

No. C.-1544 of 1919.

OFFICE OF THE DIRECTOR OF INDUSTRIES,
New Customs House, Ballard Road,
Bombay, the 8th October 1919.

From

R. D. BELL, Esq., C.I.E., I. C. S.,
Director of Industries,
Bombay;

To

THE CHIEF SECRETARY TO GOVERNMENT,
Revenue Department,
Bombay.

Sir,

I have the honour to submit the annual report of the Department of Industries for the year 1918-19.

2. Mr. P. J. Mead, C.I.E., I. C. S., held charge as Director till 18th April 1919 when I relieved him. In the following month I took charge, in addition, of the appointment of Controller of Munitions, Bombay Circle.

Expenditure.

3. The expenditure on the Department during the financial year 1918-19 was Rs. 73,000.

Staff.

4. There is still no full-time expert staff at the command of the Department which meantime relies for technical assistance and advice on the part-time services of officers of other departments and institutions. In engineering matters the Mechanical Engineer to Government with his staff and Mr. Tom S. Dawson, Principal

of the Victoria Jubilee Technical Institute, have been of great help. Dr. A. N. Meldrum, Professor of Chemistry, Gujarat College, Ahmedabad, and Mr. A. J. Turner, head of the chemistry section of the Victoria Jubilee Technical Institute, have dealt with chemical problems, Mr. E. R. Fern continued to serve as pottery expert, and Mr. T. J. Walke as part-time Superintendent of Fisheries, Southern Range. In addition there are in this and other provinces special departments and technical or research institutions which have been consulted, when necessary, regarding matters on which their members are expert advisers. I have also been fortunate in obtaining useful information and assistance in connection with the vegetable oil industry from Lieutenant A. F. Yuill, Assistant Controller, Oils and Paints. The appointment of a suitable expert staff is the first requirement of the Department, but in the circumstances of the year this has been impracticable.

5. The members of the Advisory Committee appointed to assist me during the year were :—

The Hon'ble Mr. Purushottamdas Thakurdas, C.I.E.,
M.B.E.

The Hon'ble Mr. Munmohandas Ramji.

C. N. Wadia, Esq., C.I.E.

The Hon'ble Mr. Chunilal V. Mehta, M.A., LL.B.

The Hon'ble Mr. Nigel F. Paton.

A. J. Raymond, Esq.

Rahimtulla Currimbhoy, Esq.

A. T. Arnall, Esq.

M. de P. Webb, Esq., C.I.E., C.B.E. (Karachi).

Policy.

6. In the last report my predecessor aptly described the policy of the new Department, under war conditions, as one of judicious opportunism, Amidst the changes brought by peace new

difficulties have arisen in mapping out definite lines of advance and of obtaining staff when advance seemed justified. The check on the initiative of the Department in this way will be illustrated in later paragraphs. At this stage of development, the activities and policy of the Department are best described, in the first instance, by illustrative examples, and in selecting those given below I have taken, as far as practicable, the chief industries examined by Mr. Mead in the preceding year.

Hand-loom Weaving.

7. There has been no new development in this section of the Department. Mr. Pomfret, the head of the textile section of the Victoria Jubilee Technical Institute, who has hitherto been the chief expert adviser in this industry, proceeded on leave early in 1919 and subsequently retired. The main work of this section is the demonstration of the use of fly-shuttle looms and their introduction amongst the weavers chiefly through the medium of weaving schools. These improved looms are now in use in large numbers in many weaving centres and the success of this line of work, of which the credit is due to the Registrar of Co-operative Societies, though limited, is undoubted. I do not entirely share my predecessor's views that the weaving schools are not the most economic arrangement possible and that they should be run by local bodies with the assistance of grants-in-aid. I have asked for sanction to introduce the method of popularizing fly-shuttle slays through demonstrators who will earn commission on each new slay which they introduce. But I understand that in another province the method of short time demonstrations has shown the defect that at the first difficulty which arises the weaver is strongly inclined to abandon any new mechanical contrivance and revert to his old methods, unless there is someone on the spot to help him. The weaving schools certainly overcome this difficulty and train the younger men in proper methods. In the early stages of a school there are advantages in having a centralized technical control free

from all possible adverse local influences, and at the present time I think that, as a rule, a local body should not be expected to finance and control a school till the latter is well established and, from the departmental point of view, has practically served its purpose. At this stage, the local weaving population are frequently keen that the school should continue its activities, and in such cases the active assistance of local bodies may reasonably be expected.

8. The introduction of improved mechanical appliances is the only profitable line of advance in the hand-loom industry at the present time. Imported healds, reeds, shuttles and pirns are now used in the schools and their advantages over the country-made articles are sufficient to have induced an increasing demand for them by the weaving population.

9. At the beginning of the year there were weaving schools at Dhulia (West Khandesh), Bhiwandi (Thana), Nasirabad (East Khandesh), Sangamner (Ahmednagar), Kamatgi (Bijapur) and Kittur (Belgaum). At Dhulia, where 650 fly-shuttle slays are now in use, the school will be closed as soon as the local authorities have decided whether to open a weaving section in the local technical institute; it is continued meantime so that there may be no break if the technical institute introduces instruction in weaving. At Bhiwandi over 500 fly-shuttle slays are in use but the school is continued in connection with local experiments in warping and sizing. The work of the Sangamner school is good, of Kamatgi fair and of Nasirabad poor but improving. The school at Kittur was closed in December after 80 improved looms had been introduced. There were also demonstrations, extending over six months or more, at three centres which resulted in the successful introduction of single and double fly-shuttle slays. Instruction was also given to the students at the Agricultural School at Devi Hosur. Experiments with a warping and sizing machine and a contrivance for producing solid silk borders were made at Dharwar but with no very definite results. The warping and sizing machine is unsuited to the individual

weaver but may be profitable to small factories employing a number of weavers and the plant will be tried further at Bhiwandi with the object of testing it for this purpose.

10. The dye market has again given trouble during the year to the weavers : a further reference to this subject is made later.

Pottery.

11. Mr. Fern's services continued during the year at the disposal of the Education Department as Superintendent of the pottery section of the Sir J. J. School of Art. It was arranged last year that no new students should be admitted to this section and that the classes should be gradually closed in anticipation of the establishment of a new Demonstration Pottery Factory in Salsette. It was soon evident, however, that to maintain continuity and keep the staff in work till the new factory was complete the pottery section must continue for some time on its original lines, and this has now been arranged.

12. After the complete surveys made last year, the samples received and tested were small in numbers, viz. :—

Clays	..	Received, 9 samples ; tested, 3.
China clay	..	Received and tested, 1 sample.
Fire clay	..	Received, 1 sample.
Sands	..	Received and tested, 3 samples.
Quartz	..	Received and tested, 1 sample.
Others	..	Received, 2 samples ; tested, 1.

13. During the year Mr. Fern resurveyed the red clay resources at Kurla for the new demonstration factory, and visited the Lakhtar State in Kathiawar to select a fire clay for the manufacture of the bricks required for the furnaces in the new factory. These will be prepared at the School of Art by the students under Mr. Fern's superintendence. He also visited the Ahmedabad district and advised a local syndicate regarding the working of its

kaolin deposit. A large deposit of China clay in the south of the Presidency is also under investigation, and arrangements have been made for refining a one-ton sample for test as a sizing material in a local mill. Mr. Fern also inspected the manufacture, for the Irrigation Department, of pipes for land drainage in the districts of Nasik and Poona, and gave advice.

14. The scheme for the Demonstration Pottery Factory has been submitted for sanction, but further progress is barred, at the moment, pending the completion of the scheme for industrial development at Kurla and Kirol in Salsette which is mentioned later. The site of the new factory has required careful consideration, and it has now been decided that it should be located, if possible, on one of the railway sidings in the new industrial area. Its exact position is therefore dependent on the scheme of development finally adopted.

15. Local private enterprise has not made any advances in this industry, and in one instance there has been a set-back. There are several schemes in the air, but the general conditions seem only to have strengthened the case for an experiment in pioneering and demonstration by Government. One mofussil enterprise started on insufficient capital applied for financial assistance which was refused. The whole policy of financial assistance by Government to industries has still to be worked out.

Oil Seed Crushing.

16. The Department has done nothing directly to assist this industry, with the possible exception of despatching a sample of good groundnut cake to the Indian Trade Commissioner in London for obtaining the opinion of an important firm of biscuit manufacturers on the possibility of developing the manufacture of nutramine. Nothing practical has resulted from the information hitherto published by the Department regarding the value of this foodstuff, nor is anything likely to result so long as the available plant in India is unable to reduce the oil content of groundnut cake to the limit

of five per cent prescribed by Mr. Mackenzie Wallis who conducted the investigations and brought his results to public notice. I mention the oil industry because it affords an opportunity of making remarks on the business side of industries generally.

17. There is a singularly large number of individuals who approach the Department for advice apparently on the assumption that the industrial battle begins and ends with the overcoming of technical difficulties in production and who overlook the elementary fact that the profitable disposal of its products is the real aim of and usually the chief obstacle to fresh industrial enterprise. The manufacture of Portland cement from pearls may be a technical probability, but it is outside the realm of business possibilities; yet schemes are gravely suggested in which the chances of profit are hardly more apparent. Even in established industries where the costs of production are known there is a tendency to think that expansion ends with the erection of new factories regardless of the need of new markets for an increased output. In India there is ample crushing power to meet all internal requirements of vegetable oil, and failing new internal demands an expanded oil industry must look for new markets abroad. The controlling factors here are the comparatively small demand in India for oil cake and the fact that a foreign market requiring both the oil and the cake naturally imports the seed and crushes for itself; the economy in containers and railway and ocean freights is obvious. The protectionist may suggest export duties on the seed, but, unless the seed is an Indian monopoly without a substitute, this course means loss to the agriculturist and no likelihood of a larger market for the industrialist.

18. Quite a number of schemes, ranging from petty to important, have been brought before me for advice on various points, and with the assistance of Lieutenant Yuill, which I have already acknowledged, the general position of the industry has been fully discussed with actual or prospective millowners. In only one case of contemplated expansion—the most important—had the need of finding new markets been recognized. The answer to the critics

who stated that the Department must investigate why Indian capital is not attracted to the oil industry and remove the difficulties, is that existing concerns can more than meet existing demands and the real problem is to find new markets. The expansion of the industry virtually depends on the rate at which the Indian agriculturist can use increasing quantities of cake for fodder and manure, and this leads into problems which are the special work of another department. Given a better Indian market for the cake, new outlets would probably arise for the oil, for example, in an expanded soap industry.

19. Whether the efficiency of the industry can be improved is another question. On the large scale a combination of cage presses with an extraction plant seems feasible. For certain seeds the rotary *ghani* is hard to beat, and it is probable that with better mechanical equipment the village oilman can still prosper. In this connection, the possibility of improving the quality of the oil from village presses may be worth investigation. Help to small concerns and consideration for the village industry must await, however, the appointment of a technical staff.

Casein Manufacture.

20. War demands led to an investigation of casein manufacture which was terminated by the resignation of the chemist in charge, Mr. Mackenzie Wallis. It has since been taken up by Dr. A. N. Meldrum with the help of an assistant chemist. An investigation of this kind must necessarily take time. The present position is that a large sample of sulphuric casein prepared by Dr. Meldrum has been sent to the United Kingdom for a report. I am also in correspondence with the Indian Trade Commissioner in London regarding technical and other assistance which may be expected from certain sources. Casein is not a new industry in the Presidency, but it seems capable of technical improvement and expansion, and two or three firms or individuals of standing are

market difficulties may ultimately prove more formidable than technical problems. The present market cannot be maintained for ever, and when old sources of supply are fully re-opened the position may be very different. My enquiries show that some time before the war one enterprising Indian studied the industry carefully in England, Europe and America, but the market collapsed for a considerable period, so that no amount of technical skill could, at the time, establish the industry on a paying basis in India. The technical uses of casein are, however, now rapidly increasing and likely to absorb an increased output.

21. Dr. Meldrum is also experimenting on the production of casein from separated milk by the method employed in France of using an electric current. He has also made preliminary experiments in the manufacture of gallalith. Mr. Mackenzie Wallis had begun an investigation of the manufacture of casein cement for aircraft purposes, and though this has not been definitely restarted, it has been found easy to produce glue of good quality. There are now good prospects of locally made casein becoming the basis of further local industrial development.

Chemical and Allied Industries.

22. *Bitterns.*—There are two or three schemes for the establishment of new chemical industries near Bombay regarding which the Department has been consulted on various points. The details are necessarily confidential, but there is no harm, except the risk of being tedious, in repeating the statement that here also the difficulty will be to obtain a profitable market for the products and, in an increasing degree, for the by-products. The chief scheme with which the Department is actively concerned is the utilization of the bitterns at Kharaghoda which Mr. Mead described as the prime subject of investigation last year. The Pioneer Magnesia Company has improved and extended its premises, installed a railway siding and loading platform and is arranging to purchase a motor rail wagon with a tank and pump in order to bring the crude

bitterns from the pans to the factory. An improved process of manufacture was devised by Mr. Mackenzie Wallis and the necessary plant designed by Mr. Dawson. A new agreement with the Company provides that it should make a trial on a large scale of the manufacture of magnesium chloride and magnesium sulphate by the new method. It is hoped that experience will prove that it is advisable to multiply the new plant. The objects of the new process are a greatly improved production of magnesium chloride, economy of fuel and the full recovery of by-products of good quality. The new experimental plant is now ready and will be worked next season. The by-products will be obtained by treating the sludge from the chloride vats with sulphuric acid so as to convert the chloride in the sludge into practically pure magnesium sulphate; the hydrochloric acid set free in this process will be utilized for the production of zinc chloride. Laboratory experiments on this subsidiary process have proved successful, and the Pioneer Magnesia Company is ordering a small manufacturing plant which, if successful, will be replaced by a large plant.

23. The whole experiment, which is under the control of Mr. Turner, has also been arranged with a view to testing the bitterns as a possible source of bromine, and arrangements have been made, through the Indian Munitions Board, for sending next cold weather a complete range of samples of brines, bitterns and crude and refined salts to England for independent analysis.

24. Similar investigations will be instituted regarding the possibilities of manufacturing magnesium salts and extracting bromides at Aden, and when Mr. Turner, who is controlling this investigation also, has completed it, the results will be submitted to the Indian Munitions Board. The investigation has been delayed by difficulties incident to obtaining a full range of samples and by the illness of the assistant chemist under Mr. Turner. The possibility of producing bromine and bromides depends on market conditions to a peculiar degree. The supplies from Germany and America are ample, and prices in the past have fluctuated over a

long range in a manner dependent entirely on whether the manufacturing organizations in Germany and America were competing or selling in agreement. The question of obtaining bromine supplies within the Empire was raised during the war, and the establishment of a bromine and bromide industry within the Empire will probably depend more upon imperial policy than mere industrial and commercial factors.

25. *Sodium carbonate*.—In December 1917 attention was drawn to the possibility of increasing the yield of sodium carbonate from the alkali deposits in Sind and these were finally surveyed in 1918-19 by Mr. G. de P. Cotter of the Geological Survey of India. The deposits are distributed over two areas, the first lying mainly, and the second entirely, in the Khairpur State. In these areas, shallow lakes or *dhands* are formed during the rains, into which are washed soluble salts from the soil and sub-soil, so that eventually they contain concentrated solutions of various salts, of which the principal is carbonate of soda. The water in the lakes concentrates during the dry season and the *chaniho* (carbonate of soda) is collected just before the rains. Only those lakes which are very shallow, usually 1 to 3 feet deep, and which therefore form natural evaporating pans, are worked for *chaniho*, and Mr. Cotter suggested that the amount produced might be considerably increased if the larger *dhands* which are over 3 feet deep were worked by constructing 'soda gardens' near their margins and allowing the solution to concentrate by solar evaporation. He also suggested that the quality of the soda obtained might be much improved by the intelligent use of hydrometers, as it has been shown that the concentration should not be allowed to pass a specific gravity of 1.280. At present the *dhands* are sometimes allowed to dry completely before any *chaniho* is collected, and the mineral is thus contaminated by the presence of the impurer fractions which are deposited after the *chaniho*. These suggestions were communicated to the Commissioner in Sind for the benefit of the Khairpur State and of the areas in Sind itself where the deposits

are worked. The amount of soda annually produced will never be very great. In addition to the portion sold in the bazars of Hyderabad and Karachi for use in washing, dyeing, cookery, etc., a variable quantity is exported. In 1916-17 this amounted to 880 tons, valued at over one lakh of rupees. Even under the best conditions the production is not likely to exceed four or five thousand tons annually, as compared with an average annual import of over 26,000 tons. The results of applying the suggestions made by Mr. Cotter, which are now the subject of correspondence with the authorities in Sind, will be watched next working season.

26. *Salai resin*.—Of other subjects referred to Mr. Turner, mention may be made of the oleo gum resin of *Boswellia serrata* to which a reference was made in last year's report. Laboratory work, which was delayed for want of suitable apparatus, has now begun. A similar investigation is also in progress at the Indian Institute of Science, Bangalore, and it is believed that private enterprise is also investigating. The turpentine produced is of good quality but the resin is not so good and the gum is practically valueless. If an improved gum can be produced the crude resin could probably be exploited with profit.

Fisheries.

27. Some progress has been made towards organizing this section of the Department, of which the main lines were laid down by Mr. Mead. Application has been made for the loan of the services of a marine biologist, with knowledge and experience of the scientific and economic sides of the industry, who will investigate the resources to be exploited and make proposals for the means of doing so and the necessary organization. A composite trawler of the Castle type, which had been constructed in Bombay for purposes connected with the war, has been purchased, and, when the services of a trawling master and mate have been engaged, the fitting of the vessel as a trawler will be made under their direction. This is a field for Government endeavour analogous to the explora-

tion of the country's mineral resources by the Geological Survey of India. In the case of fisheries, however, I consider that mere exploration work should, at the outset, be subordinated to the policy of ascertaining definitely whether trawling will or will not pay in Bombay waters. If it does pay, and perhaps even if it does not pay, there will probably be for many years to come a rich field for scientific and economic enquiry.

28. Mr. Walke, part-time Superintendent of Fisheries, Southern Range, continued his local enquiries till he was transferred to Bombay. At his suggestion, the Collector of Kanara has taken measures for the protection of the natural oyster beds situated at the mouth of the Tadri creek in the Kanara district, and Mr. Walke is carrying out operations to help the beds to recover from the depletion which they had suffered. Next year he will make experiments and demonstrations in the manufacture of fish oil, for which purpose he has been provided with two portable presses. It is unfortunate that unavoidable delay in securing his transfer from the Salt Department has prevented him from beginning full-time work at the opening of the new fishing season.

Glass.

29. The glass factories were heavily handicapped in the earlier part of the year by difficulties in obtaining coal, and at a meeting of their representatives with Mr. Mead, arrangements were made in consultation with the Coal Controller for a minimum supply of coal to keep in working order furnaces which were engaged on orders from Government and public bodies. Nevertheless, some factories had occasionally to close altogether for want of fuel and raw materials. Mr. Dawson gave one factory aid in working useful plant which had been lying idle. Recently the Director of the Geological Survey has accepted proposals for a survey of the sands in the Presidency, suitable for glass manufacture, and this will be made in the cold weather. A conference will also shortly be held with representatives of the

industry to discuss what measures can be adopted for its assistance. Here, again, it is not the difficulty of making glass but the difficulty of meeting foreign competition which has to be overcome, and probably the first step is for the Department to devise a costing system and arrange for its introduction in one or two factories with the object of ascertaining what the economics of the industry really are. Bombay City, where no less than six glass factories are now located, is far from the Indian sources of sand and coal, and has not the protection against foreign competition which is afforded by railway freights to a place like Allahabad which has sand at its door and coal not far distant.

Sugar.

30. I mention this for two reasons. The Advisory Committee has recommended that the next State technical scholarship should be awarded for the study of sugar technology including sugar chemistry. Secondly, a member of the Belapur Sugar Syndicate has kindly supplied statistics to show that there are good prospects for an industry undertaking the manufacture of a standard *gur* packing case and his suggestions are now under the consideration of the Forest Department.

Tanning.

31. It is most unfortunate that at a time when the tanning industry in other provinces is making preparations for developments on a notable scale, the industry in Bombay should be handicapped by uncertainty regarding its location in the future. Dharavi, where the tanneries are now situated, must be evacuated in connection with improvement and extension schemes in the north of the island of Bombay, and till large schemes now under the consideration of Government mature, the tanners are at a loss what to do.

32. Government have issued orders regarding experiments in the extended cultivation of *tarwad* (*Cassia auriculata*), the bark of which is the staple tanning material in India, and the Forest

Department is testing the cultivation in Sind of *Caesalpinia brevifolia* which has been recommended by the Tanning Adviser to the Indian Munitions Board.

33. During the previous year instructions were issued, at the instance of the Indian Munitions Board, with the object of improving the flaying of skins and hides. There is nothing to show that any improvement actually resulted and the problem, which is one of great difficulty, has again been under examination.

34. I shall now endeavour to sum up many of the scattered activities of the Department under one or two general headings.

Pioneering and Demonstration.

35. These are the methods which chiefly fascinate the popular imagination and it is worthwhile to consider their limitations. In Indian agriculture they are practically the standard methods of progress, but agriculture is sharply differentiated from industries in that it works for the advantage of thousands of small producers and scarcely knows the fear of over-production. When the Agricultural Department has successfully pioneered on its own farms the cultivation of, say, an improved variety of cotton, its demonstrations are attended with little or no risk that the new variety will be sown by too many cultivators or that large sums will be invested in the new cultivation by individuals who have neither the knowledge, experience or natural aptitude for any form of cultivation whatever. In Indian industry the case is different. Except in special cases, it is impossible for the fruits of any successful pioneering effort to be reaped directly by more than a few. The special exceptions include the village industries, of which handloom weaving is typical. Here the Industries Department is working on lines analogous to those of the Agricultural Department, and any improvements which are found suitable for the industry benefit workers by the thousand. The small scale factory for the production of articles in large demand is the next most suitable field for pioneering and demonstration. But the limitations are

obvious. Private enterprise leaves few profitable branches of manufacturing industry unexploited and the idea that a Government Department should successfully pioneer new industries and transfer them when established to private enterprise can only very occasionally be realized. The Department has made arrangements to pioneer in trawling and has submitted a scheme for a similar experiment in pottery and there the pioneering effort rests for the moment. One defect of these experiments, from the business point of view, is that they have usually to be arranged on a scale as small as is compatible with the demonstration of a commercial proposition, whereas the private industrialist naturally plans his venture on as large a scale as his market, his resources and other governing factors will permit.

