine suitable scientific qualifications in engineering and chemistry with sympathetic knowledge of the country and of local conditions. The Bengal Government have made some proposals for such an appointment, and the subject is still under discussion. There were many causes of the comparative failure of the extension of the improved hand-loom in Bengal, but in my opinion the chief reason was that most of the agents employed were admittedly amateurs. An officer of Government is required not only to give the impetus, but to give advice and encouragement. In a sentence, a second Mr. Chatterton is wanted for Bengal.

3. Next, it is advisable for Government to improve technical instruction by the concentration of thought and expenditure on the central institutions. These are in Bengal the Sibpore Engineering College, the scope of which is much wider than its limited title would denote, and the Government School of Art. My proposals under this head have been given in detail in Chapters II and VI of Part I. They are simply the development of the policy laid down by the Bengal Government in 1891. Concentration is also required in the industries which Government has elected as subjects for technical instruction. These are weaving and leather work, the proposals for which are to be found in Chapter III of this Part II.

4. The imperial technical scholarships have since 1904 been given in Bengal for the subject of mining engineering; and the advice of the mercantile community is to continue this subject for state scholarships. But only one state scholar can, as a rule, be selected in each year for each province. In the year 1908, however, two scholarships were given to Bengal in mining engineering and in leather-work. I recommend that the Bengal Government should be prepared to subsidise, under certain conditions, the local association which has already sent abroad many youths of this province for technical education, and also that the Bengal Government should independently give scholarships to youths who wish to study the industry of leather-tanning in Madras or Cawnpore.

5. Encouragement should continue to be given to district exhibitions of industries and industrial arts. Hitherto assistance has been given only by the Agricultural Department and on account of agricultural products. The conference which the Industrial Education Committee held with Bengal officers on the 14th December, 1901, decided that such exhibitions were of great value, specially at *melas*. Sir George Watt suggested that money awards be given and that the best articles be purchased as samples. It is perhaps too much to say that a spirit of emulation has been excited. Some of the exhibitions would lapse entirely in the absence of official support. But still it is in this way that the local artisan can be encouraged, and that the local notables can be induced to take an interest in encouraging him. Some exhibitions have been started in connection with *melas*, as those at Dumka and Behta; some as an industrial show, as that of Bankipur; and some in conjunction with agricultural exhibitions, such as those at Bankura and Hooghly. There was also the comprehensive industrial exhibition in Calcutta in December 1906. There are now 20 districts out of 33 in Bengal, Bihar and Orissa in which annual exhibitions are held. *Melas*, indeed, must in Bengal for some time take the place of the other forms of advertisements, such as catalogues, circulars and newspapers, amongst the uneducated public. At the following places the exhibitions specially include industrial products:—Banjetia, Barasat, Basirhat, Kushtia, Jhenidah, Bankura, Ohinsura, Midnapore, Suri, Kendrapara, Angul, Balasore, Sambalpur, Ranchi, Bankipore and Monghyr. A perusal of the reports of these exhibitions reveals an unexpected amount of inventive ingenuity principally in connection with weaving. This is likely to be lost, unless examined by an expert and made the subject of experiment at a Government weaving institute.

6. The local industrial arts can be effectively encouraged by a ready sale of the best articles, which arises principally from advertisement and publicity. Hence grants should be made for the inauguration of sample art ware depôts at district head-quarters, provided the local public take up the matter themselves, and in connection with the School of Art in Calcutta. In most districts will be found men of public spirit and culture. Samples of the work of those artists and artificers, who are ready to execute orders, should be obtained, and each sample should bear a note as to the maker's name and address and the price of the article. As Mr. Collin and others have said, native workmen are frequently unenterprising and usually dilatory; but still there is even now a difficulty in obtaining orders from want of publicity. There is an art agency at Murshidabad and another in Cuttack, which effect a little good; and I have recently obtained Government assistance for sample depôts which are being started at Bankura and Bankipore. I am simply repeating

what Mr. Coldstream, a zealous Panjab officer, urged before the Art Conference of 1894 held at Lahore.

