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Department of Industries, Madras

AN ACCOUNT
OF THE
WORK AND ACTIVITIES
OF THE
DEPARTMENT OF INDUSTRIES
MADRAS



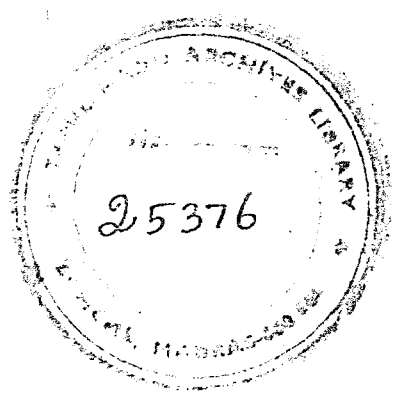
Scholarships tenancy or
Training of Mappillas

MADRAS

E. F. THOMAS,

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PREFACE.

THE annual administration reports contain a detailed account of the activities of the Department of Industries from time to time, but the circulation of these reports is necessarily restricted. It was, therefore, suggested by the Hon'ble the Minister for Development that a separate account of the activities of the department should be compiled so that they may become more widely known. While, before the Reforms came into force the general public took comparatively little interest in the detailed working of the department, an ever increasing measure of attention is now being directed towards it. It is hoped that this account of the work of the department will fulfil the object of showing to the public what the State is obtaining in return for the money expended on it. The financial stringency of the last few years has precluded the provision of funds necessary to permit of any large measure of development. Nevertheless, as this publication itself will show, a large amount of very useful work has been done by the department, and in fact it is not perhaps too much to say that practically all the main sections of the department have made definite progress and increased their sphere of usefulness. An article on the Tanning Industry of the Madras Presidency has been included since it was thought that this would be of general interest. Notes on other industries or industrial processes have been included as these can more appropriately

be included in the bulletins which are issued from time to time. The bulletins issued by the department will be found of these can be obtained from the Press, Mount Road Branch, Madras, at

E. F. THOMAS,

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Department of Industries.

AN ACCOUNT OF THE WORK AND ACTIVITIES OF THE MADRAS DEPARTMENT OF INDUSTRIES.

CHAPTER I.

POLICY.

The Secretary of State's despatch.—The most important event of the last decade in connexion with the policy to be adopted to further industrial development in India was the receipt in the year 1919 of the Secretary of State's despatch, signifying his general assent to several of the proposals made by the Indian Industrial Commission and supported by the Government of India. The despatch of the Secretary of State on the Report of the Indian Industrial Commission in 1919 indicated his adherence to the policy advocated by the Madras Government of active participation by the State in the industrial development of the country, and thus marked a distinct change in policy, for, he definitely accepted the two fundamental principles underlying the recommendations of the Commission, first, that in future, the Government should play an active part in the industrial development of the country and secondly, that the Government could not undertake this work unless provided with adequate administrative equipment and forearmed with reliable scientific and technical advice. The Secretary of State, therefore, reversed the restrictive policy laid down by Lord Morley in 1910, which, though modified by Lord Crewe in 1912 and temporarily in abeyance while the Commission was conducting the inquiry, was still in force, and recognized that if the active participation of Government in the industrial development of the country was to be accepted as one of its legitimate functions, a new policy would be required. The Secretary of State's policy thus marked the end of a long period of uncertainty and the commencement of a new era in respect of industrial development by the Government.

The following is a brief review of the history of the Department of Industries with reference to the efforts made by the Government of Madras to secure the Secretary of State's adherence to the new policy.

In 1905, a scheme was submitted to the Government of India for the further advancement of the industrial development of the Presidency, and it was proposed to create a department which should make a survey of existing industries and should investigate the possibility of creating new ones. It was not proposed to work industries experimentally on a commercial scale, but merely to initiate experiments which might assist private enterprise to take up fresh industrial undertakings. Lord Morley, who was then Secretary of State for India, did not view the general principles underlying the scheme with much favour. He regarded with scepticism the prospect of attaining satisfactory results from the direction of State effort towards the creation of industries, and he doubted whether the lack of industrial energy and progress in the Madras Presidency might not be due to economic causes beyond the reach of State endeavour. Lord Morley, however, sanctioned the creation of the department, and the appointment of Mr. (now Sir) Alfred Chatterton to the charge of it with the title of Director of Industrial and Technical Enquiries. Thus, the Department of Industries came into existence in 1906, though not under that name.

Ootacamund Industrial Conference, 1908.—In 1908, an Industrial Conference was held at Ootacamund, at which representatives of the leading industrial interests attended. The object of the Conference was to consider the best method of developing further the work which had been begun by the Director of Industrial and Technical Enquiries, and also to review the question of the improvement and extension of technical education. The Conference passed a number of resolutions and defined the three functions of the Department of Industries as:—

(1) the supply of advice in regard to new industries, and the introduction of new methods and processes,

(2) the carrying out of investigations and experiments, and

(3) the development of selected industries, and added that the department should establish a bureau of information and an industrial museum. In regard to the vexed question of pioneer industries, the Conference passed a resolution to the effect that, subject to certain specified conditions, Government might undertake, as a pioneer, the introduction of new industries for the purpose of training students or apprentices or for demonstrating that such industries would be commercially successful. The resolutions of the Conference, however, were not passed without protest, and three prominent representatives of European business interests in Madras recorded a minute of dissent from the resolutions relating to industrial development, holding that the Government should confine its assistance to commerce, to matters of research, technical education, industrial instruction, and the dissemination of industrial information. On this point, the Government recognized as a general principle that the exploitation of industries should be regarded not as a normal, but as an exceptional function of Government, and on the general question of the limitations that should be set to the functions of the State in attempting to

promote industrial development, they accepted the conclusions arrived at by the Conference. Accordingly in March 1909, they made the following proposals to the Secretary of State:—

(1) that a permanent Department of Industries under the control of an officer, to be styled the Director of Industries, should be created;

(2) that industrial education, as opposed to technical education, should be placed under this department; and

(3) that the department should further be entrusted with the duty of encouraging trade by the introduction of new industries and that it should establish and maintain a bureau of industrial information, and that it should have the charge of the well-boring and pumping operations which were then in progress.

Lord Morley, however, in a despatch, dated the 29th July 1910, differed fundamentally from the views expressed by the Conference and approved by Government, as to the functions of a Department of Industries. As before, he condemned a policy of attempting to create new industries by State intervention, and he was sceptical as to the utility of State effort in this direction, unless it was strictly limited to industrial instruction and avoided the semblance of a commercial venture. The policy which he sanctioned was that State funds might be expended upon familiarizing the people with such improvements in the methods of production as modern science and the practice of European countries could suggest; further than this, the State should not go, and it should be left to private enterprise to demonstrate that these improvements could be adopted with commercial advantage. As the result of these orders, the Department of Industries, which, on the recommendation of the Conference, had been created in anticipation of sanction in October 1908, was abolished.

Lord Morley's orders, however, aroused considerable opposition in India. In February 1911, a resolution was passed in the Legislative Council of Madras, inviting the Secretary of State for India to reconsider the decision. In pursuance of this resolution, the Government again addressed the Secretary of State for India in May 1911. They referred to the general disappointment which Lord Morley's orders had occasioned and laid stress on the difference between the industrial conditions of India and those prevailing in Europe, pointing out how difficult it was in a country like Southern India 'to bridge the gulf' which exists between mere scholastic instruction and the practical application of an industrial teaching, unless factories under State management were founded; and they asked for authority in special cases, and subject to the safeguard suggested by the Industrial Conference, to undertake the experimental introduction of industrial processes.

Creation of the Department of Industries.—These proposals were supported by the Government of India, and Lord Crewe's reply, in a despatch, dated the 15th March 1912, was not altogether unfavourable. He reaffirmed Lord Morley's decision against the extension

of the activities of a Department of Industries to trading on a commercial scale, but he had no objection to the creation of a separate Department of Industries, provided that its functions were confined within certain limits. Accordingly the creation of the Department of Industries was sanctioned on the 21st March 1914, and the functions of the Director were thus defined :—

- (1) to collect information as to existing industries, their needs and the possibility of improving them or of introducing new industries;
- (2) to carry out and direct experiments connected with local inquiries;
- (3) to keep in touch with local manufacturers to bring the results of his experiments to their notice and to obtain their co-operation in the conduct of experiments on a commercial scale;
- (4) to supervise the training of students; and
- (5) to advise Government with regard to technical matters involving legislation.

Indian Industrial Commission.—The next event which calls for passing notice was the report of the Indian Industrial Commission to which reference has already been made. The Commission was appointed by the Government of India in 1916 to advise on measures necessary for developing the manufacturing industries, and the Commission recommended large increases of the technical services based on an extension of technological education, with a scheme for the co-ordination of private as well as official work, both imperial and provincial. It is unnecessary to refer in any detail to the proposals of the Indian Industrial Commission as they have been so largely rendered ineffective by the changes which have occurred in the relation of the Provincial to the Imperial Government consequent on the Government of India Act of 1919 and they are now in most cases of little more than academic interest. The problem of industrial development in India has changed considerably since the Industrial Commission reported, for industrial projects, schemes of organization, and research must now be conceived almost entirely on a Provincial basis. The disadvantage of this tendency in policy is that it is not always possible for a provincial Government to maintain a sufficient variety of specialists.

Madras Industrial Conference, 1920.—In March 1920, His Excellency the Governor presided over a Conference at Madras, which was largely attended by representatives of commercial and industrial interests as well as by members of the Legislative Council. The business of the Conference was not so wide as that of the Conference held in 1908, but was confined to five specific points which were to be discussed at a Conference of Directors of Industry to be held at Simla in the following April. The Madras Conference generally approved of :—

- (1) the creation of a Board of Industries for this Presidency;

(2) the creation of an Indian Industrial Service (this proposal has since been abandoned);

(3) the control of Industrial education by the Director of Industries;

(4) the extension of schemes of apprenticeship; and

(5) the establishment of demonstration factories by the Government.

Advisory Board of Industries.—The Indian Industrial Commission, in their report, recommended the constitution of a Board of Industries to act as an Advisory body to Provincial Directors, and in pursuance of the views expressed at the Conference referred to in the preceding paragraph, Government in November 1920 sanctioned the appointment of an Advisory Board of Industries for the Madras Presidency consisting of 12 members. The Director of Industries was the Chairman and Convenor of the Board, and the remaining eleven members were non-officials, with the Deputy Director as Secretary. Each member of the Board held his appointment for a period of two years. The functions of the Board were advisory, but all matters of general importance affecting industries or industrial education were laid before the Board. The Board had power to co-opt other officials and non-officials for the consideration of particular subjects or classes of subjects, and those co-opted, whether officials or non-officials, were entitled to vote on resolutions relating to subjects for the discussion of which they were co-opted. The Board could also appoint Committees, consisting of its own members or persons co-opted to standing or temporary committees, for the consideration of special subjects. The Board which was constituted in 1920 for a period of two years, automatically ceased to exist towards the end of 1922. It was not reconstituted since the Advisory Committee of the Legislative Council for the Departments of Industries and Fisheries had been appointed in the meantime, and it was intended to appoint a separate Statutory Board to consider applications for State Aid under the provisions of the State Aid to Industries Act. The number and variety of subjects placed before the original Board of Industries was large and on the whole it can be considered as having been responsible for some very useful work.

STATE AID TO INDUSTRIES.

The recent constitutional changes have brought the Department of Industries into fresh prominence as one of the principal spending departments in charge of the Hon'ble the Minister for Development, and the question of pioneering industries with Government money is likely to be considerably affected by the passing of the State Aid to Industries Bill which was introduced in the November session of the Legislative Council in 1922 by the Hon'ble the Minister for Development. The Bill which was warmly supported in Council by representatives of all sections of the public was subsequently referred to a Select Committee for detailed consideration and was passed with certain amendments and modifications in the subsequent

session of the Council amidst every manifestation of popular approval. A separate Committee was appointed to frame the requisite rules under the Act and they had the force of law as from the 27th December 1923.

STATUTORY BOARD OF INDUSTRIES.

Under section 3 (1) (a) of the Madras State Aid to Industries Act, 1922 (Act V of 1923) a Board of Industries, consisting of 12 members, was constituted in February 1924. The Board is required to submit an annual report on its operations at the close of each financial year, and a detailed review of the working of the Act during the last official year will be found recorded in G.O. No. 1529, Development, dated 24th October 1925. The Board consists at present of the following members :—

1. Director of Industries, Chairman.
 2. The Secretary to Government, Finance Department.
 3. The Chief Conservator of Forests, Madras.
 4. W. O. Wright, Esq., O.B.E., elected by the Madras Chamber of Commerce.
 5. S. J. Green, Esq., elected by the Madras Trades Association.
 6. M.R.Ry. Narayan Doss Girdhar Doss Avargal, elected by the South Indian Chamber of Commerce.
 7. M.R.Ry. Diwan Bahadur K. Suryanarayanamurti Nayudu Garu, M.L.C., elected by the Madras Legislative Council.
 8. M.R.Ry. Sami Venkatachalam Chettiyar Avargal, M.L.C., elected by the Madras Legislative Council.
 9. M.R.Ry. Rao Bahadur A. M. M. Murugappa Chettiyar Avargal, M.L.C.
 10. M.R.Ry. Rao Sahib K. V. Ramachari Avargal, B.A., M.L.C.
 11. M. Muhamad Ismail Sahib Bahadur.
- Non-officials appointed by Government under section 3 (2) of the Act.
- with Mr. L. B. Green, M.B.E., Deputy Director of Industries, as Secretary to the Board.

Meetings of the Board are held periodically, and on an average at least once in three months. Up to the 1st January 1926, the loans sanctioned and actually disbursed to applicants were five in number and involved an aggregate amount of Rs. 4,83,200. In Appendix B will be found particulars of the loans so far disbursed and the individuals or firms to, and the purposes for, which the loans were granted. By far the most important application so far dealt with by the Board has been that of the Carnatic Paper Mills. The Company originally submitted two applications. The first was under section 6 (f) of the Act and related to the supply of water, bamboos and fuel at concessional rates in order to enable the mills, which have been erected on the banks of the river Gōdāvari at Rajahmundry, to commence the manufacture of paper pulp from bamboos and also, later on, from paddy straw. The second application was for a loan from Government of Rs. 4 lakhs under section 6 (a) of the Act, and for the guarantee of an overdraft or fixed advance with a Bank, of a further Rs. 2 lakhs under section 6 (b) of the Act. The loan was

required partly for the purpose of repaying short-term loans, partly to pay off overdrafts with banks, and partly for the purpose of obtaining working capital to enable the company to secure delivery of the balance of plant and equipment and to finance manufacturing operations in the initial stages. Government accepted the recommendations of the Board and sanctioned a loan of Rs. 4 lakhs to the Company, which amount was disbursed to them in March 1925. Subsequently, Government sanctioned the lease to the Company of the bamboo coupes in the Rekapalle Reserve forests in Upper Gōdāvari for a period of three years on an annual payment of Rs. 10,000. A condition to the grant of the loan was that the Company should appoint the Director of Industries and the Collector of Gōdāvari as members of the Board of Directors for the period of the loan. The proceeds of the loan granted to the Company were first to be applied to the redemption of the prior mortgage and secondly, for the clearance of the other liabilities of the Company, and it was hoped by Government that the grant of this substantial loan would engender confidence in the soundness of the Company's proposition and stimulate the flow of the further capital required. This hope has not, however, been realized, and the Company is passing through a severe financial crisis, for, owing to the lack of adequate finance, it has not been possible to commence manufacture and no revenue has therefore been forthcoming. The Company has recently applied for further loans of Rs. 50,000 and Rs. 3½ lakhs respectively, in addition to the guarantee of the overdraft of Rs. 2 lakhs previously applied for. Government have recently sanctioned a further loan of Rs. 30,000 to enable the Company to maintain the machinery and plant in proper condition pending arrangements being made for the development of their operations while the other applications for financial assistance are under consideration. It will be seen from the schedule of loans disbursed (Appendix B) that among the other loans sanctioned by Government under the Act have been one of Rs. 50,000 to a firm of silk cloth manufacturers in the Gōdāvari district to enable them to develop their factory so as to permit of the preparation, twisting and dyeing of silk for handloom weavers, a loan of Rs. 18,600 to the Kallakurichi Co-operative Agricultural and Industrial Society, Ltd., for the development of the industries carried on by the Society, viz., groundnut decorticating, rice hulling and sugarcane crushing, a loan of Rs. 9,600 to the Canara Rice and Saw Mills, Ltd., Coondapur, South Kanara, for the purchase of a vertical band saw and one of Rs. 5,000 for the purpose of enabling the applicant to set up two cotton gins in conjunction with an existing rice mill at Gudiyattam, North Arcot district. A number of other applications are at present under the consideration of Government. During the last official year, four loans were sanctioned and an aggregate amount of Rs. 4,64,600 was sanctioned for disbursement to the applicants. In cases where applications for financial assistance have been rejected, it has usually been owing to the fact that they did not fulfil certain of the provisions of the Act or that the security offered was inadequate.

The experience so far gained of the working of the Act has not revealed any very serious difficulties or imperfections although the correct interpretation to be put on certain sections of the Act has in practice given rise to some uncertainty and conflict of opinion. When the rules under the Act were first framed, it was considered premature to make rules under certain of the sections and the question was left over until sufficient experience had been obtained of the working of the Act. Experience having shown that it was necessary to frame rules under these sections of the Act, the necessary rules have since been drawn up in consultation with the Board of Industries. It is provided in the Act that every recipient of aid shall make such provision for the training of apprentices as the Government may from time to time prescribe, but after careful consideration, the view of the Board was that in view of the difficulty of formulating a definite rule under the proviso to section 5 (2) of the Act which would be suitable for general adoption, the question of whether or not the entertainment of apprentices should be made a condition precedent to the grant of a loan, and, if so, the number of apprentices to be taken and the conditions of their training, should be determined by Government on the advice of the Board of Industries, in the case of each individual application and this has been accepted by Government. One of the most important new rules provides that the value of the additional assets that will be created by the application of the loan granted by Government shall be the money expended on the acquisition of immovable property and machinery of a permanent nature and on the liquidation of encumbrances on existing fixed assets which contributes to the enhancement of the capital value of the concern.

The period during which the State Aid to Industries Act has been in force is too short to permit of a considered opinion as to whether the Act is likely to realize its object in stimulating the industrial development of the Presidency. It seems probable that the greater number of applications received will be for amounts not exceeding Rs. 50,000. If, however, the Act is successful in stimulating the establishment and development of mills and factories which have for their object the utilization and working up into manufactured form of the agricultural and forest products of the province, it will serve a useful purpose, whilst it is hoped that well-organized industrial co-operative societies will find themselves able in increasing measure to take advantage of the facilities afforded by the Act. It is perhaps doubtful whether these facilities will be availed of to any very large extent for the purpose of developing small scale factory industries and cottage industries, for the reason that the Act imposes on the grantee of a loan the necessity of maintaining a proper system of accounts, and of having them examined and audited at least once every year by an auditor approved by Government. The mortgage deed executed by the grantee of the loan also provides that the premises, buildings, plant and machinery shall be insured against loss or damage by fire. The difficulty, of course, is that in the case of

cottage and other small scale industries, it is not customary for the proprietors to maintain accounts on the scale required under the Act and moreover it is very seldom that such persons incur the expense of insuring their property. The work in connexion with the scrutiny and consideration of the applications for assistance under the Act involving, as it does, a careful examination and investigation of the several aspects of the various applications is of a very exacting nature and is carried out in a thorough albeit sympathetic manner. The Department will always be pleased to explain the provisions of the Act to intending applicants for assistance, and to advise whether they could suitably take advantage of the facilities afforded by the Act and submit an application in the prescribed form for the consideration of the Statutory Board, and subsequently of Government. The State Aid to Industries Act and the Rules framed thereunder have been published in pamphlet form and copies can be purchased from the Superintendent, Government Press, Mount Road Branch, Madras, at a price of 4 annas 6 pies each.

ACTIVITIES OF THE DEPARTMENT OF INDUSTRIES.

The various activities of the Department of Industries have now grouped themselves under the following heads:—

(i) General assistance to trade and industry including the collection of statistics and of industrial and commercial information, and the supply of information to the public, as regards the sources of supply of, and markets for, various articles of commerce.

(ii) Experiments and enquiries having for their ultimate object, the starting, either by private owners or by the Government, of new industries or of new branches of or improved processes in existing industries.

(iii) Management of manufacturing institutions owned by Government which have passed beyond the early experimental stage. Examples of such institutions are:

(1). The Kerala Soap Institute, Calicut.

(2). The Government Industrial Institute, Madras. (The Ink Factory).

(iv) Assistance to scattered industries, not conducted in factories, of which the weaving industry is at present the most conspicuous example.

(v) Similar assistance intended principally for the benefit of agriculturists, which head covers most of the work which is conducted by the Pumping and Boring Section.

(vi) Industrial education in all its branches including education in arts and crafts and the grant of scholarships.

CHAPTER II.

BUREAU OF INDUSTRIAL AND COMMERCIAL INFORMATION.

The Bureau of Industrial and Commercial Information, which is attached to the Department of Industries, was founded some year ago as a result of the Industrial Conference held at Ootacamund in 1908. The Conference considered that a Bureau of Information should be provided from which information could be obtained on points of commercial importance and interest. The purpose of the Bureau is to provide information on general, industrial and commercial subjects in connexion with the existing industries, and on projected developments of industries in the Presidency, and to answer inquiries relating to commerce, trade and industries, affecting the Madras Presidency. These inquiries have increased considerably during recent years and the consideration and answering of them now forms an important part of the activities of the department. A considerable number of visitors call at the office to make verbal inquiries, and in fact a not inconsiderable portion of the time of the Director and Deputy Director is absorbed in interviewing callers and discussing matters with them. The Bureau has to deal daily with a large number of inquiries for information covering a wide range of industrial and commercial subjects and particularly in regard to the sources of supply and markets for various articles and commodities. In case the Bureau has not got the information desired, it can usually secure it more fully and with less delay than the individual firms or private persons. It is difficult to determine what is the direct outcome of many of the inquiries, but it is permissible to conclude that in most cases the information supplied or service rendered is turned to account, and the fact that the number of inquiries continue to increase affords *prima facie* evidence of its value and utility. In fact the services which the Bureau is able to offer are being appreciated to an increasing extent by the public who are constantly making use of the Bureau, and whose appreciation of the facilities which it offers is amply testified to by the numerous letters of thanks for information supplied or assistance rendered. It may fairly be claimed, therefore, that the work of the Bureau is of real value to the public generally, who are becoming increasingly cognisant of the fact that advice and assistance on industrial and commercial questions is always at their disposal whenever they care to seek it.

Commercial inquiries.—In addition to inquiries on industrial questions, a large number of commercial inquiries are received and answered. A number of references are received from the Director-General of Commercial Intelligence, Calcutta, in regard to overseas trade in general and with reference to the financial standing and

business reputation of firms in particular. A considerable number of traders and merchants including visitors from overseas with or without letters of introduction from the Indian Trade Commissioner in London, call at the office, during the course of the year, to make verbal inquiries. The department is in close touch with the United States Trade Commissioner and the Assistant United States Trade Commissioner, at Bombay and Calcutta respectively, who are furnished from time to time with reports on certain aspects of Madras trade, in which an interest has been evinced in America, and in return furnish this department with valuable information as to American trade conditions. Information is also exchanged from time to time with H.M. Trade Commissioner at Calcutta and with various Foreign Consuls at Bombay, Calcutta and Madras. The number of references received from Indian firms, merchants and traders, requesting to be placed in touch with overseas firms interested in Indian produce and manufactures is by no means inconsiderable, but in very many cases they prove on inquiry, to be of insufficient financial standing to permit of their being given overseas trade introduction through the agency of the Director-General of Commercial Intelligence. Apart from the question of financial standing, foreign merchants are reluctant to enter into business transactions with firms in the mufassal unless they have assurances that the latter are conversant with the principles and practice of international trade. Many small firms and traders possess an inadequate appreciation of the advantages conferred by conducting business through an established Bank and moreover some of them who desire to embark upon overseas trade possess insufficient capital and do not carry sufficient stocks to fulfil contracts in time. The department, however, is able to be of considerable assistance to firms with little, or at the best a very limited, knowledge of foreign trade practice, and such assistance is generally appreciated.

The Director-General of Commercial Intelligence is furnished with a weekly review of trade and market conditions in respect of the main classes of produce.

Scope of work of the Bureau.—A detailed account of the work of the Bureau during the last few years would be voluminous, and it is only possible to give here a general idea of its scope and activities. For fuller information reference may be made to the administration reports of the department.

Among the measures taken to assist individuals or firms anxious to start new industries or to extend and improve their business connexions may be mentioned :—

- (i) Furnishing information in regard to new processes of manufacture, use of machines, markets for goods and sources of supply of materials and commodities, prices and openings for capital,
- (ii) Indicating possible sources of raw materials and their suitability for various purposes,
- (iii) Assisting to find markets for finished products by placing manufacturers in touch with consumers, wholesale dealers, or exporters of approved financial standing,

(iv) Giving technical advice and offering opinions on the commercial possibilities of projected schemes,

(v) Arranging for analyses to be carried out where possible on raw materials forwarded by parties and indicating their commercial value.

The following 25 examples of some individual service rendered may also serve to illustrate the many and varied ways in which the Bureau is of practical use in supplying information and advice on industrial and commercial subjects:—

(i) Information was furnished to an inquirer in regard to the imports and principal consumers of emery goods as well as the grades manufactured and in use. The inquirer was subsequently granted, on the recommendation of this department, a prospecting licence over a deposit of emery in the Salem district.

(ii) The Chairman of a municipality was supplied with detailed information in regard to the demand for and industrial utilization of groundnuts. The same inquirer was also furnished with information in regard to the establishment of additional spinning and weaving mills, for communication to certain merchants in his district who had evinced an interest in the subject.

(iii) An estimate of the existing power demand for industrial purposes in an important town in the Presidency was furnished to a firm who contemplated drawing up an electric power and lighting scheme.

(iv) A Central Jail was assisted in the matter of finding a market for its surplus stock of indigo.

(v) An inquirer was furnished, on request, with a sketch of a kiln suitable for burning kunker limestone. Another inquirer was furnished with a suitable design of kiln for ordinary limestone.

(vi) A firm on the West Coast were furnished with detailed information as to the location, quality and probable quantities of felspar available in the Madras Presidency.

(vii) A Government department in one of the other Presidencies was furnished with detailed information in regard to the existing position of the coir industry in the Madras Presidency, and as to the lines on which this department proposed to assist in its development.

