

Government of Madras.

HOME DEPARTMENT

(EDUCATION)

G.O. No. 1051, 4th October 1916

NOTES
PRINTED

INDEXED

Department of Industries

Recording the administration report of the — for the year 1915-16.

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G.O. No. 1051, 4th October 1916

N.F.
ORIGINAL.

Department of Industries

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GOVERNMENT OF MADRAS

HOME DEPARTMENT

(Education)

READ—the following paper :—

Letter—from K.T. B. TRESSLER, Esq., Acting Director of Industries.

To—the Secretary to Government, Educational Department.

Dated—Madras, the 20th July 1916.

No.—A-11.

I have the honour to submit herewith my administration report for the year 1915-16.

2. The year under review has been an extraordinary one owing to the prevalence of a state of war and the work of the department has had to be carried on in the face of difficulties of an exceptional character.

3. Military requirements have made certain calls on the department. As mentioned in my previous report, Mr. Wills, my Personal Assistant, took a commission in the Flying Corps in March last. Mr. Guthrie, the Leather Expert, followed him to Mesopotamia with a commission in the Artillery three months later. Three men from the workshop also proceeded on active service. When the manufacture of munitions was begun in India, the department and the schools controlled thereby placed 14 machine tools at the disposal of the munition authorities, whilst the departmental motor-tractor was employed for some months in carrying about shells. In this connection I have to mention the patriotic assistance rendered by the trustees of the Chengalvaraya Naicker's Technical Institute, the St. Joseph's Industrial School, Coimbatore, and others.

Recruiting was also undertaken for mechanics for Mesopotamia and about 150 names were collected. At the moment of going to press I have further received a notification posting me to the Sappers and Miners.

4. Military requirements have led to a curtailment of civil expenditure. Since the reorganisation of the department in April 1914, I have been asking for extra staff, both superior and subordinate, and adequate accommodation. During the year the cost of direction increased by only $2\frac{1}{2}$ per cent. On the other hand, the revenue receipts increased by 15 per cent and the total revenue expenditure fell slightly. The net revenue cost of the department for the year was about 2.24 lakhs, as compared with 2.3 in the previous year.

5. The cost of maintaining the department has been steadily falling ever since I took over sole charge nearly three years ago. Increased receipts and reduced working expenses in the semi-commercial branches no doubt contribute to this economy, but a reduction in costs for the department as a whole, in spite of the large expansion of work of an unremunerative character in the experimental department and the Bureau, can only indicate one thing, viz., "overloading" somewhere or other. I have now been running the Department of Industries practically single handed for three years, and I accordingly requested Government early in the year to take steps to put the department on a definite footing. Government have now decided to appoint a member of the Indian Civil Service for the purpose of formulating proposals for the reorganisation of the Department of Industries.

6. As a first step towards this reorganisation, orders were issued for the transfer of the Pumping and Boring Department from my control to that of the Director of Agriculture.

7. The department at present consists of seven sub-departments, viz., (1) Administration, (2) Education, (3) Engineering, (4) Boring, (5) Workshop, (6) Experiments and Demonstrations, (7) Bureau. I am in direct charge of practically all of them.

ADMINISTRATION.

8. As already stated Mr. Wills and Mr. Guthrie have gone on active service. In the place of Mr. Guthrie, Dr. Marsden was, as a temporary measure, transferred from Madras to superintend the work of the Leather Trades School and provide the scientific instruction. For the practical work Messrs. Chambers & Co. were kind enough to permit me to utilize the services of their head tanner Mr. Mason. At the same time steps were taken to introduce a more permanent arrangement and towards the end of the year Mr. Raghava Kurup (a former pupil of mine at the Sembium Tannery) was appointed Assistant Superintendent to take charge of the tannery pending Mr. Guthrie's return.

During the year two supervisors took two months' leave; one subsequently went sick again and was granted three months' extension. Seeing that the supervisors of this department who had reverted to the Public Works Department had all secured an increase in pay, I could not stand in M.R.Ry. K. Ranganatha Ayyangar's way when he also asked to be allowed to revert to the Public Works Department. M.R.Ry. K. Ranganatha Ayyangar was one of the original departmental supervisors and the development of the pumping operations in the southern districts has been very largely due to his intelligent efforts.