The subject is discussed at page 19 of Part I of this Special Report as well as in Chapter V of this Part II.

7. It is advisable that Government should disseminate more freely among the public the information which is obtained so laboriously by its officers. Let me point out that Mr. Collin's report of 1890 on arts and industries, full of excellent suggestions as it was, was never formally published. It was criticised by a few heads of departments, and in 1895, three years after its publication when I asked for a copy, I was informed that it was confidential. A monograph on a selected subject has year by year been prepared; a copy has been forwarded to the Government of India; but few outside official circles have known that it has been published. The recent reports by Mr. Watson on leather-curing and tanning deserve the widest publicity. I found that the manager of a new tannery in Bengal had never heard of Mr. Rowland Chandra's exhaustive monograph on tanning published in 1904. Professor T. K. Gajjar in his address before the Industrial Conference at Surat in 1907 has drawn attention to the imperfect circulation of such literature. A Director of Industries would circulate much information through the press; he would know to whom particular information might be useful; and would doubtless copy the methods of the Agricultural Department in issuing leaflets. In the Appendix to the present report a small bibliography of books and papers dealing with industries has been prepared. The following is a list of Bengal industrial monographs, as prescribed by Government. Eleven out of the fourteen monographs have been written by Indian officers.

YEAR.	Subject prescribed by the Government of India.		
1893-94 Brass and Copperware.
1894-95 Pottery and Glassware.
1895-96 Dyes and Dyeing.
1896-97 Cotton Fabrics.
1897-98 Woollen Fabrics.
1898-99 Silk Fabrics.
1899-00 Ivory Carving.
1900-01 Nil.
1901-02 Wood Carving.
1902-03 Tanning and Leather Work.
1903-04 Gold and Silverware.
1904-05 Stone Carving.
1905-06 Carpet Making.
1906-07 Iron Work.
1907-08 Paper Making.

8. Government should, I think, in addition to the provision of technical education, hold tests and give certificates of competency. There are two models to follow: the Madras system of technical examination (Calendar of the Commission for Government Examinations, Madras, 1907-08, page 64), or the Bombay system (Calendar of the Victoria Jubilee Technical Institute, 1908, page 60). In the former the Government itself gives a certificate, a group certificate or a diploma for an immense variety of subjects ranging from practical telegraphy to horticulture and from carpentry to lace making. In the latter, the Technical Institute holds the examinations on behalf of the City and Guilds of London Institute, which has a list of no fewer than 74 subjects, ranging from soap manufacture to motor car machinery. As Bengal already gives, or is about to give, recognized diplomas in mechanical engineering electrical engineering, mining, agriculture, and veterinary science, I suggest that the

new joint technical examination board for Sibpur College and its affiliated schools in both provinces might arrange to hold examinations in several of the subjects named in the City and Guilds of London list and grant certificates therein. I am sure from what I have heard that many employers as well as employees would welcome some such impartial proof of qualification. The argument that examinations would be held in some subjects in which no instruction is formally given is not conclusive. The system has prevailed in Madras for many years, and under its old name of "Higher Examinations in various branches of Technical Science and Art and in Industries" was one of the few things which met with commendation in the MacDonnell Memorandum of 1886.

9. It is finally submitted for consideration that in the distribution of honours for public service recognition might be given to those who have proved themselves public spirited captains of industry and who have piloted new industries successfully; and that rewards be offered by Government for certain inventions which might improve the quality and outturn of indigenous manufacture, such as for example, the adaptation of the fly-shuttle hand-loom for the weaving of tussar silk.

In the body of this report it will be found that it has been suggested that Government may appropriately assist in the following industries:—Weaving, leather manufacture, iron work, brassware, and chemical manufacture. It has also been pointed out that there are openings for Indian capitalists in the following industries:—weaving, carpet weaving, pottery, carpentry, matware, leather tanning, cutlery, brassware, glass manufacture, chemical manufacture, dyeing, match making, soap making, perfume manufacture, lac manufacture and in the manufacture of vegetable oils.