(viii) A Government department in the Punjab was supplied with a comprehensive list of wholesale suppliers in the Madras Presidency of raw and reeled silk.

(ix) A Co-operative Society was furnished with detailed information in regard to the possibilities of extracting groundnut oil on a commercial scale in their area and as to the most suitable type of machinery and plant to instal for the purpose.

(x) A sample of groundnut cake received from a party in the Guntūr district was analysed for oil and nitrogen content and the results furnished to the inquirer together with information in regard to the exporters of, and demand for, the cake in countries overseas.

(xi) A firm was advised in regard to the possibility of importing ump or dry alizarine and moistening it on arrival in India, instead of in the form of paste as had been the usual practice hitherto.

(xii) Information was given to a firm in regard to the apparatus required for and the method of testing lemongrass oil.

(xiii) A firm in Coimbatore was furnished with detailed information in regard to the process of lacquering the inside of tins for the canning of jams and ginger preserves.

(xiv) A firm manufacturing finished leather goods required supplies of waste lye liquor derived from paper manufacture. The several paper mills in India were addressed, and finally arrangements were made for the supply to the firm of a sample of the liquor which a mill offered to supply, and which *prima facie* appeared to be suitable for the purpose.

(xv) A firm, producing firebricks, forwarded for test and advice a specimen consignment of their manufactures. Arrangements were made to have the specimens tested at the departmental workshops and subsequently a report embodying the results obtained with suitable advice for improving the quality of the firebricks was furnished.

(xvi) An inquirer was furnished, on request, with information in regard to the possibilities of growing camphor in the Nilgiris, as also with details of the experiments carried out in India in recent years and of the process employed in camphor distillation.

(xvii) A railway administration was supplied with a comprehensive list of the names and addresses of manufacturers and wholesale suppliers of rape-seed oil in the Provinces of Bengal, United Provinces, and Bihar and Orissa.

(xviii) An inquirer was furnished with a description of the processes involved in curing raw cardamoms and converting them into finished form ready for the market.

(xix) A merchant in the Guntūr district was furnished with a description of the processes followed on the West Coast for the drying and curing of green ginger for the purposes of inland and export trade.

(xx) An inquirer was furnished on request with a description of the machinery used in the process of polishing turmeric in the Guntūr and Cuddapah districts.

(xxi) A firm in the Kistna district which contemplated starting a soap factory was furnished with an estimate of the machinery and plant required for a factory capable of producing 5 tons of boiled soap per week and 5 cwt. of cold process soap per day.

(xxii) A Government department in Bengal was furnished with a list of manufacturers of cigars in Trichinopoly, Dindigul and other places, and with information as to the sources from which the raw tobacco is derived and other particulars, relating to the present position of the industry.

(xxiii) Information was given to an inquirer in regard to the names and addresses of the principal importers and dealers in Bengal of emery powder, emery cloth, sand paper, etc., and the principal consumers in India of emery and emery products.

(xxiv) A merchant in Bangalore who contemplated the manufacture of cutch in this Presidency, as an extension of the operation already carried on by him in the Mysore State, was furnished with full information in regard to the occurrence in certain areas of the trees from which the product is manufactured. The experiment carried out by the party with a sample consignment of *Acacia Sundra* supplied by the Forest Department appear to afford some promise of the manufacture of a suitable quality cutch in this Presidency.

(xxv) A number of firms engaged in the manufacture of tiles were assisted to obtain a concession in freight rates in respect of the transport of tiles from the West Coast and finally the railway authorities agreed to a rate which was satisfactory to the tile manufacturers and which should prove also remunerative through increased traffic to the Railway.

Library.—A library is attached to the Central Office which contains a large number of books on subjects relating to commerce, technology and manufacture, besides a considerable number of monographs, bulletins, transactions of societies, and miscellaneous scientific and technical publications, directories, trade and market reports, catalogues, statistical publications, Patent Office Publications, and the publications of other Government departments. The Library, although primarily intended as a reference library for the use of departmental officers, is open during office hours to the public and is freely resorted to. About 50 journals and periodicals on scientific, technical and commercial subjects are also received in the department, the more important of which are placed on the table in the library for consultation and reference by the general public. The Library, as at present organized, does not function as a lending library, but applications for the loan of books and other publications for reference or study by any persons engaged in trade or industry, are invited and will receive consideration. The Dhanakoti Mudaliar Library of the Victoria Technical Institute was taken over a few years ago on the understanding that purchases out of the endowment funds should be restricted to books dealing with architecture and art in relation to industries. The Library, when handed over to the Department of Industries, contained a number of out-of-date volumes of little or no value for reference purposes and these are gradually being replaced by more up-to-date and authoritative works of reference on architecture and art. A number of new books were added to the Library during the year, and it now includes a very comprehensive range of books on industrial and commercial subjects. A library catalogue has recently been printed and distributed to Government departments and other libraries in Madras and elsewhere. A suggestion book is now kept in the library, and recommendations for an extension of its scope and usefulness and for the purchase of new books are invited from the public who resort to it.

Statistics.—In accordance with the recommendations of the Indian Industrial Commission, the work of collection, compilation and distribution of statistics relating to commerce and industries was

transferred from the Board of Revenue to the Department of Industries in 1920, and is carried out in the Bureau. The statistics compiled in the department include statements of cotton, jute, paper and woollen mills, mines and minerals (including the annual report on the working of the Mines Act) and planting products, as also the fortnightly returns of wholesale prices of certain basic commodities at selected marts in the selected districts of the Presidency. The accuracy of the statistics compiled in the department may, on the whole, be considered very fair, and an improvement has certainly been effected in this respect during the last few years. The department, however, has no control or real check over the primary reporting agencies or offices in which the figures of individual estates, etc., are consolidated, and it is in the direction of instructing and supervising to some extent the persons responsible for the preliminary statistical work that any further improvement in the accuracy of the statistics must be looked for.

Mining.—Another of the recommendations of the Indian Industrial Commission was that the functions of the provincial Departments of Industries should include the furnishing of advice to Government on the industrial and commercial aspects of the Mines Act and the Mining Rules. It was not considered necessary that the entire administration of the Act and the Rules should be transferred to the Department of Industries though in order to safeguard the interests of industrial development it was provided that the Director of Industries should be regularly informed of all applications for prospecting licences or mining leases received by the Board of Revenue or Collectors. The department is thus enabled to get into touch with the applicants and to initiate any enquiries which may be deemed desirable, and moreover it is now regarded as within the province of the department to advise on any particular point regarding a prospecting or mining application which is considered of importance to the development of industries. In this way the department maintains touch with mining developments and is enabled to advise, where necessary with reference to the outlets for the minerals proposed to be worked and in some cases to place overseas buyers in touch with producers in the Madras Presidency. Considerations of space admit of only a passing reference to the incidence of, and demand for, Madras minerals. Mining at present is carried on in the districts of Vizagapatam, Nellore, Anantapur, Kurnool, Bellary, Salem and the Nilgiris and the minerals raised are manganese, magnesite, mica, steatite, barytes, gold and silver. Prospecting for asbestos and emery has recently been carried out in the Cuddapah and Salem districts. The greatly increased and sustained demand for manganese is being reflected in an appreciably larger production of the mineral. Mining operations for mica are now in progress in the Nilgiris and the deposits of the Wynaad mica mines are understood to have proved to be substantial and productive and to yield a good quality 'Ruby mica'. Incidentally there has been a considerable improvement in the mica trade and owing to the development of electrical engineering the

demand is likely to expand still further. Arrangements are made for analyses of minerals to be carried out for private parties and for an opinion to be given as to their commercial value.

Special investigations.—In addition to the above more or less routine activities; the Bureau initiates or carries out special investigations from time to time. One of the many difficulties which lie in the way of development on a large scale of industries in India, is the high price and scarcity of fuel owing to the fact that nowhere south of the Hyderabad State has coal been found to exist in workable deposits. Accordingly the department a few years ago recommended that the possibility of finding coal in the Gōdāvari valley should again be explored and as a result, an officer of the Geological Survey of India was deputed to proceed to the Beddadanole coal field in order to fix suitable sites for the boring. Subsequently a Madras firm were granted prospecting licence over certain areas of the Kistna and Gōdāvari districts. It is regrettable to have to record, however, that the borings conducted in this area have not yielded satisfactory results, although five boreholes were sunk and one of them was taken to a depth of 900 feet. The prospecting operations for coal were subsequently abandoned, and the experience in the conduct of boring operations in the Beddadanole area leaves little room for doubt that no workable seams of coal exist in the Kistna and Gōdāvari districts. The matter has been mentioned, however, in order to show that the department explores from time to time the different avenues of development. The efforts of the department to interest private enterprise in the establishment of a cement industry at Bezvada were only prevented from materializing by the adverse financial conditions which precluded the raising of the necessary capital. The question of the exploitation and development of the deposits of phosphatic nodules in the Trichinopoly district was also investigated as also that of the manufacture of toys. A careful inquiry into the possibilities of resuscitating the indigenous bangle industry was also carried out. The resuscitation of the Masulipatam cotton printing industry has also received attention as also that of the exploitation of the Salem iron ores, the possibilities of which now appear a little more promising. The Bureau is in close touch with the Victoria Technical Institute in regard to the development of the art and cottage industries of the Presidency.

Lace and Embroidery Industry.—The measures to be taken to improve and develop the existing lace and embroidery industry of the Presidency have also been engaging the attention of the department, and the services of Miss Tweddle, a missionary lady with considerable experience of the lace and embroidery industry and of the organization of cottage industries for Indian women, were kindly lent by the Wesleyan Mission for a period of five months to carry out a comprehensive survey of the lace and embroidery industry in the Presidency and to supply all the facts bearing on the question that could be collected within a reasonable period. Miss Tweddle visited all the important centres of the industry in Southern India, conferred

with the correspondents of industrial schools where instruction in lace and embroidery is imparted, discussed matters with various persons interested in the industry and collected a number of specimens of lace and embroidery. It was evident from her report that the production of lace and embroidery in the several conventual institutions, and that controlled by private enterprise in the Kistna district is considerable and capable of expansion if markets can be found. Miss Tweddle found in many institutions rather large accumulations of stocks owing to the dullness of markets and reported that the crochet lace industry of Kistna had contracted considerably owing to the same cause. It was obvious, therefore, that it would be unwise to undertake measures for expanding the industry, unless and until a wider outlet could be developed for the accumulated stocks and for the products of women engaged in the industry, and that without an investigation into markets overseas the survey carried out by Miss Tweddle would be largely nugatory. Accordingly, Miss Tweddle, who on the completion of her period of employment in the department proceeded on furlough to England by way of the East and North America, was entrusted with the task of investigating conditions in the Philippines and other Eastern countries with the products of which the Indian industry has to compete, and subsequently to inquire into the possibilities of markets in North America and in England as also possibly in other European countries. Miss Tweddle, who was granted an honorarium of Rs. 2,000 for her services in connection with this further investigation, left for England via the Far East in March and is expected to return to India shortly.

Among the measures undertaken, independent of Miss Tweddle's survey, to assist the industry have been—

(i) the collection of information as to the patterns of lace and embroidery now in demand in the English and other overseas markets;

(ii) the distribution of lace patterns to the chief agencies engaged in the industry in this Presidency with a view to test the London market with counter samples manufactured here; and

(iii) stimulating a demand by enlisting the support of an English firm interested in the trade.

There is reason to apprehend, however, that the recent decision of the British Government to impose an import duty on all descriptions of lace and embroidery, whether made by hand or machine, will render very difficult the development of a demand for Indian lace in the English market, although India is entitled to the benefit of the preferential tariff on Empire goods. At present, the workers merely copy Western designs and it is possible that a larger market would be open for Indian lace, the design of which represented something of the Indian spirit. It is proposed to draw up some special lace designs based on Indian carving and art, and if these are able, by giving a distinct individuality to Indian lace, to set a new style, the difficulty of finding a market for the products of the industry may perhaps to some extent, at least, be overcome.

General.—The work of the Bureau is not so spectacular as that of some of the other sections of the department, but it is hoped that sufficient has been said to illustrate its usefulness. It is often constructively helpful, while in many cases it gives an inquirer sound advice as to the value and practicability of a project before it is launched. In this way, the Bureau endeavours to save the public from waste of time and money and the disappointment that would result from injudicious enthusiasm in pursuing ill-considered schemes which would almost certainly end in disaster.

CHAPTER III.

This chapter will deal with experiments and enquiries having for their ultimate object the starting either by private owners, or by Government, of new industries or of new branches of or improved processes in existing industries. This work which is carried on mainly in the Bureau includes most of the chemical experiments initiated by the department.

Chemical work of the department.—The suitability of Madras as a centre for the manufacture of certain basic chemicals has been investigated from time to time, but the prospect of the development of a heavy chemical industry in Madras is remote owing to the absence of many of the essential raw materials and the high cost of fuel. Nevertheless, the Director of Industries has, from time to time, to deal with enquiries relating to chemical industries and chemical processes. The staff of the department included a post of Industrial Chemist up to the 14th March 1925 when Dr. Marsden retired from Government service and the post was abolished as recommended by the Retrenchment Committee. The main function of the Industrial Chemist was advisory, but researches and investigations were carried out by him as occasion arose. The researches undertaken by the Industrial Chemist in recent years were all the outcome of enquiries by people in the Madras Presidency and gave results upon which suitable advice could be given in answer to enquiries which were and still continue to be received. These researches were undertaken because information was required on the various subjects, and the value of the researches lay in the fact that they enabled enquiries to be adequately answered. A proposal to utilize the Indian Institute of Science for the purpose of carrying out the chemical research work of the Presidency in return for a substantial contribution to its funds had been under consideration for some years but was negatived in the year 1923-24 on the ground mainly of the financial condition of the Presidency, although an additional reason which influenced the decision arrived at was that Government considered it advisable that the Presidency should have a research institute of its own and that this should be provided by expanding the chemical laboratory provided in the extensions to the Leather Trades Institute. The whole question of the organization of the chemical branch of the department, as also that of the comparative advantages and disadvantages of utilizing the Indian Institute of Science for conducting the chemical research work of the Presidency or of establishing a research institute in the Presidency itself, has recently been under review. Finally, Government decided that a provincial research institute of the magnitude contemplated by the Chemical Services Committee could not be developed out of the small research laboratory provided in the extensions to the Leather Trades Institute, and

that an institute of the kind would require a personnel and equipment which this Presidency could not afford. They therefore decided that the proposal should not be proceeded with. Government also agreed that the major chemical problems arising in the Presidency after the retirement of Dr. Marsden, the Industrial Chemist, should, as recommended by the Retrenchment Committee, be referred to the Indian Institute of Science, Bangalore, for investigation and in return for this service, Government made a contribution of Rs. 10,000 to the funds of the Institute for the year 1925-26. It is probable that a similar amount will be contributed during the next financial year. As regards minor chemical problems, Mr. Seshachallam, the Leather Research Chemist, and his two assistants now deal with miscellaneous chemical enquiries, as well as those pertaining more properly to the leather and tanning industries, or, in other words, Mr. Seshachallam now performs the functions of a General Chemistry Assistant to the Director, in addition to his leather chemistry research work.

Citric and tartaric acids.—Although the post of Industrial Chemist has been abolished, it may be of interest to refer to the more important of the researches conducted by Dr. Marsden during the two years immediately preceding his retirement. The question of the utilization of limes and tamarinds as sources of citric and tartaric acids respectively was investigated by him. Limes from the Kistna district were examined and found to contain 3 per cent citric acid which could be expressed and citrate of calcium of fair quality prepared from the juice. The success of the manufacture would appear to require the evolution of a machine press which would treat the whole fruit and yield a juice containing but little of the mucilage or pulp of the lime. The final results of the investigation in regard to the possibility of manufacturing citric acid were not encouraging and it was considered inadvisable to attempt the manufacture of citric acid in view of the inadequacy of the raw material, the high cost of sulphuric acid, and also of the elaborate plant that would be required, and the loss which might be expected from the great solubility of the acid. It was considered that any manufacture attempted should be restricted to calcium citrate though in view of the very low acid content of Indian limes, as compared with Sicilian limes, and the relatively small quantity of fruit available in India, the possibilities of commercial exploitation, even of calcium citrate, were not considered very promising. A bulletin entitled "The manufacture of citric acid from Limes" embodying Dr. Marsden's experiments and conclusions has been published. As regards the manufacture of tartaric acid, the conclusions arrived at by Dr. Marsden were that considering the price of tamarind, it would not be a commercial proposition to extract the acid unless the alcohol could be distilled off and marketed and that for separation of saleable tartaric acid products from tamarind, the work could most advantageously be carried on in connection with an existing distillery which could readily permit of the utilization of the sugar content. The Industrial Chemist considered that it would be practicable to produce

calcium tartrate of a quality which should find a ready market. It was found that autoclaving at high pressure (subjecting the material to the pressure of steam in a closed chamber whereby the temperature is increased) was essential for the liberation of the tartaric acid in a form in which it could be recovered and that by fermenting the aqueous extract before autoclaving a good yield of alcohol was obtainable. The results of the investigation were subsequently published in the form of a departmental bulletin entitled "The Utilization of Tamarind."

Alkaline earths.—The question of the exploitation of the alkaline deposits (psoudu) of the Kistna and Gōdāvari districts and of the manufacture of sodium carbonate therefrom, has also received attention during the last two or three years. The conclusions arrived at, based on the results of analyses and extraction of about 30 samples of scraped soils, were that, although there are soils with a fair alkaline content, and crude alkali could be obtained from them by extracting the soluble matter in water, evaporation, and roasting, it was doubtful whether the manufacture would be commercially remunerative, in view of the prohibitive cost involved in transporting the earth to a factory and the difficulties in obtaining fuel at reasonable prices. Finally it was decided that it would not be advantageous to manufacture alkali from these deposits. The results of this investigation also have been published as a departmental bulletin.

Malted foods.—An investigation in regard to the possibility of manufacturing malted foods from cholam was also undertaken in co-operation with the Agricultural Department. Information in respect of the processes of malting in bulk was collected by the Industrial Chemist and proposals and plans for the erection of an experimental malting house were prepared. Before proceeding with the establishment of a demonstration factory, however, and with a view to determine whether malting on the plains could be controlled to give regular results or whether the process would require to be carried out in the cool climate of the hills, arrangements were made for a series of large scale trials and experiments to be conducted by the Agricultural Chemist at Coimbatore. The experiments proved that malted foods of a standard high enough to enable them as far as quality is concerned to compete successfully in the market could be produced. In view of the financial position of the Presidency, and also on other grounds, Government considered it inadvisable to assume the responsibility of undertaking the manufacture of the product on a commercial scale and directed that the report on the results of the investigations should be published for general information and that it should be left to private enterprise to proceed further. The report has since been published.

Coir Industry.—The most important investigation of recent years has been that into the process of coir production. Although this is an old established industry, there is practically no literature on the subject and no information regarding the fundamental facts was

available. The opinion was generally held that for efficient retting, tidal waters, in which to soak coconut husks, were essential and that the presence of salt in the water played an important part. The preliminary investigation opened up a wide field of most interesting work, for the supposition that the process is bacterial was confirmed and it thus became necessary to elucidate not only the characteristics and behaviours of the bacterial flora and its sources, but also the constituents of the husk which require to be removed before the fibre is freed. The Industrial Chemist examined carefully the conditions under which retting takes place, and conducted numerous bacteriological examinations of samples of water and husk. The retting of sample husks was carried out in fresh water and a small quantity of good quality coir was obtained, thus demonstrating that brackish water is not essential for the purpose, and further that the active bacteria are present in the husk itself. These bacteria were cultivated under sterile conditions for examination, and an examination of the husks was carried out with a view to determine the nature of the material which holds the fibres of the husks together and is removed in the process of retting. The pith which is so prominent as an interfibrillar matter gradually diminishes as retting proceeds and the residue is removed in the final beating, but this pith does not appear in itself to constitute an active combining principle. It appears to be a cellular structure through the medium of which juices and active binding matter are disseminated. Extraction with various solvents demonstrated the presence of sugar and tannin matters, but the structure was not altered until the material was treated with water under pressure. The cohesion between fibre and pith was then broken down and from the presence of wood, sugar and gum acid, in the aqueous extract, it may be deduced that the binding material which is attacked and destroyed in the retting process is of the character of a gum or mucilage. For the production of good quality coir, retting under suitable conditions appears to be the only practicable process, as softening the husk by chemical means results in a very dark coloured fibre greatly inferior to that obtained in the natural way. The investigation proved that suitable conditions alone are required for the disintegration, as the coconut itself carries the active bacteria which in a continuous or intermittent gentle flow of water, are able to destroy the binding matter and free the fibre, and an examination of the nuts from different districts indicated that the active bacterium is of one type and common to all. Laboratory trials indicated that the period required for retting could be materially shortened by soaking the husk until the bacterial growth was established and then lifting the husk and, after crushing between heavy rollers, returning it without delay to the soaking pit. In the laboratory, good quality fibre was obtained in this way in less than two months. The scientific results of the investigation were published in the Journal of the Indian Institute of Science, while the results of the experiments on the retting, separation and utilization of coir fibre were also published in the form of a departmental bulletin which

was drawn up by Dr. Marsden on the eve of his retirement. This bulletin has been very well received by firms and others interested in the trade.

Copra and coconut oil industries of the East Coast.—The possibilities of developing the extraction of coconut oil on the East Coast of the Presidency have been under the consideration of the department. It was suggested that an oil mill should be started on the East Coast primarily for the extraction of oil from copra though the possibility of utilizing the mill for demonstrating the commercial extraction of oil from other seeds, such as gingelly, groundnut and castor, particularly for example when the high price of copra rendered it uneconomical to extract coconut oil, was also examined. The desiccation of coconut and its preparation for export, and the preparation of coir and fibre either as independent units or in conjunction with the proposed oil mill was also investigated. A consideration of the statistics which were collected in respect of the production of and trade in coconuts, and the mills which already existed for the expression of coconut oil in the area which offered the best prospects for the establishment of a mill, and a discussion with those engaged or interested in coconut oil pressing and the trade in coir products, indicated that no necessity existed for the establishment of a demonstration plant under the control of the department which would necessarily compete with the existing presses. It was therefore decided to abandon the proposal to establish a demonstration factory on the East Coast for the manufacture of oil from coconuts. The department will, however, always be pleased to render all possible assistance to persons who contemplate the establishment of an oil mill not only in the matter of applying for aid under the State Aid to Industries Act, but also by rendering technical assistance in the way of preparing plans and estimates for projected mills and by advising in regard to the prospect of success of such concerns.

Coconut desiccation.—The question of starting a factory on the East Coast for the desiccation of coconut and its preparation for export also received attention. There is a considerable overseas demand for desiccated coconut, but it is a very fluctuating one. The Director of Agriculture, Ceylon, where the industry is highly developed, although at present in a depressed condition after enjoying a period of prosperity, was addressed with a view to ascertain whether in the event of an officer of the department being deputed to Ceylon to make a study of the conditions under which the industry is carried on there and of the processes employed in the preparation of the product, it would be possible for him to secure from any of the mills the requisite facilities for carrying out a thorough investigation of the industry. It was found that the mills there were not unnaturally somewhat reluctant to show their methods and explain their processes, and moreover on further investigation the prospect of starting the industry in India did not appear to be very hopeful. In fact, if coconut desiccation were a commercial proposition it is probable that

the enterprising merchants of Malabar and Cochin, who are engaged in the coconut oil and coir manufacturing industries would have started it long ago. Finally, it was decided to drop the proposal in view of the fact that the industry in Ceylon is now reported to be in a bad way.

Coir production.—The position of the coir industry on the East Coast has also been recently examined, and with a view to improve the quality of the fibre, instructions for the retting of coconut husk for extraction of clean fibre and for the spinning and weaving of coir yarn, were drawn up, and copies distributed by the district officers of the department to those interested in the industry. It was hoped by these means to induce private enterprise to take up the experiments, and the Assistant Industrial Engineer, Bezwada, was instructed to offer all possible assistance to such persons. The attempts made by the department to persuade the people in the Gōdāvari district to adopt the improved methods of retting coconut husk did not prove successful. The coir industry on the East Coast, such as it is, is almost wholly in the hands of poor women who live from hand to mouth, and with most of them it is a part time occupation from which they require an immediate return. They were thus unable to undertake an experiment which would necessarily have extended over a considerable period and involved an expenditure of a certain amount of money. As soon as money can be found for the purpose it is proposed by the department to initiate the experiment which will consist essentially of soaking husks separated from the nuts at the proper stage in water under proper conditions for some months. After the husks have been thoroughly retted, the fibre will be beaten out and twisted into yarn by a maistri who will have to be brought from the West Coast. Once the possibility of getting good fibre and twisting good quality yarn on a paying basis on the East Coast is established, the development of the further processes of cleaning the fibre, weaving of matting, etc., can be taken up in an experimental factory later on, as and when funds are available. In the first instance, it is proposed to demonstrate the advantages of the retting methods followed on the West Coast, and to show that good fibre and yarn of good commercial quality can be produced on the East Coast. There need be no apprehension that if the coir industry is successfully started in the East Coast, it will react unfavourably on the old established West Coast industry, as for some time there has been a shortage in the available supply of weaving yarns owing to the insufficiency of seasoned husks. It seems to be the case that both the local mat and matting industry in Malabar and the export trade could absorb an increased quantity of weaving yarns, and in view of this and, of the fact, that high grade yarns such as Alapat and Anjengo are now quoted as high as Rs. 140 to Rs. 150 a candy as against Rs. 60 to Rs. 70 two years ago, the desirability of taking steps to explore the possibility of increasing the supply of weaving yarns is sufficiently obvious.

Extraction of vegetable oils.—The department has in recent years collected a good deal of information on the subject of the expression of and trade in vegetable oils in the Madras Presidency, and will always be glad to assist enquirers with estimates of machinery and plant required for the establishment of mills for the extraction of oil from the various classes of seeds, and to advise in regard to the possibilities of developing a market for the oil produced. It is economically unsound for the Madras Presidency to export oil seeds in large quantities instead of the manufacture of oil and oil-cake being carried out in the Province itself. For, not only does it take from the country much useful material in the form of cattle food and manure, but it also gives the manufacture to other countries. The extraction of oil on a commercial scale is not impossible, but the difficulties before it are very great since Marseilles and other crushing centres in Europe have already an established position in the world's markets for the different classes of oil in which they are protected by high tariffs. Oils lend themselves very readily to adulteration and it would require a long period of good work for Indian mills to obtain the reputation which Marseilles factories now possess and which forms such a valuable asset in international trade. If an adequate market in India could be obtained for all the products of a number of large scale oil mills, the position would be very different, but at present the disposal of the oil and the oil cake presents difficulty. The cake obtained from the extraction of some vegetable oils is a highly nutritive food for cattle while other oil-cakes afford a valuable manure, the manurial value of which is not affected by the removal of the oil but depends on the nitrogen content. The demand for oil-cake for these purposes is, however, very limited in India at present and until the demand increases very considerably, the greater part of the production of any large oil mills established in the Madras Presidency would have to be exported. There is, of course, a considerable internal consumption of vegetable oils, particularly groundnut, in this country, and it may be considered therefore that there is scope for the setting up of improved modern oil mills with the primary object of meeting the internal demand for oil. The difficulty, however, as already indicated, is that it would probably be difficult to find a market for the cake in India until the ryots become more educated to its use.