As the amount of plant in the charge of the department is rapidly increasing, it was considered desirable to obtain an expert Superintendent for the workshop, and Government sanctioned such an appointment in the place of the Sub-Engineer's post reserved in the Public Works cadre for this department. Mr. Apte, Superintendent of the Chengalvaraya Naicker's Technical Institute, Madras, was appointed to this post in January.

A Superintendent for the Bureau of Industrial Information on a pay of Rs. 100-5-125 was also sanctioned in January.

Owing to pressure of work I was unable to do very much touring and the only outside functions I attended were the Tiruppur Cattle Show and the Industrial Conference at Nellore. In Madras I read certain papers and arranged the industrial section of the exhibition held at the People's Park.

During the year I prepared a Pumping Manual which has been submitted to Government for consideration. I have also written a companion volume, viz., a Boring Manual.

I invented an integrating gas-engine indicator. An improved solid border slay has also been invented and the practical details are being worked out by the Superintendent, Peripatetic Weaving Party No. 2. Further, a method of graphite refining which is believed to be entirely original has been evolved and one of the supervisors is engaged in elaborating the method.

In connection with the shortage of dyestuffs Dr. Marsden proceeded to Bangalore for a month and a half to carry on certain investigations there. He subsequently went to the Titagarh Paper Mills to investigate and study the process of pulp manufacture and later proceeded to Punalur to supervise manufacture there.

My personal assistants and the Superintendent of the Bureau visited various local exhibitions and shows and delivered lectures. Mr. Subrahmanyam Ayyar, the weaving assistant, also wrote several technical articles for the press.

EDUCATION.

9. During the year the Code of Regulations regarding technical education prepared by me was under the consideration of Government. It was returned for revision towards the end of the year and a revised draft has been resubmitted. The appointment of an Inspector of Industrial Schools was sanctioned by the Secretary of State two years ago, but no appointment has yet been made.

Schemes for the establishment of industrial teaching centres at Coimbatore, Vizagapatam and Tindivanam were worked out but had to be deferred owing to shortage of funds. A similar scheme for the establishment of an industrial school at Cocanada was sanctioned. The preliminaries of this scheme have been settled and plans and estimates are under preparation.

As regards Government institutions, the Madura Technical Institute was begun last August and it is hoped that part of the premises will be ready for occupation this summer.

A scheme for the establishment of a Trades school in Madras was also submitted. But Government ordered that in the first instance the classes should be temporarily held in hired premises. At present it is next to impossible to get any machinery and, so far, I have been unable to discover temporary accommodation of a suitable character in a suitable locality. The scheme is therefore in abeyance for the time being.

Pending the sanction of the new Technical Education Code the existing industrial school system was not interfered with and continued unchanged. During the year three new schools were temporarily recognised and one was closed owing to lack of funds. The number of recognised institutions on the 31st March was 37.

The State Technical Scholarship for the study of Electrical Engineering in England was awarded to Muliyl Karuvén. As in previous years six scholarships were offered at the Victoria Technical Institute, Bombay. But as before, the majority of applicants did not satisfy the conditions laid down by Government and only two scholarships have actually been awarded.

CONSULTING ENGINEERING—(PUMPING).

10. During the year the number of applications for assistance and advice was the same as in the previous year. The supply of engines from England has become very uncertain and firms, being able to dispose of the whole of their limited stocks for cash, generally refuse to sell on hire purchase. Two years ago proposals were submitted to Government for the introduction of a State hire purchase system similar to that introduced by Mr. Chatterton in Mysore. No orders were passed on these proposals during the year, and as most ryots are unable to find ready cash, such engines as are available usually go to firms of standing who can make cash payments, rather than to ryots who often cannot.

But apart from the question of plant and payment, the fact has to be recognised that during the prevalence of war conditions, ryots are somewhat chary of investing money. Towards the end of the year there were signs of reviving confidence and if the loan rules are sanctioned, and the supply of engines improves, I anticipate a considerable expansion of work during the coming year.

It is gratifying to note that two firms in this Presidency are seriously considering the local manufacture of oil engines.