Mr. Trailokya Nath Mukharji, whose opinion is of value as he was the founder of the Indian Industrial Association, informs me that in his opinion there are openings for the manufacture of umbrellas, paints, hosiery, braziery, soaps, candles, leather articles, lamps, and in the preservation of fruits. These are also recommended to the notice of capitalists. Mr. E. R. Watson, F.C.S., of the Indian Educational Service, whose researches in leather manufacture and in iron work are of great value, suggests that there is an opening in the following subjects:—Dyeing and cotton printing, soap making, lac refining, glass manufacture, varnish and paints, scents, cement, matches, tanning extracts, oil, enamelled ware, pencils, tobacco, silk weaving, rice bowls, and in sugar. Indigenous enterprise has already taken up the manufacture of soap, matches, pencils, tobacco and silk weaving. Mr. Henry T. Tozer, the industrial expert of the India Office, commends the indigenous manufacture of leather goods, silk goods, paper, iron and steel, and soap. Mr. S. J. Tellery, a recognized expert in Indian art industries, commends the revivification of fancy silk weaving, metal work, wood and stone carving, and states that the manufacture of the following might be worked with commercial success: woollen pile carpets, embroidery, enamelling on metal, and hand printing on cotton and silk.

Though Government assistance is expected and on certain lines has been granted to a considerable extent, yet both Indian and European official and non-official observers coincide in the view that it is by the addition of indigenous capital and brains to the indigenous inherited skill, both manual and artistic, of the Indian artificer that any improvement in indigenous manufactures, whether purely industrial or artistic, will ensue.

A few quotations are given. In the Viceregal Council, the Hon'ble Mr. Harvey, the Member for Commerce and Industry, said at the Budget Debate in March 1908:—

"Government have already done a good deal and are anxious to do more, but it is only with the co-operation of the people themselves and active assistance from capitalists of the country that great results can be obtained."

At the Industrial Conference for the United Provinces in August 1907, the Lieutenant-Governor, Sir John Hewett, said:—

"But if Government does its part, if it trains up skilled workmen and foremen capable of managing industrial businesses, the people must do their part, they must make up their minds to invest their capital in the development of the country."

In his address at the opening of the Chittagong Cotton Mill, Sir Lancelot Hare, Lieutenant-Governor of Eastern Bengal and Assam, said:—

“You have risked your own money—not I truly hope running an immensely great risk—and have not, as some have, called upon other people whom it is their fashion to represent as on the verge of pauperism to pay the cost of protecting an industry against its own inefficiency due to a conservatism which refuses to take advantage of improved methods.”

Mr. Pramatha Nath Bose in his “Essays on Industrial Development” has written:—

“Besides the comparative scarcity of capital, the inadequacy of technical training and the lack of the amount of co-operation requisite for large undertakings, there is another and probably more patent cause which stands in the way of industrial development—the hereditary aversion of the higher castes for trades and industries which have hitherto been relegated to the lower, and in some cases, to the very lowest classes of the Indian society.”

The Hon'ble Babu Bhupendra Nath Bose has stated in *The Indian World* for January 1908:—

“It is becoming more and more apparent that the realisation of our political ideals is to a great extent, if not wholly, dependent upon our progress as a nation, in the paths of useful knowledge, industry and commerce, and upon our powers of co-operation, combination and organization.”

Mr. B. C. Dutt, C.I.E., presiding at the Benares Industrial Conference of 1905, said:—

“We must change our old habit of universal cottage industries, and learn to form companies, erect mills, and adopt the methods of combined action, if we desire to foster or revive our industries.”

We find also the same opinions expressed in organs of the press which ordinarily have different points of view. *The Statesman* confirms the findings of the Industrial Conference of 1907 that the obstacles to development are lack of adequate technical knowledge and lack of capital. *The Pioneer* says that the most hopeful sign for the future is the recent development of some interest in the subject of industrial enterprise, academical and intermittent as that interest is, and that when the leading politicians back their sentiments with capital and send some of their sons into industry the battle will be more than half won. To the would-be industrialist in Bengal, I can only say:—

“Ingeniis patuit campus, certusque merenti
Stat favor: ornatur propriis industria donis.”