Match industry.—The question of conducting a survey into the possibilities of the match industry in the Madras Presidency was considered, but finally it was decided that the department could probably best assist the industry by working in close co-operation with the Forest Department to furnish inquirers with information as to the availability of timbers likely to prove suitable, their quality and distribution and the price at which they could be made available at various centres, and by placing inquirers in touch with the manufacturers of up-to-date machinery and chemicals. Assistance has been rendered on these lines to a considerable number of enquirers.

A number of industrialists who have started, or contemplate starting, small factories do not appear adequately to have appreciated the vital necessity of selecting a suitable site for their operations, and of ascertaining beforehand whether suitable matchwoods can be delivered at the factory site at a price which will admit of manufacture at a profit. Instances have occurred where small concerns have come to grief owing to the failure of their proprietors to make the essential preliminary enquiries. A scheme for the starting of a small match factory requires to be very carefully investigated as it seems doubtful whether in view of the development of the larger match making companies, small factories worked by hand can possibly hope to operate at a profit. It is certainly essential that, before a factory of this kind is started, the cost of raw materials at site, chemicals and labour should be worked out with the greatest care as the margin in the business is of the smallest and it should preferably be established near the source of timber supply and in proximity to a forest depot. A factory started, as some have been, on the assurance of the vendors of hand machines that very large profits can be made, and with little preliminary investigation, is unlikely to win through to success. The match industry is carried on in Japan largely on cottage industry lines, and the possibility of developing the industry in this Presidency, at least partly on these lines, has not been overlooked by the department. In any case, if progress in this direction is found practicable, it will certainly lie not in the installation in cottages of the inferior match making machines manufactured in Bengal, which appear to be cheap and indifferent imitations of German machinery and which have not yielded satisfactory results in practice, but by the setting up of a central factory equipped with modern machinery for the manufacture of boxes and splints and their distribution to cottage workers for "finishing" the matches as a home industry. Under a scheme of this kind the function of the workers would be to dip the splints into the chemical solution which they would be instructed how to prepare, fill the boxes and paste the printed labels thereon, and return them to the factory. Several timbers such as Bombax Malabaricum and Alstonia Scholaris have proved suitable for match manufacture, but many of them are available only in small quantities, and it has therefore become necessary to experiment with some of the commoner species which up to the present have not been utilized for match manufacture. The difficulty of extracting timber at a price low enough to enable match manufacture to be conducted at a profit is not always sufficiently appreciated, and any scheme for exploiting these woods should preferably be linked with a general scheme for extracting all marketable timbers and utilizing waste ends for splints and veneers by working them up at the site.

Miscellaneous chemical inquiries.—In concluding this chapter a few instances may be given of the miscellaneous chemical inquiries dealt with during the last two years. These included three relating to the manufacture and preservation of butter, ghee and honey. The view

appears to be generally held that the addition of some preservative is essential to ensure good keeping power whereas all that is really required is extreme cleanliness and care in seeing that the material and containers are properly sterilized before closing the packages. Serious danger might conceivably arise if the use of "preservatives" without restriction became general, for a reagent used in a small proportion may be effective as a preservative while in a large proportion it may act as a poison. A sandalwood oil factory required assistance in the preparation of a special quality of oil and the conditions necessary for a series of experimental distillations were laid down for the proprietors to work to. Advice was given with regard to the value of an oil cake as a manure, and the value of a kaolin rich in alumina for the manufacture of pottery and glazes for covering lead pencils, while information was supplied in regard to the manufacture of starch from potatoes and the possibility of successfully doing this in the Madras Presidency. A jail was advised as to how aloë fibre might be freed from a bad smell to which objection was taken. Other inquiries dealt with have included the identification of fibres; the extraction of juice from cashew fruit, the casting of alloys, the bleaching of cotton towels, the dyeing of silk cloths and the preservation of milk. A sample of clay was also reported on with reference to its suitability for cement manufacture and advice given as to the suitability of a sample of peat for utilization as manure. With the abolition of the post of Industrial Chemist and the departure of Dr. Marsden, the Department has ceased to be in a position to render assistance to the jails in respect of the dyeing of textile fabrics and to answer the more technical of the miscellaneous inquiries in regard to dyeing generally, which are however comparatively few in number.

THE KERALA SOAP INSTITUTE.

CHAPTER IV.

MANUFACTURING ACTIVITIES UNDER THE CONTROL OF THE DEPARTMENT OF INDUSTRIES.

The success which attended the efforts of the Department of Industries under the guidance of Sir Alfred Chatterton in introducing the Aluminium industry and the chrome process of manufacturing leather is too well known to need special mention. The last decade has not been barren of results and the Government Pencil Factory was, after a period during which its successful working as a commercial concern was demonstrated, transferred to a private syndicate. The introduction of the soap industry is due chiefly to the foresight and initiative of Sir F. A. Nicholson. The manufacturing activities which are at the present time under the direction of the department are soap and glycerine, fluid, powder and tablet inks, jams and preserves. The experimental manufacture of printers' ink has also recently been initiated and the laboratory results so far obtained are distinctly promising. The aim of Government with regard to these manufactures is to ascertain and overcome the initial difficulties and discover whether the industry offers prospects of commercial success. The work of the Department of Industries in regard to the promotion of industrial development falls into two stages—the demonstration stage and the pioneer stage. In the first of these the object of the Department is to demonstrate that an article not hitherto manufactured in the Presidency can be produced of a standard high enough to enable it, as far as quality is concerned, to compete successfully in the market. Once this is established, it has to be decided whether the Government should undertake the manufacture of the product on a commercial scale or should leave this to private enterprise. If Government undertake pioneer manufacture, their policy is directed to the ascertainment of the possibility of manufacture on a profitable basis. In view of the facilities now offered by the State Aid to Industries Act, Government consider that the experimental work of the Department should not, as a rule, proceed beyond the stage of laboratory test, and that pioneer manufacture on a commercial scale may in future be left mainly, if not entirely, to private enterprise. The introduction of the system of commercial accounts has had a stimulating effect upon all the pioneer factories, while the fact that the factory accounts are maintained on the lines of privately owned and run commercial concerns should facilitate the disposal of those which Government considers have served their purpose, when a favourable offer is received for them.

History.—The Kerala Soap Institute represents the results of one of the many disinterested activities of Sir F. A. Nicholson as the Honorary Director of the Department of Fisheries. In 1913, Government appointed Mr. A. K. Menon, an Oil and Soap Expert, who had received practical training in England while holding a Government of India State Scholarship, as an assistant to Sir F. A. Nicholson in examining the question of fish oil and its uses, its possible utilization for the manufacture of soap and the best method of dealing with its large percentage of stearine (fish tallow). During the first year of his work, Mr. Menon was successful in utilizing fish oil in the manufacture of fish oil soap for use on harness and leather goods, and the manufacture of fish oil soap thus initiated constituted an important local outlet for the fish oil and stearine which were being produced at that time in the fish oil and guano factory at Tanur. These experiments, however, led Sir Frederick Nicholson and his assistant to experiment in regard to the production of ordinary and high class soaps from vegetable oils and tallows, and with a view to ascertain whether the soaps thus manufactured could be marketed at a profit, the Government sanctioned early in 1916, Sir Frederick Nicholson's proposals for the establishment of a small complete factory for the experimental manufacture of soaps and the operations were carried on in a rented building. In September 1917, Sir Frederick Nicholson submitted proposals for the establishment of a factory in permanent buildings of its own. His object was that the factory with its chemists, laboratory, and other industrial aids should form a technological institution where other branches of the oil and fat industries, such as the manufacture of candles, glycerine, oil paints and varnishes, edible fats, etc., could be studied and demonstrated. It was intended that the Government factory, besides serving as a stimulating example to encourage small capitalists to establish similar factories, should also provide facilities for the training of students in the process employed; or in other words the object of the soap factory was to establish soap manufacture and to demonstrate that soap could be made profitably in this Presidency, and at a later stage it was intended to train students in soap manufacture up to the limits of the factory accommodation and equipment. Government therefore sanctioned in 1917, the establishment at Calicut of a permanent factory, and a site measuring 3.75 acres was acquired for the purpose at a cost of Rs. 21,000. At this stage the factory, which had up to this time been under the control of the Department of Fisheries, was transferred to the Department of Industries as Sir Frederick Nicholson desired to be relieved of the charge of it. The transfer took place in April 1919, and subsequently the name of the factory was changed from 'Government Soap Works' to 'Kerala Soap Institute'. The estimates and plans for the new factory were sanctioned by Government in October 1921 and the construction of the new building was completed in May 1922. The cost of the new buildings amounted to approximately Rs. 94,570. The Retrenchment

Committee recommended that as the Kerala Soap Institute has already demonstrated the possibility of manufacturing soaps, and has therefore ceased to be a pioneer factory it should be sold as a going concern. The Government after a careful examination of this recommendation considered that the Institute should be continued or existing lines for another year when the question should be examined again. The question of the future of the Institute is now under the consideration of Government.

Glycerine recovery.—The success or failure of soap manufacture, as in the case of many other industries, depends largely upon whether it is possible to utilize the bye-products derived from the process of manufacture. When soap is made by the boiled process, glycerine which forms about 10 per cent of the weight of the oil used is set free and in large factories is recovered and refined. This is an important bye-product as glycerine commands a considerable price and as such it is obviously advantageous for the manufacturer of boiled soaps to recover the glycerine. A glycerine plant has now been installed and is in operation in the institute which enables the factory to recover, as a bye-product from the soap lyes, a satisfactory quality of 80 per cent concentrated crude glycerine. The question of finding a market for the crude glycerine produced has received close attention, and prolonged negotiations have been conducted with, and a considerable number of samples sent to various firms and merchants in America where there appears to be a considerable demand for this valuable bye-product of soap manufacture. The demand for the product in India appears to be somewhat limited, as apart from its use in textile mills, its only uses are for the purposes of preserving dead bodies in dissection theatres, in mortuaries, and to a much smaller extent in the process of leather dressing; presence in the glycerine, however, of a small quantity of salt, while adding to its preservative properties, renders it injurious to leather. It is hoped that it will shortly be possible to develop a market for the full quantity of glycerine produced in the factory and in this event the cost of production of the soaps should be materially reduced.

Varieties of soap manufactured.—The soaps manufactured are of excellent quality and are guaranteed pure. A strict control over the quality of the raw materials and the finished products in different stages of manufacture is exercised in the laboratory, and every cake or bar of soap that is despatched from the factory is guaranteed to be pure and free from injurious ingredients and in accordance with the nature and specification of the soap. It is no small thing that the Institute has achieved in placing on the market pure soap at prices within the reach of practically everybody. The products of the Institute had been exhibited at various exhibitions and a number of gold medals and other awards have been secured for the exhibits of soap. The following are the main lines manufactured :—

- (1) Vegetol.
- (2) Milled toilet soaps.

- (3) Washwell and other household soaps.
- (4) Leaf soap.
- (5) Saddle soap.
- (6) Insecticidal soap.
- (7) Disinfectant soap.
- (8) Soft soap of various descriptions and
- (9) Shaving soap.

Washwell, which is a high grade washing soap, maintains its hold on the market and its ability to compete with the best imported brands, but like all first class products it is comparatively expensive. It was therefore decided to manufacture also a less expensive household soap containing about 62 per cent of fatty acids and during the last two years orders have been received from the Director of Contracts, Army Headquarters, for the supply of about 226 tons of this soap. It is anticipated that the demand for this soap will expand considerably as it should appeal to the class of consumer who, while appreciating the merits of Washwell soap, is either unwilling or unable to pay the price demanded for it. About 30 tons of Vegetol is on an average sold annually, and in view of the severe and increasing competition of country made soaps, it is satisfactory that this variety is at least able to maintain its position in the market, and in fact there are indications that the demand for this soap is likely to increase as many persons have proved to their cost the injurious nature of several of its imitations. The sales of soft soap are increasing. The Kerala Soap Institute is in a particularly advantageous position to manufacture high grade soft soap at comparatively low rates and several satisfactory contracts are secured from time to time. Endeavours have also been made, with some measure of success, to popularise still further the insecticidal soaps made from fish oil and rosin which are employed for destroying the insects and pests on estates. It is understood that as a result of regular spraying operations conducted with the mixtures of this soap, many of the estates have got rid entirely of the green bug and other pests. The sale of toilet soaps has been the one disappointing feature of the factory's operations during the last two years. The chief obstacle to the development of sales of a good indigenous toilet soap is the marked preference, based largely on habit, of the Indian consumer in particular, for the imported article, while the high rate of exchange has facilitated the marketing of imported soaps. A fair quantity of textile soap has been sold to the mills in Bombay and elsewhere and it is hoped that the demand for this class of soap will increase considerably when the present depression in the mill industry disappears.

Sales Organization.—In the early days of the Institute, sales were effected mainly from the factory itself. This system worked fairly well in the special circumstances of the time, but it was not considered entirely satisfactory and later it was decided to employ an agency system for selling the soap and factory sales were given up.

A firm were appointed as agents for the whole of the Presidency outside the West Coast; but the results were poor and the agency was terminated. The system of travellers was subsequently employed but as this also did not prove satisfactory in practice it was superseded by a system of sales agents working on commission. Owing to various reasons, however, several of the agencies had to be terminated and subsequently a number of local stockists were appointed in the more important centres of the Presidency. The territory allotted to the agents was probably too large and in practice the majority of them acted merely as shop-keepers serving a very limited local area and with one or two exceptions they did not function satisfactorily as distributors. A feature of the new scheme was that instead of being given a flat rate of commission, irrespective of the turn over, the stockists were given a smaller rate of discount or commission plus a bonus on a sliding scale varying with the volume of orders placed with the Institute. They had thus every incentive to increase their turn-over with the Institute to the utmost possible extent. The results, however, have not been so satisfactory as anticipated owing mainly to the difficulty experienced in securing a sufficient number of stockists of sound financial standing.

Propaganda.—The products of the Institute are kept sufficiently before the public by newspaper and other forms of advertising. Not content with this, an active propaganda campaign has been conducted during the last two years from the head office, and an exceptional effort put forth to offset the effects of trade depression and the intensive competition of imported soaps. Individual letters, descriptive of the soaps offered by the Kerala Soap Institute, were addressed to all large consumers south of a line drawn from Bombay to Calcutta, as well as the leading consumers in industrial centres further north such as Cawnpore, as well as in Ceylon. Railway administrations, mills, factories, estates, and hospitals are all periodically addressed. Propaganda of this kind is certainly more effective and less costly than newspaper advertising and the sustained effort put forth to develop sales has been attended with a fair measure of success. High freight rates militate against expansion in the markets of the north of India with the exception of Bombay to which consignments can be shipped during part of the year by country craft at comparatively low rates.

Profit and Loss.—In 1921 Government ordered that the factory should be managed primarily as a commercial concern designed to yield a profit on the capital invested so that the right kind of private enterprise may be induced to take up similar ventures. The profit and loss statements for the year ended 31st March 1925, as audited by Messrs. Fraser and Ross, disclosed a net profit of Rs. 23,164-2-9 on the year's working, and a return of 7.11 per cent on the average capital of Rs. 3,25,643 employed by the Institute. The profit was struck after debiting an amount of Rs. 2,308-5-0 for direction charges, Rs. 1,446-6-1 for audit fees and Rs. 2,233-1-0 on account of leave and pension contributions,

all of which appear to be excessive and greater than a commercial factory would have to carry. The year was one of expansion in all branches of the factory's activities and the volume of orders received and executed greatly exceeded those of the previous year both in quantity and value, the policy having been to obtain as many orders as possible, even at a very small margin of profit, so as to spread the heavy overhead charges over as large an output as possible. The satisfactory results which were obtained in spite of the generally unfavourable conditions which prevailed during the year was attributable mainly to the large contracts for soap yellow and soft soap obtained from the Director of Contracts, as well as a number of smaller contracts obtained from other authorities, as a result of the active propaganda campaign, and partly to the careful and prudent buying of the raw materials. The conditions generally were not favourable for an expansion of sales since the exchange remained at a high level and ruled in favour of importers throughout the year, while the dislocation of traffic and trade caused by the unprecedented and disastrous floods in July and August was another adverse factor. The financial results of the working of the factory for the current official year ending 31st March next are likely to show some fall in profits though it is hoped that a small profit will be shown. The following table shows the profit or loss of the Institute from the year when it commenced to operate on a commercial scale.

Year.	Net sales.	Net profit.	Net loss.
	RS. A. P.	RS. A. P.	RS. A. P.
1917-18 ...	1,38,511 13 1	38,409 1 2	...
1918-19 ...	2,37,931 12 0	47,400 8 5	...
1919-20 ...	2,75,996 3 10	6,216 10 7	...
1920-21 ...	1,72,008 0 2	...	14,268 4 5
1921-22 ...	2,27,350 0 3	16,152 4 2	...
1922-23 ...	2,10,951 12 6	...	23,320 12 5
1923-24 ...	1,33,553 12 1	...	9,939 8 5
1924-25 ...	2,28,135 2 8	23,164 2 9	...

Training of Apprentices.—As already indicated, one of the objects underlying the establishment of the Institute was to train students in the process of soap manufacture. While the factory was located in confined and otherwise unsuitable rented buildings it was not possible to make any appreciable progress in the training of operatives and soap managers. Now that the Institute is accommodated in a building of its own and the glycerine plant has been brought into operation, it would be possible to provide the necessary facilities for training in soap manufacture. But it has to be recognized that the training of apprentices would interfere to a considerable extent with commercial production, and Government have ordered therefore that the question whether arrangements should be made at the Institute to admit and train apprentices in the manufacture of soaps should be deferred until the future of the Institute is definitely settled.

Accordingly many applications from individuals who desired to undergo an organized course of instruction at the Institute have had to be declined.

Establishment of small cottage factories.—There is no statistical information available as to the number of small cottage industries that have sprung into existence in the Presidency as a result chiefly of the establishment of the Kerala Soap Institute but there is reason to believe that the number of small factories producing soap by what is known as the cold process, which is easy of manipulation by the aid of cheap and simple machinery, is considerable. Most of these cold-process soaps, however, are of inferior quality as they are manufactured by uninstructed persons by the use or misuse of materials whose chemical characteristics are unknown to them. Although it is quite possible to manufacture, by the cold process, a good class of toilet soap somewhat similar to the 'Vegetol' made in the Kerala Soap Institute, the majority of the soaps that are turned out by these small factories, are positively injurious for toilet use. Every effort is, however, made by the department to assist the owners of these factories with advice and suggestions by carrying out analyses of soaps manufactured by them, and pointing out how mistakes could be rectified. A bulletin entitled 'Soap making by the Cold Process' has been issued by the department for the information of the public. There is no doubt, however, that these soaps are being used largely for semi-toilet and for household use and on this account they have replaced to some extent several varieties of cheap foreign soaps which were popular in the Indian bazaars before the War. There is no doubt that local competition in cheap soaps is being felt by foreign soap manufacturers.

Raw materials for soap manufacture.—As regards raw materials for soaps, this Presidency offers a wide range of vegetable and fish oils, of which coconut oil, groundnut oil, elupa oil, castor oil, moura oil and maroti oil are the most common. Tallow of a poor quality prepared from buffalo, beef and goat, is available in small quantities. For preparing soap by the cold process, coconut oil is eminently suitable. For making high-class toilet soaps, hard fats such as tallow are used in European countries. It is possible, however, to prepare hard fats from vegetable oils by the process of hydrogenation.

GOVERNMENT INDUSTRIAL INSTITUTE, MADRAS.

Scope and objects of the factory.—The Institute which is now exclusively devoted to the manufacture of fluid inks and ink powders was originally located at Coonoor. The operations were transferred to Madras in 1922 and, in the absence of more suitable premises, were carried on in the old Municipal cattle-sheds at Washermanpet. This accommodation proved entirely unsuitable and quite insufficient to permit of the manufacture of standard inks on a large scale or of the initiation of other lines of work. Subsequently premises in Wallajah Road were taken on lease for the accommodation of the Institute and since its transfer thereto the scope and activities of the

Institute have increased rapidly and progress in various directions has been rapid; for not only have the output and sales shown considerable development, but as a result of the experimental work undertaken, several new lines of manufacture have been introduced with success. The object of starting the ink factory was to demonstrate that with the aid of indigenous materials it was possible to prepare inks and writing fluids of such quality as to compare favourably with standard imported inks. Anyone can make ink but few can make good ink and the process of manufacture of fluid ink is more complicated than many people realize. A considerable proportion of the cost and much of the difficulty of ink manufacture lies in the proper maturation of the ink. Ordinary high-class writing fluids require several months to prepare and mature during which period important chemical changes and sedimentation take place, and this again involves the provision of storage facilities on a considerable scale as well as of a suitable plant. The manufacture of fluid ink, worthy of the name, from the preliminary extraction and mixing to the dyeing, sedimentation, and maturation of the ink, extends over a period of three months and this period cannot be shortened without impairing the quality of the product. The aim with which the experimental manufacture of ink was undertaken has largely been achieved as the inks produced are of excellent quality and have been proved by tests—practical, microscopic, and chemical—to possess all the characteristics of good inks. The factory has demonstrated that the manufacture of ink can be carried on successfully under Indian conditions and it is the only one in Southern India in which inks are manufactured on scientific lines and up to the standard of the superior brands of imported inks. The present pioneer factory is paving the way for the establishment of private factories, and as a result of its efforts it is hoped that in course of time the use of foreign inks will be largely superseded by superior country-made inks. The difficulty as regards containers, however, has not been entirely overcome as suitable stoneware jars are not at present available in India at an economical price.

VARIETIES OF INK MANUFACTURED.

Originally the Institute manufactured only blue-black writing ink, blue-black record ink, blue-black fountain pen ink and scarlet ink, but later in addition to these varieties, the manufacture of copying ink, concentrated cheque ink, green ink, violet, red and black stamping inks and cyclostyle inks, were also taken in hand. It was found, however, that the demand for liquid ink, although far from inconsiderable, was nevertheless limited as the use of cheap ink powders was widespread and increasing. Accordingly the possibilities of manufacturing ink powders were carefully investigated, and it was found that powders of superior quality could be manufactured at prices which would admit of competition with the very inferior ink powders manufactured locally, and as a result blue-black, scarlet and red ink powders were placed on the market and have met with a steady demand from the public. It was subsequently found that there was a considerable

demand for ink powders in the form of compressed tablets, and accordingly a suitable stamping press for the preparation of tablets was obtained and installed in the factory and a number of varieties of ink tablets in various colours placed on the market. The quality of the standard fluid inks has recently been still further improved, partly as a result of the experimental research and partly in some cases by the substitution of more suitable materials. Experiments have been in progress with a view to the evolution of new varieties of inks and ink powders, as a result of which violet copying ink, a cyclostyle ink suitable for use on the Gestetner rotary machine, metal stamping ink, duplicating ink and various drawing inks, have been or are on the point of being placed on the market. The ordinary blue-black writing ink now produced by the Institute is of excellent quality and is equal in merit to the best imported brands. The inks have been displayed at a number of exhibitions and several awards secured.

Production and accounts.—The output during the year ended 31st March 1925 amounted to 3,350 gallons of various classes of fluid inks, 79,442 tins of ink powders and 1,964 packets of ink tablets. The sales amounted to 2,718 gallons of fluid ink, 77,868 packets of ink powder, 433 tins of cyclostyle ink and 984 packets of ink tablets against 1,924 gallons of fluid ink, 14,468 packets of ink powder, and no packets of ink tablets during the previous year. The value of the sales effected amounted to Rs. 26,156-0-5 as against Rs. 12,607-6-1 in the previous year. The accounts as audited by Messrs. Fraser and Ross showed the very satisfactory net profit of Rs. 3,110-7-3, and the high return of 15.5 per cent on the capital invested in the Institute, as against a profit of Rs. 2,796-7-6 in the previous year. The profit, in each case, was struck after providing for direction, audit and all other overhead charges. The percentage of sales to the Superintendent of Stationery to the whole factory sales declined from 84 per cent in the year 1923-24 to 64 per cent in the last official year, sales to the public, including municipalities, district boards, railway administrations, educational institutions, banks and commercial houses, showing a decided increase. This is a satisfactory feature of the position for, although inks are supplied to the Superintendent of Stationery at competitive rates, i.e., at or below current market prices, yet it is obviously desirable that the basis of the factory sales should be widened as far as possible, as in this way the goodwill of the concern is enhanced. The factory is now fairly fully employed in complying with orders received from the Superintendent of Stationery, public authorities, and other large consumers, as well as from the general public, and the manufacture of ink in Madras may now fairly be said to be a paying proposition and to have established itself as such.

Sales organization.—Messrs. T. A. Taylor & Co., one of the largest importers of foreign inks in Madras, were induced to accept the sole agency for the sale of inks manufactured at the Institute. It is clearly an advantage to have obtained the collaboration of this

firm in developing a market for the inks produced, for obviously to the extent to which they sell Government inks in preference to imported inks, the competition to which the Institute would otherwise be subjected is correspondingly reduced.

PRINTERS' INK.

Government recently approved a proposal that the Department of Industries should carry on the experimental manufacture of printers' ink in the old Glue Factory building at Washermanpet. The value of printers' ink imported into the Madras Presidency has averaged about Rs. 55,765 per annum during the last three years, and the volume of imports appeared to justify an attempt to establish the industry. The manufacture of printers' ink is an entirely separate industry from that of ordinary writing fluids and ink powders, and the experimental manufacture of printers' ink is accordingly treated as an entirely separate pioneer industry and the cost of the experiments are debited against a separate allotment and not against the profits of the ink factory proper. In fact the only connection between the two factories is that they are under the direct charge of one officer.