11. The appended table gives, in an abstract form, the number of factories of different kinds in the Presidency at the end of the year. As compared with last year, progress has not been up to average for the obvious reason that the war has caused a curtailment of investment and expenditure. The sections under which the greatest progress is shown are Section I—Agriculture and Irrigation, Section VII—Food, Drink and Tobacco trades, Section VIII—Chemical and allied trades and Section V—Textile trades. The increase in Section I is mainly due to pumping plants, in Section VII to rice mills, in Section VIII to oil mills and Section V gineries.

Section	Trades.	Number of factories.	Horse-power.				Total excluding horse-power of boiler.
			Engines.	Boilers.	Oil or gas.	Others.	
I—Agriculture and irrigation		701	..	1,484	8,671	..	8,671
II— Mines and quarries		21	262	1,484	149	..	401
III—Iron, steel and engineering trades		61	859	4,948	1,240	..	2,108
IV—Metal trades other than iron and steel		3	..	137	150	..	147
V—Textile trades		243	16,687	18,693	2,475	1,150	19,312
VI—Clothing trades		..	..	..	8	..	8
VII—Food, drink and tobacco trades		46	2,672	12,899	7,974	120	10,966
VIII—Chemical and allied trades		45	297	1,207	556	527	1,380
IX—Paper, printing and allied trades		30	63	222	273	76	432
X—Leather, canvas and India rubber trades		5	41	64	10	..	51
XI—Timber trades		22	62	50	132	114	303
XII—Clay, stone building and contracting trades		29	1,405	1,869	78	5	1,488
XIII—Miscellaneous trades		..	..	..	..	..	..
XIV—Public utility services		31	6,556	2,743	601	15	7,232

12. Of the 136 applications dealt with by the department about one-half were connected with power pumping and the other with industrial plant. As explained in last year's administration report, the department is discouraging the installation of plant in places where it would constitute reduplication of existing plant and interference with established enterprise. For this reason the erection of rice hulling plants in Tanjore, which constituted so marked a feature of departmental work two years ago, has been almost entirely stopped. On the other hand several schemes on novel lines have been taken up. In Tanjore a new type of vertical spindle pump has been introduced and is being tried; and a large central electric power scheme is being worked up for an enterprising ryot in the Coimbatore district.

The special feature of this year's work is the development of the compounding fees system. The principal difficulty the small machinery owner has to face is the maintenance and supervision of his plant. The compounding system was originally introduced in order to give ryots an opportunity of having their plant regularly inspected by a departmental officer. During the year the scheme was amplified and the department now arranges for the supply of spares also when desired. This innovation has made the compounding fee system much more popular and the number of fees collected has increased by 20 per cent as compared with last year.

Excluding a special loan of Rs. 25,000, only three Government loans were sanctioned during the year and were of the value of Rs. 5,400. During the last three years loans have gradually been falling from Rs. 62,500 to the present figure. The reasons for this falling off are largely due to war conditions. The reduction in the loan disbursements constitutes a good indication of the present financial situation.

Considerable economies were effected in this department during the year. Whereas the total receipts fell slightly, the expenditure was reduced still more and the cost of this department shows a reduction of 5 per cent on last year's figures.

BORING DEPARTMENT.

13. In the Boring Department the total depth bored through was about 25,000 feet which is somewhat less than the previous year. The number of borings was nearly 500 which also shows a slight reduction as compared with last year's figures. On the other hand the number of successful borings has increased to 80 per cent as against a little over 70 per cent previously. The reduction in depth and number is due largely to the fact that ryots are being encouraged to persevere with their borings instead of giving them up. The average depth of borings during the current year was 15 per cent greater than last year. Boring work was carried on during the current year under great difficulties as the greater part of the departmental workshop machinery was engaged on war work and delays in the execution of repairs occurred in consequence. Further the supply of lining pipes has been erratic and work has frequently been held up owing to lack of pipes. Even now orders sent to Europe eight months ago are still unfulfilled.

In the circumstances the reduction of costs in this department is remarkable. The cost of drilling 100 feet deep has been reduced to less than half of what it was two years ago.

The departmental plant—chiefly pumping engines—has been in constant use during the year. Although the department now has 14 engines available for hire, the demand exceeds the supply and there is a long waiting list. Engines have to be rushed out again almost as soon as they come to the workshops and consequently the difficulties of maintenance are greatly enhanced.