J. G. CUMMING, B.A., I.C.S.,

On Special Duty, Industrial Enquiries.

APPENDIX I.

WORKS OF REFERENCE FOR SPECIAL REPORT, PART II.

GENERAL.

- Financial and Commercial Statistics of British India; Calcutta, 1907.
- Census of India, Bengal: Part I.—Report, Chapter XII: E. A. Gait, I.C.S., F.S.S.
Part II, Tables: Part III, Provincial Tables.
- Annual Statement of the Sea-borne Trade and Navigation of the Bengal Presidency, 1906-07: Calcutta, 1907.
- Report on the Maritime Trade of Bengal, 1906-07: Calcutta, 1907.
- Report on the Maritime Trade of Bengal, 1907-08: Calcutta, 1908.
- Report on the Trade carried by Rail and River in Bengal, 1906-07: Calcutta, 1907.
- Report on the Land Revenue Administration of the Lower Provinces, 1906-07: Economic Developments, paras. 199 to 204: Calcutta, 1907.
- Memorandum on the Material Condition of the Lower Orders in Bengal, 1882-1891: F. H. B. Skrine, I.C.S., Calcutta, 1892.
- Memorandum on the Material Condition of the People of Bengal, 1892-1901: L. P. Shirres, I.C.S., Calcutta, 1902.
- Report on the Existing Arts and Industries of Bengal, 1890: E. W. Collin, I.C.S., Calcutta, 1892.
- Papers read at the Industrial Conference at Benares, December 1905: Nateson & Co., Madras.
- Papers read at the Industrial Conference at Calcutta, December 1906: Nateson & Co., Madras.
- Papers read at the Industrial Conference at Surat, December 1907: Nateson & Co., Madras.
- Report of the work of the Indian Industrial Conference, 1906: Caxton Printing Works, Bombay; also Mazumdar Press, Calcutta.
- Report of the work of the Indian Industrial Conference, 1907: Thompson & Co. Madras.
- Indian Industrial Guide: Dakshina Ranjan Ghose, B.A., Lahiri & Co., Calcutta, 1907.
- Industrial India: Glyn Barlow; Nateson & Co., Madras, 1907.
- Manufactures of India: Tozer, Journal of the Society of Arts, London, 2nd June 1905.
- Thacker's Directory of the Chief Industries of India: Thacker Spink & Co., Calcutta, 1908.
- Directory of Indian Goods and Industries: Thompson & Co., Madras, 1907.
- The People of India: Chapter III; Sir Herbert Risley: Thacker, Spink & Co., Calcutta, 1908.
- Report of the Committee of the Chamber of Commerce for 1906, Volumes I and II; Newman & Co., Calcutta, 1907.
- ✓ Essays and Lectures on the Industrial Development of India by Pramatha Nath Bose, B.Sc., F.G.S., Chapters I to IV of Section I; Newman & Co., 1906.
- Industrial Organization of an Indian Province, Chapter VIII on the village artisan: Theodore Morrison; John Murray, London, 1906.
- Art Manufactures of India: T. N. Mukharji; Calcutta, 1888.
- Industrial Arts of India: Sir George Birdwood; Chapman and Hall, London, 1880.
- Indian Art at Delhi: Sir George Watt; Calcutta, 1903.
- Report of the Calcutta Industrial Exhibition, 1906: Industrial India Office, Calcutta, 1907.
- Industries of the Patna Division: Khadga Bilas Press, Bankipore, 1908.

- Reports of District Officers and Commissioners in the Annual Miscellaneous Report for 1906-07.—Part relating to Manufactures and Mines.
- Reports of District Officers and Commissioners in the Annual Return of Important Industries for 1906-07, submitted to the Director-General of Commercial Intelligence.
- Proceedings of the Indian Industrial Association for 1894 and 1896.
- Industrial India, Volumes I to V, 1904-1908.
- Bengal District Gazetteers: Chapters on Occupations, Manufactures and Trade: L. S. S. O'Malley, I.C.S., 1906-1908.
- Administration of Bengal; Annual Provincial Reports on: Chapter IV under head Manufactures.
- Proceedings of the Industrial Conference at Naini Tal, United Provinces, in August 1907: Sir John Hewett's Address.
- Watt's Dictionary of the Economic Products of India.
- Report on Trade Conditions in India: Charles M. Pepper, Special Agent of the Department of Commerce and Labour: Washington, U. S. A., 1907.
- Inventions and Designs Act, 1888, with an explanatory memorandum for the guidance of parties applying for protection of inventions and designs: Patent Office, Calcutta, 1907.