36. As a supplement to complete pioneering efforts, such as fish trawling and pottery manufacture, work of an experimental nature will be done by the Department to assist the pioneering of new industries without the Department itself actually organizing production on a factory scale. Instances of this line of activity at the present time are the manufacture of magnesium chloride, bromine and bromides, casein and casein derivatives, and the utilization of the gum oleo resin of *Boswellia serrata*. Last year certain button making machinery was taken over and experiments begun with the object of assisting to meet the war demands for buttons, but I have meantime stopped this pseudo-pioneering effort till more information is collected.

37. The idea of demonstration factories is another product of the discussions of recent years but it has not yet in this Presidency been developed except for pottery where demonstration will be combined with pioneering and experiment. It has its origin in the dearth of local experts and in the lack of facilities for the adequate training of young Indians in manufacturing industries. To those who understand the conditions abroad which create the expert and the manager, the idea of reproducing these conditions in a Government demonstration factory will readily

suggest criticisms. The demonstration factory is mentioned here, not for its merits, if it has any, or its defects, which are obvious, but to draw attention to the lack of facilities for the industrial training of young Indians which the public, including the local capitalist, rightly feel must receive attention from Government. As a palliative at least, this Department can arrange to a limited extent to provide the capitalist and the industrialist with the technical advice and aid which is otherwise lacking.

Technical Assistance to Industries.

38. With the staff at its disposal the Department has done what was possible to meet the demand for technical assistance. Mr. Dawson has devised an improved silk twisting machine for the silk industry at Surat. The machine now in use is good of its kind and Mr. Dawson's aim is to produce a standardized model which will give better results than the make-shift varieties now in use. Success is reduced to a matter of costs and these have still to be investigated. Mr. Dawson also gave assistance to a gold and thread factory of which I hope to give the results in a future report, to a factory producing raw hide pickers and to a hosiery factory. Mr. Turner has devised for a brush factory a method of sterilizing bristles. These are instances of assistance which should be multiplied.

39. A plant for the improved distillation by steam of *rosha* grass oil, which was designed by the Forest Economist at Dehra Dun, was completed, delivered and put through a trial working in the jungle by the staff of the Public Works Department Workshop at Dapuri. The trial gave satisfaction to the producers of the oil but owing to short supplies of *rosha* grass consequent on the bad monsoon of 1918 further operations had to be postponed.

Industrial and Commercial Intelligence.

40. Under industrial intelligence I class information enabling enquirers to approach direct the proper authorities or experts. As an instance, enquirers regarding the paper pulp and paper industries are supplied by the Department with information.

of purely local import and for the rest are referred to the Consulting Cellulose Expert to the Government of India. Many of these industrial enquiries are, as might be expected, entirely futile, and the Department serves to sift the chaff from the grain; otherwise, to vary the metaphor, it acts as a switchboard to direct the currents of enquiry. Commercial intelligence covers a wide range, and in obtaining it I owe acknowledgments to His Majesty's Trade Commissioner at Calcutta, the Director-General of Commercial Intelligence, Calcutta, the Indian Trade Commissioner, London, and numerous private sources. This is a sphere of Government activity which requires development and better organization, not only for the province but for India as a whole. Indeed, it is incapable of proper organization on purely provincial lines.

General Assistance to Industries.

41. *Sites for Industries.*—A most useful measure for the assistance of industrial enterprise was taken by Mr. Mead in initiating the acquisition and development for factory sites of five hundred acres of land in Salsette. At the moment of writing, the applications received show that the whole area will be taken up. The scheme involves the construction of sidings and roads, the provision of housing accommodation and the introduction of an ample water supply and drainage system. For the preparation and execution of the scheme in detail a special officer will probably be necessary.

42. *Excise and Salt.*—One manufacturer and several users of denatured and rectified alcohol for industrial purposes have made representations against the restrictions under which they operate. The industry in this province works under disadvantages which do not exist in some other provinces or in Indian States and its grievances will be investigated in consultation with the Department of Excise. The manufacture of refined salt is also under discussion.

43. *Dyes.*—The supply of dyes to industries has received considerable attention. Alizarine dyes became available in larger

quantities during the year, but the demand, especially from the village dyers, soon outstripped the increasing supplies. The measures taken by the agents of the British Alizarine Company to ensure that the dyes reached actual users in the mofussil at the Company's selling price were evaded by dealers who at one period were able to obtain more than three times the price charged by the Company. The position was explained to Collectors of districts and new methods of control introduced. The only real remedy is, of course, an adequate increase in supplies to meet all demands and I have been in correspondence with His Majesty's Trade Commissioner with this object in view. More recently the supply of all classes of dyes has been examined and will probably require attention in the current year.

44. *British Industries Fair*.—At the instance of His Majesty's Trade Commissioner and the Indian Munitions Board, arrangements are being made for the representation of Bombay village industries at the British Industries Fair to be held in the Crystal Palace, London, next February. This Fair is restricted to certain classes of goods and the local exhibit is therefore limited to the following classes of articles:—electro plate, silverware, toys, sports goods and fancy goods. This restriction on the scope of the exhibit causes less practical difficulty in collecting articles for exhibition than the fact that the Fair is a Trades Fair and involves arrangements for the execution of orders with reasonable punctuality and in fair accordance with the samples exhibited.

Conclusion.

45. The Department has been in existence for less than two years and the exceptional circumstances of this period have naturally affected its development. If this report appears a fragmentary record, it but reflects the fragmentary character of the work up-to-date. It is impossible to mention all the odds and ends of work. I have merely endeavoured to illustrate by example the nature of the Department's activities and to indicate the lines on

which development is proceeding, viz., special sections for fisheries, industrial engineering, industrial chemistry and commercial intelligence with a side show in pottery. There are other matters, notably technical and industrial education, in which the sphere of the Department has barely been yet considered. Till the reform scheme is settled and till decisions are reached on the recommendations of the Industrial Commission, the next step in some direction is sometimes difficult to decide. I do not submit this consideration as an excuse for any failure to meet reasonable expectations of the Department's usefulness. There has been plenty of work to hand and it is a constant difficulty to keep clear of a mass of details in order to organize the Department as an efficient aid to industries.

46. The first charge on the Department must always be assistance to private enterprise and, judging from the increase in personal interviews and the standing of the enquirers, in this respect the recognition of its usefulness is growing. The results are frequently negative and those which are positive are not easily focussed in a report. I look forward to increasing association with private enterprise. Not only should the Department be developed on lines to assist, so far as Government action can assist, private enterprise, but unofficial aid should, *pari passu*, become available for the assistance and development of the Department. I gratefully acknowledge the assistance given by the members of the Advisory Committee, collectively and individually, and only regret that there were not more occasions and more important business to justify calls on their services.

I have the honour to be,

Sir,

Your most obedient servant,

R. D. BELL,

Director of Industries.

No. C—1616 of 1920.

OFFICE OF THE DIRECTOR OF INDUSTRIES,
Old Customs House,
Bombay, the 13th September 1920.

FROM

G. H. THISELTON-DYER, Esq., M.A., Assoc.M.Inst.C.E.,
Acting Director of Industries ;

To

THE SECRETARY TO GOVERNMENT,
Revenue Department,
Bombay.

Sir,

I have the honour to submit the annual report of the Department of Industries for the year 1919-1920.

2. Mr. R. D. Bell, C.I.E., I.C.S., held charge as Director until the 28th of February 1920, when he proceeded on nine months' leave. I took over charge from Mr. Bell and in addition have carried out the duties of Controller of Munitions, Bombay Circle. It cannot be denied that the work in connection with the winding up of munitions operations in Bombay has been a handicap to me, as I have to devote a large amount of my time to that Department. I am able to report, however, that the work in several branches of the Munitions Board has now been closed down and the Board at Simla are taking steps to relieve the Controllers in Bombay and Bengal of all but a very inconsiderable amount of work. I anticipate, therefore, that the Director of Industries will before long be able to devote the greater part of his time to work in connection with industries.

Expenditure.

3. The expenditure incurred by the Department during the financial year 1919-20 was approximately Rs. 1,10,000.

Staff.

4. A commencement was made during the year to organise a technical staff and the following temporary appointments were made :—

Mr. G. H. Thiselton-Dyer who was holding the appointment of Mechanical Engineer to the Government of Bombay was transferred as Deputy Director of Industries, from November 1st.

Mr. F. E. Bharucha, Assistant Professor of Mechanical Engineering at the College of Engineering, Poona, was transferred to the Department from 12th May 1919 as Mechanical Engineer to the Director of Industries. He has since been appointed as Assistant Director of Industries, Northern Division, Ahmedabad.

The transfer of the Public Works Department Central Store and Workshops at Dapuri near Kirkee to the Department of Industries took place on the 11th October 1919, and this necessitated the transfer of the late Mr. A. T. Gosford, Executive Engineer in charge, and Mr. C. Holliman, the Works Manager.

Mr. E. R. Fern, Superintendent of Pottery at the Sir J. J. School of Art, continued to serve as Pottery Expert.

Mr. T. J. Walke has carried on the work of Superintendent of Fisheries.

Mr. T. S. Dawson, Principal of the Victoria Jubilee Technical Institute, has continued to give great help to the Department in engineering matters.

On the Chemistry side, pending the report of the Chemical Services Committee, no steps could be taken to make any permanent arrangements for carrying on work in this important branch. Fortunately the services of Dr. A. N. Meldrum, Acting Principal of the Gujarat College, Ahmedabad, with his assistant Mr. D. M. Gangolli, and Mr. A. J. Turner, Head of the Chemistry Section at the Victoria Jubilee Technical Institute, Bombay, assisted by Mr. M. M. Koppikar, have remained at the disposal of the Department.

Lieutenant A. F. Yuill, lately Assistant Controller, Oils and Paints, also continued to give valuable advice and information in connection with the vegetable oil industry.

Proposals for entertaining a permanent staff to deal with engineering questions have been submitted to Government, and Mr. Bell, while on leave, has been instituting enquiries regarding the selection of suitable officers to fill the appointments when they are sanctioned. The appointment of a full-time staff is becoming more and more necessary, but I do not think it can be said that the Bombay Presidency is behind other provinces in this respect, and the general policy must be to proceed on cautious lines and not to make mistakes by securing unsuitable officers to deal with the work.

Advisory Committee.

5. There were no changes in the personnel of the Advisory Committee appointed to assist the Director and the members were :—

The Hon'ble Mr. Purshottamdas Thakordas, C.I.E., M.B.E.

The Hon'ble Mr. Manmohandas Ramji.

C. N. Wadia, Esq.

The Hon'ble Mr. Chunilal V. Mehta, M.A., LL.B.

M. de P. Webb, Esq., C.I.E., C.B.E.

The Hon'ble Mr. Nigel F. Paton.

Rahimtulla Currimbhoy, Esq., B.A.

A. J. Raymond, Esq.

A. T. Arnall, Esq.

Owing to changes in the office of Director and to the Munitions work, it has not been possible to have a satisfactory number of meetings and to make full use of the Advisory Committee, but it is clearly evident that this Committee must be of the greatest use to the Director in framing the policy of the Department and also in dealing with cases which come up from time to time, and on which the opinion of an Advisory Committee is essential. Such Advisory Committees have been or are being instituted in all other provinces,

and I have been informed by other Directors of Industries that the assistance of their Committees is of the greatest value.

Policy.

6. Little can be added to the remarks made by Mr. Bell in his report for 1918-19: On the engineering side, however, the proposals of the Industrial Commission for dividing up a province into a certain number of areas, each in charge of a Deputy or Assistant Director with engineering qualifications have been agreed to. Each of these officers will eventually have under him a number of Circle Officers, also engineers, who will be able to give direct and practical assistance to industrialists. A start has already been made by placing Mr. F. E. Bharucha in charge of the Northern Division, and the results of his inspections during quite a short period are most encouraging, and his advice is now being freely sought. The staff at the Dapuri Workshops have also been able to assist industrialists within a limited range of Poona, and here again the response has shown that the policy is a good one and likely to be popular.

Industrial Workshops, Dapuri.

7. These works were started on a small scale in 1914 for the purpose of repairing machinery for Government use and were carried on under the Public Works Department. The works comprise shops for joinery and furniture making, pattern making, iron and brass foundry, smith shop, machine shops, machine fitting and erecting shops, and about 150 artisans are employed. It was decided to transfer the works to the Industries Department as the necessity for having workshops where industrial engineering problems could be worked out on a practical scale, had arisen. These works, which were under the charge of Mr. A. T. Gosford, Executive Engineer, and Mr. C. Holliman, Works Manager, have arrived at a high stage of efficiency, and owing to the insistent demand from boys and young men to become apprentices, the idea of utilising the works for training artisans and industrial engineers has long been before me. It appeared

to me also that such a workshop might be organised on somewhat modern lines with the idea of improving the conditions under which artisans have frequently to live and work in this country, and that by demonstrating in a practical manner that the daily life of a skilled workman can be made attractive, fathers might be encouraged to put their sons forward for training as future industrialists. Mr. Gosford (whose untimely death from enteric fever has been a great loss) had taken up these ideas, and with the assistance of Mr. Holliman, his Works Manager, provision was made for a grain shop, medical attendance, cricket club and sports. Attention has also been given, as far as possible to the provision of quarters for the men, and I believe that these ideas have been fully justified by the increased efficiency and contentment among the men. The most pleasing side, however, is that applications have already been received from boys (who would otherwise have entered on a clerical career) to become apprentices, and every facility is given to the limited number who can be taken in to learn one or other branches of practical engineering. I am hopeful that this important work may be developed and that more facilities will be given for the housing and training of a considerable number of boys who wish to earn their living as skilled workmen.

Technical and Industrial training.

8. My remarks at the end of the last paragraph lead me to touch on this important question. If industries are to be developed rapidly in this Presidency, the problem of providing the necessary skilled workmen must be faced. In the Bombay Presidency, there is no store of skilled workmen such as is found in the Punjab to draw from. It has been my experience to find that when really skilled workmen are required they are actually brought down from the Punjab, and I am convinced that there is a very serious shortage of such men in this Presidency, and that the creation of industries will be prejudiced unless efforts are made to train our own raw material. It is so often stated that the Indian boy dislikes any form of manual labour. This may be perfectly correct, but we are rapidly

arriving at a stage when the question of living expenses is a very serious problem, and I believe that if the Indian skilled workman is allowed to work and live under healthy conditions and is paid good wages there will be no difficulty in attracting plenty of young raw material to train up to become artisans. Enquiries have shown that the pinch is already being felt by many firms who employ skilled labour, but so far, with the exception of the Railways (who cater for their own needs), little or nothing has been done by firms on this side of India to help to train apprentices. I feel, however, that the position is now different and that we can look to the Engineering Firms for assistance. Skilled workmen cannot be produced outside commercial workshops, and I venture to think that if engineers who are concerned in running the big engineering workshops in this Presidency are invited to assist Government in tackling this vital matter, a great deal can be done to set up means for training material for working industries. There are many branches of industrial work for which training in commercial shops is not possible. Technical colleges have been designed to cater for young men who wish to take up work in connection with chemical industries, electrical work, tanning, boot making, textile work, dyeing, bleaching, etc. Admirable facilities already exist at the Victoria Jubilee Technical Institute in Bombay, and to a certain extent at Ahmedabad and in other big towns, but expansion in this direction is indicated already.

Fisheries Department.

9. Up to the middle of October 1919, Mr. T. J. Walke was able to devote a certain amount of time to fishery work in addition to his other duties in the Salt Department, but from that time onwards he has worked at Karwar as a full time officer of the Department of Industries. Mr. Walke reports that he has been experimenting with sardines for the purpose of obtaining oil and also guano. The oil so far produced has been of a very good quality and has been favourably reported on by certain medical officers as a possible substitute for codliver oil. It is considered to be more pleasant to drink than

cod liver oil, but the question whether it is equally well provided with the nourishing and curative properties for which cod liver oil has obtained such a reputation, is still unsettled. The fish guano has been very favourably reported on by the Agricultural Department and so far it appears that there are good prospects of developing a profitable industry by the manufacture of oil and guano. It is encouraging to note, therefore, that land at Majali and Mallukurva has been taken up for the organisation of fish oil factories by private enterprise. Experiments have also been carried out by Mr. Walke in smoking fish with favourable results. Mr. Walke has visited as many of the fishyards along the coast as possible and has collected a large amount of useful information and given help and advice to fishermen and others. The proposal to purchase an experimental trawler has been sanctioned and steps have been taken to secure and equip a suitable boat in England which, it is hoped, will arrive in Bombay next cold weather. The work of this trawler will be of particular interest to people living in Bombay and within a reasonable radius because the present supply of fresh fish is inadequate, and if it is found that suitable trawling beds exist, I have no doubt that the fishery industry will become one of considerable importance. The trawler will be equipped with a refrigerating plant so that she can remain at sea for several days and still bring fish to harbour in a fresh state, but in order to cope with a successful catch it will be necessary to establish cold stores in Bombay. I understand that the Bombay Municipality have this question under consideration, but it is also a matter in which private enterprise might become interested. The appointment of a Marine Biologist has been sanctioned, and an officer will arrive early next cold weather. With the advent of the trawler, Fisheries will become a very live branch of the Department, and it is anticipated that useful results will be obtained and that the stimulus to this neglected industry will awaken private enterprise to the possibilities that almost certainly exist.

Chemical Branch.

10. Pending the report of the Committee which has been touring India to consider the question of forming an Imperial Service

of Chemistry, it has not been possible to bring forward any definite recommendations for setting up a staff of chemists with a suitable laboratory and equipment. The development of industries in this Presidency depends to a very large extent on chemistry, and the chemists and engineers of the Department will have to work in close touch with each other.

Dr. A. N. Meldrum and Mr. D. M. Gangolli have continued to do work for the Department and have published the first bulletin of the Department dealing with the preparation of sulphuric casein. Dr. Meldrum is continuing work on this important subject and promises a further bulletin dealing with practical methods for producing casein with a very low fat content. The object of this research is to find out satisfactory methods by which a really pure form of casein can be produced on a commercial scale. There is a considerable amount of casein produced in this Presidency, much of it being made in a very crude manner and consequently the price obtained is low and often quite unsatisfactory. It is thought, however, that if simple methods can be worked out for producing a really high grade casein, it will become quite a profitable industry in districts such as Gujarat where milk can generally be obtained in large quantities. It was intended to open a small demonstration factory at Anand where the manufacture of a good quality of casein could be carried out, so that villagers and other people who now make casein by crude methods could see the whole process and receive help in their difficulties. Unfortunately, owing to the scarcity of milk, the proposal had to be deferred, but Dr. Meldrum intends to carry out this idea as soon as circumstances permit.

Dr. Meldrum has also investigated the problem of improving the quality of locally made raw hide pickers. There is a large demand for pickers, but the locally made article has not been entirely satisfactory and has had some difficulty in competing with the imported article. It is hoped now, however, that Dr. Meldrum has found a solution of the difficulty and that the local manufacturers who consulted him will be able to produce pickers which will be equal in quality to those which are imported and lower in price.

Considerable help has also been given to oil mills in the vicinity of Ahmedabad in analysing their oils so that they can market them according to quality.

The ancient industry of hand-made paper in Ahmedabad has also received attention both from Dr. Meldrum and Mr. Bharucha, and efforts have been made to popularize the unglazed paper for laboratory filter work and also as an absorbent paper for drying plants. The glazed paper is of a fair quality, but owing to primitive methods the price is rather high.

Mr. A. J. Turner, with his assistant Mr. M. M. Koppikar, has continued his work in connection with the Kharaghoda bittern problems and has brought out bulletin No. 2 on the Utilization of Bitterns. He is continuing this research and has produced a sample of epsom salts which holds out great promise. In addition, Mr. Turner has investigated the possibility of obtaining refined salt from ordinary salt crystals in an economical manner. The results being quite favourable, a plant has been designed by Mr. T. S. Dawson, for the Pioneer Magnesia Company, which it is hoped will be constructed and working in the coming cold weather. The extraction of bromine from bitterns at Kharaghoda and Aden has also been investigated, but opinion appears to be that owing to the small demand for bromine now that the war is over the possibility of producing bromine in paying quantities from these sources is not very hopeful.

Mr. Turner has also carried out a large number of analyses of oil-cakes for the Department and has made an examination of "crude soda liquor" obtained in Sind, with a view to producing a good grade of washing soda. He has also visited several factories and advised them with regard to their difficulties.

As an example of the way in which the Chemist and the Engineer must work together for the development and maintenance of industries and industrial concerns, I should mention the valuable work which has been done by Mr. T. S. Dawson in collaboration with Mr. Turner. Mr. Dawson has worked alongside Mr. Turner in practically all the investigations which I have referred to above, and

has been directly responsible for designing apparatus and plant and affording very valuable advice in introducing work on a practical scale.

Before leaving this section I would note on the enquiries and the interest which has been taken in the subject of wood distillation. The idea of distilling wood and obtaining a large number of valuable by-products has appealed greatly to industrialists with capital. The question has been investigated very thoroughly by experts who are familiar with the processes and working of the plant, and the Forest Department has also afforded a large amount of information regarding possible areas where timber could be obtained in quantity and at a reasonable cost. Unfortunately, the conclusions arrived at are that, as far as this Presidency is concerned, the installation of a fully equipped plant would not be a successful enterprise. The amount of wood required is a very serious item for a plant which is to be worked on a commercial scale, and it does not seem possible to find an area where such supplies will be constantly forthcoming and where the wood can be obtained at all times of the year in a sufficiently dry state. Now that the war is over, the market for by-products has fallen away, and unless India is able to take up and make use of all the by-products it is not considered that it will pay to produce them for export only. There is, however, another side of the problem which requires investigation. In India the demand for charcoal is increasing rapidly and the methods of production are crude and inefficient. It appears, therefore, that there may be an opening for wood distillation, the primary object being to produce charcoal of good quality at a reasonable price. By-products will probably be neglected, although it is possible that a plant might be designed to deal with one or more particular by-products for which there is a market, without going into the expensive refinements for the complete distilling plant.

Power.