Composition of Printers' Ink.—Printers' ink consists essentially of carbon black incorporated in a medium of varnish, the latter of which is obtained by boiling linseed oil and igniting the resulting vapour until the correct consistency is reached. Rosin, soap and a blue pigment are also introduced in small quantities and dissolved with a view to impart clearness and brightness to the impressions made with the finished ink. The five ingredients used in the manufacture of printers' ink thus consist of carbon black, linseed oil, rosin, soap and a blue pigment (natural indigo or prussian blue) all of which are obtainable in India with the exception of carbon black which is usually imported from America. The experiments have only been started during the last two months and although the laboratory results so far obtained are decidedly promising, it is not possible to say at this stage for how long a period the experimental manufacture is likely to extend over as much will necessarily depend on the course of the experiments, and in view of the complexity of the subject, striking results cannot be expected within the short space of a few months. The process of manufacture of printers' ink is highly technical and scientific, and the necessary skill in carrying out operations can only result from considerable experience, whilst the evolution of suitable recipes to suit the varying requirements of the trade can only be obtained by prolonged experiments. During the initial stage of the experiments the materials have been ground by manual labour with stone slabs and rollers although the necessity at a later stage of installing mechanical mixing and grinding apparatus was foreseen. The results of the preliminary laboratory experiments have been such as to justify the purchase of this machinery which is essential if further progress is to be made in the evolution of a satisfactory commercial

product and it is hoped that the necessary mechanical apparatus will be obtained during the course of the next official year.

FRUIT PRESERVING INSTITUTE, COONOR.

Origin and early work of the factory.—The Fruit Preserving Institute at Coonor owes its inception to Sir Frederick Nicholson. The object of starting the Institute was to create an organized fruit preserving industry on the Nilgiris coupled with the necessary co-development of systematized fruit culture not only to supply the requirements of the factory, but also to supply the public needs and to benefit the fruit growers, actual or prospective. The preliminary experiments conducted at Sir Frederick Nicholson's residence with plant which was domestic in character were considered sufficient encouraging to justify the building of a factory and the installation therein of the requisite plant for fruit preserving. While the factory was in course of construction, the Lady Manager proceeded to England on deputation to extend her knowledge of the subject, to study the latest methods and processes of manufacture, and to arrange for the purchase and shipment of the necessary plant required for manufacture on a commercial scale. The building was completed and the requisite plant and fittings were installed during the year 1922-23. In June 1922, production was started on an experimental scale and small batches of jams under varying temperatures and pressures were manufactured and the climatic effects on standard recipes were noted and the recipes revised accordingly. Experiments were made with the following fruits for the manufacture of jams and jellies, bananas, bilberries, billimbies, Chinese papaya, giant tree tomatoes, granadillas, hill guavas, hill pineapples, kew pineapples, mangoes, oranges, ordinary guavas, peaches, pears, pomelos, quince, raspberries, roselles, strawberries, strawberry guavas, sweet lines, tiparees tree tomatoes and tomatoes. Experiments were also conducted in the canning and bottling of fruits. As experience was gained, however, as to the lines which were in demand and were likely to compete successfully as regards quality and price with similar imported jams, it was decided later to restrict the number of varieties manufactured to such as had proved satisfactory and were in demand and gradually to eliminate the lines in which, either as regards quality or price, it was difficult to compete with the imported product.

Production and Profit and Loss.—The actual production in the factory commenced on the 19th July 1922, but from the first the sales have been disappointing. The result of the working of the factory for the year 1923-24 showed a loss of Rs. 23,158-8-5 and during the following year the loss increased to Rs. 23,681-10-9. Although the volume of sales showed an increase over that of the previous year, nevertheless the rate of progression was far from satisfactory, and it was apparent that the Institute was still far from the point at which demand would overtake economic production.

Markets.—It has been demonstrated that jams of good quality can be manufactured from Indian fruits but the crux of the difficult problem of the future of the Institute is undoubtedly markets. In order for the finance of the Institute to balance, it is estimated that about 200,000 lb. of jams and allied products, valued at approximately Rs. 1,27,500, would have to be disposed of annually. The total average import of jams and jellies into the Madras Presidency during the last few years has averaged only 88,099 lb. of the value of Rs. 61,991. (The imports recently have shown a tendency to increase, and it is possible that the demand has been stimulated by a decline in the price of imported jam, for there have been heavy imports of cheap bounty-fed Australian jams and preserves with which the Institute is quite unable to compete at the same price. The experience of the last two years shows conclusively that it would be a very difficult matter to replace the ordinary brands of jams which are well known to consumers, and further even if the whole of the present import trade in jams and jellies were captured, the sales of the Institute would not amount to a figure which represents an economic output. The figures given above do not include canned and bottled fruits. The preserves turned out by the Institute, however, hardly seem to be of equal merit to the jams, and it is perhaps doubtful whether the comparatively tasteless Indian fruits are particularly suitable for the manufacture of preserves, the development of which in any case is probably a matter for experts. It would be even more difficult, therefore, to develop a satisfactory market for preserves than it is in the case of jams and jellies, and it seems very doubtful to say the least whether the Institute will ever be able to compete in the larger markets of Southern India, with imported fruits canned in Australia and elsewhere in enormous quantities in factories adjoining ports and within easy reach of the districts supplying the fruits. There is little doubt that jam must always be the main line of manufacture in the Institute, and here the difficulty is that jam is essentially an English, and in the case of Indians an acquired, taste. It is unlikely, therefore, that the consumption of jams and jellies will increase to a point at which the factory will pay, in the reasonably near future, in the absence of a large jam consuming population in the area which can be supplied by the Institute to make the manufacture of jams and allied products a feasible proposition, or in other words, the demand for the products of the Institute within the area which it serves or could ever hope to serve appears to be insufficient to absorb an economic output. Government shortly after the opening of the current financial year decided that the Fruit Preserving Institute should be continued for the present, every effort being made to reduce the cost of production and increase the sales through the medium of two specially appointed canvassers. The volume of business introduced by the travelling salesmen, however, leaves a great deal to be desired and the general position has undergone no improvement. The position of the Institute will shortly be again reviewed by Government when a definite decision will be made as to its future.

GLUE.

Early history.—The experiments conducted by the department in 1916 to manufacture glue locally from fleshings though not completely successful were sufficiently encouraging to warrant further experiments. When, therefore, in the following year the Indian Munitions Board required supplies of glue in India for use in aeroplane construction, the investigations, previously initiated, were carried a stage further and after research and some practical experiments, a method of treating the fleshings was evolved which yielded a satisfactory product. At this state, it was decided that further experiments in regard to the manufacture of glue on a commercial scale should be conducted by a private syndicate, and Government accordingly sanctioned, under certain conditions, the lease to Messrs. Beardsell & Co., of the building, plant and appliances, etc., for a period of one year. The firm took charge of the factory in August 1920 and after managing it for a year, during which period they had actually been producing glue of good quality, expressed their inability to continue the experiments and their wish to withdraw from the enterprise altogether. The factory was therefore taken over by Government in October 1921.

Profit and Loss and Markets.—The result of the first fifteen months working of the factory showed a loss of Rs. 14,458-10-5 while the working of the factory during the year ended 31st March 1924 resulted in a deficit of Rs. 17,041-2-4. The loss on working of the factory was attributable to the difficulty experienced in finding a market for the glue even at competitive prices for an output sufficiently large to make the factory pay. The glue produced in the factory was of excellent quality suitable for high-class furniture and book binding and it is a matter for gratification that the difficulties attending the manufacture of glue under tropical conditions, which many chemists considered insuperable, were in a large measure overcome and that a glue was produced which compared favourably with the average imported product. It was evident, however, from an examination of the working of the factory that the crux of the problem was the cost of producing the glue and it could not be shown that it was possible to find a market for the glue which would absorb a quantity adequate to render manufacture on a commercial scale possible. Finally the Government accepted the recommendation of the Director of Industries, which coincided with that of the Retrenchment Committee, that the Glue Factory should be closed and further experiments to prove that glue could be manufactured at a commercial price should be abandoned since they were satisfied, after a very careful examination of the position, that the difficulty of manufacturing glue on a small scale at a competitive price, and of finding a market for the product could not be overcome by continuing the experiments. The attempt to pioneer the glue industry in the Madras Presidency has therefore definitely failed. It is hardly necessary, however, for the department to apologise for having made an endeavour to pioneer the industry. It was a well conceived and well

executed attempt which at one time appeared justifiable, and at least it cannot in future be said that the possibilities of establishing the industry have not been fully explored. The action of the department in attempting to pioneer the industry has probably saved private enterprise sooner or later from burning its fingers more or less badly. The data obtained during the period of experimental manufacture is on record and is at the disposal of any member of the public who may evince an interest in the subject at any future time. The glue factory building has been utilized partly for the conduct of experiments in the manufacture of printers' ink, to which reference has been made elsewhere, and partly for the purpose of carrying out large-scale experiments and researches on tanning problems. The tannin extraction plant and the evaporating pans, which formed the greater part of the glue-producing plant, have been transferred to the Leather Trades Institute where they are of the greatest use in the conduct of research work generally and of the experimental preparation of tannin extracts in particular.

PALLAPALAIYAM SUGARCANE CRUSHING FACTORY.

History.—The cane-crushing station was first started by Mr. (now Sir) Alfred Chatterton and the objects of its establishment were as follows:—

- (a) to evolve a suitable design of furnace capable of boiling cane juice into jaggery with megass for fuel thus rendering any additional or other fuel unnecessary;
- (b) to demonstrate to agriculturists the increased percentage of extraction of juice from sugarcane which results from the use of power-driven mills in the place of bullock-driven iron mills;
- (c) to determine the smallest economical size of power plant by which jaggery can be manufactured at a cost lower than that at which it can be produced by bullock driven mills and country furnaces.

In 1914, after a number of experiments, an improved furnace was produced in which megass and trash could be used without additional wood or other fuel and various other improvements have been carried out from time to time. As a result of the experience gained, and with a view to improve still further the existing furnace, arrangements were made for air gratings to be fitted sloping away from the chimney and for the insertion of partitions to retain the hot gases in the furnace for a longer period so as to ensure their imparting an increased percentage of heat to the upper pans. This resulted in a further considerable saving in the consumption of megass and trash. It cannot be claimed, however, that the early experiments were successful. Indeed in most seasons, the factory appears to have worked at an actual loss. The inability to show a profit in the early years was due partly to the fact that the rate charged to the ryots for manufacturing jaggery was too low. In many cases, operations were started too late in the season and no megass was stored

at the end of the previous year for use at the commencement of the following season. The lack of success was chiefly due, however, to the disappointing percentage yield of extraction obtained. Indeed the results obtained from the three-roller mill installed in the factory showed little improvement on that obtained from the ordinary iron bullock-driven mill. Arrangements were therefore made for the installation of a five-roller mill with a view to improve the percentage of extraction.

Transfer of the factory and results of its working.—The factory was transferred to the Department of Agriculture along with the Pumping and Boring operations in 1916, but reverted to the Department of Industries in 1920. The factory showed a profit of Rs. 1,050 on the season's working in the year 1921-22, Rs. 1,077-2-3 in 1922-23, Rs. 761-8-5 in the year 1923-24 and Rs. 716 in the year 1924-25. With the improved five-roller mill of Messrs. Blair Campbell and Mclean's manufacture an extraction of about 72 per cent is obtained as against about 65 per cent with the old three-roller mill.

Sugarcane developments.—In the year 1922-23 the mill was lent to the Kallakurchi Co-operative Agricultural and Industrial Society free of rent. The object was to introduce and demonstrate in a new area the power crushing of cane as a paying proposition, and in this it was successful as the Society has since installed mills of its own. The success and economy of power crushing has now been sufficiently demonstrated at Pallapalayam, and there is thus no object in continuing the operations there any longer. Endeavours have, therefore, been made to induce a group of local ryots and land owners to form a co-operative society to take over the factory and it is hoped that the proposal will materialise before the next crushing season. It is, of course, very much to the ryots' interests that the power-crushing plant at Pallapalayam should be continued in operation as they are enabled thereby to get their canes crushed and jaggery manufactured at a lower rate than would be possible by bullock-driven mills and country furnaces. Inquiries are proceeding in regard to other large cane-growing areas where the power crushing of cane as a paying proposition might advantageously be demonstrated. It may well be worth while, if funds permit, to set up in suitable areas several crushing plants of the Pallapalayam type with the object of encouraging the cultivation of sugarcane. The department has recently been considering the possibilities of cane crushing in South Kanara and it is hoped that a co-operative society will be formed shortly and set up a cane crushing plant in that area.

CHAPTER V.

THE TEXTILE BRANCH.

General.—Amongst scattered industries not conducted in factories, the most important is the handloom weaving industry. The activities of the Textile section of the department cover also cognate subjects, such as hosiery, lace, embroidery, dyeing and printing, and textile education, in addition to sericulture and silk filature reeling. The handicraft art of weaving comprises the manufacture of fabrics from a number of different textile fibres in the production of which some form of handloom is invariably used and the Indian handloom, which has undergone very little change during the course of many centuries, has been found by experience to be the simplest and cheapest. In this Presidency cotton, silk, wool, kora, aloe and jute are utilized in the weaving of cloth, rugs, carpets, blankets, mats and other goods. The manufacture of these various fabrics is carried on by different classes of handloom weavers who follow their hereditary occupation under varying conditions. After agriculture, handloom weaving is not only the largest, but the most important, as well as the most ancient industry in this Presidency. The Textile industry in Europe to-day is represented by a highly developed mechanical industry which has practically extinguished the old handloom industry. In India, however, the ancient handloom industry, the history of which goes back some twenty centuries, maintains its vitality in spite of several depressing and unfavourable factors. According to the census of 1921, there are 170,000 looms at work in this Presidency, and it may safely be taken that the textile industry, including the production of raw silk, affords a means of subsistence to one million people. In the case of cotton goods, one-third of the total quantity manufactured on handlooms in India is produced in Southern India and the consumption of mill-made cotton yarn by the handloom weavers in this Presidency amounts to approximately 60,000,000 lb. per annum. The consumption of Kollegal raw silk alone may be taken as 30,00,000 of rupees per annum. Nearly 50,000 cumblies valued at Rs. 2,50,000 are produced annually in the Bellary and Anantapur districts. The Madras Presidency has also developed and retained a comparatively large export trade, amounting annually to about Rs. 2,10,00,000, in coloured goods comprising lungis and sarees, while the value of the export trade in, that description of coloured goods known as, Madras handkerchiefs is about 30,00,000 of rupees. It will be evident from the foregoing that the textiles represent a very important branch of the departmental activities.

History of early departmental efforts.—Experiments in improved methods of weaving were commenced in 1901-02, and a few fly shuttle frame looms of the European type were set up in the School of Arts and Crafts with the object of obtaining experience as to their

another village, but a maistri remained behind for some time to watch the looms at work and to help the weavers should any difficulty arise in working the new appliances and to combat any effort on the part of the sowcars to induce the weavers to discard them. With a view to ascertain whether the improved appliances had been retained or discarded, the parties re-visited the scene of their former activities from time to time. The parties also took advantage of weekly shandies, where weavers come from long distances to give demonstrations of improved appliances and accessories. It was one of the duties of the Weaving Superintendents to train the village carpenters in the construction of improved weaving appliances in the hope that they would assist in extending their use when the party moved to another village. The parties have, since their inception, in 1918, introduced a very large number of weaving appliances and accessories in the several villages they have visited in the Madras Presidency, including fly shuttle slays, shuttles, dobbies, pirns, healds, reeds, temples, picker shuttle wheels, frame looms, pit-looms, tape looms, sash looms, silk ribbon looms, twisting machines, jacquards, warping mills, hand-driven sizing machines, and power sized warps.

Present scope of the peripatetic weaving parties.—The number of peripatetic weaving parties has now been reduced to five. The reason for the decision to reduce the number of parties was that, as a result of the backward weaving centres in the Northern Circars and Ceded districts had been visited and it was considered that in many of the tracts covered by the parties the general adoption of the common type of improved appliances had proceeded so far, or that further propaganda work in this direction was no longer required and that it would be possible with the remaining parties to introduce more complicated appliances such as the jacquard, more elaborate dobbies, hand-driven winding, warping and sizing machines, and to induce weavers to take to ready-made power sized warps wound on weaver's beams. The Superintendents are placed in charge of a district and do not, as in the past, move more or less rapidly from village to village, but stay at selected weaving villages in a taluk for some time and direct their efforts chiefly to the improvement of the preparatory processes, the demonstration of the departmental hand-sizing machines, the distribution of power sized warps and the development of the sericultural operations in the districts. The peripatetic weaving parties are now working with their centres at Vizagapatam, Anantapur, Salem, Madura and South Arcot. The Weaving Superintendents are maintaining close touch with the Assistant Registrars of Co-operative Societies in their jurisdiction. The Superintendents, in the course of their duties, also collect statistics of the various looms and improved appliances in use, the class of cloth manufactured, the seasons of demand for cloth, etc., in the districts visited by them.)

Linked organization in handloom weaving.—Early in 1920, the Textile Expert prepared a memorandum in which he endorsed the view previously expressed by Mr. (now Sir Alfred) Chatterton

that the introduction of improved weaving appliances was only a partial solution of the problem of how to effect the salvation of the handloom weavers, for weaving after all constitutes only one stage in the process of converting cotton into manufactured cloth, and if the economic condition of the weavers is to be materially ameliorated, increased attention would have to be paid to the preparatory processes. The cost of machinery is beyond the purchasing capacity of the weavers though even in a small weaving centre labour-saving hand-operated appliances should benefit them materially. The most economical system, where a large number of weavers have to be supplied with warps is, as will be shown later, to put up a power-driven factory containing winding, warping and dresser-sizing plant. In this way, the material can be delivered to the handloom weavers in a condition suitable for immediate use on their looms and the community would then be in a position to devote their whole attention to weaving instead of giving much of it to the slow, tedious and laborious preparatory processes as at present. And it is in the direction of creating a linked organization amongst the cotton, silk and woolen weavers by which they would be linked with the speedier mechanized preparatory processes, that an improvement in the handloom weaving industry is possible. Before the introduction of the fly shuttle slay in the cotton hand-loom weaving industry, and while the primitive appliances in force, only short lengths of warps sufficient for the weaving of one piece of cloth at a time was produced by a family. With the introduction of the fly shuttle slay, however, the weaver was able to increase the output by 50 per cent in the case of medium counts, but the rest of the family, who were responsible for the preparation of the weft, could not keep pace with the weaver and accordingly endeavours were made to replace the crude peg warping board by warping mills. The latter, however, were costly and also produced far more warps than a weaver having only one loom could possibly utilize. Hence, a number of master weavers established, with the assistance of the department, small linked unions, consisting of warping mills, for the preparation and sale of unsized warps, the work of sizing continuing to be carried out by the usual street method. The method of street sizing, however, is exceedingly laborious and tedious, and moreover during the occurrence of excessive heat, or wet, or wintry weather, operations have often to be entirely suspended. Formerly, ample space was generally available for the carrying out of the process of sizing, but much vacant land has now been taken up for house sites, and other purposes with the result that the street sizers find it very difficult to carry on their work and in many cases have to do it on public roads and lanes with all the attendant inconvenience due to dust. The hand-sizing machine evolved by the Textile Expert, which is capable of sizing yarns ranging from 20s to 120s counts is also beyond the reach of a weaver and far too productive for a single loom. It is, however, suitable for small groups of handloom weavers possessing from 20 to 25 looms and endeavours are being made to

demonstrate the work of this machine and to popularize the of machine-made warps and thus gradually to pave the way for necessary units of weavers to be linked with a power plant to which reference will be made later.

Present policy.—The policy underlying the activities of Textile branch of the Department of Industries came under review year. The Retrenchment Committee had observed that until some method of stimulating the demand for the product the handloom or of cheapening the raw materials required by weaver or of altering his economic condition could be devised the benefits of the methods now followed by the department for uplift of the community, which aim mainly at the increase or acceleration of production were somewhat doubtful. The Committee held that the improvement of the handloom weaving industry must be undertaken on a comprehensive scale, and recommended that the work should be converted from an extensive to an intensive basis. The precise signification of this pronouncement was not altogether clear and the Government, therefore, proposed to appoint a committee of gentlemen conversant with the industry and with the in hand-woven goods to examine the present position and the prospects of the industry after a survey of the economic conditions of the handloom weavers had been carried out. Finally, an informal conference of the officers of the department and non-officials who were considered by Government to possess a special knowledge of the industry was held instead. The consensus of opinion of the non-official gentlemen present at this conference was that, as a result of the introduction of the improved methods and appliances, the general economic condition of the weaver had on the whole improved. The continuance of the system of peripatetic weaving parties was therefore, considered to be justified, but it was suggested that instead of moving from village to village at fairly frequent intervals, the different parties should settle down in selected centres for periods of six months at a time and demonstrate by the actual output of finished goods, working as far as possible under normal village conditions, the practical advantages of improved methods and new appliances. Incidentally, the Committee were of opinion that the personnel of the parties should be drawn from caste weavers and that a few scholarships should be instituted at the Textile Institute to provide for their recruitment. A commencement has been made in this direction by replacing some of the depressed class maistris by caste weavers, and this process will gradually be accelerated by the posting to the weaving parties of students who have completed the two years' course of training in the Government Textile Institute. Proposals have also been submitted to, and are under the consideration of, Government for the institution of six scholarships tenable at the Textile Institute. Wherever possible caste weavers will be recruited for these scholarships, but while such applicants will be given preference, the scholarships will not be definitely restricted to them. It was agreed at the conference that the Textile Institute served a useful purpose.

The conference further considered that the improvement of the economic condition of the weaving community is, as much, if not more, dependent on the influences of education and of the co-operative spirit as on the introduction of improved appliances, and that therefore it was advisable to organize special schools and special co-operative societies for the benefit of weavers under the direction of the Department of Industries. This very important question of the development of co-operation has received attention and it is hoped that it will be possible, by attaching an experienced officer of the Inspector grade in the Co-operative Department to the Department of Industries, to organize new, or re-organize the existing, co-operative societies, with a view to getting them to work co-operatively on the lines this department advocates.

TEXTILE INSTITUTE.

It was originally intended to utilize a portion of the Madura Industrial Institute for the purpose of training head maistris and weavers of the peripatetic weaving parties, as a central manufacturing and distributing agency of slays, looms, warp and weft preparation machinery and other improved apparatus connected with the handloom weaving industry and for the preparation of warps for sale to weavers. The weaving block of the Institute, however, proved to be ill-designed and otherwise unsuitable for the purpose of the Textile Institute. The Textile Expert therefore recommended the opening of a Textile Institute in Madras. It was proposed that the Textile Institute, when opened, should serve the following purposes:—

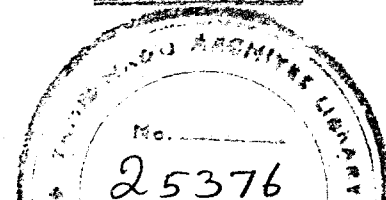
- (a) to provide practical training for students, caste weavers and maistris engaged in handloom weaving and for teachers of weaving employed in schools;
- (b) to demonstrate to handloom weavers the economy of power-sized warps;
- (c) to demonstrate the weaving of various fabrics with the aid of the improved looms and appliances;
- (d) to devise, manufacture, and demonstrate improved types of handlooms, and hand-driven warp and weft preparation machinery, and new appliances, which, after demonstration, would be forwarded to the weaving parties for introduction in the districts, as well as to serve as a central distributing factory for the supply of improved weaving appliances and accessories connected with the handloom industry, including special warp and weft preparation machinery;
- (e) to train and maintain a staff of maistris for setting up looms and appliances for private parties, schools and factories;
- (f) to undertake the testing of yarns with the special plant installed for the purpose;
- (g) to serve as a research institute in which experiments could be carried out on various problems connected with the textile industry which still await solution with a view to the introduction of more improved methods;

(h) to serve as a permanent museum for the display of all types of hand-woven fabrics, improved looms and accessories.

The orders of Government were received in May 1922 sanctioning the scheme, but difficulty was experienced in securing suitable accommodation in Madras. The transfer of the training classes for maistris from the Madura Industrial Institute to the Textile Institute, as soon as it was opened, was also approved. The Institute was opened in a rented building in Davidson Street, Georgetown, Madras, in July 1922, and subsequently it was removed to the more spacious rented premises which had formerly housed the Trades School in Muker Nallamuthu Street. With the establishment of the Textile Institute, and the resulting provision of facilities for the training of the personnel of the weaving parties, and the construction and demonstration of improved weaving appliances, the long-standing disadvantages under which the Textile Branch of the department laboured for many years were removed. The Textile Institute has been sanctioned on a temporary basis up to the 31st March 1926, but having fully justified itself by results and sufficiently demonstrated its usefulness, it is hoped that in due course it will be made permanent. The various activities of the Institute are developing satisfactorily and its scope is being gradually enlarged. The Institute is attracting an ever-increasing number of visitors from the weaving community and the general public, practically all of whom appear to be favourably impressed with its achievements and potentialities.

The following is a brief account of the activities of the Institute under the several heads:—

(a) *Technical training.*—The Textile Expert has devoted special attention to the preparation of lectures designed to suit the varied character of the instruction which it is desired to impart, and the training is of a thoroughly practical character. The Institute provides two courses of instruction: the Supervisor's course, which extends over a period of two years and the Artisan course, in a number of different subjects, which is restricted to six months. The Supervisor's course is primarily designed to train students who look to the industry for their livelihood in the art of weaving and for those who intend to become teachers in weaving schools and managers of weaving factories. The course, which embraces both the theory and practice of textiles, comprises instruction in the weaving of cotton, silk and woollen yarns, the dyeing and printing of cotton cloth, sericulture, silk flature reeling, and power-loom weaving, as also in the testing of textile fabrics, yarns and cloths, in hosiery manufacture, and in the process of power warp preparation. The Artisan course, in various subjects, is purely practical and is intended to turn out competent men suitable for employment as weavers in handloom factories and craftsmen. There are now forty-one students under training in the Supervisor's course and six in the Artisan course. It is anticipated that there will be an increasing demand for the men turned out by the Institute not only from schools and educational institutions, but also in connexion with the establishment and operation of handloom



weaving factories. One of the causes of the failure of many handloom factories has been that the small capitalists who embarked on the venture were ignorant of the technique of the industry and consequently entirely at the mercy of the sometimes not overscrupulous caste weavers. It is hoped that the students trained at the Institute will not only be able to secure employment in existing handloom factories, but also be of great assistance in organizing new weaving factories. The students turned out by the Institute are generally better educated, and, on the completion of their course, much better qualified than the professional castemen.