Careful working accounts have been maintained during the last two years, and it is now possible to determine exactly what departmental service actually costs. In the light of these figures it was found that the charge for a certain class of service was insufficient and proposals were submitted to Government for the revision of the scale of fees.

WORKSHOP.

14. A considerable amount of up-to-date plant was sanctioned by Government for the purpose of enabling the departmental workshop to cope with the ever increasing demands made thereon. The machinery was received just before the great munition

movement and had not been in the country more than a month before it was requisitioned for munition purposes. Government sanctioned its loan to the Perambur Workshops for the time being and the shops had to do the best they could with the balance of plant left. By dint of over-time and extra pressure all round, they managed to keep up more or less with the demands made upon them.

The shops show increased receipts and reduced expenditure, but I am afraid the former have been secured by overcharging the other departmental branches. In the circumstances under which the workshop has had to work during the past year a certain amount of loss must be expected.

EXPERIMENTS AND DEMONSTRATIONS.

15. In this department 11 of the 12 experiments begun last year were continued. Of these, seven are of an ordinary routine character and the other five represent experiments undertaken more particularly on account of the war conditions.

During the year no further experiments were sanctioned by Government.

The two *Peripatetic Weaving Parties Nos. 1 and 2* continued their work during the year. M.R.Ry. N. Subrahmanya Ayyar in charge of Party No. 1 toured in the south of the Presidency and M.R.Ry. N. M. Sundaram in charge of Party No. 2 in the north.

The progress of these parties as evidenced by results continues to be satisfactory. (Vide appendix.)

16. *No. 3. Gunjana project.*—This project was again worked this year, but on representations being made, Government passed orders that the project should be closed and the plant removed. Proposals for its establishment elsewhere have been called for and a scheme is now under preparation.

17. *No. 4. Motor tractor.*—As it is possible to use this plant for ploughing purposes only during certain seasons of the year, attempts were made to see whether it could not be used for haulage work during the off season. After the close of the ploughing season the tractor was overhauled previous to its being sent to Coimbatore in accordance with an application by the Forest Department. Before it was despatched, however, it was claimed for munitions work and was employed for several months in Madras in hauling shells. After that the Forest Department application had to be dealt with and forest work kept it engaged until the end of the year. Owing to these demands on the tractor for haulage purposes it has not been available for ploughing purposes during the year.

A report on mechanical traction embodying the experience obtained in these trials is being published in bulletin form.

18. *Nos. 5 and 6. Singanallur and Hospet sugar stations.*—After a great deal of uphill work these stations have proved a great success during the year. At Singanallur 10,750 maunds of jaggery were manufactured and manufacture showed a gross profit of Rs. 1,348.

At Hospet difficulties connected with labour and supplies of cane have been experienced from the first, chiefly owing to the unhealthy character of the locality and the lack of enterprise on the part of the local ryots.

When therefore an application was received from the village munsif of Chittavadigai for the hire of the plant, specially favourable terms were offered. The hire was fixed at the low figure of Rs. 250 a month, and this brought in a revenue of Rs. 1,000; 6,670 maunds of jaggery were manufactured.

19. *No. 7. Lime brick plant.*—In G.O. No. 1472, Educational, dated 23rd December 1914, Government sanctioned the purchase of a plant for the manufacture of bricks from lime and sand. The plant has been erected in the premises of the South Indian Industrials who have undertaken to supply all raw materials at cost price. Here, as in all cases where questions of machinery arise, the delivery of plant has not been completed owing to the pressure of munitions work at home. Some extra machinery has however been borrowed from the Public Works Department and with the aid of this, bricks are being manufactured and utilised for the construction of the oil mill. Commercial data cannot now be given as the present plant is of a make

shift character and the cost of operation is therefore considerably higher than it should be. Information has however been received that the missing items are being shipped and a bulletin will shortly issue describing the results of trials.

The foregoing experiments are those which were undertaken before the outbreak of war. The ones hereafter enumerated all owe their origin to war conditions.