11. The problem of supplying cheap power for industrial concerns is now engaging attention all over the world. This is principally due to the fact that the output of coal has been greatly restricted

and the price has reached a figure which was never before contemplated. This rise in the price of coal has been viewed with grave apprehension, but it is yet possible that it may prove to be a blessing in disguise, because it will bring home to users of fuel the necessity for economising resources and developing new methods for utilizing fuel with the least possible amount of waste. The neighbourhood of Bombay is well provided by nature with facilities for obtaining cheap electric power from water, and in other parts of the Presidency investigations of all likely sources of water power are being carried out by Government. For many years the small industrialist has made use of the steam engine or the oil engine, the latter using refined or residual oil. The steam engine user is faced with the increasing cost and the difficulty of obtaining coal for his boilers. The user of the oil engine is also faced with the much higher cost of oil fuel and the prospects of these prices falling are not in any way favourable. The demand for Indian coal is increasing and the cost of production and transport is also increasing, so that the price of coal in the Bombay Presidency is not likely to lower. Owing to the enormous increase in the price of coal and the difficulty of obtaining supplies and labour to stoke boilers, there is an almost universal movement in the direction of using refuse or crude oil for firing boilers. This method of using oil is not economical, but it has been forced on to boiler users, with the result that the price of oil has increased, will go on increasing, and is not likely to decrease. The consequence of this is also found in the scarcity and increased cost of the lighter products of oil distillation such as petrol. The idea of finding some cheap substitute to take the place of petrol has aroused a large amount of interest. Power alcohol has become a popular cry and many enquiries have been received regarding the possibilities of obtaining materials from which cheap alcohol can be manufactured. In this Presidency, the proposal to make use of 'Mahua' flowers for producing cheap alcohol has been thoroughly looked into, but owing to the difficulty of collection, price and the short season during which the flowers are available, it is quite certain that

a large distillery could not be made to pay or even compete with petrol at its present price. A plant for producing alcohol and ether (the mixture which is being used successfully as a substitute for petrol) is being completed in Hyderabad State (Deccan). This plant will distil alcohol from Mahua flowers, but it is not known at what cost the mixture will be sold. An investigation of all other possible sources of supply has led to the conclusion that until big supplies of molasses are available from sugar factories, any proposal to distil commercial alcohol will not be successful. It must not, however, be forgotten that there is a remote possibility of discovering some rapidly growing plant which will flourish on waste lands and produce either flower, fruit or tubers from which alcohol can be made at a cheap rate. It may be noted in passing, however, that Java has enormous supplies of waste molasses some of which are used for producing alcohol at the present time. Alcohol from Java is imported into India at a cheap rate ; so any proposal to distil alcohol in India on a large scale will have to reckon with competition of imported alcohol from Java. One of the remaining sources of power which has been curiously neglected, possibly owing to the counter-attractions of the oil engine, is the suction gas producer, working a simple gas engine. Such producers work extremely well when using charcoal, although many forms of refuse can also be used. I consider, however, that this Department will have to take up the question of popularising the use of suction gas producers in order to provide the small industrialist who is out of reach of cheap electricity with a simple and cheap power equipment for his factory. The question of supplying charcoal in better and cheaper qualities has already been touched upon, but the co-operation of the Forest Department will be very necessary to assist in producing more and more charcoal. The problem of obtaining fuel for power purposes is engaging very serious attention in England and has led to the establishment of a Fuel Research Board with an experimental station outside London. The reports of this Board are being watched very carefully by the Department of Industries with a view to following up their results in a

practical manner for the benefit of industrialists. It is interesting to note that the conclusions arrived at so far point to the fact that coal as a source of power is still the cheapest if utilised to the best advantage, and that it is probable that low temperature distillation of coal will produce a number of different varieties of fuel, all of which can be utilised for special purposes according to the most economical methods.

Pottery.

12. Mr. Fern continued during the year as Superintendent of the Pottery section of the Sir J. J. School of Art. A good many enquiries have been received by the Department from people who are interested in the development of pottery works, glass-making, etc., and some 78 samples of different sands, clays, etc., were tested and reported on. There were eight students in the Pottery section throughout the year, two of whom completed their course of study, one having joined a private brick factory. Progress with the final plans and estimates for the Demonstration Pottery which is to be situated on the Kurla-Kirol area has been delayed owing to the extreme difficulty of getting accurate quotations and information from manufacturers of such machinery in Europe. It is hoped, however, that more rapid progress will be made during the coming year. An enquiry was also received from the Public Works Irrigation Department regarding the possibility of setting up a small pioneer factory in the Deccan for manufacturing agricultural drainage pipes. These pipes are required for draining waterlogged lands in the neighbourhood of certain sections of the canals, and the price of pipes which have to be railed from a long distance renders such drainage work prohibitive in cost. Quotations for a suitable plant have been asked for, but unless the output is sufficient to lay down a plant of a certain size, it will not be possible to run it as a commercial enterprise, and for this reason I am proposing to attach a small brick-making plant in order to increase the output.

Kurla-Kirol Industrial Area.

13. Some 500 acres of land have been acquired at Kurla-Kirol in Salsette for the purpose of affording sites for industrial concerns

and for the Demonstration Pottery. Applications were called for by advertising in newspapers, and as a result 33 requests were received by the end of September 1919, for plots ranging from one acre up to one hundred acres. The area applied for is in excess of the land available, but pending the development of the site which, it is understood, will be taken in hand during the cold weather of 1920-21, it has not been found possible to make specific allotments. It will be necessary to level a considerable portion of this area, to lay down sidings from the railway, to provide roads, drains and water-supply. It is hoped also that cheap electric power will be available in the future from one of the Tata hydro-electric schemes. The provision of sites for new factories is an urgent necessity, and many applications for assistance have been received, but pending the preparation of a comprehensive scheme for the development of Salsette, it has not been possible to afford much assistance. One of the great needs, however, for almost any type of factory is a plentiful supply of fresh water, and as Salsette is not well off in this respect I feel some apprehension that the development of industries may suffer some delay from this cause.

German Reparation Dyes.

14. A consignment of 200 odd tons of German reparation alizarine dye was allotted to India in 1919. At that time the import of dyes into India was prohibited and there was a considerable amount of suffering among dyers owing to the extreme shortage of alizarine dye, the use of which is very popular among small dyers. It was decided that the reparation alizarine dye should be sold at a controlled rate of Rs. 1-3-0 per lb. and the distribution was undertaken by the Director of Industries, Bombay, with the assistance of Messrs. Latham Abercrombie & Co. who actually handled the casks and distributed them according to instructions. Owing to the uncertainty as to the composition of the dye, it had to be repacked and tested in England before despatch, with the result that the consignments were received in small quantities and the total quantity was insufficient to meet the big demand. Efforts were made to distribute the dye

throughout India in as fair a manner as possible, but disappointment was inevitable in many cases. But owing to the fact that a single cask could be resold at a profit of at least Rs. 3,000, extreme precautions had to be taken to see that the distribution of the dye was kept under strict control. An additional supply of English made alizarine to the extent of 25 tons per month was also promised, but unfortunately none of this has been received. It is understood that towards the end of the year the new works of the British Alizarine Dye Company at Manchester will be in full working order, and if this turns out to be the case, the demands of India will be met in full. India's share of reparation dyes other than alizarine are being secured by the Indian Trade Commissioner in London. Great difficulty is, however, being experienced owing to the fact that the dyes have been received from Germany without labels or marks, and this necessitates careful investigation to ascertain the contents of each cask. Arrangements are being made to ship the dyes to India and distribute them as fairly as possible, but in this case also it is evident that the quantities are really insignificant, and it will be impossible to meet the requirements of everybody.

Sugar.

15. In the previous report, it was noted that the Advisory Committee had recommended that a state technical scholarship should be awarded for Sugar Technology including Sugar Chemistry. Mr. R. G. Padhye has been awarded a scholarship and has proceeded to the Audubon Sugar School, Louisiana; U. S., and will then proceed to the West Indies for a further course of study.

The supply of "gur" packing cases on a limited scale has been taken up by the Forest Department, but it is evident that there is a considerable demand for light packing cases for different products, which should engage the attention of private capital.

Co-operation with other Departments.

16. The appointment of a Forest Utilisation Conservator has led to the Departments of Industries and Forests coming into close

touch with each other. Many enquiries which come to the Industries Department are of interest also to the Forest Department, and by working together it has been possible to distribute information which should be of considerable value to the enquirers.

The appointment of an Assistant Registrar of Purchase and Sales Co-operative Societies with an office in Bombay will also facilitate a rapid interchange of information between the two Departments, and this should produce good work also.

The Director and Deputy Director of Industries have attended meetings of the Advisory Board of the Poona Engineering College, the Victoria Jubilee Technical Institute, and the Committee of Direction for Technical Education, thus enabling the Department to keep in touch with the educational side of industrial work.

Glass.

17. Difficulty continues to be experienced in obtaining coal for the glass works, but the re-appointment of the Coal Certifying Authority in Bombay has enabled the Department to render some assistance to the factories in obtaining coal. The fact remains, however, that supplies have not always been forthcoming and the cost of coal has been in many cases very high. An attempt has been made to form a glass manufacturers' association so that the proprietors of the different firms could meet together and assist each other or discuss their needs and difficulties. Mr. Chandorkar of the Paisa Fund Glass Works, Talegaon, has done his utmost as Secretary of the association to induce the members to attend meetings, but so far without much success. I hope, however, during the next cold weather, to arrange for some demonstrations of bottle-making machines at one of the works in Bombay which may produce the effect of bringing forward the usefulness of co-operation. The industry appears to have done fairly well during the year owing to the lack of foreign competition, but efforts will have to be maintained to introduce modern improvements and more satisfactory products, if the industry is to be able to hold its own in the future."

Handloom Weaving and Dyeing.

18. The work of this branch is being continued, and weaving schools have been carried on at Bhiwandi, Sangamner, Dhulia, Nasirabad and Kamatgi. The Dhulia school having served its purpose of introducing fly-shuttle looms, was closed from 1st April 1920, and the weaving school was handed over to the Edward VII Technical School. At Kamatgi, it was ascertained that the school was not attracting interest, so it has been replaced by a demonstration of fly-shuttle looms at Ilkal from 1st February 1920. A similar course has been taken with the Nasirabad weaving school, and a demonstration of the fly-shuttle loom has been opened at Erandol.

The instruction given in the schools includes the weaving of cotton and mercerised bordered 'sarees', silk 'sarees', 'dhoti' pairs and cloths of complicated designs, and lessons are also given in arithmetic. As a rule, the students who are trained in the schools purchase fly-shuttle looms, and with the exception of the places named above, the schools, and especially those at Sangamner and Bhiwandi, have been very successful. The principle followed is, that when the school has fulfilled its purpose and a considerable number of students have been instructed, to move on to some other locality where a call for teaching has been previously ascertained. The weaving demonstrations appear to be popular, and in this case also the demonstrator moves from place to place.

In the month of March, dyeing demonstration was started at Sangamner. This new venture appears to be most promising and is likely to be of considerable benefit in many places.

The result of the Bhiwandi weaving school has been to introduce 650 looms into the town, while at Sangamner 204 have been introduced. At Dhulia, the number had reached 710 when the school was closed. Kamatgi and Nasirabad are only responsible for 25 and 20 respectively.

Weaving demonstrations have been responsible for introducing 15 looms and 30 dobbis at Sulebhavi, whereas at Faizpur in East Khandesh a satisfactory record of 28 looms and 35 dobbis has been

obtained. The other places do not show such satisfactory results. Great interest is being taken in weaving and dyeing, and the results so far obtained are distinctly encouraging. It is hoped to be able to expand this branch to meet the demand for instruction which has been brought about by the work and demonstrations which have already been done.

Tanning.

19. The industry both in Bombay and in Karachi is still handicapped by uncertainty regarding its location.

Calico Printing.

20. The ancient industry of calico printing which is still carried on to a very considerable extent in Ahmedabad and other towns in Gujarat, has been investigated by Mr. F. E. Bharucha, the Assistant Director of Industries. Fortunately, during this investigation Mr. G. P. Baker arrived in Bombay from London, with the idea of touring India to see for himself what is now being done in the way of producing printed calicos. Mr. Baker is an authority on this industry and exhibited proofs of plates from a book he is bringing out shortly, describing and illustrating the work which was carried out in India many years ago. The present work which is produced is unfortunately very inferior to the works of art which were made formerly. But after a tour through India, Mr. Baker informed me that he considered there was still a chance of reviving this industry, and if this can be done, he assured me that there is a ready market in Europe for the produce. Up to the present, I have been able to do little in the direction of improving the industry beyond assisting the printers (of whom there are some 14,000 in Ahmedabad alone) to obtain supplies of alizarine dye, and efforts have also been made to start co-operation among them. To effect improvements, it will be necessary to introduce some means of teaching and producing good designs, and the quality of the printing and dyeing needs considerable attention. A system has also to be devised for collecting the printed cloth and marketing it, and in this connection the general problem

of assisting small and scattered cottage industries and of marketing their goods arises. I hope that a scheme can be devised for improving the work of the calico printers, and by doing this, to revive a very ancient industry which should not on any account be allowed to die out.

British Industries Fair.

21. The British Industries Fair was held at the Crystal Palace in London during February and March. This fair is a trade exhibition and has been instituted with the idea of enabling dealers and traders to see samples of different goods and to place orders at wholesale rates. A small collection of fancy goods which included ivory goods and 'agate' articles, wood lacquered-ware, gold and silver embroidered silk, sandalwood articles, carpets, etc., was hurriedly collected together and sent to the Indian Trade Commissioner in London who looked after the Indian exhibit. A number of the samples was sold and orders have been received to the value of Rs. 830. These orders include principally wood lacquered-ware and fruit-toys. But in the absence of any system for placing orders, inspecting the goods when manufactured, forwarding them to London and collecting the cost and making payments, it has been a matter of some considerable difficulty to carry out such orders with the present staff. As noted above in my reference to calico printing, it appears to be essential, that if the small industries of India are to look to European markets as an outlet for their goods, to set up not only a permanent warehouse in London where samples can be exhibited, but means by which orders when placed in India can be inspected, packed and forwarded to purchasers.

Conference of the Directors of Industries.

22. During the month of April, I attended a conference of Directors of Industries which was presided over by Sir Thomas Holland, K.C.S.I., K.C.I.E., at Simla. A report of this conference has been published by the Board of Industries and Munitions, and it

is intended to hold a second conference in November. The subjects covered a wide range. Among those discussed was the question of the marketing of village industry products outside India; financial and other forms of assistance for new industries, pioneer and demonstration factories, the standardisation of machinery and plant with a view to manufacture in India, technical and industrial education and apprenticeship schemes. The report referred to contains a short note on each subject discussed and forms a useful indication of the nature of the discussions.

Industrial and Commercial Intelligence.

23. A large and increasing amount of correspondence is being received by the Department in which information on an enormous number of different subjects is asked for. In addition, there are many callers at the office who come to ask for information or to discuss problems. The number of enquiries of a serious nature is on the increase, and every endeavour is made to supply the requisite information, and to render assistance where possible. I must acknowledge the assistance I have received in this respect from the acting Director-General of Commercial Intelligence, Calcutta, and H. M. Senior Trade Commissioner, Calcutta, both of which officers, I hope, will shortly be represented in Bombay. I should also acknowledge the assistance which I have received from the Secretary, Board of Industries and Munitions, Simla, with whom I am able to correspond demi-officially.

Conclusion.

24. This report covers the work of the Department up to July 31st, 1920, and represents a definite amount of progress and a good deal of preparation for the future. Previous reports have been subject to a certain amount of criticism because more has not been accomplished and better results shown. I do not consider, however, that with the changes in personnel and the absence of staff it would have been possible to do more, and I think that what has been done in this

Presidency has not been surpassed in other Presidencies. I can, however, say with confidence that the spadework which has been done will mature before very long, and the skeleton Department as it now exists will become a reality, with a staff properly equipped to produce the results which are so impatiently awaited. The Department has felt its way along in a cautious manner, and by doing this I feel sure that serious mistakes have been obviated. I am well aware that our methods have not been sufficiently progressive to meet the needs of the purely speculative company promoter. But at the same time I feel quite happy in my mind that the progress made is sound, and that if we had hurried along without considering the position very carefully we should share the fate which, I fear, will overtake some of the younger concerns which have been created without considering whether raw materials can be obtained or whether there is a market for the finished product.

I have the honour to be,

Sir,

Your most obedient servant,

G. H. THISELTON-DYER,

Acting Director of Industries.

No. C—2067.

OFFICE OF THE DIRECTOR OF INDUSTRIES,
New Custom House, Ballard Road :
Bombay, the 8th September 1921.

FROM

R. D. BELL, Esq., C.I.E., I.C.S.,
Director of Industries,
Bombay ;

To

THE SECRETARY TO GOVERNMENT,
Revenue Department,
Bombay.

Sir,

I have the honour to submit the annual report of the Department of Industries for the year 1920-21 (1st August to 31st July).

2. At the beginning of the year I was on leave and Mr. Thiselton-Dyer continued to act as Director till my return in the beginning of December when he proceeded on nine months' leave. Since May 1919 the Director of Industries had also held the appointment of Controller of Munitions, Bombay Circle, but during 1920 the operations of the Munitions Board in Bombay were wound up and on my return in December the office of Controller of Munitions was closed. The Director of Industries is now the Chairman of the Sales Committee which advises regarding the disposal of surplus stores, but this involves no administrative duties. Throughout the year I was also in charge of the sale of German reparation dyes taken over under

the reparation clauses of the peace treaty. This involved considerable work in organisation at the outset but is now running on routine lines.

3. Another important *quasi* official duty of the Director is membership of a number of Committees. In addition to the Sales Committee I served on a committee to enquire into the working of the Government Central Press and am at present a member of a committee appointed under the chairmanship of Sir M. Visvesvaraya to draw up a scheme for technical and industrial education in the Presidency. I am also a trustee of the Victoria Jubilee Technical Institute, a member of the Committee of Direction for Technical Education and a member of the Provincial Co-operative Conference Committee. The total number of committee meetings attended during the eight months since my return from leave was fifty.

Expenditure.

4. The expenditure incurred by the Department during the financial year 1920-21 and the two preceding years has been as follows :—

	Rs.
1918-19	73,000
1919-20	1,56,000
1920-21	1,45,542

The final figures have not yet been obtained from the Accountant General, and practically all the expenditure incurred in the purchase of the trawler is excluded. Although the vessel was purchased more than a year ago I have not yet been able, although repeated enquiries have been made, to obtain an account of the disbursements by the Stores Department of the India Office.

Staff.

5. Mr. G. H. Thiselton-Dyer, who was appointed as Deputy Director of Industries at the end of 1919, has not yet been able to

organise his establishment. Immediately after his appointment he was required to act as Director for nine months, and thereafter proceeded on leave till the close of the year under report.

Mr. F. E. Bharucha held the appointment of Assistant Director of Industries, Northern Division, Ahmedabad, throughout the year, but till January last was engaged entirely in overhauling and repairing a dilapidated distillery plant belonging to Government.

The appointment of Executive Engineer in charge of the Central Store and Workshop at Dapuri, near Kirkee, has been held throughout the year by Mr. F. C. Davies and the appointment of Works Manager by Mr. C. Holliman. The latter was on leave till the end of January 1921.

Mr. E. R. Fern, Superintendent of Pottery at the Sir J. J. School of Art, continues to serve as pottery expert. Mr. Fern returned in December from six months' leave during which time Mr. C. P. Shah officiated.

For advice on matters relating to fisheries, Government have obtained from the Ministry of Fisheries and Agriculture, England, the temporary loan of the services of Mr. A. E. Hefford. Mr. Hefford arrived in India in December and holds the appointment of Marine Biologist. Mr. T. J. Walke remains as Superintendent of Fisheries.

On the chemistry side there are still no permanent arrangements as regards staff or laboratory accommodation and chemical problems continue to be taken up, in addition to their ordinary duties, by Dr. A. N. Meldrum, Professor of Chemistry, Gujarat College, Ahmedabad, who was assisted by Mr. D. M. Gangolli, and by Mr. A. J. Turner, now Principal of the Victoria Jubilee Technical Institute, Bombay, who is assisted by Mr. M. M. Koppikar. Dr. Meldrum was absent for most of the year on leave.

6. In November 1920 the Department lost the part-time services of Mr. T. S. Dawson who retired from his appointment as Principal of the Victoria Jubilee Technical Institute. Lieutenant

A. F. Yuill, formerly Assistant Controller (Oils and Paints), also resigned Government service to take up private employment. Mr. Yuill gave very valuable help to the Department in connection with the vegetable oil industry and the results of his enquiries have since been published in a departmental bulletin which is a great advance on anything hitherto published regarding this important industry in India. At the close of the year Mr. Gangolli, assistant to Dr. Meldrum, resigned his appointment to take up an important and well paid post elsewhere. I do not regret such a loss as this. One of the functions of the Department is to assist in training young chemists and mechanical engineers and, although it is a great handicap to lose the services of promising young men at the very time when the Department is expecting to reap the fruits of their training, the supply of trained men to private enterprise, on the one hand, and the well paid employment of the young men, on the other, are themselves objects worth attaining. Three honours graduates in science were provided at the close of the year with scholarships for training in technical chemistry at the Indian Institute of Science, Bangalore, while three men, of whom two were graduates in engineering, were selected for training in the engineering workshop at Dapuri.

7. All the staff mentioned above is still temporary. Throughout the year a great handicap was imposed on the Department by the number of officers who were on leave, by permanent losses of personnel, and by the performance during the first half of the year of other important duties by the Director and Mr. Bharucha.

Advisory Committee.

8. In March 1920 Mr. C. N. Wadia resigned and Mr. Nigel F. Paton, representing the Bombay Chamber of Commerce, vacated his place on the committee by proceeding on leave. In January 1921 the Hon'ble Mr. Chunilal V. Mehta, who represented the Indian Merchants' Chamber and Bureau, resigned on accepting the appointment of Minister. In March Mr. Purushottamdas

Thakurdas, C.I.E., M.B.E., Mr. Manmohandas Ramji, M.L.A., and Mr. A. J. Raymond retired by rotation and in April the committee unfortunately lost by death the valuable services of the late Mr. Rahimtulla Currimbhoy. Of last year's committee only two members now remain, *viz.*, Sir M. de P. Webb and Mr. A. T. Arnall. The members of the Committee now are :—

1. Director of Industries.
2. A. T. Arnall, Esq.
3. Sir M. de P. Webb, Kt., C.I.E., O.B.E., M.L.C.
(representative of the Chamber of Commerce, Karachi).
4. Ambalal Sarabhai, Esq. (Ahmedabad).
5. Sir Alfred Chatterton, Kt., C.I.E.
6. H. P. W. Macnaghten, Esq., M.L.C. (representative of the Chamber of Commerce, Bombay).
7. Lalji Naranji, Esq. (representative of the Indian Merchants' Chamber and Bureau).
8. Cowasji Jehangir, Esq., C.I.E., O.B.E., M.L.C.
9. G. B. Trivedi, Esq., B.A., M.L.C.
10. Mangaldas Girdhardas, Esq., M.L.C. (Ahmedabad).
11. Rao Bahadur R. R. Kale, LL.B., M.L.C. (Satara).
12. Mahomedbhoy Currimbhoy, Esq.

No meetings of the Committee were held till my return from leave after which five meetings were held before the end of the year. In order to give the Committee an assured status and secure for it a practical working basis a statement of its functions was submitted to Government at the close of the year and has since been approved. This will give the Committee a close control over all the operations of the department. It is worth noting that six of the eleven non-official members are members of the Legislative Council so that popular control is well blended with business advice.