(b) *Warp preparation section.*—One of the purposes underlying the establishment of the Madras Textile Institute was, as already stated, the training of students in the speedier and more economical methods of warp preparation and the demonstration to handloom weavers of the economy of power-sized warps. It has already been shown that the introduction of improved weaving appliances affords only a partial solution of the problem of improving the condition of the handloom weaver, for weaving after all constitutes only one stage in the process of converting cotton into manufactured cloth, and, if any material improvement in the economic condition of the weavers is to be effected, increased attention must necessarily be paid to the preparatory processes. Accordingly arrangements were made through the High Commissioner for India for the supply of the requisite power-driven machinery for the setting up of a pioneer warp preparation factory and the machinery arrived in October 1923. It was found impossible, however, to accommodate the machinery and plant in the premises of the Institute proper, and accordingly the old Pencil Factory buildings at Washermanpet were adapted to accommodate the warp preparation section of the Institute. The plant comprised a 200 spindle bobbin winding machine for winding yarns from hanks to warpers bobbins, a beam warping machine with an end-an-end leasing comb for preparing warps for the sizing machine, a dresser-sizing machine for sizing yarns in sheet form, a cross warp-balling machine for winding sized warps on wooden tubes, and a mixing beck for preparing size mixings. This type of sizing machine enables the warp to be sized and dressed in an exposed sheet form, applies oil to the yarn, keeps every thread quite separate during the entire operation, and allows an end-an-end lease to be introduced in the warp to enable the weaver to group the requisite number of threads for his cloths. The method of sizing with this plant thus resembles closely the street method of sizing by hand to which reference has already been made, but whereas it requires eight handlooms to keep pace with one power-loom, it requires 280 operatives to do by hand the work of one person in the power preparatory processes for warp alone, the winding of weft being an extra operation. Obviously, therefore, if the economic condition of the handloom weaver is to be materially ameliorated, attention, as already indicated, must be concentrated primarily on the preparatory processes, as it is clearly useless to increase the production of the loom unless the weaver is linked with a

more economic and up-to-date method of warp preparation. The type of dresser-sizing machine installed in the Institute represents a model, which is employed in connexion with the sizing of fine and superfine yarns and it turns out a quality of sized warp which is not surpassed by any other type of modern sizing machine. There is no reason to doubt, as a result of the experience gained during the past year, that it is by far the most suitable type of machine for the Madras Presidency. Experiments in regard to the evolution of suitable sizing mixtures to correspond with the practice in vogue in different localities have also been carried on. There is, of course, a good deal of popular prejudice on the part of the weavers against the use of machine-sized warps, but this is gradually being overcome as the practicability of producing warps suitable in every way for the requirements of the handloom weaver has been conclusively demonstrated. It will not be possible to utilize long-machine sized warps unless the weavers are induced to adopt weaver's beams on their country beams and learn how to wind long warps on such beams. It is gratifying to be able to record, therefore, that while two years ago there was not a single beam in use, there are now several hundreds of looms fitted with weaver's beams. It is particularly noteworthy that these beams are being used to an increasing extent in the production of Madras handkerchiefs which are woven with 60s coloured yarns.

(c) *Weaving section.*—In this section have been fitted up a comprehensive range of modern handloom appliances including 24 looms of the pit and frame type which are fitted with various types of picking, beating and shedding motions as also multiple box slays, rack and pinion type slays, etc. A number of automatic handlooms of the Hattersley and Salvation Army types have also been installed. With the aid of these appliances, it is possible to demonstrate to interested parties the economic weaving of various descriptions of fabrics.

(d) *Manufacture and distribution of appliances.*—The manufacturing section of the Institute is now fully occupied with the construction and supply of improved types of handlooms and appliances which, after prolonged tests, have proved suitable for adoption. A number of these are supplied to weavers, handloom factories and educational institutions, not only in the Madras Presidency, but in other provinces also. The appliances manufactured and sold include Amalsad hand-sizing machines, vertical warping mills, jacquards, bobbins and pirn winders, doubling machines, centre shed dobbies, various types of pit and frame looms and other miscellaneous appliances and accessories. An Amalsad hand-sizing machine has been supplied to the Borstal Institute, Tanjore, and one to the Central Jail, Hyderabad; two of these machines have also been supplied to the Weaving Superintendents for purposes of demonstration.

(e) *Erection staff.*—A special staff of maistris has been trained, and is maintained, in the Institute for the purpose of setting up looms and appliances worked by both hand and power for private parties

and giving instruction in their manipulation. The maistri erectors are deputed from time to time to erect appliances in various municipal and district board schools as well as in jails and power factories. The working of the Amalsad hand-sizing machine has been demonstrated at a number of industrial exhibitions held at the various centres of the Presidency.

(f) *Yarn testing.*—The Institute contains a set of yarn testing appliances suitable for the conduct of research, and yarns are tested for lengths contained in the hanks and for the ascertainment of the true counts. The facilities offered by the Institute in this connexion are becoming widely known and appreciated.

(g) *Research and experiments.*—In the research section of the Institute, experiments are carried out from time to time on various problems connected with the textile industry which still await solution with a view to the introduction of new methods and progress continues to be made in various directions. A number of special types of simple ever dobbies, elaborate centre shed dobbies, and multiple box slays have been evolved. Improvements have been made to the existing type of warping mills. A hot air sectional iron-sizing machine for sizing 240 threads at a time (the price of which is Rs. 1,600) was also designed and patented. A satisfactory wooden cold air-sizing machine has been evolved and the warp delivery motion embodied in it has been so perfected that the handloom weaver finds no difficulty in preparing warps of any length and of any desired number of threads. The cost of this machine is Rs. 300 and it is primarily intended for such as cannot afford to buy the Amalsad patent hand sizing machine. Experiments made in the design and construction of the various types of automatic frame looms for weaving cotton goods and woollen cumblies have yielded very satisfactory results.

(h) *Museum.*—This section of the Institute serves as a permanent museum for the display of all types of hand-woven fabrics, improved looms and accessories. A very comprehensive display of looms and weaving appliances has been collected and, in the opinion of more than one of the visitors, the display of the appliances is one of the best of its kind in India.

(i) *Hosiery section.*—A course of training is provided in the Institute in the manufacture of socks and stockings from cotton, artificial silk and woollen yarns on hand-driven circular and flat bar machinery, and an attempt has been made to introduce hosiery as a home industry. A survey was conducted in the city of Madras with a view to ascertain the number and types of knitting machines at work, as a result of which it was found that there were about forty machines of various types and makes at work in Mylapore, Royapetta, Triplicane, Chintadripet, Periamet, Purasawakam, Parktown, Mannadi, and Washermanpet. Machines for instructional purposes are already installed in a number of institutions, such as the Sri Ramakrishna Mission Students' Home, the Women's Indian Home, Mylapore, and the Government Mental Hospital, Purasawakam. The Hosiery Instructor visited these institutions and gave instruction in

the working of the machines and, where necessary, carried on necessary adjustments and repairs. The Institute is equipped with a power-driven automatic hosiery machine.

(j) *Lace and embroidery section.*—Arrangements were made during the year to provide training for women in lace and embroidery work, and a number of samples of needle work have been prepared and exhibited in the Textile Institute. Arrangements have also been made to provide training in lace and embroidery in selected centres. In all, 16 women are at present undergoing instruction.

(k) *Dyeing and block printing section.*—A passing reference has been made elsewhere in this publication to the development of the Masulipatam palampore industry. The possibility of utilizing alizarine dye in the manufacture of Masulipatam palampores has been under examination in consultation with one of the chief dye importing firms in Madras, and demonstrations in the printing of the palampores both with indigenous and alizarine dyes, have been carried out at the Textile Institute and the results obtained from the latter are promising. At the demonstration of cotton printing with alizarine dye at the Institute, several of the leading block printers of Masulipatam attended, and they appreciated the comparatively low cost of dyeing with alizarine and the advantage of being able to produce by the employment of this dye a considerable range of fast colours in cloth.

Textile publications.—For detailed information in regard to handloom weaving, the reader is referred to the publication "Handloom Weaving in the Madras Presidency" by Mr. D. M. Amalsad, copies of which can be obtained on application to the Superintendent, Government Press, at a price of Rs. 1-8-0 each. The recent departmental publications issued by the Textile Expert include notes on "The Woollen Pile Carpet Industry in the Madras Presidency," "The Development of the Coir Industry on the East Coast," and "The Woollen Cumbly Industry of the Ceded Districts."

Power spinning and weaving.—In view of the fact that 75 per cent of the raw cotton produced in the Madras Presidency is exported, there is considerable scope for the establishment of additional power spinning and weaving mills, and the department is always ready to assist in this direction with technical advice. The Textile Expert has from time to time prepared plans, estimates and specifications, not only for cotton but for wool spinning and weaving mills and silk weaving factories also. A scheme and detailed estimates for a cotton spinning mill in the Central Jail, Coimbatore, have recently been drawn up as also estimates for a wool spinning plant in the Central Jail, Bellary. A recent enquirer was advised in regard to the opening of a projected silk waste spinning mill.

SERICULTURE.

The stimulation of sericulture represents an activity of Government which was embarked on in Madras only about six years ago. The

control of the operations was originally vested in the Director of Agriculture, but in October 1922 the entire operations, including the control of the industry and the supervision of the mulberry growing and silk farms, were transferred to the Department of Industries. The Agricultural Department acts in an advisory capacity and the services of its officers are available for consultation in connexion with the diseases affecting the crop. There is only one portion of the Presidency in which sericulture forms an important industry at present, and that is, the Kollegal taluk of the Coimbatore district, where there are 11,000 acres of land under mulberry cultivation and sericulture forms the main occupation in many villages. The magnitude of the industry may be gauged from the fact that in the Kollegal taluk 30 lakhs worth of raw silk are manufactured annually. Investigations which have been carried out with a view to determining in which localities in the Madras Presidency suitable climatic and other conditions requisite for sericultural operations obtained indicate that a number of tracts in various parts of the Presidency either fulfil the necessary climatic conditions or offer other facilities requisite for worm propagation in the cooler months and that the Mysore multivoltine worm, which is the species best adapted for the climatic conditions prevailing in the plains of this Presidency, can be successfully reared in many parts where the atmospheric temperature ranges from 75° F. to 80° F. with 50 to 70 per cent of humidity at least during some portions of the year, and that the bush mulberry, which forms its food, may be grown over a wide range of soil and in climates possessing an annual rainfall of 45 inches or otherwise possessing irrigation facilities. The hilly parts of the West Coast, the whole of the Nilgiris district and the Shevaroyes are considered to be very favourable for the growth of the tree mulberry and the rearing of the more valuable species of uni and bi-voltine silk worms. New tracts have been brought under mulberry cultivation in places such as Parlakimedi in the Ganjam, Narasaratnam in the Vizagapatnam, Peddapuram in the Gōdāvari, Nuzvid in the Kistna, Hudem and Kudligi in the Bellary, Penukonda in the Anantapur, Chirala in the Guntūr, Madanapalle, Punganur and Ponnatipalam in the Chittoor, Berikāi, Hosur and Denkanikota in the Salem, Palayamcottah in the Coimbatore and Azhikode, Cannanore and Tirurangadi in the Malabar district.

Scope for the development of the industry.—It will be evident that if the industry can be extended to so considerable an area of the Presidency, the value of the silk produced should extend to crores instead of to lakhs of rupees. Since the control of sericulture has been taken over by the Department of Industries, a scheme has been drawn up and approved by Government with a view to place the sericultural activities on a clearly defined basis with a definite programme. The proposals, as finally accepted by Government, may be summarized as follows:—

(i) that a peripatetic rearing party should be formed the function of which was to tour the villages of the Kollegal taluk, and

as will be explained later, to instruct the rearers how to carry out the testing of the moths and how best to handle the worms;

(ii) that the hill farm at Coonoor should be expanded into a central distribution station for eggs or seeds, cuttings or seedlings, and into a research institute for cross breeding of worms of different species and for the evolution of a race of caterpillar which will stand the strain of the plains, under the direct supervision of the Sericultural Assistant. For this purpose, sanction was accorded to the extension of the mulberry plantation at Coonoor by the addition of a further 10 acres of land and to the construction of a rearing house, as also for the provision of the necessary apparatus for conducting research work and microscopic tests. The staff sanctioned comprised a foreman and two rearers and two mulberry cultivators;

(iii) that for the development of the industry outside the Kollegal taluk, the Silk Superintendent should be deputed to the various selected localities to assist private persons in the choice of suitable land for the planting of mulberry, pruning weeding and eradicating pests which attack the plant. During the rearing season the duty of the Superintendent is to rear one or two crops with the help of the weaving maistris at the respective stations and to reel silk by the improved domestic plant. The administrative control of the sericultural operations in the districts was placed under the weaving superintendents, and it was arranged for the weaving superintendents and the weaving maistris to receive training in sericultural methods to the extent necessary to enable them to carry out the duties entrusted to them.

Coonoor silk-rearing station.—In most countries or areas in which sericultural operations are carried on, it is generally considered beneficial to use seeds which have been raised in the more elevated parts of the country. The Coonoor silk farm was established in the hills in order to enable the plains to be supplied with seed grown in the hills and Coonoor was selected for the purpose partly because worms reared at a high altitude are more vigorous than those bred in the plains, and partly because the seeds are more free from disease and the worms produced from them spin good cocoons and yield a greater remuneration to the rearers. It will be apparent, therefore, that the maintenance, expansion and careful supervision of the work done in this farm are essential to the progress of sericulture in the Presidency, particularly as the climate of Coonoor is best suited for conducting research work in cross breeding, while as the mulberry tree also grows well on the Nilgiri plateau, the more valuable species of uni-voltine and bi-voltine worms which live on the leaves of the tree mulberry can be reared there. Furthermore, land was available at Coonoor for the extension of the bush mulberry plantation at a very little cost to Government. The Coonoor seeds sold to Kollegal rearers yield superior and healthier cocoons from which the rearers secure a good crop. A block of 12 acres of land on the Tiger Hill, Coonoor, for the expansion of the mulberry cultivation, was finally chosen in consultation with the Forest Department and was acquired in June

1924. The land which was covered with tree growth had first to be cleared before it could be prepared for mulberry cultivation. Unfortunately, the mulberry planted on the land has since been attacked by a virulent powdery fungus disease and the Government Mycologist is now carrying out experiments with a view to its eradication. In the circumstances, the construction of a rearing house for the station has had to be deferred for the present. During the last calendar year 10,510 layings of seed were supplied from the Coonoor Farm to Kollegal and 1,810 layings to newly started sericultural areas in other districts of the Presidency. The Sericultural Assistant has recently devoted part of his attention to the conduct of research work with a view to the evolution of a suitable variety of multivoltine worm by cross breeding the European and Mysore races.

Peripatetic silk rearing party.—The proportion of the whole Kollegal requirements of seed, which can be supplied from the sericultural station at Coonoor, is at present relatively small, the total requirements amounting to about 75 lakhs of layings per annum. Even when the operations at Coonoor are fully developed, it is not anticipated that it will be possible to produce more than 3 lakhs of layings per annum for distribution to the rearers in Kollegal. Obviously, therefore, the bulk of the rearers will still have to depend upon Mysore for supplies, and hence efforts are being made by the department to educate the rearers to test their own moths. It is with this object that the use of the microscope is demonstrated by the peripatetic rearing party. The industry has been so long established in Kollegal that the ryots of that area possess already a knowledge of mulberry growing, of rearing of worms, and of the production of silk. The one difficulty with which they are faced is the prevalence of "Pebrine," a disease with which a large proportion of the moths is infected, and which results in the death of the silk worm at the very time when the rearing operations are almost over and the worm is ready to spin. The native rearer is still the cause of most of the disease, which results from ignorance, neglect, and unsuitable rearing houses, and as silk worm rearing is purely a cottage industry, the peripatetic rearing party is obviously the most effective agency for demonstrating the importance of pure air, space, cleanliness, regular feeding, etc., to the rearers in their own homes. It is hoped that the rearers will gradually learn to appreciate the advantages of being able to distinguish good from infected seeds.

District sericultural work.—A number of new tracts has been brought under mulberry cultivation during the last two years and in some cases the rearing of silk has also been undertaken. These operations are carried out under the control of the Weaving Superintendents, each of whom is assisted by a practical sericulturist. Although the area of many of the plots of land brought under mulberry cultivation is small, the total acreage brought under cultivation so far is fairly satisfactory. The department is proceeding slowly and cautiously in the matter and the owners of the land naturally desire to ascertain whether mulberry cultivation pays as

well as food crops before putting a large area under the former. These experiments have not involved the department in any expenditure, as the advice rendered has been confined to the provision of expert advice and practical guidance. The experience recently gained indicates that it is possible to grow mulberry on an extensive scale, but that the rearing of silk worms cannot be undertaken throughout the year. It has also been ascertained that the average outturn of leaf per acre per annum is approximately from 30 to 40 head-loads worth between Rs. 2 and Rs. 3 a load, and that the average annual expenditure on the cultivation of bush mulberry amounts to about Rs. 30 per acre. Thus the return per annum may be taken at approximately Rs. 60. It has also been estimated that an acre of land will provide sufficient leaves for 500 layings per annum, although in the absence of power filatures to absorb the dry cocoons it has not been possible to estimate the earnings of a rearer.

Silk filature.—The manufacture of silk goods is by no means an unimportant section of the handloom weaving industry, while silk enters into combination with cotton in a number of varieties of cloth. The investigation into the silk industry carried out by the late Mr. Maxwell Lefroy, in 1916, showed that the Kollegal variety of silk, although not equal to the Italian, French and Chinese silks, could yet be considerably improved, if greater attention was paid to the rearing of worms and modern processes of reeling and twisting were adopted. Improvement in quality is, therefore, the first essential and this can be effected only by substituting for the primitive appliances now in use modern improvements such as Italian domestic filature reeling machines. The breeding of silk worms and silk reeling, as practised at present, are cottage industries, but the former industry is more correctly described by that name. The two industries even now are distinct in Kollegal, where alone sericulture is established as an industry. Silk reeling is not practised as a rule by the same persons who grow silk cocoons. The silk reeler buys his cocoons to reel and to some extent, at least, the industry is financed by petty capitalists and the cottage worker works for hire. The indigenous methods of reeling and preparing silk leave much to be desired; the silk produced is suitable only for internal consumption and has no value in the world's markets. It is obviously undesirable, therefore, to introduce widely the crude type of Kollegal reeling machine and if any improvement or progress in the method of preparing silk is to be made, and the Indian reeler is to be shown how to produce a higher quality of silk, which will command more than the local limited market and realize a higher price, it is necessary to set up silk filatures for reeling silk on modern French or Italian machinery. It is proposed by the department to introduce sericulture in extensive areas throughout the Presidency wherever it is found that the mulberry bush, and the silkworm that feeds on it, will thrive. If these efforts are successful, there will be a greater volume of silk to market, and the steps taken by the department to popularize sericulture carry with them the necessity to teach modern methods of

reeling, throwing and preparing silk, as otherwise the local markets may be flooded by inferior silk. It is an established fact that the reeling of silk is essentially a power process. The proper line of development, therefore, is to base compact silk filatures of a modern type on compact cocoon producing areas, which will enable raw silk of a better quality and commanding a better price to be produced. Similarly an improvement of the quality of Indian silk cloth involves the introduction of modern methods of throwing silk by which alone a better quality of yarn can be produced. Modern methods of preparing improved silk yarn for the loom are equally necessary and there seems no possibility of development, or of South Indian silk finding its way into the world's markets as raw silk yarn and cloth, so long as the present primitive reeling and throwing persist. Accordingly two domestic filature reeling machines of the Italian type have been obtained for purposes of demonstration and the training of operatives in the cocoon producing areas, as well as one steam two basin filature for demonstration at the Textile Institute so as to enable instruction to be given in modern methods of reeling, throwing and preparation. Now that the latter plant has been installed at the Textile Institute, it is possible to show persons interested what processes are involved in the manufacture of high class silk and to train operatives in such processes. It is hoped that on the completion of their training the students will be able to interest capital in the industry and that, in this way, a number of steam filatures will be set up in suitable areas. If, however, this hope is not realized, it will be necessary for the department to consider the question of pioneering the industry itself.

CHAPTER VI.

THE INDUSTRIAL ENGINEERING BRANCH OF THE
DEPARTMENT OF INDUSTRIES.

Historical.—In 1903, Mr. (now Sir) Alfred Chatterton proposed that a number of pumping installations should be set up with the object of demonstrating the advantages of modern machinery in agricultural operations. Some work had already been done in this direction, and Mr. Chatterton himself, and the Public Works Department had both experimented with pumping by machinery. But these experiments had furnished evidence merely as to the value of lift irrigation on a comparatively large scale, and much scepticism still prevailed as to whether comparatively small areas of land could be profitably irrigated by small engines and pumps. One small installation had already been put up at Melrosapuram in the Chingleput district, and in 1904 permission was obtained to open four other pumping stations where experiments were begun with engines varying in horse power from $3\frac{1}{2}$ to 6 and with 3 and 4 inch pumps. From the first, the progress made was encouraging, and by March 1905 so many applications for assistance had been received that Government agreed to advances being made under the Land Improvements Loans Act for the purchase of oil-engines and pumps, and provided Mr. Chatterton with the nucleus of a staff to assist those wishing to put up installations with advice and supervision. A class for training oil-engine drivers was also opened at the School of Arts. It soon became evident, however, that very few of the wells in the Presidency could furnish enough water to justify the putting up of an engine and pump, and that in order to bring pumping installations into more extended use, it would be necessary to deepen the existing wells or to sink new ones so as to tap the subterranean reservoirs which were suspected to exist at no very great depth in certain districts of the Presidency. These results had been anticipated from the very beginning, and in 1904, a set of boring tools had been purchased with which experimental borings had been put down in various places. This led to the discovery of sub-artesian water both in the Chingleput and South Arcot districts and it became evident that it was desirable greatly to extend the scale of operations. Accordingly in 1906, the Boring branch of the department was inaugurated by the deputation of a special party to the Chingleput district, partly to develop well irrigation by the expeditious disposal of applications for loans, and partly to prevent waste of money by putting down trial borings before wells were sunk. Later on, the operations of the party were extended to the improvement of existing wells and from this time forward progress was rapid until the outbreak of the war operated as a check. A number of oil-engines were also installed under the advice, and

with the aid, of the department in rice mills and other small industrial concerns. The oil-engines first used by the department were worked with kerosene oil, but subsequent experience indicated that the Hornsby-Ackroyd oil-engine was equally well adapted for use with either liquid fuel or kerosene oil, and on this fact being made known numerous users of Hornsby-Ackroyd oil-engines in the Madras Presidency naturally at once displaced kerosene oil by liquid fuel which could then be obtained at two annas a gallon in Madras. The great reduction in the cost of generating power consequent upon this discovery gave a considerable impetus to the development of small power installations. These were principally applied to the preparation of agricultural produce for the market and in the course of a few days numerous rice hullers, oil mills, and other forms of industrial machinery were installed. A very large number of rice hullers were put down in the Tanjore district. In the year 1910, there were only some four or five mills worked by power, and nearly the whole of the paddy of the district was husked by hand. In that year, however, the Department of Industries installed a small rice milling plant driven by an oil-engine at Tirukkattupalli and the success of that installation induced other people to start similar mills in various parts of the Delta. In the following year, 19 similar installations were fitted up and the demand for them continued year by year until in 1918 there were 215 mills in the Tanjore district representing an aggregate horse power of 5,360. The establishment of these small mills was thought at the time to be a good way to begin the introduction of power machinery and it was hoped that these small hulling plants would pave the way for the establishment of large scale central factories. Unfortunately, however, when the people saw a successful new industry in course of establishment, they rushed into it in great numbers with the result that eventually in many centres the business was overdone and more plants were set up than could be kept profitably employed.

Transfer of the operations to the Department of Agriculture.—In March 1916, Government decided to add an Agricultural Engineer to the staff of the Agricultural Department and as a corollary to the creation of this appointment, they resolved to transfer to that department the pumping and boring operations which until then had been carried on under the control of the Director of Industries. The transfer was effected on the 1st August 1916, the advisory and inspection work in connection with industrial plants such as rice hullers, cotton gins, and groundnut decorticators remaining with the Director of Industries. This arrangement was adversely criticised by the Indian Industrial Commission in paragraph 307 of their Report. The Commission considered that where a well-equipped Industrial Department was in existence it was a waste of control to have one department installing power plant for agricultural purposes and another for small industries side by side in the same district, that such work was of a totally different character from that which properly belonged to the Department of Agriculture, and that

valuable adaptations and improvements were not likely to be forthcoming except from a technical department which commands the services of industrial specialists. The Government in 1920 accepted the Commission's recommendations and directed that the Pumping and Boring department with the workshop attached to it should be re-transferred from the Department of Agriculture to the Department of Industries. This transfer was given effect to on the 9th September 1920. Up to the 31st March 1925, 7,493 borings had been put down, the percentage of success being about 60 and approximately 560 pumping and 348 industrial plants, had been set up while a sum of Rs. 5,68,900 had been advanced under the provisions of the Land Improvements Loans Act to 167 persons for the purchase of oil-engines and pumps. The chief difficulties in the way of development since the war have been (a) the high price of machinery (which however has recently come down considerably) and (b) the very high cost of liquid fuel.

STAFF AND ORGANIZATION.

The staff of the Engineering branch of the department now consists of an Industrial Engineer, who is stationed at Madras, 4 Assistant Industrial Engineers with headquarters at Madras, Tanjore, Coimbatore, and Bezwada, respectively, 18 supervisors, 40 mechanics and 80 boring maistries and drivers and 16 apprentice boring maistries. In Appendix A will be found the territorial jurisdiction of the executive staff as it stood on the 31st March 1925.

The work of the Engineering branch, as at present organized, may be classified as follows:—

- (a) Maintenance of power installations and industrial machinery already at work,
- (b) Investigation of new engineering projects,
- (c) Erection of new installations,
- (d) Collection of data regarding the performance of engines and industrial machinery under working conditions,
- (e) Examination and testing of industrial machinery to determine whether it is suitable or not for the purposes intended.

The Industrial Engineer acts as professional adviser on engineering questions to officers in charge of the several branches of the department, as well as to the various departmental institutions, and to such other Government departments as may require advice or assistance.

Information and advice.—General information and advice on engineering questions, as is now well known, is given free, provided no local inspection is involved and a considerable number of such inquiries are dealt with during the course of a year. In cases where a local inspection is necessary, a fee of Rs. 15 is payable, in return for which advice is given in regard to the selection of a suitable site for a mill, factory or installation and as to the most suitable type of machinery for the purpose. Advice is also given to Government

departments and co-operative societies, from time to time, on a variety of engineering matters. The following table shows the number of applications, for the preliminary investigation of schemes under the system, received and disposed of during the last official year:—

Divisions.								Received during the year.	Disposed of during the year.
Tanjore	...	...	...	...	...	...	...	52	54
Coimbatore	...	...	...	...	...	...	...	53	43
Bezwada	...	...	...	...	...	...	...	38	46
Madras	...	...	...	...	...	...	...	14	16
Total								157	159

SYSTEM OF COMPOUNDING FEES.