20. *No. 8. Pencil manufacture.*—A great deal of progress was made in this industry during the year. Last year an expert was engaged. In a comparatively short space of time, he got the plant into working order and turned out pencils with a reasonable finish. The graphite used was not however satisfactory, and the wood supplies had not been ascertained. During the current year therefore these two important commercial factors were investigated. To begin with, 34 or 40 different species of wood were collected and tested, and of these 8 were selected and tested in bulk. The bulk trials showed that several varieties which at first appeared suitable possessed drawbacks which made them unfit for pencil-making purposes. Of the 8 selections 3 species were finally chosen and the supplies of these species were investigated with reference to their commercial characteristics, viz., quantity and price. As the best price that can be paid for timber is 10 annas a cubic foot delivered, it is evident that the question of price is one that requires a great deal of consideration. Since most timber in India is not gregarious, the problem of supply in commercial quantity is one that offers considerable practical difficulties. Ultimately, it was found that in one species adequate supplies could be obtained from three circles at a commercial figure.

The graphite problem proved an equally difficult one. When it is remembered that a minimum 75 per cent purity is required and that the ore available in South India only averages about 80 per cent purity and that further the graphite and silica (with which it is mixed) have almost the same specific gravity, the nature of the problem will be appreciated.

A supervisor was deputed to go to the Indian Institute of Science and he spent several months there studying the problem. None of the known methods of refining proved of the slightest value, and, finally, an entirely novel method of refinement was introduced. The supervisor in charge of the experiment also made trials with red, blue and copying leads and achieved satisfactory results. Copying leads are coloured with methyl violet which, being a German dye, is not at present available.

Preliminary investigations were complete early in December. I have now received funds which will enable me to place a certain number of pencils on the market.

The experiments made are published in the departmental bulletins.

21. *No. 9. Glass manufacture.*—The three essentials in glass manufacture are (a) a furnace of high efficiency capable of giving a temperature of not less than 1,500 centigrade; (b) a knowledge of the composition of glass; (c) practical experience in the manipulation of the metal.

The furnaces in the old glass factory were in several ways defective and, during the year, experiments were made with regenerative oil furnaces. In Madras oil fuel is more satisfactory from the commercial and practical point of view than coal. In Europe the reverse holds true; hence European experience of coal fired furnaces is not of very much use in dealing with the furnace problem under Indian conditions. Information was collected as far as possible from various furnace makers, but this did not prove of much value for the reasons stated and we were thrown back on direct experiment. Towards the end of the year a satisfactory form of oil furnace was evolved.

As regards the composition of glass, formulæ are usually treated as a trade secret. On the outbreak of war an English chemist was placed on special duty to analyse the various kinds of glasses and to determine their composition. These analyses have been secured by me and a considerable number have been practically tested with the materials locally available. Some of them have been found unsatisfactory: others have proved good.

The commercial manufacture of glass in the existing factory will involve considerable structural alterations and a good deal of rebuilding. As the factory was only leased, it was considered undesirable to make these alterations and Government were requested to acquire the property. This was done at the end of the year and a new furnace is now under construction.

In connection with the practical side of glass-blowing, I have instituted several enquiries regarding a glass expert. But all the private reports received have been unfavourable with one exception. When this individual was addressed, it was found that he had gone on active service.

A fairly large exhibit of bottles made in the glass factory was shown at the People's Park Exhibition.

Further particulars of the experiments made are published in the departmental bulletin No. 25.

22. *No. 10. Paper pulp.*—Last year the owner of a defunct paper mill applied to the department for assistance to revive his mill and arrangements were made to overhaul his plant. The work was carried on under difficulties as there was another claimant for ownership who raised objections to anything being done. After trying vainly for nine months to get the parties to come to some arrangement, I at last had to inform them that unless a final arrangement was immediately arrived at I should have to withdraw from the undertaking altogether. This threat led to an agreement between the parties but only after nearly a year of valuable time had been wasted. Work was begun in February.

As a preliminary, Dr. Marsden visited the Titagarh Mills to study the processes there. He subsequently proceeded to Punalur to take charge of the mills. Owing to the fact that during the period of idleness the mill had been systematically despoiled, a large number of important parts were found to be missing, other important parts of the machinery had been badly damaged so that work was carried on under difficulties. Nevertheless pulp-making has now been started. Great assistance was rendered both by the Indian Institute of Science in lending me valuable plant and by the Travancore Government in granting me the use of 1,000 tons of bamboos free of seigniorage charges.

The mill has not run sufficiently long during the year to furnish adequate data and it would be premature therefore to express an opinion.