COTTON.

- Government of India Memorandum on Hand-loom Weaving in India, circulated in October 1906.
- Monograph on the Cotton Fabrics of Bengal: by N. N. Banerjei, Calcutta, 1898.
- Hand-loom Weaving in India: E. B. Havell. Supplement to *Industrial India*, February 1905.
- Hand-loom Weaving in India: R. B. Patel, M.R.A.C., Benares Conference of 1903.
- Hand-loom Weaving in India: R. B. Patel, Calcutta Conference of 1906.
- Hand-loom in Ahmednagar: D. C. Churchill, Surat Conference of 1907.
- Salem Weaving Factory: Alfred Chatterton, B.Sc., Surat Conference of 1907.
- Report on Hand-loom Competition, Calcutta, 1906. Appendix III of Report of Indian Industrial Conference for 1907.
- Weaving Competition in Madras, 1908: A. Chatterton, B.Sc., *Indian Trade Journal* for 9th April, 1908.
- Weaving in India: Address to South Indian Association: A. Chatterton, B.Sc., Indian Press, Allahabad.

SILK.

- Monograph on the Silk Fabrics of Bengal: N. G. Mukerji, M.A., M.R.A.C., Calcutta, 1903.
- Report on an Enquiry into the state of the Tasar Silk Industry in Bengal and the Central Provinces of India: N. G. Mukerji, Calcutta, 1905.
- Report of a Committee appointed to Enquire into the Conditions of the Silk Industry in Bengal: Calcutta, 1906.

WOOL.

- Monograph on the Woollen Fabrics of Bengal: N. N. Banerjei, Calcutta, 1899.
- Monograph on Carpet Weaving in Bengal: N. G. Mukerji, Calcutta, 1907.

POTTERY.

- Monograph on Pottery and Glassware of Bengal: T. N. Mukharji, F.L.S., Calcutta, 1895.

LEATHER WORK.

- Report on Dyes and Tans of Bengal, Chapter VI: H. W. McCann, M.A., D.S.C., Calcutta, 1883.

- Tanning Materials: Agricultural Ledger, 1896, No. 9, Calcutta, 1896.
 Indian Tanning Materials; Agricultural Ledger, 1902, No. 1: D. Hooper, F.I.C., F.C.S., Calcutta, 1902.
 Tanning and Working in Leather in the Province of Bengal: Rowland Nagendra Lal Chandra, M.A., Calcutta, 1904.
 Monograph on the Tanning and Working of Leather in the Madras Presidency: Alfred Chatterton, B.Sc., Madras, 1904.
 Chrome-Tanning: Alfred Chatterton, Calcutta Conference of 1906.
 Enquiry as to the Possibility or Desirability of Improving the Cure of Hides and Skins exported from Bengal; E. R. Watson, M.A., F.C.S., Calcutta, 1907.
 Enquiry as to the Desirability of Developing the Tanning Industry in the Province of Bengal, and to the Possibility of Government assisting in the Development by means of Education or Instruction: E. R. Watson, Calcutta, 1907.

BRASS WORK.

- Monograph on the Brass and Copper Manufactures of Bengal: T. N. Mukharji, F.L.S., Calcutta, 1904.
 Statistical Reporter, page 282, for April 1876.
 Manufacture of Brass and Copper Wares in Assam: E. A. Gait, I.C.S., *Journal of Indian Art*, October, 1897.

GLASS MAKING.