9. The principal subjects on which the advice of the Committee was tendered to Government were :—

(1) The principles and procedure according to which the law should be amended in order to permit of the compulsory acquisition of land for industrial purposes ;

(2) the terms of a concession for the collection of the oleo-gum-resin of *salai* (*Boswellia Serrata*) ;

(3) participation in the British Empire Exhibition, 1923 ;

(4) the organisation of an industrial bank ;

(5) an industrial and economic products section for the Prince of Wales Museum ; and

(6) participation in an all-India hand-weaving exhibition.

The Committee receives full monthly reports on the working of the steam trawler.

Policy.

10. The year was one of industrial depression ; this was reflected in the diminution of requests for advice in the selection and installation of small plants. These circumstances, the financial stringency, and the lack of personnel owing to resignations and leave reduced policy in many directions to marking time. There were therefore no notable developments in the department except in fisheries.

Cottage Industries.

11. *Hand-loom Weaving.*—The oldest sections of the Department of Industries is organised for the improvement of the hand-loom weaving industry. Its object is to introduce improved appliances and methods amongst the weaving population so as to raise the standard and increase the amount of their output. The most important mechanical improvement in handloom weaving in recent years has been the introduction of the fly-shuttle slay of which large numbers are now in use in this presidency. By its means the output of the weaver is increased by something like 40 per cent. Another

useful appliance of which the use has been largely increased is the mechanical dobbie of which there are several types. The weavers have also learned by experience the advantages of imported healds, reeds, shuttles and pirns over the country made articles and the former are in increasing demand.

12. The use of improved appliances and improved weaving methods is taught in two ways, namely, by means of weaving schools and by demonstrations. The weaving schools are equipped with fly shuttle looms,—khadi looms for beginners and saree looms for advanced pupils. Dobbies suited to the local weaving patterns are also supplied. There is a regular curriculum and instruction is given in the weaving of cotton and mercerised bordered sarees, silk sarees, dhoties, khans and cloths of intricate design. Provision is also made for lessons in simple arithmetic, but generally the boys who are admitted have already studied up to the fourth vernacular standard. Instruction is given free and for the first three months pupils receive a stipend of Rs. 3 monthly. Thereafter small prizes are given to the most regular attender and to the pupil who produces the best cloth. By this time the boys are able to earn a little in the school as the proceeds of their output are paid to them after deducting the cost of the yarn. They are encouraged to place a portion of their earnings in the Post Office savings bank so that on leaving the school they can set up for themselves with a fly shuttle loom and a dobbie. Registers of old pupils are kept so that touch may be maintained after they leave school. Some of these schools have been very successful, the appliances and methods used by ex-students being readily adopted by other local weavers. In other cases the school propaganda has practically no influence on the local weavers. This is undoubtedly due to the deep-rooted conservatism of the weavers in some parts. The master of a weaving school who has made an instant success of his school in one town has failed after nearly two years' labour to produce any results in another.

13. At the beginning of the year there were two weaving schools, one at Bhivandi and the other at Sangamner. These were

transferred in November 1920 to Ahmednagar and Yeola (Nasik District), while a new school was opened at Belgaum in December. The Bhivandi school was a striking success and of 1,200 local throw-shuttle looms six or seven hundred had been fitted with fly shuttle slays when the school was closed. The manufacture of these slays is now a local industry. There are now also many small handweaving factories which work entirely with fly shuttle slays while several have adopted a double box motion the use of which was taught in the school. In addition to the increased output thus secured many of the local weavers now produce higher class cloth. Two looms were specially maintained at the school for this purpose and weavers who formerly prepared only sarees are now preparing silk khans, lace bordered sarees, and silk edged dhoties with special designs. I have dealt with Bhivandi at length because it exemplifies the standard which the Department seeks to reach in all the schools. The Sangamner school was also very successful, nearly 400 fly shuttle looms having been introduced before it was closed. At Yeola and Ahmednagar over 500 and 100 fly shuttle slays have been introduced already. At Belgaum progress has been slow but already 50 fly shuttle looms are at work, and a handloom factory has also been opened.

14. The demonstrations are on less elaborate lines. A demonstrator is sent to a weaving centre for about six months with two looms. On one of these he works with the appliances and methods which the department seeks to introduce and on the other any local weaver can receive instruction and practice for himself. In some villages the results from these demonstrations have been very satisfactory and they frequently evoke a request from the local weaving population that a weaving school should be opened in their village. At the beginning of the year four demonstrations were in progress, of which three have since been closed. Six new demonstrations were opened during the course of the year, all of which still continue. About 400 improved looms and the same number of dobbies have been introduced during the year as a result of these demonstrations.

15. -The full staff of the weaving establishment is six head-masters, seven assistant masters and six weaving demonstrators. Owing to the difficulty of obtaining suitable men the staff is never at full strength and the demonstrations especially have been frequently interrupted by resignations and otherwise. It is almost impossible to get competent weaving masters and demonstrators ready made and all the department can do is to enlist suitable individuals and train them for their duties. The work of the schools and demonstrations is supervised by two assistants and the total annual cost of the section is about Rs. 15,000.

16. *Experiments in sizing.*—In connection with the weaving schools at Bhivandi and Ahmednagar experiments were carried out with a warping and sizing machine. The machine is much too expensive for the individual weaver but can frequently be used with advantage by the owner of a handloom factory. It requires more intelligent demonstration than it has received and I hope to make better arrangements for testing its use next year.

17. *Dyeing.*—A small dyeing demonstration was started last year at Sangamner at the request of the local weavers. The number of pupils rose from eight to thirty and there was something like a protest when the demonstration was transferred with the weaving school to Yeola in November 1920. At Yeola the demonstration was not successful and was finally brought to a close by the resignation of the demonstrator who obtained a better appointment in private service. A new demonstrator has recently been appointed and will begin work at Ahmedabad. In connection with the controlled-distribution of alizarine dyes Mr. Bharucha came into close touch with the Ahmedabad calico printing industry. A Co-operative Society was formed but has been handicapped by the prevailing trade depression.

18. *Hand made paper.*—Assistance was given last year to the paper makers in Ahmedabad, chiefly in finding new customers. After consulting Mr. W. Raitt, the Cellulose Expert at the Forest

Research Institute, I reached the conclusion that there is no chance of improving this industry. At present it meets a certain demand and so long as this demand exists it will linger.

19. *Casein*.—The research work in connection with casein is dealt with later. A demonstration casein factory was started at Anand last December with the object of applying the results of the work done at the Gujarat College to the methods used for the manufacture of casein in the villages of the Kaira District. Kaira casein has earned a bad reputation in the world's markets not because the villagers cannot make fairly good casein but because hitherto the trade has not attempted to maintain a standard either by rejecting inferior casein or by grading according to quality. The result is that Indian casein now fetches nothing more than the price of the worst casein. Samples of caseins made at the Department's small factory at Anand were sent to London for opinion. Both the dealers consulted gave very favourable reports; one expressed the opinion that the sample was as good as the average quality of Argentine lactic casein. This means that a villager who will take the trouble to produce casein of similar quality can obtain a price probably 50 per cent. higher than he has hitherto obtained provided always that special arrangements are made for marketing it. At present if it is put on the market through the usual channels it will, as Indian casein, fetch exactly the same price as the worst qualities now made in Kaira. The casein made at Anand was analysed at Ahmedabad from time to time and the details of the process modified as the analytical results seemed to require. The methods used are capable of still further improvement. At the moment the propaganda work has been held up by the state of the casein market. Casein which sold for over £60 a ton in February realised only £30 in June while simultaneously the price of separated milk rose to a figure which made the profitable manufacture of casein impracticable. The important result is, however, that good casein has been made on much the same scale as that on which the Kaira villagers work and by a method and with appliances which the villagers can easily use.

20. The demonstration factory was visited by both local makers of casein and dealers. There is still a wide field for investigation. It is necessary to consider, for example, the numerous uses to which casein is put, to enquire which require good casein and to ascertain whether a few of these cannot be developed so as to establish a market for the good casein in India. There have already been demands for casein glue from various quarters and the glue supplied by the factory was admitted to be of a good quality. In two cases however it was unsuitable for the special purpose in view. This can probably be remedied by modifications in the formula. Glue is mentioned chiefly as an instance of the possibility of making local use of first class casein. Again, in the villages, the casein is all sun-dried and manufacture cannot be carried on during the rains. A simple type of drying machine has been designed by Mr. Bharucha and a trial of it will be made in due course at the demonstration factory.

21. Even a small project holds many difficulties at the outset. I desire to acknowledge assistance given at Anand by Mr. Frost, Assistant Director of Dairy Farms and the successive managers of the Government creamery. Mr. C. B. Almoula, B.A., B.Sc., the supervisor of the factory, did excellent work.

22. *General.*—It is not always realised that the improvement of cottage and small scale industries cannot be effected without an adequate and qualified staff. For handloom weaving the technical knowledge required is not of a high order, but for the improvement of dyeing methods considerable technical knowledge is required as well as skill and experience. Even for such a simple village industry as casein making research work of a high order is necessary before improved methods can be devised and the application of these improved methods may require men with a scientific education. If other village industries are to be dealt with staff must be provided. There is a disposition amongst critics to suggest that, because the Department of Industries has some staff, it can tackle any problem; it is only necessary to point out that a demonstrator trained to intro-

duce an improved method of manufacturing casein cannot be switched on to improved weaving methods, or the manufacture of carpets, or the making of glass bangles—to state three instances at random. Before any of these industries can be dealt with enquiry is necessary to ascertain what are its weaknesses and to devise methods of removing its defects. After a course of action is made clear it is seldom that demonstrators for propaganda work can be found ready made and measures must be taken to train them. Again, the Department has also always to keep in mind the fact that it is useless to train artisans to produce better goods unless a better price is obtained for the improved article. It is certain, for instance, that when the casein market improves the makers of good casein in Kaira District will not obtain a fair price for their production unless the Department of Industries takes special steps in the matter. The tax-payer rightly expects, moreover, that the gain to the producer will be good value for the public money spent on research and demonstration. Nothing can be done without a call on the tax-payer and nothing should be done with his money which is not a sound business proposition.

Technical Advice and Assistance.

23. As already mentioned there was a decrease in the requests for technical assistance. During the year a plant for refining common salt was erected at Kharaghoda to plans prepared by Messrs. Dawson and Turner. It is of an experimental character and capable of dealing with two tons per twenty-four hour day. There were, as might be expected, initial difficulties in getting the requisite degree of fineness but, with Mr. Turner's assistance, these were overcome and salt is now being marketted which is equal in quality and fineness to the salt used in creameries and for consumption in Bengal. The prospects of the experiment are therefore promising.

24. Full enquiries were completed regarding the manufacture of aluminium combs and the metal parts of umbrellas but the intending promoters of the factories have apparently been discouraged by prevailing conditions from embarking on these ventures at present,

25. Mr. Bharucha was unable to attend to his ordinary duties till the end of January. Thereafter he gave advice at Ahmedabad regarding design and construction of new chimneys, reservoirs and mill buildings. He also designed a cooling tower for the hot water from the engine condenser of a flour mill ; the design was carried out and works satisfactorily. Other advice of a technical nature and regarding plant and machinery was given. This branch of the Department's activities has hitherto remained practically untouched for lack of staff but I hope that some progress will now be made. In some instances the advice and assistance is not of a kind which can be given free and fees are charged in suitable cases. The total fees charged and credited to Government during the year amounted to Rs. 700 in addition to fees for analyses.

26. Mr. Bharucha also visited Malegaon (Nasik District) and made arrangements in conjunction with the local honorary organiser of Co-operative Societies, for a local company establishing works for dyeing cotton yarn by modern methods. The greater part of the population of Malegaon depends, directly or indirectly, on handloom weaving and the first big success in the introduction of fly shuttle looms was scored here by the Registrar of Co-operative Societies.

27. In April the project for the dyeing shed was so far advanced that some of the leading promoters were invited to Bombay to discuss the final arrangements for plant and the engagement of an experienced dyer. I was then informed that the managers were being boycotted by non-co-operators and they had therefore decided to postpone the execution of their plans till local feeling quieted down. It was later explained that a majority of the shareholders had become non-co-operators. A few days later rioting occurred and apparently destroyed, for the time, all hopes of the local people sinking political differences to co-operate in industrial enterprise.

28. The difficulties in the way of providing technical assistance have been mentioned with reference to cottage industries ; they natur-

ally increase with the scale of the industry. A purely indigenous industry which requires and is prepared to pay for technical aid is the glass industry which is now represented in the province by over a dozen glass factories. The Government of India have made efforts for over a year to secure two experts but so far without success.

Chemical Research.

29. This is probably the most fascinating aspect of industrial development in India at the present time, but in discussing it popular writers are apt to overlook the fact that the object of industry is not merely to make articles but to sell them *at a profit*. In discussing chemical research and chemical industries there is naturally a tendency to concentrate on the possibility of the chemical operation and to neglect the commercial aspects. The commercial aspects of various chemical industries in India have recently been examined by Dr. H. C. Watson of the Indian Institute of Science and, by an ingenious system of awarding points, he has made rough estimates of the commercial prospects in India of each of 33 chemical industries. By his method of calculation an industry for which all commercial factors are good obtains 9 points whereas one for which all factors are very unfavourable obtains 27 points.

30. *Casein*.—I refer to Dr. Watson's paper because one of the industries of which the possibilities are estimated by him is casein which is the sixth in the order of merit on his list with 14 points, the salt industry heading the list with 11 points. It is interesting to have so much justification for the research work undertaken on casein at Ahmedabad by Dr. Meldrum and Mr. Gangolli. During the year a second bulletin was published dealing specially with the proportion of fat in casein. The circumstances which led to the publication of this bulletin are of interest. The investigators had already arrived at the conclusions that a low fat content was essential to a good casein and that a low fat content in the casein could only be reached by thorough elimination of fat from the separated milk.

A sample of the casein prepared at Ahmedabad was sent to the Imperial Institute, London, which reported that the casein was regarded by experts as of good quality and that material equal to the sample would find a ready market in the United Kingdom. Nevertheless, in spite of this approval by experts, and in spite of the fact that the casein had been prepared with special care so as to ensure that it should contain a minimum amount of fat and had been found on analysis in India to contain only 0·24 per cent. of fat, the Imperial Institute reported that their analysis of the fat content showed 7·4 per cent. It was at least singular that two analyses should differ so widely and while Dr. Meldrum and Mr. Gangolli admitted that their methods did not give absolute results they could not believe that they indicated only one-thirtieth of the true value. They were thus led, in the first instance, to investigate methods for determining the amount of fat in casein and the first part of the bulletin deals with methods of analysis. It was a matter, however, of greater importance to decide definitely that casein approved as good could not contain 7 per cent. of fat, as the analysis of the Imperial Institute would mean that fat in casein is under estimated not only in Ahmedabad but all over the world. Dr. Meldrum and Mr. Gangolli were therefore induced to investigate the matter thoroughly and were able (1) to indicate the probable source of error in the Imperial Institute analysis, (2) to devise an absolute method for determining fat in casein, and (3) to vindicate the methods which they and chemists in other parts of the world had previously used.

31. The second part of the bulletin deals with the practical problem of the elimination of fat. The subject has been dealt with at length here in order to illustrate how the improvement of a simple village industry may depend on research work of a high order and how there may arise out of the apparently simple practical problems of the villagers issues of a purely scientific nature which must be settled before a sound solution of the practical problems is assured.

32. It is creditable to the Department that Mr. Gangolli should have received the degree of M.Sc., Bombay University, solely on

account of a thesis that was based on the work that he did on casein and that he should have been appointed to an important post at Rangoon. Mr. Gangolli directed the work of the demonstration casein factory (paragraph 19) from the beginning.

33. *Castor oil*.—Work was also done by Mr. Gangolli on the treatment of castor oil. Simple methods were devised for reducing the acidity of this oil and the results on the small scale have been quite satisfactory. What is now needed is a trial of the method on the “semi-large scale” with the use of a centrifugal separator to clarify the oil. The vegetable oil industry is important at Ahmedabad and I have encouraged it to make use of the services of the chemical staff by charging low fees meantime for analytical work. The remaining work was routine analysis.

34. *Bitterns*.—The principal research work of Messrs. Turner and Koppikar was again concerned with the development of the bitterns industry at Kharaghoda. The bitterns are the mother liquors left after the extraction of common salt from the brines which occur in this locality. The magnesium chloride produced locally, though perfectly white in the crystal, shows signs of discolouration when the crystals are fused preparatory to filling the drums in which the chemical is placed on the market. As the imported article is generally fairly white its superior appearance gives it a corresponding hold in the mill industry. Mr. Koppikar conducted a number of experiments on large scale batches of material at the factory itself. The results varied. Although in some cases a translucent salt was obtained the results could not be repeated with certainty. Laboratory experiments are now being conducted in Bombay to determine the correct working temperature for the final stage. Except for the colour the quality, which will be mentioned again below, is quite satisfactory. The manufacturing company added during the year to its equipment a motor wagon for conveying the bitterns from the salt pans to the company's factory. It is also making efforts to sell its output in foreign markets, and a concession as regards royalty has been submitted for the consideration of Government.

35. The production of epsom salts received further but, owing to lack of suitable apparatus, inadequate attention. The earliest experiments were directed towards recovering epsom salts from the sludge left after the extraction of the magnesium chloride from the bitterns, but it seems probable that a better line of attack will be to extract the epsom salts from the bitterns first and afterwards to recover the magnesium chloride from the residue. The experiments had to be suspended till suitable apparatus, now on order, is received. Experiments were made on extracting epsom salts from hard sludge. Experiments on a "semi-large" scale were successful; commercial production has not yet been considered.

36. The bitterns of Kharaghoda offer great opportunities for scientific research as well as prospects of economic development. In order to check the results obtained in India a large range of samples of brines, bitterns, salts and sludges were sent last year for independent analyses to the Government Laboratory, London. The report of the Government chemist stated that "all the samples" (of magnesium chloride) "may be considered good commercial magnesium chloride (fully hydrated)."

37. The presence of potassium salts and bromine in the brines and bitterns is confirmed by the analyses of the Government chemist. Regarding these I quote below the remarks made by the Department of Scientific and Industrial Research, London, through which the report was forwarded. "Perusal of Sir James Dobbie's report indicates that the samples of brines and bitterns collected in accordance with his directions contain such quantities of potassium and bromine compounds as warrant careful consideration of the possibility of extracting these valuable bye-products on a technical scale. The figures given above, considered in the light of the present (and relatively small) output of salt and of the potentially great future output, appear to indicate that the valuable bye-products, potassium chloride and magnesium bromide are obtainable in very considerable quantities in the Runn of Cutch..... A careful chemical survey of the district may possibly yield evidence

of the presence of other commercially valuable materials in workable quantities."

38. The Chemical Services Committee last year drew attention to the fact that little or nothing is known regarding the vast salt deposits of the Runn and that a thorough investigation of the area by a staff of skilled chemists is necessary to determine its industrial importance. Referring to this recommendation the Department of Scientific and Industrial Research has suggested that, pending action on it, tests upon a "semi-large scale" should immediately be put in hand in order that more exact information may be available when it is found possible to proceed further with the question.

39. There the matter rests for the present. As the royalties paid on the bitterns for the manufacture of magnesium chloride (as well as the income-tax paid by the company working them) are taken by the Imperial Government further expenditure can hardly be incurred by the Government of Bombay at the present time. But the work done so far by the Department of Industries has been justified both by the commercial success of the Pioneer Magnesia Company and by the suggestions for continued research by the Chemical Services Committee and the Department of Scientific and Industrial Research, London.

40. The miscellaneous work of Messrs. Turner and Koppikar consisted chiefly of analyses of minerals from Salsette undertaken at the instance of the Geological Survey. A complete collection of the lime-stones of the Presidency was also made. These are now under analysis.

41. *Trona*.—The results of a survey of the alkali deposits in Sind were given in the annual report of 1919-20. Experiments were subsequently made locally for improving the production of *chaniho* (crude sodium carbonate). The object of the experiments was not precisely understood at first, as the local authorities aimed at producing a pure sodium carbonate. It was pointed out that all that could be obtained by the methods suggested was a fairly

pure form of the mineral "trona" which is a combination of the carbonate and bicarbonate. This is itself a valuable commercial product worth producing and is the same as the crude soda of Lake Magadi. The reports of last season's work have not yet been received.

Pottery.

42. At the beginning of the year Mr. E. R. Fern, Superintendent of the Pottery Section of the Sir J. J. School of Art, was on leave and Mr. C. P. Shah acted for him till December.

43. *Work at the School of Art.*—The year was devoted principally to experiments with red clays found in the vicinity of Bombay. Exhaustive tests were made, with good results, of the manufacture of terra cotta bricks and flooring tiles while tests on glazed red wares were brought to a successful conclusion. China clay from one source was found suitable for high class porcelain; cups and saucers made from it were quite as good as the best ware imported into Bombay. Earthenware cups, saucers and tea pots made from clays in Kathiawar were as good in quality as those of foreign manufacture but were not so white in colour. Several large pieces of majolica ware were successfully prepared to order and flooring tiles of various colours were made as good as the imported article.

44. These facts sufficiently indicate that suitable raw materials exist for the manufacture of flooring tiles and articles such as tea-pots for both of which classes there is a large local market. As the scheme for a demonstration pottery factory is still in suspense pending completion of the plans for the development of the area in which it will be located I am arranging that, at a slight expenditure, the equipment of the pottery section of the School of Art should be extended so as to permit of production of flooring tiles and tea-pots on a semi-commercial scale. This will give students a more practical training than they get at present, and will enable the market to be tested by locally made articles.

45. *China Clay*.—Two large deposits of China clay in the Southern Division were investigated by the Geological Survey and a three ton sample of one of these deposits was levigated under the superintendence of Mr. Fern and tested at a local spinning mill as to its suitability for sizing purposes. The results of these investigations and tests will be published separately by the Geological Survey.

46. *Local Resources*.—The Geological Survey made during the year a complete survey of the building resources of the Salsette Taluka and the clays surveyed were made into briquettes by Mr. Fern and about seventy tests were made for contraction, absorption, percolation and crushing strength. The full results will be separately published but it is worth noting here that the brick mixtures containing paddy husks mixed by the methods employed by local manufacturers, all showed very high percolation and absorption while the crushing strength in the majority of cases was extremely low. The same mixture ground to pass 17 mesh to the inch sieves had a better crushing strength but percolation and absorption were still both very high. It may be added that, in addition to the clay tests, arrangements were made for an equally large number of tests of building stones to be made at the College of Engineering, Poona. As already mentioned the minerals were analysed by Mr. Turner at the Victoria Jubilee Technical Institute.

47. *Waste Mica*.—A member of the Advisory Committee drew attention to the need of a market for waste mica. At the suggestion of the Director-General of Commercial Intelligence, Calcutta, experiments will be made with ground material in the manufacture of heat proof tiles and bricks as well of slate pencils.