In the circumstances of Southern India, it was necessary to provide for the supervision and periodical inspection of the engines, pumps and industrial machinery installed. Under this system, for a fixed fee of Rs. 15 per annum, owners of private installations are entitled to have their plants inspected and overhauled three times a year, and also at other times if special requisitions are received for which, however, extra fees are charged. Furthermore, compounded installation owners are entitled to utilise the departmental workshops for the carrying out of repairs and renewals of component parts of their engines, pumps, or industrial machinery, and the facilities offered by the workshops for the quick, economic and efficient conduct of repairs are greatly appreciated by the ryots and small industrialists, and in fact have helped not a little to popularise, and give the public confidence in the work of the engineering branch of the department. In addition to assisting owners to maintain their plant in good conditions, an essential service in a country where there is such a dearth of skilled artisans, this system has the further advantage of enabling the department to suggest improvements and to encourage the industrialist or the ryot to extend and develop his operations. That the service continues to be appreciated is evident from the following statement which shows the number of plants under maintenance in the three divisions during the year 1924-25:—

Division.	Industrial plants.	Pumping plants.	Combined plants.	Total.
Tanjore	123	36	11	170
Coimbatore	39	35	13	87
Bezwada	42	22	2	63
Madras	...	...	...	48
Total	...	...	...	371

ERECTION OF MACHINERY AND PLANT.

The erection of machinery and plant is undertaken for a nominal fee of 2½ per cent on the capital cost of the machinery installed. This service, while enabling the ryot or small factory owner, to have his engine and pump or industrial machinery erected at the minimum cost, also ensures the engine being set up under proper technical supervision. The following table shows the number of plants erected in the various divisions during the last official year:—

Divisions.	Received during the year.	Disposed of during the year.	Remarks.
Tanjore	25	20 (a)	(a) Eleven industrial, eight pumping and one combined. (b) Four industrial, nineteen pumping and one combined. (c) Eight pumping and three industrial.
Coimbatore	2	24 (b)	
Bezwada	13	11 (c)	
Madras	5	5	
Total	63	60	

LOANS UNDER THE AGRICULTURISTS' LOANS ACT.

As already stated, loans under the Agriculturists' Loans Act are granted by Government on favourable conditions to ryots for the installation of pumping machinery in cases where there is a reasonable prospect that by means of such loans the lands of the ryot will be improved and his income increased. It is frequently found that an applicant proposes to put a power pump in a well which has not enough water to keep a pump going for more than an hour or so. In such cases, the applicant is advised to try to increase the water-supply by deepening his well, and if it is found that an adequate supply cannot be provided, a loan has to be refused in the ryot's own interests, for obviously it is uneconomical to instal an expensive power pump which can work only an hour or so a day. Eighteen loans were sanctioned during the year ended 31st March 1925 and an aggregate amount of Rs. 88,500 was sanctioned for disbursement to the applicants. The amount actually disbursed during the year was Rs. 97,300 of which loans sanctioned during the year accounted for Rs. 57,500 and loans sanctioned but not disbursed during the previous year for the balance. Of the 18 loans sanctioned last year eight were in the Tanjore division, six in the Coimbatore division, three in the Bezwada division, and one in the Madras subdivision.

The amounts disbursed in the preceding four years were:—

	RS.		
1920-21	12,000	disbursed to	2 applicants.
1921-22	33,000	do.	5 "
1922-23	46,500	do.	9 "
1923-24	74,000	do.	11 "

It will thus be seen that there is a progressive increase in the amounts sanctioned, and this is attributable to the speeding up of the enquiries preliminary to the grant or refusal of loan. The department, as already shown, grants loans only on satisfactory proof that the supply of water is adequate, that the water can be used profitably for irrigation and that the borrower can give adequate security while it has also to be ascertained that the Irrigation department has no objection to urge. Investigation on these lines necessarily takes time, but under the existing arrangements avoidable delays are rare and the period of the enquiry has been shortened from years in some cases to a few months.

BORING.

Water in greater or less quantity is an absolute necessity under any agricultural conditions. Water may be secured from rivers or canals or by storage in tanks and much of it actually is obtained in this way. In many cases, however, direct supplies of this kind are not available, and then the ryot has to think of some other way of securing water. The obvious thing to do is to sink a well. A large number of wells have already been sunk in this Presidency, but the number is still inadequate so that there continues to be a demand for more. When a ryot sinks a well he does so more or less in the dark. He cannot tell whether he is going to strike water until the well is actually completed. If it remains dry, he knows that his well is a failure and that his expenditure of, perhaps, several hundred rupees has been fruitless. Well sinking, therefore, is often a speculation and this being so it is obviously desirable to spend as little money as possible until it is known exactly how matters stand. It is here that the boring section of the department is of assistance. If a ryot wishes to explore for water, he can do so more expeditiously and cheaply by employing a boring set than by sinking a well. If the boring fails to tap water, another trial may be made somewhere else; if water is discovered, a well can then subsequently be put down in the ordinary way. So far boring has been considered merely as a substitute for well sinking for the purpose of finding water. The cost of well sinking is so great that ryots rarely go beyond 30 feet, but it has been found that sweet water is often met with very much further down and the use of boring tools enables us to explore for these deeper supplies also. The department having put down several thousand borings all over the Presidency are often able to give ryots some sort of idea as to whether they are likely to find water or not.

The drills employed by this department are of two kinds: hand and power. A hand drill is used where borings are shallow and the soil is soft. For boring in hard or rocky strata, or in cases where it is necessary to bore to a considerable depth, a power drill is necessary. The department in recent years has maintained in operation five power drills and fifty hand drills, but these proved quite insufficient to meet the demands of the public and other departments of Government. Provision was, therefore, made for the purchase of the

additional drills required to meet the increasing demands for assistance received from ryots. It was considered advisable, however, that before entering into contracts for the supply of these, the subject of modern boring practice in Great Britain and the United States should be first studied by the Industrial Engineer with a view to obtain the types of drills which are best suited to the conditions in the Madras Presidency and to carry out an investigation into boring conditions and methods of operation. Drills for use in the Madras Presidency must be capable of being managed by the class of labour which is available to work them, while the relative spheres of usefulness of the hand and power drill also required investigation. There were many other problems in connexion with boring operations in respect of which the knowledge of the department was admittedly imperfect, and which required investigation in the light of the latest practice. For instance, much more information than is available was required in regard to the efficient operation of drills under the varying conditions of strata which are ordinarily met with. The question of keeping the borehole clear during the drilling operation required study, while another point for investigation was that of the size of the borehole. In short, it was considered vitally necessary that the department should bring its knowledge of modern boring practice up to date, and that before entering into contracts for the supply of the requisite power drills the Industrial Engineer should be deputed to visit the United States where both oil and water drilling are highly developed, to study the latest American practice. The great importance of developing boring operations in the interests of the agricultural and economic development of the Presidency appeared to fully warrant the deputation of an officer for the purpose. In June 1924, Government sanctioned Mr. Pinto's deputation to Great Britain and America and he returned therefrom in April 1925. Arrangements have since been made to obtain from America three power drills in accordance with the Industrial Engineer's recommendation and these have been assembled in the departmental workshops and are now undergoing preliminary trials. The Industrial Engineer, on his return from deputation, submitted a comprehensive report on the subject of modern drilling practice, which contains a great deal of valuable and interesting information on a subject of which up to then there has been little or nothing on record. There is now something definite for the department to work upon and it is anticipated that a gradual and progressive development in drilling operations in this Presidency will result from Mr. Pinto's investigation. It is hoped to frame proposals from time to time for the development and expansion of the departmental boring operations in the light of the information acquired by Mr. Pinto during his deputation and the experience which will be gained of the new plant under working conditions. The total depth bored during the last official year was 28,841 feet as against 24,180 feet in the previous year, the average depth of a boring working out at about 42 feet. The following table exhibits the territorial

distribution of applications received for hand and power borings, the number of feet bored in each of the divisions and other relevant particulars:—

Division.	Applications pending on 31st March 1924.	Applications registered during the year.	Disposed of during the year.	Pending on 1st April 1925.	Total number of feet bored.	Number of borings put down.	Number of successful borings.	Number of unsuccessful borings.
Tanjore	31	76	81	29	6,493	197	146	51
Coimbatore	58	51	62	50	3,618	124	61	63
Bezwada	84	163	180	67	13,401	240	151	89
Madras	8	61	64	5	5,328	133	76	57
Total	184	354	387	151	28,841	694	434	260

The following condensed account of some of the more interesting features of the boring work recently conducted in the several divisions may be of interest as illustrating the nature of the work carried out and the services rendered by the boring staff of the department.

Bezwada division.—In the Bezwada division the greatest depth recently bored with a hand boring set was 241 feet which was conducted at Tadepalligudem in Kistna district for the purpose of augmenting the water-supply to a rice mill, a supply at the rate of 25 gallons per minute being provided. Three other borings were also conducted up to depths of 200 feet. An interesting boring, which attracted considerable notice in the locality, was made in a village near Bezwada, a depth of 60 feet had been bored in a well of 40 feet depth when an inflammable gas and crystal-like white pebbles arose from the borehole. The people in the locality believed it to be coal gas and that there was a deposit of coal underneath. Samples of the stones brought out of the borehole were sent to the Director, Geological Survey, for examination, and his report was to the effect that the material was white quartz and possessed no practical value. In another case, there was no water in a well of 28 feet depth, but on a boring being put down to a depth of 32 feet, 10 feet of water accumulated in the well which enabled the owner to irrigate several acres of dry crops. In a boring carried to a depth of 67 feet in an existing well 18 feet deep in a village in Guntur taluk, there was a 9 feet rise of water in the well, and this enabled the owner to employ two mhots, whereas before the boring the water was unusable on account of its brackish properties. In another village, an attempt was made to tap artesian boring, and after boring

for about 120 feet, water rose to about three inches above ground level. Unfortunately, however, the water was saline and hence unsuitable for the irrigation of paddy for which the supply was required.

Tanjore division.—The greatest depth recently bored in this division was 242 feet for a party in Pattukkottai in the Tanjore district. The boring was successful. Nine other deep borings ranging from 150 feet to 218 feet were also conducted, of which two were successful and two were for the purpose of testing the subterranean strata.

Coimbatore division.—The greatest depth recently bored in this division by a power drill was 231 feet 6 inches for a party in Palayakottai and was quite successful. In a number of cases, the supply has been enhanced to such an extent as to warrant the installation of a power pump.

PUMPING SETS.

Well irrigation in the ordinary way is expensive, but about 25 years ago, the department proved that for lifting water it was often both possible and advantageous to substitute mechanical for animal power. It is often a very paying proposition to put down an engine and pump, but in every case, a very careful preliminary investigation is requisite and this the department is always pleased to conduct. The department maintains a number of pumping plants comprising oil-engines and pumps. These are of two kinds, one of which is used for pumping water for irrigation purpose, and the other for well sinking. The former, which comprise crude oil-engines and pumps, are maintained for the purpose of (i) demonstrating to the ryots the advantages of lifting water by mechanical power and (ii) watering crops to save them from withering pending the repair of an existing installation. The second type of plant, which consists of kerosene oil-engines and pumps, is utilized in connexion with the construction and sinking of wells. For several years it has not been found possible to comply with more than a small proportion of the applications received for assistance, and Government have recently sanctioned the purchase of twelve new pumping sets at a cost not exceeding Rs. 42,000. The following table shows the number of applications for pumping sets registered and disposed of during the last official year:—

Division.	Number of applications registered during the year.	Number disposed of during the year.
Tanjore	16	15
Coimbatore	13	14
Bezwada	12	15
Madras	19	19
Total	60	63

Torpedoing.—The torpedoing sets possessed by the department are used for blasting boreholes in rocks in the hope of exposing the water sources in the fissures caused by the explosion. Torpedoing is tried as a last resort when a bore through a rock fails to find water and judging by results is of somewhat speculative value. The following statement shows the number of applications for torpedoing registered and disposed of during the last official year:—

Division.	Registered during the year.	Disposed of during the year.
Tanjore	8	10
Coimbatore	8	8
Bezwada	7	7
Madras	1	1
Total	24	26

MAPPING OF UNDERGROUND WATER-SUPPLIES.

Two surveyors are permanently employed by the department on the work of connecting the levels of boreholes put down by the department with mean sea level for the purpose of collecting data with the view eventually of preparing a map of the underground water currents of the Madras Presidency. The work of mapping out the underground water currents of the Madras Presidency, is one of considerable magnitude as in order for this to be done with any degree of certainty, it is necessary to have at least one borehole for every square mile of area. Work is now in progress in the Nellore district and last year 188½ miles of levels were taken and 131 borings were connected with mean sea level. Operations are also being carried on in the Kistna district. Another surveyor is now at work in the Coimbatore subdivision.

RULES FOR THE LEVY OF FEES.

The main object of the pumping and boring operations conducted by the department is to increase the agricultural wealth of the country and as such the fees charged are only nominal. Copies of the rules for the levy of fees for work done in connexion with industrial undertakings, including the pumping and boring operations, can be obtained from the Director of Industries, Post Box No. 432, Madras, from the Industrial Engineer, or from the local Assistant Industrial Engineers or Supervisors of Industries. The cost of the district staff, of their travelling, and of the transport of plant renders it impossible, without restricting the value of the work that is now being carried on, to make the Engineering branch self-supporting, but with the increasing popularity of the services rendered, and the considerable reductions effected during the last three years in the departmental workshops and in other directions, the net cost

of this branch of the department has been materially reduced and there can be no doubt that the public is getting good value for the expenditure incurred.

INDUSTRIAL WORKSHOPS.

In the departmental workshops at Washermanpet, the machinery employed by the Pumping and Boring and other branches of the department is maintained and repaired. A considerable and increasing volume of repair work is also executed for private individuals who have compounded installations and for other Government and quasi-Government departments. Experimental work is also conducted and tests are carried out of new boring tools and departmental plant, both of the Engineering and other branches of the department, manufactured or repaired in the workshops. New Industrial machinery is also frequently placed at the disposal of the department by private firms and individuals for testing and examination with a view to test its suitability for the purpose intended. Further, the workshops provide the necessary training facilities in the assembling and operation of drills, and departmental machinery, as well as of improved tools and appliances designed by the department for such of the subordinate engineering staff of the department as are newly recruited or require special training in new plant or machinery of which they have had no previous knowledge or experience. The workshops have been organized with reference to the particular needs of the department and are capable of turning out the work required of it both economically and rapidly. The latter is obviously an important consideration since it is necessary for the departmental repairs to be carried out expeditiously as if delay occurred in the repair or replacement of an important part of a pumping or drilling plant, not only would the department lose the price of hire of the machinery but the ryot would often lose a considerable part of his crop. The workshops have in recent years invariably been run at a profit. The value of the work turned out by the workshops last year amounted to Rs. 89,882 and the operations yielded a profit of Rs. 4,237-8-4.

The following particulars of some recent work executed by the workshops may be of interest. All the hand boring sets maintained by the department were provided by the workshops with collapsible iron derrick posts, while, as an experimental measure, a number of boring sets were provided with a complete set of tempering apparatus which enables a boring maistry to forge and temper his tools on the spot correctly to gauge and so renders him independent of the village blacksmith, who is not always found within reasonable distance of the workspot, and in any case usually demands exorbitant rates. A borehole test pump designed to suit the requirements of the department has been constructed in the workshops and proved very successful in operation. One of the functions of the Engineering branch, as already explained, is to examine and test industrial and pumping

machinery with a view to determine whether it is suitable or not for the purpose intended. At the request of Messrs. McDowell & Co., the local agents for Jastram pumping sets, an official trial was made with a view to determine the suitability of the plant for ryots possessing small holdings. The trials conducted included tests of the petrol and kerosene oil consumption, load under varying heads, and the mechanical efficiency of the combination. This plant has the advantage of very great portability which enables it to be moved readily from one well to another. Particulars of the trials conducted by the department with this plant will be furnished to enquirers on request. A wind mill of Messrs. Geo. Brunton & Sons' manufacture was also placed at the disposal of the department for an official efficiency test and experiments therein are still in progress. A power driven deep well pump, possessing some special features, imported by a local firm has also undergone trials and the results obtained were so promising that a pump of this type has since been purchased for work in the districts.

BUILDING WORK AND CONSTRUCTION.

With the appointment of a separate Industrial Engineer in the year 1920, it was decided that part of the departmental building programme should be carried out from time to time under the agency of that officer and a commencement was made on these lines with the construction of the Fruit Preserving Institute, Coonoor. The construction of the new Soap Institute at Calicut and the Industrial Workshops at Washermanpet were also carried out departmentally by the Industrial Engineer. Another item of constructional work for which the Industrial Engineer has been responsible was the adaptation of the old Pencil Factory building at Washermanpet to accommodate the dresser sizing plant.

CHAPTER VII.

INDUSTRIAL EDUCATION.

The Industrial Conference held at Ootacamund in 1908 which reviewed the question of improving and extending technical and industrial education, among other things, recommended that the control both of industrial instruction and technical education should rest with the Department of Industries, and that a whole-time Inspector of Industrial Schools should be appointed. Government accepted this recommendation in respect of industrial instruction, but decided that technical education should remain under the control of the Director of Public Instruction. The control of industrial education was finally vested in the Department of Industries in 1914, and, in 1916, Mr. Pyfe was appointed part-time Inspector of Industrial Schools, without prejudice to his duties as Instructor in Manual Training in the Department of Public Instruction. The services of Mr. Pyfe were permanently transferred to the Department of Industries in 1919 for whole time employment as Inspector of Industrial Schools.

AIDED INDUSTRIAL INSTITUTIONS.

In the Madras Presidency, Government institutions for industrial education are few and the development of industrial education is provided for largely by aided institutions, the Institute at Madura, the Madras Trades School, the Leather Trades Institute, the Textile Institute and the School of Arts and Crafts being the only examples of Government Institutions engaged in industrial education. There are now 52 recognized industrial schools of which all except two are assisted with grants-in-aid by the Department of Industries. These institutions include the Chengalvaroya Naicker's Technical Institute, the Madras Anjuman Industrial School, the Orr Assisted Industries School, the Church of Scotland Mission School, Kilpauk, the Sri Ram Motor School, the Women's Home of Service, Mylapore, the Ramakrishna Students' Home Industrial School, Mylapore, and 45 institutions situated in the mufassal. These assisted schools provide a reasonably efficient form of trade instruction at an extremely low cost to Government and they fill a real need in accomplishing work which could not be accomplished by purely Government institutions except at a very considerable cost to the State. Larger grants are, however, required if they are to maintain their efficiency as well as substantial building and equipment grants, and will, it is anticipated, be forthcoming now that financial conditions have improved. It is unfortunate that these aided schools are not distributed so evenly as might be desired and though the Tamil districts have the Madura Industrial

Institute, as well as a number of excellent aided schools, other parts of the Presidency are less favourably situated. Eventually, therefore, it will probably be necessary to establish Government institutions in areas not otherwise satisfactorily provided for. An idea appears to be generally current that as a large proportion of the aided industrial schools are maintained by Christian Missions working in the country, these schools are not open to other than Christians, belonging to the missions which maintain them. This is by no means the case. All, or practically all of the mission industrial schools are ready to admit Non-Christians of whatever persuasion, and in fact in many of them Hindus of all kinds and Muhammadans are freely accepted, as will be seen from the fact that at the close of the last financial year there were 2,584 pupils under training, of whom 1,616 were Indian Christians, 456 Non-Brahman Hindus, 178 Muhammadans, 175 from the depressed classes, 82 Brahmans, 65 European and Anglo-Indians and 12 others. An amount of Rs. 68,900 was distributed to these institutions in the form of maintenance grants-in-aid representing an average of slightly over Rs. 26-8-0 per pupil per annum. A further amount of Rs. 14,873 was distributed as half grants for the purchase of equipment, while a total of Rs. 21,395 was also expended in building grants. Five fresh recognitions were granted during the year and a number of other applications were held over for consideration when funds were available. Many of the schools continue to suffer from scarcity of funds, and in particular the finances of such of the institutions as belong to foreign missions have been hard hit by the heavy depreciation in the Continental Exchanges which in a number of cases has resulted in a stoppage of contributions from abroad.

The subjects taught in the boys' schools include carpentry, cabinet making, fitting, turning, moulding, blacksmithy, weaving, oil engine and motor car driving, printing and allied trades, agriculture, scientific instrument making and shoe making, and in the girls' schools, mat and basket making, weaving, lace work, embroidery and needle work. Sixty scholarships tenable in aided industrial schools, or classes or workshops and mills, where provision exists for the instruction of apprentices and learners in subjects likely to improve their value as workers are annually awarded by the Director of Industries. These scholarships are of the value of Rs. 1-8-0 per mensem rising to Rs. 7-8-0 per mensem and are tenable for periods not exceeding five years. They are found to be of considerable assistance in enabling needy students to remain long enough in training to acquire something more than the rudiments of a trade. In accordance with the provisions governing the tenure of these scholarships, a bonus of Rs. 35 each was granted during the last official year to 23 pupils who had been nominated for scholarships tenable for a period of five years from 1st July 1920, and who had satisfactorily completed their course of study.

A few notes are appended on certain of the schools assisted with grants-in-aid by the Department of Industries.

ORR WORKS SCHOOL.

One of the most interesting of the aided institutions is the works school established by Messrs. P. Orr & Sons, Scientific Instrument Makers, Madras, with a view to improve the education of the young boys employed by them. The practical classes are taught by the European Works Manager and his Assistant and the theoretical classes by a trained Indian teacher. The Government have supported the experiment by grants-in-aid and the development of the school is proceeding satisfactorily. Such apprenticeships in commercial workshops supplemented by class instruction should serve to turn out a number of artisans of the type so urgently needed all over the Presidency, and it is hoped that classes on similar lines will be established by other manufacturing firms for the benefit of the young artisans whom they employ.

Sri Ram Motor School, Madras.—This institution is not at present aided financially. It is recognized by this department as a school competent to provide instruction in motor driving and mechanism, in which direction it is filling a real need and receiving the support of the motor car trade in Madras. The school is undoubtedly of considerable value in the development of the motor industry, and if still further developed should go a long way to provide the class of driver mechanic likely to be required in increased number during the next few years consequent on the replacement by motor transport of the primitive methods which are at present in force.

The Wesleyan Mission Industrial School, Ikkadu.—This school was only recognized about two years ago, although it had been in existence for several years as a centre for a well organized lace industry in the district. The institution has recently undergone considerable development. New centres have been started in surrounding villages and teachers trained at Ikkadu have been deputed to teach lace work in the surrounding villages. The lace teachers are generally welcomed in the homes of the local villagers and many caste women are now making lace for sale through this institution. A number of other institutions have drawn on this school for the supply of teachers to initiate similar work in other localities. A weaving section has also been added to the school.

St. Joseph's Industrial School, Coimbatore.—This is now a large and flourishing institution which continues to develop and to provide a very efficient form of practical training much in demand in the locality. The school is perhaps fortunate in being advantageously situated at Coimbatore where orders are readily forthcoming from Government departments and the general public, although most of the orders are secured in competition with other schools and private merchants.

The Rajah's Industrial School, Parlakimedi.—This school is particularly noteworthy by reason of the fact that it is the only one of its kind maintained by a Zamindar in this Presidency and as such

is worthy of encouragement as an inducement to other landowners to establish similar schools. It provides instruction in weaving as well as in carpentry.

The Hindu Girls' Lace School, Kudangulam.—This institution, although very small, is well managed by the wife of the local postmaster who has been able to get into touch with merchants in England able and willing to absorb the comparatively small output of the school. As an example to other public spirited Indian gentlemen in out of the way localities, this small school is deserving of every encouragement. In addition to lace making, girls receive instruction in reading, writing and arithmetic in their vernaculars.

The Women's Home of Service, Mylapore.—The lace making and embroidery classes attached to this Home were recognized last year and already show signs of considerable improvement. It is hoped that this school will develop and fill a want in that locality where many women feel the need of a subsidiary industry by which the domestic budget may be augmented in times of scarcity.

Considerations of space preclude a reference to the many other deserving institutions in receipt of aid by the department, but information in regard to any of them will be gladly furnished on request. A compendium containing complete information in regard to the various industrial institutions under the Department of Industries has been published and copies can be obtained either from the Superintendent, Government Press, or the Director of Industries, at a cost of Re. 1.

MADURA INDUSTRIAL INSTITUTE.

Among the industrial schools transferred to the control of the Department of Industries in 1909, in pursuance of the recommendation of the Ootacamund Industrial Conference, were the two technical institutes maintained by the District Boards of Tinnevely and Madura. Subsequently, both institutions were taken over by Government, and while the Tinnevely Institute was abolished, it was decided to re-build and remodel the Madura one on a more ambitious scale. The construction of the building has involved an outlay of about Rs. 3 lakhs. The institute was re-organized in the year 1920, and now provides a five years' apprenticeship in (a) Metal Working and (b) Wood Working. In addition to the five years' full time course, short courses are provided in motor car driving and mechanism, oil and gas engine driving and care of industrial machinery. The wood working course includes carpentry and cabinet making and a certain amount of pattern making. The metal working course includes foundry work, blacksmith's work, fitting, machine shop practice, and the management and care of steam boilers, steam, gas and oil engines. In both the courses, instruction in freehand and mechanical drawing is imparted. The apprentices who undergo the five years' course join the institute at the age of 13. They receive stipends ranging from Re. 1 a month in their probationary period to annas twelve a day in

their fifth year, and on completion of their course of training, the apprentices receive a bonus. There are now on the rolls 120 apprentices. A hostel is also maintained with a warden in charge. The courses in motor car mechanism and engine driving extend from six to twelve months; and in their case, there is no age limit and no stipends are paid. Students desirous of taking up these courses are required to pay fees at the rate of Rs. 12 per mensem paid three months in advance. The scheme of organization has on the whole worked well and there can be no doubt as to the practical and efficient nature of the instruction given. Now that the first batch of students have completed their five years' apprenticeship, the position will be reviewed by Government, and if necessary the scheme of reorganization modified in the light of the experience gained.