- Report on the Suitability of the Presidency of Bengal for Glass Manufacture by N. B. Wagle, Calcutta, 1906.
 Glass Making: Alakh Dhari: Paper read at the Industrial Conference of 1906.
 Report on the suitability of the sands occurring in the Rajmahal Hills for glass manufacture: Murray Stuart, B.Sc., F.G.S., Geological Survey of India: Records of Geological Survey.

IRON AND STEEL WORK.

- Monograph on the Iron and Steel Work in the Province of Bengal: E. R. Watson, M.A., B.Sc., Indian Educational Service: Calcutta, 1908.
 Iron and Coal Trades Review, December 7, 1906. Manufacture of Iron and Steel in India (gives account of the Tata Iron and Steel Works).
 Lecture by Mr. Axel Sahlin at Bombay on 31st March 1908:—The Development of the Iron and Steel Industry in India (gives account of Tata Iron and Steel Works).
 Report on Conditions in India favouring a *Swadeshi* Iron Industry submitted to the Tata Iron and Steel Company, Limited, Bombay, by Mr. Axel Sahlin: 1908.
 Transactions of the Mining and Geological Institute of India, Volume I, part 3, for January 1907:—Barakar Iron Works, by Mr. W. McFarlane.
 Iron Industry as carried on in Bengal and the Central Provinces: Agricultural Ledger, 1900, No. 14, Calcutta, 1900.

DYEING AND PRINTING.

- Dyes and Tans of Bengal: Dr. H. W. McCann, M.A., D.Sc., Calcutta, 1883.
 Monograph on Dyes and Dyeing in Bengal: N. N. Banerjee, Calcutta, 1896.
 Fastness of the Indigenous Dyes of Bengal: E. R. Watson. *Memoirs of the Asiatic Society of Bengal*, Vol. II, No. 3, pages 25—41.
 The position of the Natural Dye Stuffs of India: G. C. Sen, M.A., F.C.S., Pamphlet read before the University of Leeds.

MINING INDUSTRIES.

Mineral Development of India: T. H. Holland, F.R.S., Benares Conference of 1905.

Coal Mining Industry of India: H. H. Macleod: Surat Conference of 1907.

Railway Board's Circular No. 29R. T., dated Simla, 26th August 1905.

Report on Coal Supply of India: Containing Bibliography on Indian Coal. Agricultural Ledger, No. 14, 1898. Calcutta, 1898.

GOLD AND SILVER WORK.

Monograph on the Gold and Silver Work in the Bengal Presidency: D. N. Mookerji, M.A., Calcutta, 1905.

IVORY CARVING.

Monograph on Ivory Carving in Bengal: G. C. Dutt, B.A., Calcutta, 1901.

METAL INLAYING.

Proceedings of the Asiatic Society of Bengal, Vol. III, No. 7, July 1907, page 539.

POTTERY AND MODELLING.

Monograph on the Pottery and Glassware of Bengal: T. N. Mukharji: Calcutta, 1895.

STONE CARVING.

Monograph on Stone Carving in Bengal: E. B. Havell, Calcutta, 1906.

WOOD CARVING.

Monograph on Wood Carving in Bengal: Chevalier G. Ghilardi; Calcutta, 1903.

LACE MAKING.

Lace as a Modern Industry: Miss Isemonger, *Journal of the Society of Arts*, May 29, 1908.

LAC INDUSTRY.

Lac and Lac Industries. Agricultural Ledger, No. IX of 1901. Sir George Watt, Calcutta, 1904.

Note on the Lac Insect: E. P. Stebbing, Calcutta, 1907.

Indian Trade Journal, Vol. I, pp. 102, 437; Vol. III, p. 294; Vol. IV, pp. 9, 380, 563; Vol. V, p. 19; Vol. VI, p. 733; Vol. VIII, page 556.

Note on Lac Cultivation in the Jangipur Subdivision of Murshidabad; Babu Ramesh Chandra Sirkar; Bengal Secretariat.

Report in the Maritime Trade of Bengal for 1907-08, paragraph 32.

ALKALIS.

Indian Alkalis. Agricultural Ledger No. 5 of 1902.

Saltpetre, Agricultural Ledger No. 3 of 1905.