48. *General*.—The total number of samples of clay, sands, etc., received for test during the year was 203, of which 176 had been tested before the end of the year. Nineteen persons visited the pottery to secure expert advice regarding clays and the establishment of pottery works. Mr. Fern also visited Malvan to advise the local potters and to inspect a local bed of kaolin which will be more

carefully investigated next cold weather. One of the local potters joined the pottery school. Fees for analyses amounted to Rs. 665.

Fisheries.

49. *Work in Kanara.*—Mr. Walke, Superintendent of Fisheries, with head quarters at Karwar, continued his work there till February last when he came to Bombay to assist the Marine Biologist in starting the trawler. One of his duties is to visit fish curing yards and assist the staff of the Salt Department in organising them on efficient and sanitary lines. Mr. Walke visited the Majali yard, where he carries out other work, 72 times and paid 21 visits to other yards. The better sanitary conditions introduced are believed to have been responsible for the absence of the blow fly in Kanara during the curing season for goal and shengala and both in Kanara and Ratnagiri when the moist curing process of mackerel was in progress.

50. Owing to the failure of the sardine season practically no further experimental work was done in the manufacture of fish oil and fish manure. Experiments were continued in fish curing and numbers of mackerel were smoked or cured. An experiment was also made in the pickling of fish. Some practical results of Mr. Walke's preliminary work are already apparent. A private fish oil factory was completed during the year although the absence of sardines prevented the owner from using it. The fish oil industry, with modern methods of hydrogenation, is capable of development but the lethargic fishing population of Kanara can be instructed only in fairly simple methods. In the Ratnagiri district Mr. Walke showed samples of salt fish, smoked fish, sardine oil and guano and found the local fishermen interested and willing to improve their methods provided they could get a market for their improved turn-out. As I have already pointed out success in all operations of this kind ultimately depends on securing a better price for the industry than it obtained before. Mr. Walke accordingly made arrangements for fish merchants to give orders at increased

prices for all fish cured according to his requirements. These arrangements will be continued during the ensuing season. Mr. Walke also gave assistance in forming co-operative societies of fishermen.

51. Arrangements were made during the year whereby the price of salt for fish curing was reduced from 12 to 10 annas in Kanara District and also to enable fishermen to purchase half their salt fine grained. The coarse grained Uran salt requires crushing before use and leads to delay and therefore deterioration of the fish in curing operations.

52. The closure of the oyster beds at Tadri in the Kanara District with a view to their recuperation has been subject to criticism. The order closing the beds has actually not been observed but despite disturbance useful observations were made with 200 limed tiles which were laid down for the oyster fry. No recuperative methods can hope to be successful, however, unless there is a period of protection for the immature shell fish.

53. *Trawling*.—With the object of making full enquiry into the conditions of the fishing industry on the West Coast and of making recommendations regarding the measures necessary for its development Government obtained during the year the loan of the services of Mr. A. E. Hefford as Marine Biologist from the Ministry of Agriculture and Fisheries in the United Kingdom. Mr. Hefford arrived in India in December last and after visits to Karwar, Calicut (where he inspected the operation of the Madras Fisheries Department) and Karachi, he became associated with the working of the steam trawler "William Carrick". The steam trawler was purchased from the Admiralty in May 1920 but its fitting out was delayed by the disorganisation and congestion which then prevailed in the shipyard and engineering industries of Great Britain. Use was made of these delays, however, to investigate the commercial application of the brine freezing process for fish preservation in which noteworthy progress has been made in Denmark and Norway. After enquiry

in these countries and consultation with the expert of the Food Investigation Board in England a small brine freezing tank was installed on the steam trawler as an accessory to the refrigeration plant. The trawler arrived in Bombay in March, but the fittings and other work which had been postponed till her arrival in India were delayed by strikes in the local ship-building yards. Thus it was not till the 17th May that the vessel made its first voyage. Before the end of July seven trips had been made. The results of these are shown in the statement below :—

Voyage.	Total catch landed.	A				B			
		Catch per hour's trawling.				Catch per hour's absence from port.			
		Rays.	Dogfish, shark, sawfish, etc.	All others.	Total.	Rays.	Dogfish, shark, sawfish, etc.	All others.	Total.
lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
I ..	1,328	10	4	42	56	5	2	20	27
II ..	1,824	27	4	27	59	10	2	10	22
III ..	3,787	47	6	53	105	23	3	26	52
IV ..	5,234	27	4	73	105	22	3	58	83
V ..	20,993	86	11	93	190	74	9	80	164
VI ..	15,702	65	21	119	205	54	18	99	171
VII ..	3,248	67	1·4	189	251	28	1	80	106

It is obvious that the success of fishing operations is not measurable by the mere quantities landed, but by the rate at which they are caught. The productivity per hour is calculated in two forms (a) as catch per hour of trawling and (b) as catch per hour's absence from port. It will be noticed that there has been a steady improve-

ment in fishing results. The last three voyages were made under monsoon conditions but on the last voyage only three hauls could be made on account of the stormy weather, so that only a comparatively small proportion of the time of absence from port was spent in fishing operations.

54. The financial return for each voyage is also best indicated by the ration between the sale of the fish and the time occupied in catching it, as in the following table :—

Rate of gross earnings per hour's fishing and per hour's absence from port.

Voyage.	Sum realised.		
	For whole catch.	Per hour's fishing.	Per hour's absence from port.
	Rs.	Rs.	Rs.
I	230	8.25	4.6
II	273	8.8	3.3
III	581	16.1	8.0
IV	814	16.3	12.9
V	2,260½	20.5	17.7
VI	2,120	27.7	23.0
VII	350	23.7	10.0

55. It is too early yet to estimate the possibilities of trawling on this side of India. Such an enterprise starts in Bombay with one essential condition of success namely a race of fishermen who, so far as mere fishing operations are concerned, have brought the industry to a high level. Everything considered, the crew of the trawler may be considered quite satisfactory, and as far as work at sea is concerned it is merely a question of ascertaining whether fish are obtainable. A single trawler operating from Bombay is at present handicapped, however, from the commercial point of view in many ways. In Britain trawling is not conducted by single trawlers any more than in Bombay weaving factories are run with a single loom.

The British steam trawler is a unit in a fleet which in many cases are all under the same ownership and in any case supply the same port, thus providing a relatively regular supply to meet a uniform and regular demand. With a single trawler supply must necessarily be somewhat spasmodic. Secondly, Bombay as a port is not organised in any way to meet the requirements of this class of vessel. Even in the smallest British fishing port a trawler is able to come in and, without delay, land her fish which are sold on the spot in a few hours and the proceeds of the sale known within a few minutes. Immediately she has landed her fish the trawler can at once take aboard coal, ice or other supplies and any repairs can be executed with equal facility and speed. All this is done under the eye of the owner whose office is on the fish quay. The trawler owner is, in practically all cases, also the salesman of the fish and generally a shareholder in the concerns that supply ice, coal and other stores. The better firms have got their own engineering shops for repairs. In Bombay the Government trawler is obliged to reach port the previous afternoon in order to make arrangements for landing its fish and carting them to the Crawford Market for sale. Comparatively long notice is required for the supply and transport of coal and ice and it is difficult to secure deliveries according to scheduled times. The water supply is obtained at present as a matter of favour. For work on the hull the trawler has to drydock in a basin suitable for a P. and O. Liner. By luck the landing place for the fish is only about a mile away from the Crawford Market. Not only is there great lack of working conveniences, but the necessity of employing outside agencies for supplies and repairs increases the delays and charges. I make these remarks so that it may be understood that although the "William Carrick" is working on commercial lines she can hardly be considered a commercial trawler. The conditions just explained impose a much larger proportion of time being spent in harbour than is compatible with commercial trawling. The circumstances of working organisation and business arrangements need not, however, prevent the staff from obtaining all data adequate to determine whether

trawling can be made a profitable industry. The chief sea work resolves itself into collecting complete data of the catch per hour.

56. There is another side of the experiment and that is the organisation of the local fish market. The scarcity and dearness of fish in Bombay has been a long heard cry. Part of the dearness is undoubtedly due to the primitive lines on which the fish trade, wholesale and retail, of Bombay is organised. At the time of the year when fish is most scarce in Bombay the trawler catches have realised, for pomfret 10 annas 5 pies per lb., for salmon 8 annas 10 pies, and for goal 6 annas 8 pies. These are the three kinds of fish in principal demand. The prices appear to bear little relation to the palatableness of the fish and depend rather upon local tastes and habits. The little known but excellent deep sea fish such as karel, palu, and tambusa are in little demand; they have been sold by the trawler for $2\frac{3}{4}$ to $3\frac{1}{4}$ annas per lb. Rays or skate, which are caught in greater quantity than any other sort, are little esteemed in the market and their average price is only one quarter of an anna per lb. A similar result was obtained in England when trawling was first introduced. Skate was then a glut on the market, now-a-days it is a popular edible fish.

57. The market results show that the high price of fish in Bombay is partly due to the primitive methods by which the fish trade is conducted and partly to the ignorance or prejudice of the fish-eating public regarding many good edible fishes.

Industrial Workshops at Dapuri.

58. These Workshops were transferred from the Public Works Department at the close of 1919, but owing to the absence on leave of Mr. Gosford, the officer in charge, and his subsequent death they have not changed materially in their organisation. With the assistance of a firm of chartered accountants the system of management and accounts is now being examined in order to place it on a commercial basis. Last year a system of apprenticeship was introduced

but has not yet been fully developed. Arrangements for giving the apprentices their ordinary education were inadequate and it is now proposed to entertain a full time school-master. When he is appointed the ordinary education of boys will be properly organised, and their pay will be regulated not only by their progress in the workshops but also by the standard of their work at school. Instruction in English and in technical drawing will be added. A beginning has also been made in the training of mechanical engineers properly so called and three appointments have been created on Rs. 150—25—200 to enable graduates in engineering to secure practical training. This is a part of the mechanical engineer's education of which the value is not fully recognised and to which in consequence little attention has been paid in India; in Europe and America its importance is recognised as supreme. A graduate in engineering in any country is not qualified for his professional career till he has put in two or three years hard training in commercial workshops, and to assist Indian graduates in obtaining this training the Department has undertaken the training of three on somewhat exceptional terms of remuneration for apprentices. Something of the kind was necessary to check the search for employment by graduates who had only a theoretical knowledge of mechanical engineering.

59. *Experimental Work.*—A small amount of experimental work is undertaken at the workshops. Two years ago Mr. T. S. Dawson devised an improved twisting machine for the silk industry at Surat. During the last year two machines to his designs were completed and will be handed over for trial to a silk factory. In an experiment of this type success is not obtained at the first venture and even when the machine is made mechanically perfect the question of cost is vital to its successful introduction in the industry. A set of experimental button making machines is also under manufacture. Two years ago a plant for the improved distillation of rosha grass oil which was designed at the Forest Research Institute, Dehra-Dun was completed and delivered. The first trials were satisfactory but the plant subsequently gave trouble. With the assistance of

Mr. Koppikar a new design was prepared at Dapuri and this, with minor modifications, has been approved by the Forest Research Institute.

60. The workshops have gradually been improved as a training school. In the last year, for instance, the number of apprentices has been increased from 17 to 45. Special attention is paid to the care of tools and every workman is taught, for example, the proper method of grinding tools for steel, iron and brass. The officer in charge of the workshops also gives advice and assistance to industries in Poona and neighbourhood.

Commercial and Industrial Intelligence.

61. The dissemination of commercial and industrial intelligence is, in several respects, the most important and useful work done by the Department. I do not refer now to publications, such as the bulletins on casein by Dr. Meldrum and Mr. Gangolli, and on the vegetable oil industry by Mr. A. F. Yuill, the latter of which is a comprehensive and really valuable contribution to the industrial literature of India. The really important work is done in answering the enquiries of private individuals and industrial firms. The general public is little aware of the great volume of information of industrial and commercial value which is regularly collected, tabulated and published by Government or which can be collected by special enquiry through Government agency. Business men may know that it is available but they cannot be expected to know exactly where to apply for every special item of information. As collecting centres and clearing houses of information required by industrial enterprise Departments of Industries must play a part of ever growing importance. Research, experimental work, pioneering, demonstrations, technical advice, assistance to cottage industries—all these frequently involve a struggle with outside prejudice, conservatism, ignorance and inefficiency. But as an intelligence bureau the department helps those who can help themselves. That the value of the department in this respect is winning recognition is shown by the fact that

the volume of inquiries grows steadily. Receipts of correspondence during the year were 7,049 against 5,959 in 1919-20, an increase of 20 per cent. It is becoming increasingly difficult to deal efficiently and promptly with all correspondence.

62. *Publications.*—The department has published four bulletins up to date; these are advertised in the covers of this report. As the series of Bulletins of Indian Industries and Labour and the Quarterly Journal of Indian Industries and Labour, which are published by the Government of India, now provide suitable means of publicity, additional provincial publications will only be issued in exceptional circumstances.

Concessions.

63. *Paper pulp.*—The syndicate to which a concession was granted in 1917 for the manufacture of paper pulp from bamboos in Kanara has abandoned its scheme, and the field is again open to other prospective manufacturers of paper pulp.

64. *Naval Stores.*—Another scheme which has been under examination for some years is the manufacture of turpentine and rosin from the oleo-gum-resin of *Boswellia Serrata*. The Advisory Committee have now recommended to Government the terms of a license for the collection of the crude resin.

65. *Matches.*—The Gujarat Islam Match Manufacturing Company was recommended for an extension of the concession under which they at present obtain their wood supplies.

Exhibitions.

66. In March 1920 the Department participated in the British Industries Fair but Government decided not to take part in that of 1921. The Department will be represented at the Fair again in 1922. Arrangements are also being made to participate in the British Empire Exhibition of 1923.

A small permanent local exhibition is required on the lines of the Commercial Museum, Calcutta; but so far neither space nor funds have been available.

The Department will participate in an All-India Weaving Exhibition to be held at Patna in November.

Miscellaneous.

67. *Coal Supplies.*—The coal situation was most acute for the greater part of the year. The glass factories especially suffered. This industry is in a special position. It requires first class coal to obtain the requisite temperatures; a stoppage involves the cooling down and cracking of the crucibles; and a long stoppage means the dispersal of labour which requires special training. At one time I made arrangements to pool the demands of this industry and get supplies for all factories from a single reliable firm but the authorities would not guarantee waggon supply. Fresh arrangements were made as the result of a conference at Simla, but the absence of complaints since then is probably due to other means which were taken to relieve the situation as a whole. India in passing through her industrial revolution seems, at the moment, to have outstripped her means of communication and coal supply is not the only direction in which industry will be handicapped till railways are improved to meet current requirements and future developments.

Conclusion.

68. The staff, in all sections, has worked, on the whole, with efficiency. The financial position has rendered it necessary for the Department to develop slowly, but this has rather aided in the perception of the special difficulties which are confronting it. These are such as inevitably arise where Government activity comes into contact with private enterprise and they naturally assume greater proportions as the industrial policy of Government tends to become

more active. Not the least is the difficulty of securing results commensurate with the expenditure involved. To assist them in solving the numerous problems which thus arise Government have hitherto been fortunate in the advice of the Advisory Committee which includes some of the foremost business men of the city. The influence and importance of this Committee are bound to increase and I gratefully acknowledge the advice and help which its members have afforded in the past year.

I have the honour to be,

Sir,

Your most obedient servant,

R. D. BELL,

Director of Industries, Bombay.

No. C.—2192/5174.

OFFICE OF THE DIRECTOR OF INDUSTRIES

Old Customs House :

Bombay, the 5th September 1922

FROM

R. D. BELL, Esq., C.I.E., I.C.S.,
Director of Industries,
Bombay ;

To

THE SECRETARY TO GOVERNMENT,
Revenue Department,
Bombay.

Annual Report—1921-22

Sir,

I have the honour to submit the annual report of the Department of Industries for the year 1921-22 (1st August to 31st July).

I have been in charge of the Department throughout the year.

2. This report does not deal with all the duties of the Director of Industries and a brief account is therefore given in this paragraph of other activities which occupied my time during the last year. At the beginning of the year I still held the appointment of Chairman of the Surplus Stores Sales Committee which advised the Government of India regarding the disposal of surplus war stores. This involved no administrative duties but at the end of 1921 I found it difficult to spare a half day each week for the meetings of the Committee and, as the operations had ceased to have any special connection with local industries, I resigned the chairmanship and membership in December 1921. A more onerous duty was the control of the disposal of German

dyes taken over under the reparation clauses of the Peace Treaty. Except a small allotment of a particular class of alizarine dye assigned to the Madras Presidency, all synthetic dyes allotted to India were sold through two firms in Bombay under my supervision. The work had been carefully organised in the preceding year and at first ran on routine lines but, owing to the subsequent slump in prices and confused market conditions, the business later required much attention and seriously interfered with other duties. When the Government of India appointed a Director of Commercial Intelligence at Bombay in the beginning of 1922, I took the opportunity of being relieved of these responsibilities in February last.

3. In December 1921, I assumed control of the amalgamated department for the inspection of factories, boilers and smoke nuisances. For several reasons the supervision of these departments has required an unusual amount of attention lately. The department has been shorthanded and this has led to difficulties and extra work. A scheme for the re-separation and re-organisation of the department has also been prepared. Finally, there has been additional work in connection with the introduction of new factory legislation which came into effect on 1st July and which involved, amongst other things, a complete revision of the rules under the Factories Act. The operations of the amalgamated department are reported in three separate reports for factories, boilers and smoke nuisances, respectively, and no further mention of the work of these departments will be made in this report.

4. Other semi-official duties were connected with the membership of a number of committees. I was a member of the committee appointed under the chairmanship of Sir M. Visveswaraya to frame a scheme for technical and industrial education in the Bombay Presidency. Owing to special circumstances, this membership threw a considerable burden of additional work on myself. I am also a member of the Board of Trustees of the Victoria Jubilee Technical Institute, a member of the Committee of Direction for Technical Education, a member of the Advisory Committee of the College of Engineering, Poona, and a member of the Provincial Co-operative

Conference Committee. The Advisory Committee of the Royal Institute of Science, Bombay, of which I have also been appointed a member, has not yet assembled. The total number of meetings of Committees, including the Sales and Advisory Committees, attended during the year was 54.

5. *Touring.*—Chiefly owing to the work described in the preceding paragraphs it was difficult to leave Bombay during the year except occasionally for short periods. Poona was visited three times for committee meetings and other work. In October I spent a week at Surat and Ahmedabad and in November attended the All-India Hand Weaving Exhibition at Patna. In March and April I made two trips to Calcutta to give evidence and to attend the Industrial Conference and in June visited Poona, Sholapur, Bagalkot and Gadag chiefly to inspect weaving schools and demonstrations.

Expenditure.

6. The expenditure incurred by the Department during the financial year 1921-22 and the two preceding years has been as follows :—

		Rs.
1919-20	.. .. .	1,56,000
1920-21	.. .. .	1,46,000
1921-22	.. .. .	1,73,000

These amounts do not include expenditure, connected with the workshops at Dapuri or the operations of the trawler.

Staff.

7. Mr. G. H. Thiselton-Dyer joined his appointment as Deputy Director on his return from leave in September 1921. Mr. Thiselton-Dyer was first appointed Deputy Director at the end of 1919 but was required immediately afterwards to act as Director for nine months after which he himself went on leave. The appointment has, therefore, been actively filled only with effect from September last. Up till the middle of June Mr. Thiselton-Dyer made nine visits to Poona and Dapuri extending over 36 days and also visited

Surat, Patna, Calcutta, Nasik, Mahableswar and Ratnagiri on various duties. His report is appended. (Appendix A.)

Mr. F. E. Bharucha held the appointment of Assistant Director of Industries, Northern Division, Ahmedabad, throughout the year, except for three months (September to December) when he was on leave. During his tours Mr. Bharucha visited Dholka, Kharaghoda, Surat, Viramgam, Anand, Bombay, Poona and Ahmednagar in addition to travelling on work for the Excise Department.

Like myself, these officers have performed duties for Government which hardly come within the scope of this report. The Deputy Director was absent for a fortnight in December on inspection duty in Bengal for the Public Works Department and since the middle of June he has been engaged entirely in advising and assisting the Commissioner of Customs, Salt and Excise. The latter officer also obtained assistance from Mr. Bharucha for a month in making a valuation of the plant of the Dhulia distillery and several liquor warehouses.

The appointment of Executive Engineer in charge of the Central Store and Workshops at Dapuri near Kirkee has been held throughout the year, except for three months when he was on leave, by Mr. F. C. Davies, and the appointment of Works Manager by Mr. C. Holliman who acted as Executive Engineer during Mr. Davies' absence.

Mr. E. R. Fern, Superintendent of Pottery at the Sir J. J. School of Art, served as pottery expert during the whole year.

Mr. A. E. Hefford, whose services were obtained temporarily on loan from the Ministry of Fisheries and Agriculture in England, has held the appointment of Marine Biologist during the period covered by this report. The appointment of Superintendent of Fisheries held by Mr. T. J. Walke was retrenched at the end of March and the appointment of Assistant Marine Biologist which was created in November 1921 was also retrenched in April 1922.

Chemical problems are taken up, in addition to their ordinary duties by Dr. A. N. Meldrum, who was transferred during the year from Ahmedabad to act as Principal of the Royal Institute of Science,

Bombay, and by Mr. A. J. Turner, Principal of the Victoria Jubilee Technical Institute. Mr. C. B. Almoula, B.A., B.Sc., formerly superintendent of the demonstration casein factory at Anand, became assistant to Dr. Meldrum at the beginning of the year while Mr. Turner was again assisted by Mr. M. M. Koppikar, M.A., B.Sc.

Advisory Committee:

8. At the beginning of the year, Mr. A. T. Arnall was absent from India and subsequently resigned his membership of the Committee; the vacancy has not yet been filled. At the end of 1921, Mr. Cowasji Jehangir resigned on accepting the appointment of Member of Council. His place was filled by the reappointment of Mr. Purshottamdas Thakoredas. Later, Mr. H. P. W. Macnaghten, the representative of the Chamber of Commerce, Bombay, resigned on proceeding on leave and the Chamber nominated in his stead Mr. N. Birrell. The members of the Committee now are:—

- (1) Director of Industries (Chairman).
- (2) Sir Montagu de P. Webb, Kt., C.I.E., C.B.E., M.L.A.
- (3) Ambalal Sarabhai, Esq.
- (4) Sir Alfred Chatterton, Kt., C.I.E.
- (5) N. Birrell, Esq.
- (6) Lalji Naranji, Esq.
- (7) G. B. Trivedi, Esq., B.A., M.L.C.
- (8) Mangaldas Girdhardas Parekh, Esq., M.L.C.
- (9) Rao Bahadur R. R. Kale, LL.B., M.L.C.
- (10) Mahomedbhoy Currimbhoy, Esq.
- (11) J. B. Petit, Esq., M.L.C.
- (12) Purshottamdas Thakoredas, Esq., C.I.E., M.B.E., M.L.C.
- (13) Vacant by resignation of A. T. Arnall, Esq.