There are no properly organized commercial workshops at Madura, and as such the only way in which facilities can be provided for the training of artisans in the south of the Presidency is by the continuance of the Madura Institute and the workshop attached to it. The institute is serving a very useful purpose in turning out skilled artisans of a type for which there is likely to be an increasing demand and moreover it also meets a real need in the southern districts where there is no other organized engineering workshop that can supply the requirements both of Government departments and private individuals. A considerable reduction in the cost of running the institute has been effected in recent years, appreciable economies having been effected under materials and wages whilst the receipts have increased. The criticism that the cost of running the institute is excessive may possibly have been justified in the past, but in view of the considerable economies in expenditure which have been effected and the increased receipts which have accrued, the cost of the instruction at present provided cannot be considered unduly high, and in fact the cost of training at Madura compares very favourably with that of other institutions of a similar kind. The only way in which the cost of running the institute can be sensibly reduced is by increasing the turnover, as the institute is capable of dealing with a larger volume of orders than it is receiving at present. In January 1924, Government constituted a Board of Visitors for the Madura Industrial Institute, with the Director of Industries as Chairman and the Inspector of Industrial Schools as Secretary. The Board has rendered great assistance in the administration of the institute and the members individually have given valuable advice from time to time. In fact not a little of the success which has attended the recent working of the institute is due to the willing co-operation of all members of the Board.

MADRAS TRADES SCHOOL.

The first practical proposals in regard to the establishment of a Trades School in Madras may be said to have originated with Sir Alfred Chatterton. His aim was to turn out qualified workmen such

as smiths, moulders, pattern makers, turners, fitters, and general machine men. The main feature of his scheme was a system of State apprenticeships by which each boy would be apprenticed to a particular trade for a period of three years. The scheme was referred for consideration to a Committee of gentlemen connected with engineering firms and workshops in Madras, who reported in favour of a system of a State apprenticeship and of providing technical training in a school outside the workshop. This may be said to be the germ of the present Trades School. A second Committee of practical businessmen was subsequently appointed to consider further the question of a Trades School. This Committee made valuable suggestions for extending the scope of the education to be provided in the proposed Trades Schools, but the outbreak of the War in 1914 prevented immediate developments. The Madras Trades School was actually started in 1916 in a rented building in Georgetown with two classes in plumbing and mechanical engineering and forty students. In the second year, the number on the rolls increased to 156 and more space had to be rented for the accommodation of the classes. The school was transferred to a permanent building of its own in Broadway, early in 1924, the foundation stone having been laid by His Excellency the Governor in March of the preceding year, and at the close of the last official year the strength of the school was 458. The number of new admissions to the school last year was 295, of which 210 were Non-Brahmans, 51 Indian Christians, 21 Brahmans, 8 Anglo-Indians and 5 Muhammadans. It is interesting to note that the admissions exceeded the total strength of the school two years ago by 78 and this is sufficient indication of the value attached to the instruction given by those interested, viz., employers of labour and their educated employees.

The object of the school is to supply the industrial public with intelligent and skilled engineers, mechanics, electricians and plumbers, equipped with sound theoretical and practical knowledge. It has also for its object the creating of an opening for the young men of this Presidency, who are educated up to the school final standard, but are not qualified for admission into the higher technical colleges. Admission is restricted to *bona fide* apprentices and workmen who are actually engaged in the trade which they wish to study. The classes meet in the mornings and evenings and no fees are charged for tuition except a deposit of Rs. 3 which is refunded to such of the pupils as have put in 80 per cent of the attendances. The following are the courses of instruction provided at the school:—

- (1) Mechanical Engineering Course—extending over a period of five years. This course includes three subjects, viz., Mechanical Engineering, Machine Drawing and Workshop Mathematics.
- (2) Minor Electrical Engineering Course of four years which includes the three subjects, Electrical Engineering, Technical Drawing and Workshop Mathematics.
- (3) Practical Electrical Wiring Course of two years.
- (4) Practical Plumbing Course of two years.

(5) Mechanical Drawing Courses in vernacular of two years each for—

- (a) Wood workers such as cabinet makers and carpenters.
- (b) Metal workers such as fitters and turners.
- (c) Brick-layers, masons and plumbers.

Classes in printing have just been added.

Perambur Railway Works School.—A notable development of the Trades School was the establishment in the year 1919 of the Perambur Railway Works branch school. It was found wasteful of time and energy to send the railway apprentices from Perambur to Madras for training and in consultation with the authorities of the Madras and Southern Mahratta Railway Company, arrangements were made whereby the railway authorities built and equipped a small school in the compound of their works. A considerable number of boys employed in the works receive four hours training per week during working hours in machine drawing and mechanics, the Madras Trades School supplying the teachers and supervision and the Railway Company bearing the cost. The value of the work done by this branch school is fully recognized by the railway authorities who, when filling up positions of responsibility in the workshops, give preference to students who have satisfactorily completed the full course of instruction in the school. The classes conducted at Perambur furnish an interesting instance of the value of co-operation between the Department of Industries and a large Works Organization. Much of the success of the Perambur branch is due to the cordial relations which exist between the staff of the works and the staff of the school, the railway officers and foremen rendering willing and valuable assistance in correlating the class instruction with the practical every-day work of the apprentices in the shops.

DEVELOPMENT OF THE MADRAS TRADES SCHOOL.

The classes in the Madras Trades School have hitherto consisted almost entirely of instruction in the engineering and building trades. The question of widening the scope of the school by commencing classes in subjects not connected with either branch of engineering has recently been under consideration and a start has been made with the organization of printing trades classes. The printing trade is one of the largest employers of labour in the City and as such appears to come next in importance to engineering. It was considered, therefore, that the trade was of sufficient importance to warrant the provision of classes in the Trades School for the benefit of the more intelligent of the young workmen and learners employed in the various presses throughout the City. Sanction was accorded to the proposal for opening of printing trades classes in August last and a sum of Rs. 8,500 was voted by the Legislative Council for the purpose. The classes have recently been opened and are becoming very popular.

PREPARATORY TRADES SCHOOL.

The question of starting a Preparatory Trades School, which will provide a three years' course of day school instruction heavily biased towards industry for boys who have completed the primary school course and are likely to enter mills or workshops in the City as apprentices and learners on the completion of such a course has received attention and proposals in this connexion have been submitted to, and are at present under the consideration of Government. In this way it is hoped to assist employers to recruit a better type of apprentice and terminate the present system in the recruitment and training of lads for the work of artisans.

SCHOLARSHIPS.

In addition to the scholarships tenable in aided industrial schools to which reference has already been made, scholarships are granted by Government, through the Director of Industries, for the study of industrial subjects in Europe, for study at the Indian Institute of Science, Bangalore, and also at the Victoria Jubilee Technical Institute, Bombay.

STATE TECHNICAL SCHOLARSHIPS.

The number of scholarships tenable in Europe at any one time has been fixed at eight, and the present value of the scholarship is £200 per annum plus 20 per cent bonus. Twenty-seven State Technical Scholars have completed, or are undergoing their scholarship course, since the scheme was inaugurated in 1906. The following table shows the subjects for the study of which the scholarships were awarded:—

Subject.	Number of scholarships so far awarded.
Textile industries	6
The tanning and manufacture of leather and leather trades chemistry	5
Electrical engineering	4
Chemistry of soap and oils	1
Metallurgy	2
Industrial alcohol	1
Paints and varnishes	1
Locomotive engineering	1
Hydro-electric engineering	1
Dyeing and colour chemistry	1
Saw-milling	1
Electro-metallurgy	1
Ceramics	1
Manufacture of standard food products	1
Total	27

The following statement shows the Madras technical scholars who are at present undergoing courses of training in the United Kingdom:—

Name.	Subject for the study of which the scholarship was awarded.
1. K. Venkataranian ...	Textile chemistry with particular reference to bleaching, dyeing and finishing of cotton and silk fabrics.
2. D. Sundaravelu Pillai ...	Ceramics.
3. V. Subrahmanyam ...	Manufacture of standard food products.
4. S. Raja ...	Practice and chemistry of leather manufacture.
5. C. K. Menon ...	Electro-metallurgy, i.e., Electroplating, electro-refining, etc.
6. A. R. Sahasranam ...	Dyeing and colour chemistry.
7. P. T. Koman Nayar ...	Saw-milling.

SCHOLARSHIPS TENABLE AT THE INDIAN INSTITUTE OF SCIENCE.

The object of the institution of these scholarships is to provide adequate facilities for the technical training of the well educated young men of this Presidency for employment in chemical industries. The value of the scholarships is Rs. 60 per mensem and the maximum number that can be held at one time is fourteen. The scholarships are normally tenable for a period of three years, but may under exceptional circumstances be terminable at the end of the first year, and in special cases may be extended for a fourth year, on the recommendation of the Senate of the institute. Preference in awarding scholarships is given to men with post-graduate training and honours graduates. The scholarships are awarded for study in the departments of General and Organic Chemistry, Bio-Chemistry and Electrical Technology. In accordance with the recommendation of the Committee on Technical and Industrial Education, Government have directed that two of these post-graduate scholarships should be reserved for candidates taking up the study of Electrical Technology.

SCHOLARSHIPS TENABLE AT THE VICTORIA JUBILEE TECHNICAL INSTITUTE, BOMBAY.

The object of these scholarships is to provide facilities for students of this Presidency to undergo technical training in (1) Technical and Applied Chemistry, (2) Sanitary Engineering and Plumbing, (3) Textile Manufacture, and (4) Electrical Engineering. The maximum number of scholarships tenable at any one time in the institute has been fixed at 20 and the value of the scholarship is Rs. 60 per mensem. Twenty-five scholarships have been awarded since 1918.

The Board of Trustees of the institute found it necessary about two years ago to approach Government for financial assistance in respect of the training of candidates from the Madras Presidency. Finally Government agreed to make a contribution of Rs. 200 per annum to the institute in respect of each of the Government scholars actually admitted and studying therein from 1923-24 onwards, subject to the limitation that the maximum number of such Government scholars should not exceed 20 at any one time. Accordingly a sum of Rs. 1,800 was contributed to the funds of the institute during the last official year.

TRAINING OF MAPPILLAS.

In addition to the grants-in-aid to industrial schools, Government last year, as a special case, made a grant of Rs. 1,000, and promised a further sum of Rs. 1,000 to the Y.M.C.A., to assist a scheme for training Mappillas in cottage industries in the rebel area of Malabar. The scheme had been started independent of Government help and came to a stop for want of funds. As a result of the provision of financial assistance by Government, a fresh impetus has been given to the work and considerable progress has been made under the management of the Local Indian Officer of the Y.M.C.A. This work on behalf of the Mappillas has been centred at Ariakode in the heart of what was once the rebel area, and though not at present recognized as an ordinary industrial school, it is inspected by the Inspector of Industrial Schools in the course of his tours in the district.

CODE OF REGULATIONS FOR INDUSTRIAL SCHOOLS.

It has long been felt that the rules and regulations governing the grant of recognition to industrial schools by the department should be assembled in convenient form and fresh rules and regulations made where necessary to regularize the existing procedure and to provide for future development. Accordingly a separate code of regulations for industrial schools recognized by this department and embodying the regulations in regard to grant-in-aid and the conditions of training of the pupils and teachers has recently been drawn up and approved by Government. Copies are now available at the Government Press at a cost of annas ten.

STANDARD SYLLABUS FOR INDUSTRIAL SCHOOLS.

It was considered desirable to lay down a standard syllabus for the various subjects in which instruction is provided in the various recognized schools, so as to serve as a guide for framing particular syllabuses suited to local conditions and circumstances. Accordingly a departmental bulletin was drawn up by the Inspector of Industrial Schools in which 37 syllabuses were framed. The bulletin also contains a note on the establishment of industrial schools, and on the methods of imparting instruction in cabinet making as well as

a copy of the course of studies followed in the St. Joseph's Industrial School at Tindivanam and in the training section attached thereto. The bulletin is No. 14 of the Department of Industries and is available at the Government Press at a cost of annas eight.

COMMITTEE ON TECHNICAL AND INDUSTRIAL EDUCATION.

The orders of Government on the recommendations of the Committee were issued in G.O. No. 2043, dated the 28th November 1924. Government accepted generally the principal recommendations of the Committee and called for detailed proposals for giving effect to such of them as do not involve any considerable financial outlay. In particular Government accepted the view of the Committee that a greater measure of assistance should be granted to aided schools and that it is desirable that model Government industrial schools should be established in each of the language areas of the Presidency. It is not possible here to refer in detail to the various recommendations of the Committee and suffice it to say that detailed proposals have been, or are in process of being worked out, and that with improved financial conditions it is hoped to give effect to the great majority of the recommendations of the Committee in the comparatively near future. Probably the first of the more important proposals of the Committee to be given effect to will be the establishment of a Preparatory Trades School to which reference has already been made.

CHAPTER VIII.

LEATHER TRADES INSTITUTE.

The Leather Trades Institute at Washermanpet was opened in 1915, and the main object of its establishment was the improvement of the methods of manufacturing leather in India, while the conception of the school course was that it should consist mainly of practical work in the school tannery, this practical work being supplemented by a measure of theoretical instruction and by laboratory checks on the processes in the tannery. The institute is now worked partly as a model tannery and partly as a research institute. It provides a course of training in tanning and leather manufacture, which extends over three sessions, to selected students who have passed the Secondary School Leaving Certificate Examination at least, or who otherwise possess sufficient general education as determined by an entrance examination, to profit by the course. Candidates with higher educational qualifications are, however, ordinarily given preference. As far as possible, admission to the institute is confined to candidates who are sons of tanners or are otherwise connected with the leather trade. The syllabus of study consists of general science, the principles of leather manufacture, and methods of tanning, currying and finishing. Special attention is devoted to practical work. The objects of the training now given in the institute are—

(1) to give students a thorough grasp of the principles underlying the various processes, and

(2) to instruct them in as many of the commoner processes as they can assimilate during the period of the course. On the completion of the ordinary course students who have had previous experience in the handling of labour and factory work are suitable for employment as departmental foremen or assistant foremen according to the scale of the factory employing them, and if employed in country tanneries, are able to indicate improvements and introduce new methods. In the case of students with no previous practical experience in a tannery under commercial conditions, the course of training in the institute must be followed by practical work in a tannery or factory before they can be entrusted with the control of a commercial tannery. In accordance with the recommendations of the Leather Industry Committee, arrangements have recently been made for the opening of classes for the practical training of tannery operatives and for the part-time training of working tanners and maistries of private tanneries, as also for the conduct of an English lecture class on Madras methods of tanning, for professional tanners and others interested in the trade.

Admissions and scale of fees.—The fees are Rs. 100 per annum in the case of students from the Madras Presidency or Coorg, and Rs. 150 per annum in the case of students from Native States

and from provinces other than the Madras Presidency and Coorg. The number of applications for admission to the institute has declined during the last two years and at present there are few, if any, signs of improvement, the fact being that in the present depressed condition of the leather industry openings for employment are too few to offer prospects of a career. The number of students on the rolls of the institute on the 31st March 1925 was ten. Since the establishment of the institute, 64 students have completed their training and most of them are now employed in tanneries or allied businesses. All the students who presented themselves for examination last year passed successfully and the examiners were favourably impressed with the knowledge shown by the students. The Examiner in Leather Manufacture stated that the papers were on the whole well answered and that a comparison of the results showed that the percentage of marks obtained were very close indeed, the average of 73 per cent being exceptionally good. The Examiner further stated that he was particularly pleased with the answers submitted by some of the students to questions set with the object of determining the action to be taken in an emergency, as the answers went to show that the training given to the students has been of a very thorough character. The Examiner in Leather Trades Chemistry reported that the students had done better in the practical than in the theoretical tests and that on the whole the results were satisfactory. Four of the students of the institute recently obtained the certificate of the City and Guilds of London Institute, two in Light Leather Manufacture, one in Heavy Leather Manufacture, and one in Dyeing and Finishing.

Finance.—The nett expenditure to Government during the last official year was reduced to Rs. 42,430-15-2 and for the first time in the history of the institute, the receipts from the sale of leather and other finished articles exceeded the expenditure on raw materials. An amount of Rs. 7,302-7-1 was realized from fees and sales of leather.

Extensions to the institute.—The extensions to the Leather Trades Institute, involving the construction of a new building, which will provide new class rooms and laboratories, in the latter of which facilities will be available for the conduct of research work in connexion with tannin problems generally will, it is expected, be ready for occupation very shortly. In February of this year, Government in pursuance of the recommendations of the Leather Industry Committee sanctioned the creation of a post of Leather Research Chemist and appointed M.R.Ry. K. Seshachallam Nayudu Garu, M.A., M.Sc., permanently to it. They further sanctioned the creation of a post of Senior Assistant Chemist on Rs. 80-4-120 and the institution of a scholarship in the Leather Trades Institute to provide for the Junior Assistant Chemist, the appointment of which was also recommended by the Committee. The two latter posts have recently been filled up. Prior to the appointment of the research

staff, practically the whole time of the staff was occupied in lecturing and supervising the work of the students, and this in conjunction with the absence of suitable laboratory accommodation necessarily restricted the volume of research work undertaken to small dimensions. Now that a research staff has been created and a properly equipped research laboratory is, or will shortly be, available it will be possible to initiate a systematic research and investigation into the various important tanning problems that await solution.

Research.—The Leather Research Chemist has been, for some time past, engaged on researches on the study of fermentation from Divi Divi. The results obtained so far are not without promise as the fermentation of the liquor has been brought under control. Mr. Seshachallam has recently been engaged in testing the conclusions arrived at in the laboratory under practical working conditions in the tannery, and much of his time has been occupied with the practical experiments and the necessary further laboratory checks on the practical results obtained. The results of the research work so far done on the subject have been published in the *Journal of the Society of Leather Trade Chemists* in the form of three separate notes entitled "A note on South Indian Divi Divi," "Fermentation of Divi Divi Liquors," and "Fermentation of Tan Liquors." The Leather Research Chemist has also been engaged in studying the effect of different kinds of water on the quality and quantity of extractable matter from avaram bark, as a preliminary to the conduct of a systematic research in regard to the action of the various impurities in water on avaram tannage and with a view to stop or reduce the great wastage of tannin that takes place in the ordinary Madras tannages. In accordance with the recommendations of the Leather Industry Committee, a comparative study of South Indian tanning materials has been initiated with the ultimate object of exploiting every promising kind of tanning material that is available and with the co-operation of the Forest Department of advising and encouraging the growth of any particular tan stuff which is found by research and by practical application to be suitable for adoption. In the tannery of the institute, experiments in the manufacture of a fair quality sole leather by re-tanning Dhori (bag tanned porous) hides were carried out and finally a suitable leather was evolved by a simple method which can be worked in any local tannery. An account of these experiments will shortly be published in the form of a bulletin. The discovery which was made in the laboratory some two years ago, that oil-tanned leather withstands the action of hard or alkaline water better than either chrome or bark-tanned leather has been carried a step further by the manufacture of a dozen oil-tanned hides and issuing them for practical tests, as kavalai trunks. The reports received on these leathers have been somewhat conflicting as some lasted well and others only for a very short time. Further experiments on this subject are now in progress. The experimental manufacture of chamois leather by a modification of the ordinary process, which is more suitable to Indian conditions, was also carried

out and very encouraging results were achieved. It is hoped that when the experiment is carried a stage further, it will be possible to put the process to a commercial test. The price of avaram has been very high for some time, and as a result a number of local tanners have used wattle bark as a substitute. In the institute a number of hides were tanned with varying proportions of wattle and by different methods and the local tanners were shown the most suitable method of using wattle with reference to their particular needs.

Leather Industry Committee.—The Committee was appointed in 1923 to examine the steps which are desirable to further the development of the leather industry of the Presidency with special reference to the constitution and aims of the Leather Trades Institute. The Committee submitted a comprehensive report and made a number of important recommendations which Government accepted almost in their entirety. The Committee were satisfied with the adequacy of the instruction now given in the institute and considered that in view of the scope which exists for improving the status of the Madras tanning trade and the difficulty experienced in securing facilities for the training of Indians in tanneries abroad, it is of great importance that the present standard of instruction should be maintained. Government accepted this view and also agreed with the Committee that in view of the existence of a demand among tanners for an improvement in the quality of their labour supply that classes should be opened in the institute for the practical training of the tannery operatives, and for the part time training of working tanners and maistries of private tanneries on the lines advocated by the Committee. Reference has already been made to the opening of these classes. One of the recommendations of the Committee was that arrangements should be made with the Inspector-General of Prisons for a portion of the leather required for the manufacture of boots and sandals in the various jails to be supplied by the institute, as a result of which the institute has undertaken to dress all the russet leather and retan and finish all the sole leather required by the boot department of the Vellore Jail. The acceptance by Government of the recommendations of the Committee that in view of the great importance and potentialities of the tanning industry in this Presidency, the institute should include a properly equipped research laboratory and an adequate research staff has already been referred to. In accordance with the recommendations of the Committee, a Board of Visitors to the institute, consisting of Messrs. P. Ramaswami Ayyangar, R. Reshid Ahmed Sahib Bahadur and A. H. Taylor of Messrs. Chambers & Co., have been appointed for a period of three years. The Committee made a number of valuable recommendations in regard to the exploitation of tanning materials generally and in particular stressed the importance of increasing the production and cheapening the supply of avaram. The difficulties in the way of securing an abundant supply of avaram to tanners at cheap prices are, however, very great and now that the institute has been provided with a research staff,

the possibilities of new tan stuffs and of substitutes for the hitherto indispensable avaram will be fully investigated. The initiation of experiments in regard to the substitution of wattle barks for avaram as a tanning agent has been referred to elsewhere and a bulletin on the subject of the utilization of wattle bark will shortly be published. The Committee also considered the question of the production of finished as against half-tanned leather, as also that of the prospects of the development of the chrome leather industry in the Presidency, and with their conclusions and recommendations Government expressed their general agreement. Considerations of space preclude a reference to other important recommendations of the Committee, some of which have since been given effect to, and suffice it to say that as a result of the acceptance by Government of the greater part of the Committee's proposals, it is anticipated that the scope and usefulness of the institute will be greatly enlarged, and that in particular research and investigation into the many important tanning problems which await solution will receive a distinct impetus. An encouraging start has already been made with the organization and development of the research side of the institute, but it need hardly be said that results cannot be shown, nor should be expected at once.

Visitors to the institute.—During the course of a year the institute receives many Indian and European visitors, including a number of local tanners, and it is worthy of record that a member of a prominent leather firm in England stated, after a visit to the institute, that it was the most interesting and instructive one of its kind he had seen in any country.

CHAPTER IX.

SCHOOL OF ARTS AND CRAFTS, MADRAS.

The School of Arts, Madras, was established privately in 1850 by Dr. Alexander Hunter, a surgeon of the Madras Army, and it was taken over by Government two years later. The school was originally known as the "School of Industrial Arts" and an extraordinary variety of arts were practised in it. In the school, the manufacture of building materials, such as tiles, bricks and terra cotta was improved and developed by Dr. Hunter and in fact this class of work formed the greater part of the industrial side of the school. The artistic department was mostly concerned with free-hand drawing, geometry, perspective anatomy, and engraving. In 1856, an artist Mr. A. Cole, was brought out from England to supervise the artistic department of the school and changes in personnel and policy have since been made from time to time. The school which was hitherto under the control of the Director of Public Instruction was transferred to the Department of Industries in October 1920. The school now provides a training in art and design as applied to various industrial crafts, the aim being to improve crafts which are capable of artistic treatment. There are separate departments in the school devoted to instruction in cabinet making, metal working, including silver-smithing, jewellery, wood and copper engraving and dye-sinking, lacquer work, painting, designing, carpet weaving, modelling, geometrical drawing, a life drawing class for ladies principally employed as teachers in schools under the Department of Public Instruction, who wish to improve their knowledge of drawing as a school subject. Each of the classes is conducted, as far as possible, as a small workshop in which students receive practical instruction in the particular art or craft they have chosen. The classes commence at 8 a.m. and finish at 4 p.m. There are no fees except for the ladies' drawing class where the scale is according to the grade entered; Re. 1, Rs. 1-8-0, Rs. 2 and Rs. 3 per month.

Strength and attendance.—The number of pupils on the rolls of the school on the 31st March 1925 was 443 of whom 20 were females. The average attendance during the year was 235 and the average number on the rolls was 428. The figures for the three previous years were:—

Year.	Average number on the rolls.	Average attendance.
1921-22	234	166
1922-23	259	191
1923-24	337	240

The strength of the school again increased considerably during the last official year, though a less satisfactory feature was the decline in attendance from 71 per cent to 55 per cent. The falling off in the average attendance was attributable partly to the abnormal illness which was prevalent in the city, and partly to the very poor attendance at the part time classes. The percentage of artisans under training is about 55. The receipts from sales have recently shown a tendency to increase while on the other hand expenditure has been reduced.

School of Arts Committee.—A committee was appointed in October 1921 to examine the working of the school and Government accepted the conclusion of the committee, that the teaching of Fine Arts and industrial art is incapable of attainment in a single school and that the object of the school should, as in the past, be to teach the application of arts to industries which are capable of artistic treatment. In consonance with this decision, the school was renamed the "School of Arts and Crafts." In other respects, the decision of Government was that the school should be conducted on the present lines.

CHAPTER X.

STAFF AND COST OF THE DEPARTMENT.

Staff.—The post of Director of Industries has, since 1916, been held by an Officer of the Indian Civil Service. In addition to the Director, the permanent gazetted staff of the department includes a Deputy Director, Principal, Leather Trades Institute and Leather Expert, Inspector of Industrial Schools, Industrial Engineer, Textile Expert, Oil Chemist and Soap Expert, Principal, Madras Trades School, Vice-Principal, Leather Trades Institute, Leather Research Chemist, Sericultural Assistant, Superintendent, Madura Industrial Institute, and four Assistant Industrial Engineers. The post of Superintendent, School of Arts and Crafts, is at present included in the cadre of the Indian Educational Service. There are a number of miscellaneous posts in the department and those of the Business Manager, Fruit Preserving Institute, the two Factory Assistants of the Kerala Soap Institute and the Officer-in-charge, Government Industrial Institute, are at present temporary. The post of Industrial Chemist was abolished in March 1925. The territorial distribution of the district executive staff of the Engineering branch of the department will be found in Appendix A. There are also five weaving Superintendents in charge of the peripatetic weaving parties, as well as a number of weaving maistries and expert weavers.