23. *No. 11. Oil-pressing.*—In the outbreak of war orders were placed for a large oil-pressing plant to be erected in Madras. This plant was to consist not only of presses but was to include also the apparatus required for refining the oil made. The experiment is perhaps the most important one now being under investigation. Part of the plant is delivered, but the manufacturers' works have been taken over by the English Government, and, in spite of the best efforts of the India Office, it has been impossible to secure delivery of the complete plant.

Land has been acquired: such of the plant as has been delivered is being erected and the buildings are approaching completion. Delivery is still hoped for, but until effected, nothing more can be done.

24. *Anderson expellers.*—Experiments with the Anderson expeller were continued during the year. A considerable amount of work was done in groundnut and after that experiments were made with different kinds of seeds. Reports on the expeller and the tests of seeds are being prepared in bulletin form. The second expeller which had been erected in Cuddalore for the purpose of helping to tide over the groundnut crisis was removed from there during the year as the demand for oil became slack and arrangements have been made for transferring it to the Northern Circars where it is likely to be of more general value.

25. *No. 12. Soap manufacture.*—Soap may be regarded as a bye-product of oil-pressing. Government have given a grant of Rs. 75,000 to Sir Frederick Nicholson to deal with this problem. At present I am not doing anything in this matter. I am however in touch with the Director of Industries and Commerce in Mysore who is making independent investigations on the subject.

BUREAU.

26. During the year the Bureau has been organized as far as is possible with the limited staff and accommodation available. A considerable library has been collected and samples of various industrial products of the Presidency are being accumulated.

With a view to co-ordinating the work with that of the Central Bureau controlled by the Director-General of Commercial Intelligence, Calcutta, the Superintendent was sent to Calcutta to study the system followed in that Bureau. It is hoped that the information which the Madras Bureau will now be able to place at the disposal of the Commercial Intelligence Department will be of value.

Enquiries received in the Bureau are rapidly increasing, and now amount to about half the correspondence in the department, equivalent to about 7,000 letters annually. An attempt has been made to register the information accumulated and records have been started so far as is possible with the staff now available.

One of the most important functions of the Bureau is to maintain accurate working accounts of all the experiments undertaken in the experimental branch with the view of obtaining "fundamental data of production." From the Bureau also emanate the circular enquiries regarding the availability and cost of raw material or manufactured goods. The collection of this information involves a large amount of work: the file relating to pencil timber, dye-stuffs, etc., have already reached large dimensions, but this information, as it is completed, is written up in the form of bulletins. Of these about 20 have been produced during the year.

27. A considerable number of investigations of a scientific character were undertaken in the Bureau during the year. In the Bureau all the boring results are co-ordinated and registered. Some time back Government sanctioned the appointment of two surveyors to connect up well levels for the purpose of an underground water survey. Work has been begun in the Chingleput and Tanjore districts. For a part of the former district an underground water map has been prepared and for the latter district one is in the process of preparation. Of other enquiries, that conducted by Dr. Marsden on the commercial value of indigenous dye-stuffs was the most important. Numerous samples of indigenous materials were collected. The collection took six months. Dr. Marsden then proceeded to the Indian Institute of Science to work them up. A complete range of yarn dyed with such indigenous dyes as were available were exhibited at the People's Park Exhibition. This research has been further described in a departmental bulletin. Later on the services of Dr. Marsden were placed at the disposal of the Director of Agriculture to devise means to combat the prevalent practice of indigo adulteration.

28. During the year Government sanctioned the purchase of an electric testing plant for the purpose of testing the efficiency and value of different kinds of machinery. As in the case of most other investigations involving the use of plant, the plant has not yet been fully delivered. When it is received (and if accommodation can be found) it will be possible to carry out a series of experiments on the mechanical merits of different classes of machinery. Meantime certain tests have been made on a new form of oil-crushing plant, and experiments on decorticators are also contemplated when accommodation becomes available.

29. During the year a start was made with the investigation of the mineral resources of the Presidency, and some promising samples were sent in by the departmental supervisors.

Several specific minerals had to be studied in connection with the experiments actually being undertaken. Thus, for purposes of pencil manufacture, it was found necessary to investigate the supplies of china clay in the Presidency. In connection with the paper and glass experiments enquiries were made regarding the availability of sodium carbonate. Considerable deposits of the former kind of varying degrees of purity have been tested, but, in the matter of carbonate, the result has so far been disappointing.