9. At the beginning of the year a statement of the functions of the Committee was approved by Government by which the Director

of Industries is required to consult the Committee in the following matters :—

- (1) The framing of the budget.
- (2) The creation of all new appointments, permanent or temporary, on Rs. 250 per mensem or over, and the conditions as regards qualifications, etc., on which such appointments will be filled.
- (3) The increase in the pay of an appointment of less than Rs. 250 per mensem so as to make it Rs. 250 or more.
- (4) All promotions, apart from sanctioned increments, in appointments on Rs. 250 per mensem or more.
- (5) All schemes or proposals involving an expenditure in any one year of over Rs. 5,000.
- (6) All matters of general policy.
- (7) All matters of public interest.

Where the Advisory Committee and the Director are in agreement, action may be taken by the Director within the powers delegated to him by Government, but where the Advisory Committee and the Director disagree, no action can be taken by the Director in any circumstances without referring the case to Government for their orders. This merely regularised what had been the practice till the beginning of 1920, but it was desirable to give formal recognition to the practice. The Committee is now in close touch with the operations of the Department and it is worth noting that half of the non-official members are also members of the Legislative Council.

10. During the year under report, the number of meetings held was eight and the chief subjects on which the advice of the Committee was tendered to Government were :—

- (1) Report of the Stores Purchase Committee ;
- (2) A scheme for an extension of work on a semi-commercial scale in the Pottery Section of Sir J. J. School of Art ;
- (3) Policy and work of the fisheries section ;
- (4) Participation in the British Industries Fair ;

- (5) The budget of the department for the year 1922-23 ;
- (6) Priority to new industrial concerns for telephone connections ;
- (7) Appointments of Personal Assistant, Deputy Director, Technical Chemist and Circle Officer ;
- (8) Disposal of applications for railway sidings ;
- (9) Cessation of operations of the steam trawler " William Carrick " ;
- (10) British Empire Exhibition ;
- (11) Travelling scholarships for small industrialists ;
- (12) The All-India Hand Weaving Exhibition at Patna ;
- (13) The Government Workshops at Dapuri ;
- (14) Repeal of the Workmen's Breach of Contract Act ;
- (15) Selection of two State Technical Scholars ;
- (16) Railway risk notes ;
- (17) Legislation to restrict transport of cotton ;
- (18) A hand weaving exhibition in Bombay ;
- (19) Compulsory acquisition of land for industrial purposes ;
- (20) Utilisation of fruits, nuts and gum of the cashew tree ;
- (21) A concession for collecting the gum-oleo-resin of *Boswellia Serrata* (Salai).

The Committee received full monthly reports on the operations of the steam trawler.

The Committee also met and had an informal discussion with Dewan Bahadur T. Vijayaraghava Charya, the Indian Commissioner for the British Empire Exhibition.

11. Some of the matters placed before the Committee are again referred to later in this report ; the recommendations made in other cases relate to matters still under the consideration of the Government of Bombay or the Government of India (e.g., Nos. 1, 14, 16, 17 and 19) and require no further mention. It is sufficient to say here that there has been a marked development during the year in the working of the Committee. During my absence on leave in 1920 no meetings were called and this resulted in loss of interest which it

required time to recover. The Committee's functions have now been defined and regular consultation with it is ensured by monthly meetings on fixed dates.

Policy.

12. The year opened amidst marked industrial depression and, although there has since been a tendency to settle down, there has been throughout the whole period a marked lack of confidence in new enterprises. Capitalists are still chary of new adventures and, in the first half of the year, there was a diminution in the requests for information, advice and assistance. Within the last few months interest has been shown in one or two special directions. Purely departmental activities have been restricted by the lack of funds and the main feature of the year's policy has been retrenchment.

Cottage Industries.

13. *Hand-loom Weaving.*—The weaving section of the Department of Industries was first organised by the Registrar of Co-operative Societies and has now been working sufficiently long to give an indication of the possibilities of Government assistance to cottage industries. The object of the weaving section is to raise the standard and increase the amount of the weavers' output by the introduction of improved appliances and methods. There are many types and variations of weaving appliances, but that which has found most favour in this Presidency and has brought the greatest benefit to the weaver is an attachment to the old fashioned throw-shuttle pit loom known as the fly shuttle slay. By means of this contrivance the output of the weaver is increased by at least 40 per cent. Another useful accessory is the mechanical dobbie, of which there are several types, for the weaving of patterned cloth. Dobbies suited to the local weaving patterns are supplied by the Department and are now popular. Improved healds, reeds, shuttles and pirns have also been brought to the notice of the weaving community and are in increasing demand.

14. The use of improved appliances is spread in two ways, *viz.*, by means of weaving schools and by weaving demonstrations. The

schools for which local committees are appointed, are equipped with fly-shuttle looms—khadi looms for the beginners and sari looms for the more advanced pupils. The use of other accessories, such as dobbies, is also taught. Instruction is given in the weaving of cotton and mercerised bordered saris, silk saris, dhotis, uparnis, khans, and cloths with intricate designs. Provision is usually made for lessons in simple arithmetic, but in the year under report, all the boys admitted had studied up to vernacular standards III and IV. Less theoretical instruction in advanced weaving was also given as there was a keen demand for hand woven cloth and the boys preferred practice in actual weaving of plain cloth to more advanced work. No fees are charged and for the first three months each pupil receives a monthly stipend of Rs. 3. Thereafter good attendance and workmanship are encouraged by the award of small prizes. By this time, the boys are able to earn a little in the school as the proceeds of their output are paid to them after deduction of the cost of the yarn. They are encouraged to deposit part of their earnings in the Post Office Savings Bank, so that on leaving the school, they can buy a fly-shuttle loom and a doobby and set up for themselves. Registers of old pupils are maintained. Occasionally adult weavers are trained at the school but the first beginnings are invariably made through young boys. It is very difficult to get the adult weaver to change his methods; he naturally loses in quality and output till he acquires proficiency. The young are more easily taught and, when they leave the school, the quality of their workmanship and the rapidity of their working are the best testimonials to the new methods and appliances.

15. At the beginning of the year, there were three schools at Ahmednagar, Yeola (Nasik district) and Belgaum. All these schools met with considerable success. The results at Yeola were particularly gratifying. This school was opened in December 1920 and all kinds of weaving were taught on 20 looms. There is a special prejudice against the fly-shuttle slay for fine work, as the learner naturally finds difficulty at the outset in maintaining the quality which he could turn out with a throw-shuttle. Yeola has a long standing

reputation for fine and costly saris and it is all the more remarkable that during the period the school was open over 600 fly-shuttle looms were introduced. It is the younger generation which has caused the change and children who formerly were engaged in the preparatory processes for their elders are now earning, by the manufacture of silk-bordered saris on fly-shuttle looms, more wages than their parents who cannot break away from their primitive throw-shuttle. At Ahmednagar, over 300 fly-shuttle looms were introduced and at Belgaum about 100. The Kanarese districts have always been difficult to work and the results at Belgaum have only been achieved very slowly and with much effort. These three schools, having done sufficiently good work, were transferred in June last to Bhingar (Ahmednagar district), Nasik and Bagalkot (Bijapur district).

A fourth school was opened at Faizpur early in the year. The ground had been prepared here by a previous demonstration. At the close of the year, 80 fly-shuttle looms had been introduced.

16. During the year, a census of the hand weaving industry was made at Malegaon which was one of the first places in which the use of the fly-shuttle slay was demonstrated. Of 3,700 looms at work, nearly 3,400 were found fitted with fly-shuttle slays; the remainder belonged entirely to old weavers who could not adapt themselves to new conditions. This result illustrates how improved working methods continue to spread in a weaving locality after the school which introduced them has been closed.

Wherever the fly-shuttle slay is introduced in sufficient numbers a subsidiary industry for their manufacture rapidly establishes itself. A committee which recently reported on the weaving schools in the United Provinces, in criticising the attempts of the provincial weaving institute to introduce improved looms and appliances, has recorded that at one town they found that weavers were importing looms all the way from Malegaon and using them as patterns for local manufacture. This town moreover has its own permanent weaving school (established in 1907) of which the same committee recorded that it "has undoubtedly done good work and has earned a

reputation which extends beyond the province". I mention these facts not so much as a testimony to the work of this department but as an illustration of how the work spreads. The present state of affairs at Malegaon and the spread of the locally manufactured loom is the result of small beginnings ten years ago and steady growth since. The type of fly-shuttle slay now used by the Department is an improvement on that introduced at Malegaon and still in use there.

17. It is frequently suggested that Government ought to take measures to train agriculturists in spare time occupations and I was requested during the year to make an experiment in this direction. I believe that the amount of spare time available to cultivators and their desire for additional home employment are frequently exaggerated. Further, a difficulty in the way of making such employment remunerative is that a spare time artisan cannot equal the skill of the full-time worker; this will always increase the difficulty which owing to inexperience, he will meet in the disposal of his output. Cloth is, however, an article which can be used by the weaver himself and his family and for this reason it was suggested to the Agricultural Department that a trial might be made in teaching weaving to agriculturists. For the purposes of the experiment the Agricultural Department selected the village of Hebsur in the Dharwar district. This village was apparently selected because the cultivators belonging to it are already engaged, in addition to agriculture, in the making of gudars or coverings for threshing floors. They will, therefore, probably take more readily to ordinary weaving if this offers any advantages, than the ordinary cultivator. Hebsur can, therefore, hardly be considered a typical case inasmuch as the agriculturists there already have some understanding of the art of weaving. The experiment is however of interest as breaking new ground.

18. The use of improved weaving appliances and methods is also spread by means of demonstrators who travel from one weaving centre to another. Each demonstrator is supplied with two looms, on one of which he works with the appliances which he seeks to introduce among the local weaving population and on the other any

local weaver can receive instruction and practise for himself. Originally, these demonstrations used to last for three or four months, in which period the number of new looms introduced varied from half a dozen to a dozen. In 1919, I found that by extending the period to six months, two dozen looms or more could be introduced. This year the demonstration periods have been further extended, in some cases to a year, and the improvement in results has been very marked in two cases.

19. Six demonstrations were in progress at the beginning of the year at Bhalod (East Khandesh), Erandol (East Khandesh), Poona, Bavdhan (Satara), Talikot (Bijapur) and Guledgud (Bijapur).

The demonstrations in East Khandesh were moderately successful. During the year the demonstrator at Bhalod was transferred to Parola (East Khandesh), while the demonstrator at Erandol was moved to the new weaving school at Faizpur already mentioned. At Poona, where the demonstration will shortly close, about 230 fly-shuttle slays and an equal number of dobbies were introduced. The demonstration at Bavdhan had poor results and was transferred to Karad (Satara District). At Talikot a previous demonstration failed but this year fairly good results were obtained and the demonstrator was under transfer to Nalatwad (Bijapur district) at the close of the year. At Guledgud, where the demonstration still continues, 300 fly-shuttle looms and dobbies were introduced.

A new demonstration was opened at Betgeri (Dharwar district) but results are poor and a change of demonstrators has been arranged. Another new demonstration at Sindikurbet (Belgaum district) did fairly well and was removed at the close of the year to Bail Hongal in the same district.

There has been a distinct improvement this year in the Kanarese districts where results previously have been poor. Both at Guledgud and Sindikurbet there were protests from the local weavers when the demonstrators were transferred.

At the close of the year there were working four schools, seven demonstrations and the special school for agriculturists at Hebsur.

20. The staff under the Weaving Assistant Mr. S. V. Telang has worked very well on the whole but there has been difficulty in retaining assistant masters in weaving schools and in filling vacancies. The assistant masters start as low as Rs. 20 which is much less than can be earned by an efficient weaver. During the last year, when conditions were particularly favourable, silk weavers earned Rs. 50 to 60 monthly and cotton weavers could easily earn Rs. 35. The result has been that it has been impossible to retain efficient assistant weaving masters and some have had to be replaced by incompetent non-weavers who have picked up a little weaving. It is a general weakness of industrial education in this Presidency that the teachers are offered less than the market rates paid to efficient craftsmen.

21. *Experiments in sizing.*—An outstanding requirement of the hand weaving industry is a suitable warping and sizing machine. Three years ago an experimental machine was obtained from Bangalore with the idea of ascertaining its utility for hand loom factories and co-operative societies. I mentioned last year that hitherto its capacity had not been properly tested for want of intelligent handling. This type of machine was awarded the special prize of Rs. 1,100 at the All-India Hand Weaving Exhibition held at Patna in December 1921. After this Exhibition a special demonstrator was engaged for fresh trials and arrangements were made to carry these out under practical conditions in a small weaving works at Ahmedabad. At the same time a second machine of an improved type was ordered.

22. A great deal of interest has been taken in these machines by small factory owners in Gujarat but the results so far can only be described as inconclusive though promising. The demonstrator was inexperienced and the trials on the old machine were a failure in two different factories. The new machine did better in a third factory but at the close of the year operations were suspended in order to send the demonstrator to Bangalore for instruction. It is proposed to transfer the trials now to Surat where tests will also be made of new machines for silk twisting and pirn and bobbin winding. The history

of these experiments illustrates the difficulty of getting competent demonstrators and teachers for this kind of work.

23. *Hand Weaving Exhibition, Patna.*—A reference may be made here to the Bombay exhibit at the All-India Hand Weaving Exhibition held at Patna last December. I wrote an account of the Exhibition which was published in the Journal of Indian Industries and Labour. The awards secured by Bombay were four gold medals, six silver medals, fourteen bronze medals, five certificates of merit and twenty-three ordinary certificates. One of the gold medals was won by a Bombay weaving demonstrator in the weaving competition. He wove 17 yards 22 inches—a total of about 23,000 picks (average 36 per inch)—in 5½ hours. The second man put in 21,000 picks at an average of 42 to the inch. In a special test the Bombay demonstrator put in 128 picks a minute but this was beaten by a Bihar weaver with 144 picks to the minute. These are exceptional results but useful as illustrating the possibilities of the fly-shuttle and its advantages over the throw-shuttle.

The awards gained at Patna by Bombay were the more creditable as I doubt whether any province in India spends less than the Bombay Presidency in assisting the hand weaving industry.

24. *Dyeing and Calico Printing.*—A dyeing demonstrator was appointed about three years ago but soon resigned owing to the poor salary offered. After sanction had been obtained to a higher rate of pay a new demonstrator was appointed at Ahmedabad in August 1921. After studying local methods and circumstances he endeavoured to interest the local calico printers in improved methods but at first without success. Mr. Bharucha then interested some of the local mill-owners and cloth merchants in the demonstration. An attempt to start a calico printing department in a local mill under adequate supervision failed as the local printers would not submit to mill discipline. A contract for work to be done in their homes was badly executed. Finally, however, the owner of a hand loom factory opened a calico printing department and with the help of the demonstrator has started what seems to be good business. A demand is

reported to be springing up in Bombay for hand woven sarees printed in four or five colours. Given good designs and colours there seems to be room for enterprise here. The Principal of the School of Art has promised assistance by furnishing designs and with well engraved blocks some improvement in the local calico printing industry may be expected. What the hand calico printer achieved in India in the past has recently been shown in the beautiful volumes of Mr. G. P. Baker and it is hoped now to rescue the Ahmedabad craft from the degradation of skill and workmanship into which it has lapsed.

By the close of the year considerable interest had been aroused in this demonstration. Instruction is now given to young men studying at the local Technical Institute or working in local mills and dyers have also come from so far away as Shikarpur and Hyderabad (Sind) to attend the demonstrations.

25. *Casein*.—The research work in connection with casein is described later. At the beginning of the year the small demonstration factory at Anand was closed on account of the appointment of the Supervisor, Mr. C. B. Almoula, B.A., B.Sc., as Assistant Chemist to Dr. A. N. Meldrum. It was re-opened under the charge of Mr. M. T. Shah, B.Sc., in October 1921 and the manufacture of a sample ton for test sale in the London market was undertaken. Actually one and half tons were made but as the earlier production was not so good as later output it was sold to a Calcutta firm. The firm were sufficiently pleased with it to offer large orders, but these could not be undertaken as the scale of the factory is limited to demonstration purposes. Samples were sent to, among others, Sir Frederick Nicholson at Connóor and a firm of casein dealers in Liverpool and favourable reports were received. The sample ton will shortly be sent to London to test the exact commercial value of the improved quality made at the demonstration factory in comparison with the ordinary village production. The casein market was very disorganised during the year.

26. The production of casein is suspended in the Kaira villages during the monsoon as the casein cannot be air dried during damp

weather. A cheap efficient artificial drier would enable production to continue without interruption throughout the year. A machine designed by the Assistant Director was found unsuitable. Another machine is now under construction to a design prepared by the Deputy Director.

27. The Assistant Chemist Mr. Almoula visited some of the principal casein making centres of the Kaira district in order to ascertain what are the obstacles in the way of making good casein in the district. He found that manufacturing conditions were not unfavourable but that market conditions were most discouraging. The local traders make no attempt to maintain a standard either by rejecting inferior casein or by grading according to quality. The result is that the mixed lots which they send to the London market fetch only the price of the worst casein. Locally, therefore, good casein fetches no better a price than bad, and the villagers have no encouragement to take care in manufacture. After the Assistant Chemist's tour village makers inspected the process at the demonstration factory. The Calcutta firm already mentioned is a considerable buyer and has provided a specification which, though not high, nevertheless provides a standard. It is encouraging therefore to report that its local suppliers have introduced in their own factory some of the ideas followed in the Government factory, and that the firm has now approached the department for assistance in standardising and testing their supplies. With the assistance of the Registrar of Co-operative Societies there are now fair prospects of improving the industry.

Technical Advice and Assistance.

28. For furnishing technical advice and assistance, especially to small and cottage industries, the Deputy Director, Mr. G. H. Thiselton-Dyer, with headquarters at Bombay has been in charge of the Central and Southern Divisions while the Assistant Director, Mr. F. E. Bharucha, with headquarters at Ahmedabad has attended to the Northern Division. No special arrangements were possible for

Sind but in one case the party interested consulted the Assistant Director at Ahmedabad. All cases dealt with by correspondence are included in paragraph 70 and Appendix B.

29. The Deputy Director examined two problems of the gold and silver wire drawing industry at Surat which he visited with me during the absence on leave of the Assistant Director. Attempts to design an improved machine for producing square section spirals were unsuccessful but experiments in manufacturing at Dapuri, steel rolls, had some success. Further reference to this industry is made later. Mr. Thiselton-Dyer also gave attention to some problems of a more general nature. These are described in his report (Appendix A).

30. The Assistant Director gave advice in the following instances to concerns chiefly in Gujarat :—

- (1) design of a chimney,
- (2) repairs to a clarifier,
- (3) scheme for a spinning and weaving mill at Karachi,
- (4) construction of extensions to a spinning and weaving mill,
- (5) erection and working of 150 b.h.p. semi-Diesel oil engine,
- (6) suggestions for improved working of two power plants,
- (7) foundations for new oil mills,
- (8) introduction of super heaters,
- (9) scheme for a ginning factory,
- (10) construction of a pottery,
- (11) remedy for a cracked steam pipe,
- (12) cooling and humidifying arrangements in a textile factory,
- (13) repairs to a wash pump, and
- (14) utilisation of heat in chimney flues for preparatory heating in a chemical factory.

31. The object of the department in this branch of its operations is to assist small industries to introduce improved plant and methods and to show them how to work efficiently so as to secure an improved and increased output. There are special difficulties connected with the work of this kind one of which appears in the programme carried out by the Assistant Director. It is not always easy to decide whether an industrial concern requires or deserves free state help of this kind, whether it may be afforded assistance on payment of suitable fees, or whether it should be required to make its own arrangements. Without discussing general principles I may merely state that in the Northern Division there has been a tendency for well-to-do concerns to seek and obtain the advice of the Assistant Director apparently for the reason that it cost them nothing. In the other two divisions little was done directly to ascertain the difficulties and needs of the smaller industries. The work recorded in this section is therefore disappointing both in amount and kind. The task is not an easy one but the difficulties will not be overcome unless the officers entrusted with it get into actual touch with industries especially the smaller concerns. I propose, when the department is reorganised, to utilise the factory and boiler inspection staffs, not for the purpose of giving technical advice and assistance, but for intelligence purposes so that the needs and difficulties of industries, which are not now the direct concern of the inspectors, may be brought to the attention of the Director.

32. It was found hopeless, at present, to revive the scheme for the small dyeing factory at Malegaon which was mentioned in last year's report as having been frustrated by non-co-operators.

33. *Small pumps and motors.*—At the instance of Sir Alfred Chatterton steps were taken to engage the interest of engineering firms in the problem of improved irrigation from wells in India. There is no difficulty about raising water from wells by mechanical means when the quantity of water to be lifted is large but for a two thousand gallons per hour supply there is nothing at present suitable to replace bullock power. There must be designed first, a suitable

pump and, secondly, to work the pump, a simple and reliable motor of about two horse power. The Deputy Director reports that he has made progress with a design for a cheap pump but a problem of this kind is not likely to be quickly and completely solved by an individual. The representatives of British engineering firms were therefore invited to meet Sir Alfred Chatterton to hear his views and discuss them. A full account of the discussion was published in the local press. British firms are now working on the combined problem.

34. As regards the motor, increased attention is being given to the possibilities of the suction gas producer and the gas engine. English firms are working on these lines and Messrs. Kirloskar Brothers, agricultural implements manufacturers, Satara District, are also taking up the manufacture of such plant. The charcoal supplies available for use with producers have also been considered and will probably be further examined by the Forest Department.

35. *Improved ploughs and other agricultural implements.*—A problem which, like the last, constitutes a link with the Agricultural Department is the manufacture of iron ploughs suitable for different tracts and soils. In connection with complaints regarding the short life of plough shares used with improved ploughs the Deputy Director demonstrated that the chilled shares made by Kirloskar Brothers are quite equal to those imported from England and the United States of America while they cost much less. The problems connected with improved ploughs and other agricultural implements were referred to a committee over which I presided in June last. Its recommendations are now under the consideration of Government.

Chemical Research.

36. Owing to the absence of new industrial enterprise and the need of practising economy throughout the year, there were no fresh developments in chemical research,

37. *Casein.*—This investigation was fully described in last year's report. During the year the casein manufactured at the

demonstration factory, Anand, was regularly analysed by the Assistant Chemist and the analytical results utilised in controlling manufacture. As the acidity of casein was found to fluctuate experiments were arranged to follow the increase of acidity during fermentation and to ascertain what is the degree of acidity which leads to complete precipitation of casein.

38. At the close of the year a communication was received from the Director of the Imperial Institute, London, with reference to the views expressed in their second bulletin by Dr. Meldrum and Mr. Gangolli regarding the best method of determining fat in casein and their criticisms of results obtained at the Imperial Institute. The Imperial Institute has not accepted the conclusions of the local investigators, but further information, which has been promised, must be awaited before the question can be further examined.