Cost of the Department.—The expenditure, receipts and net cost of the department during the last ten years have been as follows :—

Year.	Expenditure.	Receipts.	Net cost.
	RS.	RS.	RS.
1915-16	3,52,814	57,762	2,95,052
1916-17	2,32,307	19,245	2,13,062
1917-18	2,79,741	84,809	1,94,932
1918-19	3,40,937	1,45,988	1,94,949
1919-20	6,30,285	3,31,114	2,99,171
1920-21	8,69,190	2,57,635	6,11,555
1921-22	11,49,593	2,86,644	8,62,949
1922-23	10,02,666	2,82,522	7,20,144
1923-24	9,74,138	3,11,239	6,62,899
1924-25	11,16,364	4,55,713	6,60,651

The steep rise in expenditure in the year 1920 was due largely to the transfer to the department of the Pumping and Boring Operations and of the School of Arts and Crafts, and to the increase in the district staff. The cost of the department rose steadily until the year 1922-23 when, despite the transfer to the Department of Industries of the control of the sericultural operations, the net cost of the department declined by Rs. 1,42,805-0-10. In the following year, the net cost of the department further declined by Rs. 57,425-4-1. In the year 1924-25, the latest year in respect of which figures are available, the general financial results were satisfactory as although there was an increase in expenditure, due to normal expansion of the departmental activities, this was more than counter-balanced by the increase in receipts. The very satisfactory financial results of the last three years were only made possible by the strict economy which has been exercised in the administration of every branch of the department.

CHAPTER XI.

THE TANNING INDUSTRY OF THE MADRAS PRESIDENCY.

Origin.—The tanning industry of the Madras Presidency differs from most Indian industries in that practically the whole of the manufactured product is exported. Though it is not, as a rule, profitable to export the poorer qualities of tanned leather which go to meet local requirements in India, the amount of leather so used does not in normal times exceed 30 per cent of the amount tanned. The industry may be considered to have originated when Charles de Sousa of Pondicherry found that by giving a bath of Myrobalam liquor to leather tanned with the bark of the avaram shrub (*Cassia Auriculata*) the colour was not so sensitive to light and the leather kept its light shade for a considerable period instead of turning to an unpleasant brick red colour in the course of a few days. Previous to the date of this discovery (between 1840 and 1850) small lots of tanned hides and skins had been exported, but the trade increased rapidly from this time.

Exports.—The amount of tanned leather exported from Madras for the years from 1910-11 to 1924-25 is shown in the following table:—

Year.	* Tanned hides.			† Tanned skins.		
	Quantity.		Value.	Quantity.		Value.
	Cwt.	No.	Rs.	Cwt.	No.	Rs.
1910-11.	124,508	1,715,073	96,52,545	116,752	15,281,674	23,78,694
1911-12.	150,208	2,094,481	1,20,13,712	126,802	16,694,528	2,55,02,674
1912-13.	192,206	2,737,948	1,60,27,098	108,005	14,746,316	2,15,69,111
1913-14.	142,370	1,905,549	1,23,25,371	110,535	14,997,188	2,23,71,263
1914-15.	170,263	2,317,963	1,79,82,387	97,472	13,434,161	1,89,87,769
1915-16.	222,418	3,054,038	2,38,58,445	105,066	14,535,230	2,11,51,059
1916-17.	142,954	3,636,259	1,85,07,211	132,958	18,366,945	3,97,46,607
1917-18.	3,180	27,740	3,63,119	10,350	1,891,506	57,77,460
1918-19.	450,487	6,341,379	6,46,62,529	26,572	3,776,979	98,33,534
1919-20.	375,023	5,819,549	5,59,42,838	82,177	14,135,225	4,09,18,411
1920-21.	65,160	1,279,501	86,32,753	47,360	8,644,615	1,80,64,472
1921-22.	88,840	1,683,649	84,64,895	70,460	12,552,973	2,13,47,667
1922-23.	161,480	3,175,999	1,70,01,036	80,306	13,247,221	2,39,31,343
1923-24.	222,540	4,153,435	2,48,97,122	85,700	15,004,030	2,41,22,720
1924-25.	217,140	...	2,58,29,000	105,740	...	3,31,61,000

* Hides are from cow, bull, bullock and buffalo.

† Skins from sheep, goat and calf.

Owing to the great shortage in freight in 1917-18, there was a fall in the shipment of tanned hides and the very large quantities which were awaiting shipment at the end of the year helped to swell the astonishing figures of 1918-19. It will be noticed that the export of tanned skins declined greatly during the years 1917-18 and 1918-19, whilst the export of tanned hides increased very considerably during the latter year. This was due to the fact that tannage of skins and the export of tanned skins were prohibited during the greater part of that period with the object of concentrating the whole resources of the South Indian tanners on the tannage of hides which were urgently needed for military requirements. In this emergency the South Indian tanner showed what a valuable asset he was to the country and to the Empire by tanning the enormous quantity of about 2,000 tons of leather per month.

The boom of 1919-20 and subsequent trade developments.—A study of the post-war figures for hides shows a great boom in trade in the year 1920 followed by a greater slump during the ensuing few years, the differences in quantity and value of exports being very marked. As regards skins, the declared value was higher in 1920 than in any of the pre-war years shown in the above table, although the number of skins exported was much less. This fall in numbers may be attributed chiefly to the greater demand for raw skins for glace kid and to the lack of demand from Central Europe which normally bought large quantities of tanned skins in the London auctions. During the years 1920-21 and 1921-22, both quantity and value fell very considerably on account of the general trade slump. The year 1922-23 showed a considerable revival in the export of tanned hides and skins although it had still to yield pride of place as the most important export trade in the Presidency to groundnuts. The increase was mainly the result of a total clearance of the stocks left in Government hands after the control was withdrawn. During the years 1923-24 and 1924-25 there was a further expansion in the export trade of tanned hides and skins, and during the latter year the value amounted to Rs. 58·990 lakhs representing 15 per cent of the total export trade of the Presidency. The quantity of tanned hides exported during 1924-25 declined slightly although the value rose from 248·97 lakhs to Rs. 258·29 lakhs. This decrease in quantity was partly attributable to the smaller production and partly to the curriers and boot manufacturers at Home resisting any advance in prices, in which, however, they have failed. It is probable that the deficiency in exports will be more than recovered during the current year. Sterling as well as rupee prices of hides are now appreciably above the prices of a year ago. The United Kingdom takes practically the entire production of Madras tanned cow hides. Exports of tanned skins show a progressive and gratifying increase. The United Kingdom, Japan and America continue to be the chief customers for Madras tanned sheep skins. Expressed as percentages to the total output, the United Kingdom takes about 60 per cent of the total production, Japan 30 per cent and America 10 per cent. The public sales in London are still the

distributing centre for tanned goat skins, 95 per cent. of the production in Madras being shipped to London and from there distributed over the Home markets and on the Continent. Formerly a very large proportion of the raw goat skins exported from Madras went to America or to Germany or other Continental countries, but an increased quantity is now being shipped to London as well as to Australia.

Process of tanning.—The process at present used is practically identical in outline with that used by Charles de Sousa as far back as 1850, but the product has improved very much indeed as the experience of 70 years has been accumulated, and those tanners who have made the greatest use of this experience have naturally been the most successful.

Early experiments.—In the early years of this century, experiments in chrome tanning were started by Mr. Chambers in his tannery in Tondiarpet and by Mr. Chatterton, assisted by Mr. N. S. T. Chari, in the School of Arts, Madras. The tangible result of Mr. Chambers' experiments is the fine factory of the Chrome Leather Co., at Chromepet near Madras, of which he is the proprietor. Mr. Chari is now the proprietor of Messrs. Chari & Co. of Calcutta, which firm are or were until comparatively recently the managing agents of several leather manufacturing concerns. The Chrome Leather Co.'s Tannery at Chromepet is in a class by itself so far as the Madras Presidency is concerned and is an up-to-date concern tanning and finishing all classes of leather, both chrome and vegetable, that are in demand in India. This firm also has a manufacturing department where considerable quantities of leather goods are turned out.

Export tanneries.—Tanneries which work for export are scattered throughout the Presidency, but particularly in the following centres:—

Northern—Vizianagaram, Bezwada, Ellore, Rajahmundry, and in Hyderabad and Mutwada in the neighbouring districts of the Hyderabad State.

Central—The outskirts of Madras, Pallavaram, Ambur, Vaniyambadi, Ranipet, Vellore, Pernampet, and in Bangalore in the Mysore State.

Southern—Trichinopoly, Dindigul, Erode and Coimbatore.

As a rule, the tanneries in the Northern division work only on hides, whilst those in the South consist almost entirely of skin tanneries. The Central division divides its energies between the two classes of goods. The tanneries vary greatly in size, from what is practically a one-man concern to those which are capable of turning out over 10,000 hides or 50,000 skins per month.

Madras tanneries.—Sir Alfred Chatterton in his "Monograph on Tanning and Working in Leather in the Madras Presidency" published in 1903 describes a Madras tannery as below, and this description is, as a rule, as accurate to-day as when written. There are, however,

tanneries originally built on this plan that have been added to from time to time until to-day it is impossible to find the original square.

"A typical Madras Tannery consists of tiled sheds built on the four sides of a square or rectangle with a blank wall externally and opening on the inside to a quadrangle. A wide doorway in the middle of one of the shorter sides of the rectangle gives access to the tannery. One half is devoted to the reception of raw materials and to the carrying out of the process preliminary to tanning. The soaking pits are usually constructed below ground level along the outer walls. They are generally square in plan and three or four feet deep, built of brick and plastered. For the removal of the lime after unhairing, tanks of brick and plaster are usually built above ground level with masonry aqueducts or channels to supply them with water. Skin tanning is invariably carried on in wooden tubes from 3 to 4 feet in diameter or more, and of about the same depth. Of these there are often more than one hundred."

In normal times, most of the Madras tanneries obtain the greater part of their raw hides and skins locally, with the result that there is a marked difference in pattern, size, etc., in the product of different districts. In times of great demand, raw materials are imported from all over India, with the result that leather from different districts to a great extent loses its individuality. This was particularly noticeable in the hides tanned during the last two years of the war period when all attempts at keeping hides tanned in different districts separate were given up, and one general selection for all tannage was introduced. There is, however, one notable exception to the above rule, in that several firms in the Northern division, and a few in the Central, make a speciality of tanning hides rejected by the Calcutta firms who buy raw hides for export.

Tanning materials.—Although there are quite a number of tanning materials available in the Madras Presidency the export tanners use only three (or four if we include wattle which is gradually coming into use), of which two are barks and the third a fruit. Of these materials the bark of Cassia Auriculata (Avaram, Tangedu, Turwad, Tanner's Cassia, etc.) is the most important as this material is the basis of all the best tannages. This shrub is plentiful in most parts of the Presidency, particularly so in the Ceded districts, but never grows in thick clumps and is always scattered so that the collection of the stick is a slow and costly business. The bark must be stripped off the sticks within an hour or two of the cutting, as otherwise it becomes impossible to remove. The right of collection of this bark on Government lands is sold by auction for various periods. This material was in the prewar period second only to Sicilian Shumach in being the most expensive tanning material per unit of tan. The high price is chiefly due to (1) the cost of collecting the sticks, (2) the time taken to strip the bark from off them, (3) the light weight of the product, (4) the prices paid at auction for the right of collection. This bark has properties that make it the simplest of materials to use for tanning and it is thus particularly suitable for use with the class of labour and supervision available in the Madras Presidency. The bark of Cassia Fistula (Konam, Rela, Amaltas, Indian Laburnum) is used

either as a substitute for part of the avaram bark or in a few tanneries in the north of the Presidency to replace it altogether. When used with care, it gives a leather only slightly inferior in colour and general appearance to that tanned with avaram. The leather has the same fault of darkening if exposed to light that avaram tanned leather has. The bark contains less tannin than avaram but is much cheaper to collect owing to its heavier nature. The tree coppices easily and is worked regularly in certain parts of the northern districts. The price of this bark fluctuates even more than that of avaram and its unit value is also exceedingly high when compared with most other materials used in India or elsewhere. Myrabolams, the dried fruit of *Terminalia Chebula*, are used to fix the colour of the leather and the Madras tanner is exceedingly particular as to the quality of the myrabolams that he uses and prefers those grown in the Shevaroy Hills to any others. This quality, known as Salem Myrabs, is decidedly richer in tannin than most others and is also of a very light colour, so that it pays the tanner of the very highest class of hides and skins to use them although they usually cost from two or three times the amount that others do.

Water used in tanneries.—The water used by the South Indian tanner is almost invariably obtained from shallow wells or tanks. It varies very greatly in character and is exceedingly impure in many cases. Samples of water from certain tanneries examined in the Leather Trades Institute, Madras, have contained well over 100 parts per 100,000 of both temporary and permanent hardness, together with considerable quantities of chlorides, so that no tanner using modern methods could possibly make a saleable leather with it, and yet the Madras tanner with his avaram tannage turns out quite a good article. There are, on the other hand, waters much less impure that seem quite unsuitable for this tannage and as the reasons for this are not understood, research work on this subject has been undertaken at the Leather Trades Institute. At the Institute are carried out analyses of various descriptions for tanners, the fee being Rs. 15 in the case of bark analyses, and Rs. 10 in the case of leather, water, chrome, and lime liquor analyses.

Tannery maistries.—Until quite recently the working of the tanneries was entirely in the hands of the "maistries" or working foremen and in many cases the tannery owners knew practically nothing about the process used. Now many of the owners are keen tanners and do most of the supervision themselves. The coolies that do the work in the tanneries are in all cases of the lowest castes and are usually exceedingly irregular in their work, keeping what hours they like and only working after they have received large advances on their pay which the tanner has to recover over a long period. This system of giving advances leads to much trouble, as in some cases the coolies take a second advance from another tanner before the first advance has been recovered in full, which naturally leads to complication. The processes used in different tanneries are almost identical,

and vary only very slightly in small details according to the class of material being worked and the labour employed.

The following is a short account of the process as carried out in Hide tanneries. In Skin tanneries slightly less time is taken in each part of the process.

Soaking.—Soaking is always done in fresh water without addition. The use of putrid soaks, which are supposed to have been used some years ago, is unknown. The softening of dried hides is usually helped by working them on the flesh with a knife when thrown over a palmyra beam, whilst cured hides are worked in the same way to remove mud. Drums and other mechanical contrivances are never used but trampling is occasionally done to help the washing and softening. Twelve to twenty-four hours in soaks is seldom exceeded in the hotter parts of the year and forty-eight in the cold weather.

Liming.—The tendency during the last ten years has been to shorten the liming and to use fresher limes. Most tanners now complete the process in from six to twelve days and they give each pack a fresh lime. The hides are handled at least once a day. This is done by the cooly standing in the pit bringing the hides to the surface with his feet and lifting them on to the edge of the pit with his hand. He then stirs up the lime and throws in the hides again and tramples them down.

Unhairing and fleshing.—Unhairing and fleshing are always done by hand over a palmyra beam with a knife similar to the English unhairing knife but lighter and more curved so as to suit the curve of the beam. Both unhairing and fleshing is done with the concave edge of the knife and this has an advantage over the use of the convex edge of the English fleshing knife in that a broad cut is not so hollow in the centre.

Deliming.—Deliming is always partial and never complete and is carried out by alternatively washing in water and scudding with the same knife used for unhairing. Hides are often scudded as many as four or even six times. The washing is usually done in fairly shallow tanks and the process is helped by trampling.

Tanning.—The tanning process proper is divided into two parts, firstly treatment in bark and secondly in myrabolams. The Indian tanner does not consider myrabolams a tanning material in exactly the same way as bark. Hides are brought from the final scudding operation and are floated into an old avaram liquor through which several packs of hides have previously passed, and are handled in this several times. A certain amount of bark is then thrown between the hides, and they are left overnight, and again handled the following morning, the same bark being again spread between the hides. After from seven to ten days in this bark during which time they are handled daily, the hides are taken out and squeezed as dry as possible by twisting them between two bamboos. The hides are now well worked on the flesh with a fleshing knife and any small portions of flesh missed

in the fleshing process are thus removed. They are then given a second and third bark, in each of them they remain from seven to ten days and are squeezed out and worked over the beam. This squeezing and working is a very important factor in the resultant leather as the more thoroughly it is done the better set out will be the finished leather. The penetration of the tannin is also accelerated by these processes. After the third the average run of hides is considered tanned, but heavies are given a fourth and extra heavies a fifth bark. The amount of bark given in the different stages varies in every tannery, but a total of about $3\frac{1}{2}$ lb. for each pound of dried leather is about the average where pure avaram is used. Usually from $1\frac{1}{4}$ to $1\frac{1}{2}$ lb. are given in the first bath, 1 lb. in the second and $\frac{1}{2}$ to $\frac{3}{4}$ lb. in the third. Where konam is used, larger quantities must be given. The myrabolam bath which follows consists in laying away the hides for three or four days in a fresh myrabolam infusion made by boiling up broken myrabolams in water and allowing the stew to cool. In use, care must be taken to see that there is a certain amount of the pulp between each hide. After this, the hides are removed, squeezed again, and worked out and are then ready for oiling off.

Finishing.—Oil is applied by sprinkling and then rubbing in with the hand and piling the hides one on another. After being in pile for some time, the hides are hung up to sam (half dry). All drying is natural air drying as no tannery has any arrangement for expediting drying in bad weather so that in damp weather, leather is often damaged by mould. The sammed hides are set out with copper slicker, dried out, and are then ready for sale. Previously the flesh of the hide was often coated with a paste of flour and grease to which other weighting matters were often added. This practice was prohibited during the period of war control, with the result that a decided improvement in the flaying of hides was noted. It is greatly to be hoped, therefore, that this practice will not again be resorted to on a large scale.

Softening.—The tanners of skins have scudding machines and one or two have pumps driven by power, but these are the only cases where power is used in any of the export tanneries. Skins are softened by staking and the flesh is rubbed with a rough hard burnt brick to smoothen it before packing for export. This process produces leather that for many purposes can hardly be improved on, but it has some very serious defects in that (1) the amount of labour necessary in the tannery is very great indeed; (2) a very large proportion of the tannin from the bark and myrabolams is wasted as very little more than 60 per cent is used in either case; and (3) this leather is unsuitable for book-binding or other similar uses as it is found that it gradually deteriorates on keeping especially if exposed to the fumes of gas or of coal fires.

Tanning trade.—As a rule, skins are sent by the tanners on consignment to the London public auctions under their own mark, whilst hides are sold to merchants in Madras who select and classify

them into well-known classes and qualities and then export them either for sale by auction or private sale, or in execution of orders previously received. The business is very speculative as raw material has to be bought for final sale at a period of at least four months afterwards. It is often asked if it would not be possible for the South Indian tanner to finish the hides or skins more profitably than the European firms engaged in this trade as labour is so much more plentiful and less costly in South India than in Europe. The answer to this is that the European manufacturers have the following advantages over any firm here in that (i) their labour is already trained and is more adaptable than Indian labour, (ii) they are near the market for the finished leather and so can follow the demand much more easily and do not have to guess what the fancies of Dame Fashion will be so long in advance, and (iii) as the chief market for crust leather is London, they have a greater choice of suitable material and are able to get larger quantities of a suitable selection than would be possible in India.

APPENDIX A.

DISTRIBUTION OF THE DISTRICT EXECUTIVE STAFF OF THE DISTRICT
ENGINEERING BRANCH OF THE DEPARTMENT OF INDUSTRIES.

BRANCH OF THE DEPARTMENT OF INDUSTRIES.

Districts comprising
the division.

Name of
subdivision in
charge of
supervisors.

Headquarters
of
subdivision.

Supervisors.

Mechanics.

Boring maistries.

Apprentice boring
maistries.

Surveyors.

Tanjore division in charge of an Assistant Industrial Engineer.

1. Madras ...	} Madras ...	Madras ...	2	4	8	1	...
2. Chingleput ...		Cuddalore ...	1	2	6	1	...
3. South Arcot ...	} Tanjore ...	Tanjore ...	1	3	2	...	...
4. Tanjore ...		Trichinopoly ...	1	4	6	...	...
5. Trichinopoly ...	} Trichinopoly ...	Trichinopoly ...	1	2	7	...	1
6. Madura ...		Tinnevely ...	1	2	7	...	1
7. Rāmnād ...	} Tinnevely ...	Tinnevely ...	1	2	7	...	1
8. Tinnevely ...		Tinnevely ...	1	2	7	...	1

Coimbatore division in charge of an Assistant Industrial Engineer.

1. Malabar ...	} Calicut ...	Calicut ...	...	1	2	...	...
2. South Kanara ...		Coimbatore ...	1	5	7	3	...
3. Coimbatore ...	} Coimbatore ...	Coimbatore ...	1	5	7	3	...
4. The Nilgiris ...		Vellore ...	2	1	9	...	...
5. Salem ...	} Vellore ...	Vellore ...	2	1	9	...	...
6. North Arcot ...		Vellore ...	2	1	9	...	...
7. Chittoor ...	} Vellore ...	Vellore ...	2	1	9	...	...

Bezwada division in charge of an Assistant Industrial Engineer.

1. Ganjām ...	} Vizagapatam ...	Vizagapatam ...	...	3	6	...	...
2. Vizagapatam ...		Bezwada ...	...	2	5	1	...
3. Godāvari, E. ...	} Bezwada ...	Bezwada ...	...	2	5	1	...
4. Godāvari, W. ...		Nellore ...	1	1	4	1	...
5. Kistna ...	} Nellore ...	Nellore ...	1	1	4	1	...
6. Guntūr ...		Bellary ...	...	2	3	6	1
7. Nellore ...	} Bellary ...	Bellary ...	...	2	3	6	1
8. Bellary ...		Cuddapah ...	...	2	3	6	1
9. Kurnool ...	} Cuddapah ...	Cuddapah ...	...	2	3	6	1
10. Anantapur ...		Cuddapah ...	...	2	3	6	1
11. Cuddapah ...	} Cuddapah ...	Cuddapah ...	...	2	3	6	1

APPENDIX B.

LOANS DISBURSED UNDER THE STATE AID TO INDUSTRIES ACT
UP TO 1ST JANUARY 1926.

Serial number.	Name of applicant.	Purpose for which loan was granted.	Amount sanctioned.
			RS.
I	Messrs. Muppala Somaraju and Veeraju, Silk cloth manufacturers, Peddapuram.	The development of their factory so as to permit of the preparation, twisting and dyeing of silk for handloom weavers.	50,000
II	Messrs. The Carnatic Paper Mills, Ltd., Wexford House, Kilpauk, Madras.	The development of their Mills at Rajahmundry.	4,00,000
III	Messrs. The Canara Rice and Saw Mills, Ltd., Coondapoor, South Kanara.	The purchase of a vertical band saw.	9,600
IV	M.R.Ry. D. Rangaswami Nayudu, 3, Thandavaraya Pillay St., Georgetown, Madras.	The setting up of two cotton gins in conjunction with an existing rice mill at Gudiyattam, North Arcot district.	5,000
V	The Kallakurichi Co-operative Agricultural and Industrial Society, Ltd., Kallakurichi.	The development of the industries carried on by the Society, viz., ground-nut decorticating, rice hulling and sugarcane crushing.	18,600
	Total ...		4,83,200

APPENDIX C.

LIST OF BULLETINS ISSUED BY THE DEPARTMENT OF INDUSTRIES.

Old Series.

Serial number.	Subject.	Price
1.	On the Assistance rendered by the Department of Industries.	6 ps.
2.	Lift Irrigation	6 ps.
3.	Power from Sunlight	1 a.
4.	Fly Shuttle Looms	6 ps.
5.	Boring	6 ps.
6.	Influence of the War on Indian Industry and Trade.	1 a.
*7.	Indian Cottage Industries	6 ps.
8.	Cotton Seed Pressing	6 ps.
9.	Cost Calculation	6 ps.
10.	Brick Manufacture	6 ps.
11.	The Development of Industries	6 ps.
*12.	Oil Pressing	6 ps.
13.	Refining Graphite	6 ps.
14.	Formulae for Glass	1 a.
15.	Timber for Pencil Manufacture ..	1 a.
16.	A Trial of the Anderson Oil Expeller	Not for sale.
17.	Pattern Weaving	1 a.
18.	Power Supply for Small Towns ...	1 a.
19.	On the Use of Indigenous Dyestuffs ...	1 a.
20.	Solid Border Slays	6 ps.
21.	Pencil Lead Manufacture	1 a.
22.	Dyeing with Indigenous Materials ...	6 ps.
23.	Pencil Manufacture	6 ps.
24.	Glass Furnace	1 a.
25.	Glass Manufacture	1 a.
26.	On the treatment of different kinds of Oil Seeds in the Anderson Expeller.	Not for sale.

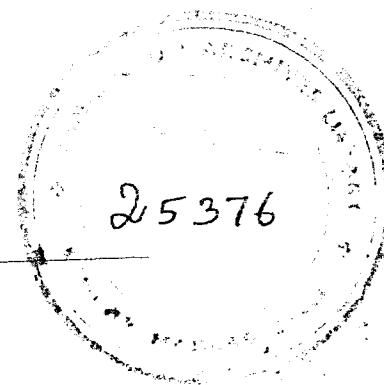
New Series.

1.	Milling of Rice in the Madras Presidency ...	2 as.
2.	Experimental Manufacture of Lime Sand Bricks in Madras.	Not for sale.
3.	Rates of Import Duty Leviable on Indian produce in certain foreign countries.	Do.
4.	The Utilization of Tamarind	3 as.
5.	The Manufacture of Glue in the Tropics from Tannery Refuse.	1 re.
6.	The Manufacture of Sodium Carbonate from the alkaline soils ("Psoudu") of the Madras Presidency.	1 a. 6 ps.
7.	The Manufacture of Citric Acid from Limes ...	1 a.

* Out of print.

LIST OF BULLETINS ISSUED BY THE DEPARTMENT OF INDUSTRIES—*cont.**New Series—cont.*

Serial number.	Subject.	Price.
8.	Soap Making by the Cold Process	8 as.
9.	A Note on the Manufacture and cost of "One Bath" Chrome Liquor.	6 as.
10.	Researches conducted in the Leather Trades Institute.	1 a. 6 ps.
10(a).	South Indian Wattles.	
11.	Technical and Industrial Schools and Institutions under the control of the Department of Industries.	1 re.
12.	Handloom Weaving in the Madras Presidency ...	1 re. 8 as.
13.	Treatise on Practical Sericulture	14 as.
14.	The Development of Coir Industry on the East Coast of the Madras Presidency.	2 as. 6 ps.
14(a).	Coir Industry in the Madras Presidency ...	1 re.
15.	The Development of Cumbly and Blanket Industry in the Ceded Districts of the Madras Presidency.	2 as. 6 ps.
16.	Woollen Pile Carpet Industry in the Madras Presidency.	3 as.
17.	Notes on starting Industrial Schools	8 as.
18.	Code of Regulations for Industrial Schools ...	10 as.
19.	Standard Syllabus for Industrial Schools ...	8 as.



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