39. The work hitherto undertaken at Ahmedabad and Anand has been directed towards the manufacture of an improved lactic casein. As mentioned in paragraph 25, the commercial value of the improvement achieved has still to be ascertained. There is however probably a better market for rennet casein which is now much used in Europe and America for the manufacture of "artificial ivory" and substitutes for celluloid. Research work on rennet casein has therefore been begun and the first experiments are encouraging. Instead of animal rennet, vegetable rennets, for the supply of which I am indebted to officials all over India, are being used.

40. Experiments were made on the production of casein glue for use in the Madras Pencil Factory and several samples according to different formulæ have been tested at the factory. Three samples were found to be suitable. Principal R. S. Cree-Brown of the College of Engineering, Poona, kindly provided a design for a testing machine and this is now under construction. This will enable glues to be tested here when they are made. For the purposes of this enquiry a scholarship in technical chemistry has been awarded to Mr. M. H. Ghadiali, B.Sc.

41. Casein is also a valuable material in the manufacture of paints and varnishes and its use for these purposes will be investigated by Mr. Turner.

42. *Magnesium Chloride*.—The magnesium chloride produced at Kharaghoda by the Pioneer Magnesia Works from the bitterns or mother liquors of the salt works shows discolouration when the crystals are fused preparatory to running the material into the drums in which it is sold. The quality of the chemical is quite satisfactory and is not affected by the discolouration but the superior white appearance of the imported chemical naturally secures it preference from the cotton mills, which use it in large quantities for sizing purposes. It is unnecessary to describe in detail the work done as all efforts to remove the discolouration have failed. The problem is also under investigation by Drs. Sudborough and Watson at the Indian Institute of Science, Bangalore. Other chemists have also given consideration to the matter. No one has found a solution and there are as many opinions regarding the cause of the discolouration as there have been investigators. It is however only by persistent labour on problems of this kind that full use can be made of the country's natural resources.

43. *Sind Soda* (Trona).—The object of these experiments which were instituted at the suggestion of Mr. G. de P. Cotter of the Geological Survey of India who surveyed the alkali deposits in Sind in 1918-19 is to improve the production of *chaniho* so as to procure the mineral "trona"—a combination of sodium carbonate and bicarbonate—in a fairly pure form. The local authorities carried out the experiments very well but misunderstood the limits imposed by natural causes. Mr. Koppikar visited Sind in April last and the impracticability under the local conditions of producing pure sodium carbonate is now understood. Good "trona" is a perfectly satisfactory substitute for soda ash in all its local uses but whether it can replace it on the market remains to be seen. The soda ash trade is well organised and a standardised product has, at all times, obvious advantages.

44. The miscellaneous work of Messrs. Meldrum and Turner consisted of examination and analyses of mineral and vegetable oils, waters, casein, butter, nectalene, tetralene, coals and coke. Mr. Turner also investigated the sugar content of cashew nuts and dealt with a number of miscellaneous enquiries.

Pottery.

45. Mr. E. R. Fern was in charge of the Pottery department of the School of Art, Bombay, throughout the year. Twelve students were under instruction.

Experiments in the manufacture of brown teapots were continued from last year and brought to a successful conclusion. White earthenware cups, saucers and teapots were also made experimentally. The scheme for the production of flooring tiles and teapots on a semi-commercial scale was sanctioned during the year but owing to the provision of funds being doubtful, the plant required could not be ordered till May and actual production has therefore been delayed. Work on the new kiln has, however, been commenced and 100 tons of Kiroil clay have been stocked and are being levigated. It is hoped that output will commence before the end of the year.

46. Further work was done on behalf of the Development Directorate. Mr. Fern visited the clay beds at Trombay and Kalyan and the brick factory at Vasind and submitted reports. Five hundred red bricks were also prepared for the Directorate from mixtures composed of 58 samples of clay from the brick area acquired at Kalyan. Ninety-three experiments were made with these clays and for the final test a kiln of 500 bricks was prepared. This represented a good deal of work but the result satisfied the Superintending Engineer, No. IV Project Division, that very good bricks can be made of Kalyan clay with appropriate machinery and expert supervision.

47. Other work at the School of Art included 25 experiments in the manufacture of pipes for the chemical industry. They were all more or less successful and two of the tests have been selected to

produce pipes of a useable size for a final test at the Cordite Factory, Aravankadu. Majolica glazed palm pots in artistic colours were also produced and 48 test trials were made for various coloured glazes. The vases were produced in some of the colours tested and were exhibited to the public. Experiments in the use of waste mica were unsuccessful.

48. Mr. Fern visited two pottery factories at the request of the owners and gave advice to 24 persons who called at his workshops in connection with pottery manufacture. One hundred and two samples of clays were received for testing and report, of which 90 samples were investigated and reported on during the year. Mr. Fern has done a great deal of valuable work in this way since he was attached to this Department, but the easy terms on which it is carried out seems merely to encourage the submission of samples by persons who have no very serious intention of proceeding further in the matter whatever the results may be. It is proposed, therefore, in future not to allow free investigation except in very special cases. The fees received during the year under report on account of testing and analyses of clays amounted to only Rs. 195.

Fisheries.

49. *Trawling.*—The steam trawler “William Carrick” made its first voyage in May 1921. In November the results up to date were summarised and placed before the Advisory Committee for its consideration. It was then apparent that trawling was not yet a commercial proposition in Bombay waters. The Committee, by a majority, recommended, however, that the experiment should be continued till the end of May 1922 in order that the results of a full season’s fishing might be available as data in the future. The recommendation was based on the ground that the financial and other factors governing the commercial prospects of trawling, e.g., local market conditions, the prices of fish, the price of coal and other stores, and the facilities for rapid removal and cold storage of the

catch, for carrying out repairs and for supplying coal, ice, etc., might change in the future, but would-be investors would always require data regarding the rate at which fish could be caught all the year round. Government decided, however, that the experiment should be closed before the end of the financial year. In order to close the accounts in time the vessel returned to Bombay from the 36th and last voyage on 27th February. Two days were occupied in landing the catch and a few more days in checking stores and preparations for laying up. The vessel was finally laid up on 9th March and the four European officers left Bombay for England via Karachi the following morning. The vessel was sold in May to the Government of Burma.

50. At the outset the results seemed promising. It took a little time to train the local crew but, taking results per hour's trawling there was a regular and rapid increase in the catches up the seventh voyage at the end of July and it seemed that trawling might, subject to certain conditions, be a feasible commercial proposition. These conditions will be discussed below. The seventh voyage was the third under monsoon conditions and as these became established trawling became more difficult and, at times, impracticable. There was violent weather from the end of July till the second week of September (7th to 13th voyages) resulting in loss of time and damage to nets. There was also considerable sickness among the crew, both European and Indian. With better weather conditions catches improved but with the re-appearance of the local fishing fleets prices fell. A great part of October was occupied in the 19th voyage to Karwar for gol but this was almost fruitless. In November the local market was glutted so the time was considered suitable for a trip to Karachi which lasted 16 days (voyages 24 to 26). Results were better on return to Bombay. In the middle of January another trip to Karachi was made (voyages 30 and 31) but this was less successful than before and had to be curtailed owing to damage by coral to the nets. After three good trips near Bombay a final visit (voyages 35 and 36) was made to Karachi. The results of all 36 voyages are

summarised in the following statements. As a separate report on the trawling operations is being prepared, I shall not discuss in detail these statements.

Catch per hour's trawling and per hour's absence from port.

Voyage.	Absence from port.	Period of actual trawling.	A.				B.			
			Catch per hour's trawling.				Catch per hour's absence from port.			
			Rays.	Dogfish, Shark, Saw fish, etc.	All others.	Total.	Rays.	Dogfish, Shark, Saw fish, etc.	All others.	Total.
Hours.	Hours.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
I ..	50	24	10	4	42	56	5	2	20	27
II ..	83	31	27	4	27	59	10	2	10	22
III ..	73	36	47	6	53	105	23	3	26	52
IV ..	63	50	27	4	73	105	22	3	58	83
V ..	128	110·5	86	11	93	190	74	9	80	164
VI ..	92	76·5	65	21	119	205	54	18	99	171
VII ..	35	14·75	67	1·4	189	251	28	1	80	106
VIII ..	32	11·25	30	3	25	58	11	1	9	20
IX ..	30	9	50	7	47	104	15	2	14	31
X ..	75·5	62·5	25	..	102	127	20	..	84	104
XI ..	54	43·25	29	1	133	163	23	1	106	130
XII ..	19	4	35	2	35	72	7	4	7	15
XIII ..	26·5	16·25	..	..	..	9	..	..	..	6
XIV ..	49	40·75	36	9	45	90	30	7	38	75
XV ..	104	42	17	..	42	59	7	..	17	24
XVI ..	75	65	55	7	59	121	48	6	51	105
XVII ..	70·5	52·5	30	..	91	121	22	..	68	90

Voyage.	Absence from port.	Period of actual trawling.	A.				B.			
			Catch per hour's trawling.				Catch per hour's absence from port.			
			Rays.	Dogfish, Shark, Saw fish, etc.	All others.	Total.	Rays.	Dogfish, Shark, Saw fish, etc.	All others.	Total.
Hours.	Hours.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
XVIII ..	74	42·25	18	7	86	111	10	4	49	63
XIX ..	188	44·75	33	..	25	58	8	..	6	14
XX ..	73	57·75	8	4	48	60	7	3	38	47
XXI ..	68	53·25	20	..	57	77	16	..	45	61
XXII ..	89	52·5	21	10	83	114	12	6	49	67
XXIII ..	99	77	12	..	42	54	10	..	32	42
XXIV ..	135·5	59·25	3	8	80	92	1·4	3·5	35	40
XXV ..	56·5	46	8	8	145	154	6	6	118	124
XXVI ..	71	11·5	8	28	127	164	1	5	20	26
XXVII ..	120	86	45	4	83	132	32	3	59	94
XXVIII ..	64	40	48	5	76	130	30	3	48	81
XXIX ..	118	70·75	16	5	58	79	9	3	35	47
XXX ..	88	34·5	6	8	76	90	2	3	26	31
XXXI ..	98	35	..	13	80	93	..	4	29	33
XXXII ..	72	58·5	33	12	121	167	27	10	99	136
XXXIII ..	75	55·5	22	9	95	127	16	7	70	94
XXXIV ..	74·5	53·5	29	14	106	148	20	10	76	106
XXXV ..	114·75	50·5	10	8	115	133	4	4	51	59
XXXVI ..	113·5	61·5	20	16	76	112	11	9	41	61
Grand Totals and General Averages..	2,851	1,679	30	7	80	117	18	4	47	69

Rate of gross earnings per hour's fishing and per hour's absence.

Voyage.	Absence from port.	Duration of trawling.	Sum realised.		
			For whole catch.	Per hour's fishing.	Per hour's absence from port.
	Hours.	Hours.	Rs.	Rs.	Rs.
I	50	24	230	9·6	4·6
II	83	31	273	8·8	3·3
III	73	36	581	16·1	8·0
IV	63	50	814	16·3	12·9
V	128	110·5	2,260	20·5	17·7
VI	92	76·5	2,120	27·7	23·0
VII	35	14·75	350	23·7	10·0
VIII	32	11·25	75	6·7	2·3
IX	30	9	165	18·3	5·5
X	75·5	62·5	1,136	18·1	15·0
XI	54	43·25	656	15·1	12·1
XII	19	4	....	....	....
XIII	26·5	16·25	....	....	....
XIV	49	40·75	429	10·5	8·8
XV	104	42	340	8·1	3·3
XVI	75	65	641	9·9	8·5
XVII	70·5	52·5	480	9·1	6·8
XVIII	74	42·25	671	15·9	9·1
XIX	188	44·75	59	1·3	0·31
XX	73	57·75	135	2·3	1·8
XXI	68	53·25	114	2·1	1·7
XXII	89	52·5	198	3·8	2·2
XXIII	99	77	210	2·7	2·1

Voyage.	Absence from port.	Duration of trawling.	Sum realised.		
			For whole catch:	Per hour's fishing.	Per hour's absence from port.
	Hours.	Hours.	Rs.	Rs.	Rs.
XXIV	135.5	59.25	143	2.4	1.05
XXV	56.5	46	283	6.2	5.0
XXVI	71	11.5	260	22.6	3.7
XXVII	120	86	863	10.0	7.2
XXVIII	64	40	517	12.9	8.0
XXIX	118	70.75	1,106	15.6	9.4
XXX	88	34.5	200	5.8	2.3
XXXI	98	35	215	6.1	2.2
XXXII	72	58.5	1,008	17.2	14.0
XXXIII	75	55.5	1,001	18.0	13.3
XXXIV	74.5	53.5	732	13.7	9.8
XXXV	114.75	50.5	1,086	9.7	4.8
XXXVI	113.25	61.5			
Grand Totals and General Averages ..	2,851	1,679	19,351	11.5	6.8

51. The average monthly expenditure on running the trawler is shown below. In this no account is taken of depreciation, while repairs and renewals are also excluded as these were, for various reasons, exceptionally high in the case of the "William Carrick":—

Monthly cost of maintenance.

	Rs.
Pay of Officers and chief engineer ..	2,960
Wages of crew	1,453

Monthly cost of maintenance—contd.

	Rs.
Stores, consumable	733
Stores, non-consumable	463
Coal (average monthly consumption 125 tons)	4,742
Ice	294
Port dues	283
Miscellaneous (water, godown rent, etc.)	247
Total ..	11,175

52. Coal was exceptionally high in price during the earlier part of the operations, but even at present rates and with Indians trained to take the place of Europeans the cost of maintenance of a trawler of the Castle type cannot be met by sales of fish at current market rates. The reduction that might be effected by training Indians to replace Europeans is not easily calculable. The Indian crew were more than twice the numbers employed in Europe, but it was impossible, owing to the more trying climatic conditions, to keep them at sea each month for more than half the period that a trawler keeps the sea in European waters. Over 41 weeks actual trawling the average time spent at sea was three days (of 24 hours) per week. In England the trawling crews get an average of one night ashore per week and it is common for trawlers to keep the sea for a fortnight before returning for two nights to port. At Bombay conditions reduced the length of voyages to an average of 80 hours and after each voyage at least two nights had to be spent in port. Before trawling can be established in Bombay the establishment of cold storage is essential and there must be special facilities for rapid coaling, supplying ice and stores, and unloading catches. Trawling at the intensive rate practised in Europe could be maintained only by keeping spare staff to give all hands frequent leave.

53. Finally, a trawling venture could not succeed without a change in the mediæval conditions under which the local fish market

is conducted. There is also a great deal to be done in the way of popularising little known species of edible fish. A large part of the fish consuming public is apt to think of trawling in terms of pomfret. But the percentage of pomfret obtained by the trawler over all voyages was less than 4 per cent. by weight. Nor is the pomfret so profitable a fish to sell as some people might conclude from their household accounts. The pomfret is dear in June, July and August when the highest price fetched was 16 annas 10 pies per lb. This fell to 2 annas 1 pie in November, while the average for all sales was 7 annas per lb. Karel, palu and tambusa, all good edible fish constituting $12\frac{1}{2}$ per cent. of the total catch, fetched less than 2 annas per lb. on the average. After pomfret the best selling fish was the ravas or salmon which fetched 6 annas per lb. but constituted only 1.7 per cent. of the catch. The gol, making 14 per cent. of the catch, was more remunerative at $4\frac{1}{4}$ annas per lb. The most abundant fish is the ray or skate which composed on the average 25 per cent. of the total catch. It is so little esteemed locally that it sold on the average at the rate of 100 lbs. for a rupee. Even at this rate large quantities could not be sold at all. At first they were "dumped" at sea, but subsequently they were handed over free to the Army Department for use as an extra ration to troops, who obtained over 9,000 lbs. in this way. Skate, which was at one time equally unsaleable in England, is now a popular cheap edible fish there and a trawling company, if it could arrange for regular supplies, might be able to arrange for the disposal of the inevitably large catches by army contracts.

54. It is unnecessary to discuss here the possibilities of a smaller type of trawler or of seine net fishing with vessels driven by power. Although the outlook for commercial trawling in the Indian ocean is meantime not hopeful, it is unfortunate that the experiment could not have been continued a little longer for the guidance of future enterprise. Unfortunately, after it was launched, prices of coal and other supplies and of personnel rose to their extreme limits and there was no counterbalancing change in the fish market. This coincided

with the occurrence of Government's financial difficulties from similar causes. At a more prosperous time Government could probably have carried on the experiment some time longer at a cost less than that involved when operations were brought to a close. In the circumstances of the time there was therefore no alternative to closure.

55. It is satisfactory to record that everything which previous arrangement and foresight could provide was done to ensure success and no part of the failure can be ascribed to lack of adequate organisation. The officers and crew worked splendidly. The fishing results have been carefully compiled by the Marine Biologist and will be published later. Mr. Hefford's administration of the operations was excellent, and his head clerk, Mr. S. Y. Anandkar, deserves to be mentioned for the zeal and efficiency with which he assisted in the administrative and other work.

56. *Other Fisheries Work.*—The Marine Biologist visited Karachi in May for further local enquiries and had under enquiry the depletion of the pearl mussel fishery in the Thana creek. The depletion is probably due to over fishing. In the time at his disposal it has not been possible to ascertain the life conditions of the mollusc. He has also collected through the Salt Department and the Collector of Customs, Karachi, fishery statistics and intelligence as a basis for studying the fishing industry and the seasonal movements of the fish.

57. The Superintendent of Fisheries, Mr. T. J. Walke, assisted in trawling operations during the monsoon and returned to Karwar in September in order to start fish oil and guano operations. The sardine season was a complete failure and nothing could be done. Before the end of March, when his appointment was abolished, the Superintendent made 127 visits to fishing yards in the Ratnagiri and Kanara sub-divisions. Information of fish catches was collected and details of measurements, stomach contents, roe, etc., were recorded for the use of the Marine Biologist. Agriculturists at several places have adopted his advice for the utilisation of fish guts for manurial purposes. Experiments were again made in smoking

and pickling fish but could not be concluded before the closing of his office. He also made enquiries about the requirements of matee bark in Kanara for tanning nets, and the Collector has been requested to make arrangements for supply from forest areas. Much time and trouble were spent in assisting the Assistant Registrar of Co-operative Societies to form co-operative societies of fishermen but, though the men appeared anxious to form societies, the influence of local savkars could not easily be overcome. Two societies were actually registered but could not be brought into working order without the services of the Salt Department's bandar karkuns and the monsoon had set in before these were allowed. The difficulty of introducing innovations amongst the fishing classes has been exemplified in South Kanara where the yard regulations of the Madras Fisheries Department led to a general strike.

58. The year virtually marks the end of the fisheries section for, in December, the Marine Biologist will revert to the Ministry of Agriculture and Fisheries in England. It was easy for critics previously to ask what Government had done for the fishing industry; it was apparently even easier for them to criticise every innovation and improvement which Government attempted to introduce when the industry was taken in hand. The fishermen resented attempts to introduce cleanliness into fish curing yards as an invasion of private rights. It is all the more a pity that, after the ground had been explored and partially broken, the need for retrenchment should render infructuous the efforts already made. I am hopeful however that the Commissioner of Customs, Salt and Excise will take up the work on fish oil and guano for which Mr. Walke had made careful preparations.

Engineering Workshops, Dapuri.

59. These workshops were transferred from the Public Works Department at the end of 1919 and are still run on their original lines. Their circumstances are peculiar. They were originally intended to carry out repairs and other works for the Public Works

Department but after their transfer to this Department the obligation on Executive Engineers to send their work to Dapuri was removed. The position now is that, prices, quality and other circumstances being equal, Public Works Department Officers are required to give preference to the Dapuri workshops over private workshops. At the same time the Dapuri workshops have not entire freedom in preparing estimates and therefore in competing with private enterprise for Government orders. Further they are not allowed to compete with private enterprise by accepting outside orders without obtaining special sanction in each case. Their scope is therefore distinctly cramped.

Attached to the workshops but separately organised for accounts purposes is a store.

60. The workshops were organised under war conditions and at the outset were equipped with what plant and tools were available at the time. At the date of their transfer to the Industries Department they had not emerged from their improvised condition. In 1919 a good selection of modern machines was purchased from the Ministry of Munitions, and since then the shops have been overhauled and extended, and with a new foundry, a new fitting shed and an improved fitting shop are now capable of carrying out a wide range and a large volume of work.

61. It was feared that last year would be a bad one for the workshops. In the previous year the overhauling of the Surat distillery brought Rs. 80,000 worth of orders to the shops but during last year there were only three orders of over Rs. 2,000 each. At the outset Public Works Department patronage was partially lost and in any event, owing to the reduction in its grants, this department was not expected to have much work to give. If the distillery work is excluded orders actually increased, however, from 336 in 1920-21 to 733 in 1921-22, while the increase in the value of the work done was 50 per cent. Without compulsion the services of the workshops are in increasing demand although the rates charged have not been altered.

62. Arrangements were made during the year to close the workshop of the Agricultural Engineer and to undertake at Dapuri the work formerly carried out at this workshop. Formal orders are, however, still awaited.

63. According to the accounts presented in his annual report by the Executive Engineer in charge of the workshops there was a turn-over in the workshops and store combined of Rs. 2,66,009 involving a loss of Rs. 29,000 as compared with a loss of over Rs. 30,000 in the previous year on a turn-over of Rs. 3,68,000. The loss is regrettable but many commercial concerns can show no better results at the present time.

64. The increased turn-over in the previous year was due to the large issues from the store. This store was designed originally to meet Public Works Department demands and when it was transferred to the Department of Industries in 1919 it contained a very mixed lot of plant and materials, a good deal of which was valued in the books at prices which soon became out of date. This caused difficulties in inducing Public Works Department officers to take plant and materials from the stores in preference to buying afresh. The idea of acting as a Public Works Department supply agency was never entertained by the Industries Department but the task of getting rid of ex-Public Works Department stores has involved Dapuri in heavy writes off. The stores are being gradually reduced to dimensions suitable for the workshops only.

65. I give the estimated loss of Rs. 29,000 during the past year with some reservation, as it is not easy to draw up a satisfactory profit and loss account from the existing accounts system. A great deal of trouble has been expended in trying to improve matters and the system was fully examined during the year under report by Messrs. Price, Waterhouse and Company, Chartered Accountants, who submitted a lengthy report with proposals for introducing a new quasi-commercial set of books. I have however suspended consideration of their report as I understand that Government have other proposals in view for these workshops which may affect the accounting.

66. Nevertheless considerable economy has been effected even under the present system. Shortly after the workshops were transferred a demand was made for six more clerks and an additional overseer. This demand was not only found unnecessary but reductions have been made during the last year in the clerical, menial and other staff to the extent of Rs. 8,650 annually in addition to reducing pumping charges by Rs. 1,800—a total saving of overhead charges amounting to Rs. 10,450 annually. Coolies have also been reduced, and a further saving of Rs. 2,000 annually effected. Further reductions are not impossible and should be practicable in the accounts department but the chief need of the moment is not more retrenchment but more work so that all overhead charges may be fully recovered. More work can be secured if the workshops are recognised in practice, as they are in name, as the *central* workshops of Government for *all* departments.

As all new works have now been completed the services of an overseer have lately been dispensed with. Till now two-fifths of the overhead charges have been debitable to original works. In future the workshops will bear the whole of the overhead charges.

67. In his report (Appendix A) the Deputy Director has suggested that the works could now be managed by a single European officer. But if full use is made of the works by Government departments, as has not been the case hitherto, it is unlikely that, in the peculiar circumstances in which work has to be done for Government departments, the Works Manager could adequately supervise the increased output and also carry on the increased correspondence and other administrative work. As it is, an appreciable portion of the Deputy Director's time has been given to the Workshops though no part of his pay is reckoned as overhead charges. The Executive Engineer may be dispensed with under an extension of this arrangement but this would merely shift administrative control and disguise its cost.

68. Three graduates in mechanical engineering are under training at the Workshops and there are about forty ordinary

trade apprentices for whom a schoolmaster is provided. Their number fell in July last owing to new factory legislation. The training of graduates and apprentices can only be fully undertaken provided work is plentiful and this constitutes another reason for making it compulsory on all Government departments to use the Workshops to the full extent possible.

69. *Experimental work.*—The button making machinery has proved successful and boys are now under training to operate it. It wants “balancing” to some extent and it will take a few more months before commercial results can be estimated. The rosha grass oil plant is still under investigation. An entirely new design has been obtained from Glasgow and if this is adopted the plant will be made by the firm supplying the design. Work on an experimental brick making machine which was taken up at the instance of the Public Works Department has been suspended for lack of funds. A vertical frame saw with timber construction has been made to a special design and will shortly be tried.

Commercial and Industrial Intelligence.

70. An incomplete but representative list of enquiries received during the year is given in Appendix B, and shows the general nature of the enquiries received. The enquirers are not always modest folks but if they are trying in the range and extent of their enquiries they are flattering in attributing to the department a first approximation to omniscience. The range of subjects to be treated is, however, very considerable and brings the department into working co-operation with nearly every other Government department. The subject of mines and minerals was transferred during the year from the Director of Agriculture. A full enquiry was made into the possibilities of industrial alcohol and the difficulties of makers of perfumes and spirituous medicinal preparations were represented to Government with partial success. In conjunction with the forest department, work has been done in developing forest resources for the manufacture of paper pulp, turpentine, rosin, buttons, power alcohol, bobbins,

rosha grass oil and matches. A collection of samples of foreign textiles sold in Australia was made available to Bombay mills while the Bombay Millowners' Association accepted and carried out a suggestion for preparing a classified list of local output. Information regarding local manufactures was supplied to the Controller of Contracts and other Government and private enquirers. Assistance and information has been given regarding the provision of railway wagons and railway sidings and the adjustment of freight rates. Closer relations with the Co-operative Department has been attained through producers' societies and two or three schemes for productive co-operation are now under examination. Till last year the lack of a local Test House was frequently felt but so far as this would be useful to the public it has been amply met in the last two years by private enterprise in Bombay. Of miscellaneous matters to which attention was paid mention may be made of the need of revising recent Government orders so as to place the standardisation of weights and measures on a sound scientific and administrative basis.

Receipts of correspondence and official references during the year were 7,371 as compared with 7,049 in 1920-21 and 5,959 in 1919-20. Letters issued were practically the same, *viz.*,—7,358.

Concessions.

71. *Turpentine and rosin manufacture.*—During the year a concession was granted on the advice of the Advisory Committee to the Eastern Development Corporation for the tapping and collection of the oleo-gum-resin of *Boswellia Serrata* for the manufacture of turpentine and rosin. A preliminary license over a limited area for five years is convertible into a license for the whole of Khandesh for twenty-five years renewable for another twenty-five years. Royalty is taken in the shape of 40 per cent. of the profits.

Paper pulp.—At the close of the year a concession in Khandesh for the manufacture of paper pulp from grass was under examination and a recommendation regarding terms has since been submitted by the Advisory Committee to Government.

Magnesium chloride.—Since 1916 over two lakhs of rupees have been received as royalties for the manufacture of magnesium chloride. Owing to the fall in the price the royalty terms are now under revision on a profit sharing basis.

Exhibitions.

72. The Department participated in the British Industries Fair, London, in February-March 1922. The samples sent included carpets, silk, embroidered trimmings, and carved sandalwood. Owing to the depression in trade no orders were booked. The expenditure incurred will be practically covered by the sale of samples.

The All India Weaving Exhibition at Patna in which the department participated has already been mentioned. It has been arranged to demonstrate at the Red Cross Fête at Bombay in December the work which is done by the department for the improvement of handweaving.

Participation in the British Empire Exhibition in 1924 is under consideration.

Technical Education.

73. The subject of technical education is under the administration of the Department of Public Instruction but the Department of Industries maintains touch through the Director's membership of the Board of the Victoria Jubilee Technical Institute, the Committee of Direction for Technical Education and the Advisory Committees of the College of Engineering and the Royal Institute of Science. Technical scholarships are also awarded on the advice of the Department of Industries which assists and advises the scholars during and after their training. At present four state technical scholarships are given for study abroad. One of these was awarded in 1919 for the study of sugar technology at the Audubon Sugar School of the University of Louisiana. The holder of this scholarship, having successfully completed his college course, is now on tour in the West Indies, Hawaii and Java where facilities for the study of factory methods have been arranged. During the year

three scholarships became vacant and, on the advice of the Advisory Committee, two were awarded for the study in Great Britain of tanning and of bleaching and dyeing. The remaining vacant scholarship has been reserved by Government for the study of actuarial science. The present system of maintaining a fixed maximum number of scholars has the disadvantage that vacant scholarships occur at irregular and not easily calculable intervals. Proposals for awarding two scholarships *annually* are under the consideration of Government.

74. Three scholarships in technical chemistry at the Indian Institute of Science, Bangalore, were awarded a year ago and were recently renewed for another year. Three new scholars were also appointed at the close of the year under report. One will assist Dr. G. Fowler at the Indian Institute of Science in research on a lactic acid forming yeast on which work was begun, in connection with the investigation of a ghee substitute, by Mr. A. F. Yuill, author of the departmental bulletin on the Vegetable Oil Industry of the Bombay Presidency. A second scholar will investigate the manufacture of casein, glues and cements. A third scholarship in pottery was not taken up.

Scholarships were offered for the study of electrical engineering at the Indian Institute of Science, Bangalore, but none of the applicants were considered to have sufficiently good qualifications and no award was made.

75. In 1919 the Advisory Committee recommended that travelling scholarships should be available for persons actually engaged in industry to enable them to go abroad, not for purposes of theoretical study or even practical training, but to make such enquiries and observations as were likely to benefit Indian industry. During the year two travelling scholarships, each of the value of Rs. 5,000, were awarded to Messrs. B. J. G. Shastri and J. K. Chapadia who are engaged in the gold and silver thread industry at Surat. It is recognised that their enquiry, which they have already begun in England and on the continent, regarding improved mechanical means of manufacture

is not an easy one but they can hardly fail to get better results for the expenditure than Government could achieve by investigation and experiments in India. There has been a demand for a Government demonstration factory in this industry but, apart from the cost and other difficulties, no one has been able to suggest where instructors can be found capable of devising or teaching improved methods. It will therefore be specially interesting to follow the results of the enquiries of Messrs. Shastri and Chapadia in their own business and in the industry as a whole.

Conclusion.

76. The staff throughout has worked, on the whole, with efficiency. There is room for improvement in the office organisation but it is impossible to retain men on the prospects offered. There are seven posts for graduates in the office and in the last three years nine graduates have received a training in these posts and left afterwards to better their prospects. It is impossible to get full efficiency from such a changing staff. These conditions and a certain degree of uncertainty regarding the future of the whole department have not, however, materially affected its energies though they have checked initiative. I gratefully acknowledge the valuable assistance of the members of the Advisory Committee who have given up valuable time to the consideration of the subjects on which their advice was sought.

I have the honour to be,

Sir,

Your most obedient servant,

R. D. BELL,

Director of Industries.

APPENDIX A.

ANNUAL REPORT OF THE DEPUTY DIRECTOR OF INDUSTRIES.

Sir,

I have the honour to submit a report on the work of the Deputy Director of Industries for the year 1921-22.

2. * * * * *

3. The Advisory Board to the Department of Industries has passed two resolutions since my return to the effect that the post of Deputy Director should be abolished and the decision of Government is awaited.

To work in a position of such uncertainty has caused me great anxiety and unhappiness.

4. The control of the Dapuri Workshops was restored to me early in the new year.

The second attempt to carry out woodwork and furniture at these works has again proved a failure.

5. Cheap but good woodwork cannot be undertaken at Dapuri until a full range of woodworking machines is installed.

Most of the operations now carried out so inefficiently by hand should be done on machines by trained men. The components of an article under construction, properly marked off, should be handed over to the joiners for fitting, glueing up and finishing. If this system is ever adopted, I believe woodworking will be a success.

6. By the end of the financial year new works at Dapuri were practically complete and the full energies of the staff can now be directed to work in the shops and to the needs of clients.

The works have always been carried on with difficulty owing to building alterations and the lack of a full range of machines.

The works are very well equipped for repair work and the production of parts of machinery, castings, etc.; and if sufficient orders are forthcoming they should pay their way.

7. A policy of reducing the stores to the smallest quantity possible has been instituted and all old and redundant stock is being sold off by auction.

8. Orders have been received to re-open a Tools and Plant Store for the Public Works Department.

9. The question remains to be decided whether the staff can be reduced further, and it seems probable now that new works are complete, that a single European officer with an Indian Assistant might be able to carry on the works and office.

10. The Gold and Silver Wire Drawing industry has been examined and unsuccessful attempts made to design a machine for producing square section spirals.

Experiments in preparing hard steel rolls have met with some success, but it is hoped to produce an article which will not require such frequent polishing.

The problem is to find a suitable grade of steel which will stand hardening and retain a highly polished surface.

11. Sawing logs into planks and scantlings by means of circular saws is wasteful and inaccurate and has led to many failures. Inserted tooth saws tried at Dapuri are more successful as they remain sharp for a longer period, but it is clear that the vertical frame saw is the correct type of machine. Unfortunately such frame saws are very costly when imported. A vertical frame saw has now been designed with timber construction and will shortly be tried at Dapuri. This saw should be popular as it is easy to make and the cost will be quite moderate.

12. Attention has been directed to the design of a cheap pumping set for small yields from wells. Progress has been made with a design of pump which promises to be cheap to make, but experience in work can alone prove whether it is to be satisfactory or not.

13. Opinion is slowly turning in the direction of utilising charcoal for the production of power in small suction gas producers.

It is hoped that before long the use of small gas engines and producers will become popular. Messrs. Kirloskar Bros. are taking up the manufacture of such plant and have already made several producers which are supplying gas to converted oil engines.

14. An investigation into the manufacture of chilled plough shares has demonstrated that the chilled shares made by Kirloskar Bros. are quite equal to those imported from England and the United States of America while the cost is half the amount paid for the latter.

15. A large number of problems submitted by industrialists have been investigated and information has been supplied in the majority of cases.

Owing to the state of trade, however, few new enterprises have been taken up seriously.

16. Investigations in the use of Bombay timbers for different purposes have been carried on in collaboration with the Forest Department, but no conclusive results are ready owing to the time required to obtain really seasoned timber from woods which are not in common use.

17. Assistance has been rendered to the Public Works Department in connection with mechanical engineering work when required. I have again been

placed on the Sanitary Board and attended an important meeting at Mahableshtar.

18. I attended the Handloom Weaving Exhibition at Patna and have attempted to find a suitable wood for making shuttles, but the investigation is incomplete.

19. A 15 b.h.p. oil engine was purchased for the Ratnagiri Industrial school and a visit was made to that institution. Plans for erecting the oil engine and setting up a number of machine and woodworking tools have been sent to the Superintendent, but in the absence of any definite programme of instruction in metal and woodwork with machines, it is rather doubtful whether the installation of power will be of much benefit to the students.

20. A set of button making machines has been designed, made and set up at Dapuri by Mr. Mustaphi who has had considerable experience of button making.

These machines are now producing buttons and it is anticipated that they will be turning out considerable quantities shortly when the workers are fully trained.

If successful, this demonstration plant should form the nucleus for an industry on this side of India as enormous quantities of "nut buttons" are now imported from Italy which might be made in India.

I have, etc.,

(Signed) G. H. THISELTON-DYER,

Deputy Director of Industries.

APPENDIX B.

COMMERCIAL AND INDUSTRIAL ENQUIRIES, 1921-22.

Subject of enquiry.	Number of enquiries.
1. Acetate of lime. Buyers of —	1
2. Acid Sulphuric. Manufacturers in India of —	1
3. „ Oxalic. „ „	1
4. Acids for dyeing. Literature on —	1
5. Agricultural implements and machinery. Imports of —	1
6. Ajwan Oil. Distilleries in India of —	2
7. Alabaster. Sources of —	1
8. Alumina Sulphate. Consumption in Bombay of —	1
9. „ Ferric. „ „	1
10. Aluminum. Importers of —	1

	Subject of enquiry.	Number of enquiries.
11.	Aluminum sheets. Dealers in —	1
12.	„ wares. Manufacturers of —	1
13.	Antimony Sulphide. Producers of —	1
14.	Apprenticeship for pharmaceutical chemist	1
15.	Artemesia. Dealers in —	1
16.	Asbestos. Producers in India of raw —	1
17.	Bags (cotton) for tobacco manufacturers in South Africa. Suppliers of —	1
18.	Bangles (glass). Dealers in —	1
19.	„ Enamelling for —	1
20.	Barytes. Producers in India of —	1
21.	Bee Keeping. Information re —	1
22.	Belting-camel — hair and leather — Suppliers of —	2
23.	Bersam seeds. Suppliers of —	1
24.	Bitumen. Sources of —	1
25.	Bone Mill. Estimate for —	1
26.	Borax (indigenous). Suppliers of —	1
27.	Bottles. Manufacturers in India of glass —	1
28.	Boxes. Manufacturers of special wood —	1
29.	„ Buyers for wood —	1
30.	Brass sheet. Dealers in —	1
31.	Brass ware. Manufactures of —	1
32.	Brick plant. Estimate for —	1
33.	Bundling machines. Suppliers of —	1
34.	Button Making Machinery	1
34a.	Burr Stones. Indian Sources of —	1
35.	Buttons. Manufacturers of thread —	1
36.	„ Machinery for and dealers in nuts for —	1
37.	Calcium Chloride. Suppliers of —	1
37a.	„ Carbide. Imports of —	1
38.	Cambric. Suppliers of —	2
39.	Canning fruits. Assistance for —	1
40.	Canvas. Manufacture of sail —	1
41.	Carborundum Powder. Sources and suppliers of —	1
42.	Cardboard. Demand for — and particulars of the industry	1
43.	Carding machinery for wool	1
44.	Casks. Information regarding manufacture, market prices, etc., of —	1

Subject of enquiry.	Number of enquiries.
45. Catechu. Manufacturers of extract of —	1
46. Celluloid Industry. Information <i>re</i> —	1
47. Chalk. Producers of —	1
48. Charcoal. Dealers in mordant —	2
49. " " " wood —	1
50. Chemicals. Manufacturers of aromatic —	1
51. " Imports of —	1
52. " Manufacturers of — in the Bombay Presidency	1
53. Chicory. Manufacturers of — in Bombay	1
54. China Clay. Suppliers of —	3
55. Chocolate. Exporters in Bombay of —	1
56. Cigarettes. Manufacturers in India of —	2
57. Cloth imports into Belgaum District	1
58. Cochineal. Sources and uses of —	1
59. Coffee-roasting factories in Bombay	1
60. Coir matting. Manufacture of —	1
61. Cotton. Suppliers of long staple —	1
62. Cotton Mills. General information <i>re</i> —	2
63. Crucibles. Manufacture of —	1
64. Enamel. Manufacturers of —	1
65. Enamel. Possibilities of — industry in India	1
66. Envelopes. Machinery for making —	1
67. Explosives. Manufacturers in India of —	1
68. Felt industry. Estimate for starting —	1
69. Fire Works. Manufacturers in India of —	1
70. Flour Mills. Estimates for and prospects of —	2
71. " " in Bombay. Names of —	1
72. Fruit Preservation. Information <i>re</i> —	1
73. Fuller's Earth. Uses, sources and producers of —	2
74. Furniture-Making. Literature on —	1
75. " Woods suitable for —	1
76. Gauging Rods. Manufacturers of —	1
77. Ghee. Purification of —	1
78. Ginning Machinery	1
79. Glass Manufacture. Information regarding furnaces, processes, factories, prospects, etc.	6
80. Glaubers Salt. Buyers of —	1
81. Glycerine. Manufacture of —	1

	Subject of enquiry.	Number of enquiries
82.	Gold lace thread. Suppliers of —	1
83.	Grinding stones. Suppliers of —	1
84.	Gums. Gum ghatti, Olibanum and mastic. Suppliers of —	2
85.	Gypsum. Sources, uses and export markets	2
86.	Hand looms. Suppliers of —	2
87.	Hand loom weaving in Bombay Presidency. Information re —	1
88.	Healds, reeds, etc. Suppliers of —	1
89.	Hosiery. Manufacturers in Bombay Presidency —	2
90.	Hydrogen. Suppliers of —	1
91.	Hydrogenation of vegetable oils. Literature on —	1
92.	Indigo. Dealers in —	1
93.	Inks (printing). Dealers in —	1
94.	Iron Sulphate. Dealers in —	1
95.	Knitting machines. Dealers in —	3
96.	Labels (cloth). Manufacturers in India	1
97.	Lac. Cultivation in Panch Mahals	1
98.	Lacquer ware. Suppliers of —	1
99.	Lasts (Shoe). Manufacturers of —	2
100.	Lead (Sheet). Demand for — in Bombay	1
101.	Liquorice root. Exporters of —	1
102.	Machinery. Miscellaneous enquiries re —	3
103.	Manganese. Dealers in —	1
104.	Manures. Dealers in artificial —	1
105.	Match manufacture. Information and literature regarding woods, chemicals, machinery and sites suitable for —. Also miscellaneous enquiries	12
106.	Mercerising yarn. Information re —	1
107.	Methyl Alcohol. Dealers in —	1
108.	Mica. Dealers in —	1
109.	Milk. Laws and regulations governing import of sweetened and unsweetened —	1
110.	Mines. List of —	1
111.	Mother-of-pearl shells. Suppliers in Bombay of —	1
112.	Motor Cars bodies. Manufacture in India of —	2
113.	Mowha flowers. Production and prices of —	2
114.	Nails. Manufacture of wire —	1

Subject of enquiry.	Number of enquiries.
115. Ochres, red and yellow. Dealers in.— purchasers of — ..	2
116. Oil cakes (various). Exporters of — ..	3
117. Oil, castor, for aero engines. Makers of — ..	1
118. „ „ Manufacturers of — ..	1
119. „ cinnamon. „ ..	1
120. „ cocoanut. „ ..	3
121. „ fish. „ ..	1
122. „ linseed. „ ..	2
123. „ mustard. „ ..	1
124. „ olive (country). „ ..	1
125. „ palm. Importers of — ..	1
126. Oil factories. Information re — ..	3
127. „ pressing plant. „ ..	1
128. Oils, essential. Manufactures of — ..	3
129. „ for hair. Information re markets for — ..	1
130. Oxide (red) of iron. Dealers in — ..	1
131. Paints and Varnishes. Manufacture. Prospects of — ..	1
132. Paper and paper pulp. Information regarding manufacture, machinery, site for mill, markets, imports, prices, etc., etc.	6
133. Pencil manufacture. Information re — ..	1
134. „ making machinery. Information re — ..	1
135. Perfumery. Dealers in — ..	1
135a. Petrol substitute. Regulations re manufacture of — ..	1
136. Photography. Facilities in Bombay for training in — ..	1
137. Pickers. Information re manufacture of — ..	1
138. Polish. Information re materials for boot — ..	1
139. Pottery industry in Bombay Presidency. Information re — ..	1
140. Printing machinery. Dealers in — ..	2
141. Printing on tins. Information re — ..	1
142. Railway stock and plant. Buyers of — ..	1
143. Rat guards. Manufacture of — in India ..	1
144. Rice Machinery ..	2
145. Ropes. Imports and manufacturers of — ..	1
146. Rubber manufacture. Information re — ..	1
147. „ „ Facilities for analyses of — ..	1
148. Safes. Manufacturers of — ..	1
149. Saltpetre. Market price of — ..	1
150. Sand. Dealers in — ..	1

Subject of enquiry.	Number of enquiries.
151. Sand paper. Paper suitable for manufacture of — ..	1
152. Saw Mills. Prospects and Estimates of — ..	2
153. Screws, wood. Information re manufacture of — ..	1
154. Silk, artificial. Materials for making — ..	1
155. Silk sewing thread. Suppliers of — ..	1
156. Silk cocoons. Purchasers of — ..	1
157. „ raw. Dealers in — ..	1
158. Sizing Machine. Particulars regarding — of dealers in — ..	2
159. Shipping agents in Bombay ..	1
160. Shoes. Rope soled canvas. Buyers of — ..	1
160a. Soap industry. Information re — ..	1
161. Soap-making machinery. Information re — ..	1
162. „ „ Chemicals. „ „ ..	1
163. Soap stones. Uses and producers of — ..	2
164. Spinning machinery. Information re — ..	2
165. Spools. Woods suitable for — ..	1
166. Squills. Dealers in — ..	1
166a. Sugar factories in India. Information re — ..	1
167. Tablets. Plant and processes for making — ..	1
168. Talc. Producers of — ..	1
169. Tanning industry in India. Information re — ..	1
170. Tent cloth. Specification for — ..	1
171. Textiles. Information re manufacturers of various — (e.g., drills various, mulmul, Melton cloth, shirtings, bunting, flannelette, press blankets, etc.) ..	5
172. Tungsten ore (Wolfram). Mines of — ..	1
173. Varnish. Formula for shellac — ..	1
174. Waggons for transport of coal and other materials ..	8
175. Weaving accessories. Dealers in — ..	2
176. Wheels and axles of steel. Market for — ..	1
177. Wire. Iron and steel. Manufacturers of — ..	1
178. Wolfram. Buyers of — ..	1
179. Wood-wool. Buyers of — ..	1
180. Yarn, cotton. Information re — (e.g., output, production of 40's and above, imports and importers, makers, etc., etc.) ..	6
181. Yarn, silk. Dealers in — ..	2
182. Zinc oxide. Producers of — ..	1