30. One of the most important events of the year was the Industrial Exhibition held in Madras in connection with the People's Park fair at Christmas. In this exhibition the industrial section was organized by the Department of Industries and appears to have attracted a considerable amount of interest. The working model of

the water-power scheme in particular seemed to take the public fancy, though the educational side of this exhibit was not perhaps adequately appreciated. It caused quite a sensation as a side show and disputes were by no means infrequent for the possession of points of vantage from which to watch the electric train coming out of the tunnel. Working exhibits of pencil manufacture were also shown, but the departmental glass furnace in which it was proposed to manufacture bottles was stopped at the last moment. Two improved looms were also shown in operation and one of these was awarded a medal. Working exhibits of improved button machinery was also arranged by the department in collaboration with Mr. Bose, a local manufacturer of these goods. Exhibits by private engineering firms were limited to articles made in this country and, with the exception of the Crossley engine used for motive purposes, the whole of the machinery exhibited in the firms section was of "swadeshi" manufacture.

31. Another investigation that has been engaging the attention of this department is that of tinning or otherwise preserving Indian fruits. The position of the carpet industry was examined. The problem of manufacturing buttons was also gone into.

32. Apart from investigation, a certain amount of practical industrial work of a minor character is also done in the Bureau. An example of this kind is the scheme which was inaugurated last year to meet the demand for cotton-webbing. Although the work is being carried on on a comparatively small scale, it has yielded very gratifying results. The weavers engaged have been earning good wages and, even allowing a fair sum to cover the cost of departmental supervision and control, there still remains an appreciable margin of profit. The venture has not yet reached a state of maturity, but it is hoped in the near future that it may be converted into the nucleus of a co-operative society.

33. A considerable part of the work of the Bureau has been in connection with commercial enquiries which have to be regarded as semi-confidential. If, for instance, a merchant has the idea of utilising some raw material not previously employed and makes enquiries regarding supplies and so on, it is only fair that his intentions should not be made public. Again a considerable number of confidential Government inquiries were received and dealt with. These, although of great interest, obviously cannot be discussed here.

34. Hitherto the Bureau has been in a singularly strong position to obtain local information on commercial matters owing to the existence of a large departmental district staff which could be called upon to report on all matters of interest. This staff is now to be transferred to the Agricultural Department, and it is not at present clear how information can be collected in future. Proposals have been submitted for the creation of a staff of industrial inspectors.

35. To summarise. The year's work has been carried on under considerable difficulties. War conditions, the impossibility of obtaining machinery from Europe, financial stringency and lack of staff and accommodation have tended to intensify the natural difficulties under which pioneer work of any kind always labours. In these circumstances, industrial education has practically remained *in statu quo*. The pumping and boring work remains at about last year's level but with increased receipts and with very materially decreased expenditure. The workshop is much the same as before. In the experiment and demonstration line, the sugar mills have reached the demonstration stage and shown a very considerable profit during the year: the rest of the experiments have not yet reached the commercial stage but considerable progress has been made in most of them. The pencil industry would have been transferred to demonstration in December had funds been available. The bulletins will also give some idea of the progress made in the other industries. The Bureau work has developed during the year.

36. Before leaving the department, I desire to bring to the notice of Government the amount of help which I have received from the members of the staff under circumstances of exceptional difficulty. Owing to pressure of work office hours have often to be considerably extended and public holidays sometimes sacrificed. This extra work the office has cheerfully performed. On the executive side I wish particularly to mention Mr. J. Narayanamurti, my Personal Assistant, who has done extremely

useful work and has stuck to the department although his juniors who have reverted to the Public Works are drawing Rs. 50 more pay. Mr. Ranga Achari, who is my Assistant in the Pumping and Boring Department, has shown himself useful and reliable. Mr. Narasimha Ayyar, Superintendent of the Bureau, has done extremely well in organising his section and introducing the departmental system of accounts, whilst Mr. Ramachandra Ayyar, the Pencil Expert whom I am training, has worked with great application and zeal throughout the year and has obtained a very sound knowledge in pencil manufacture. Reports of the various sections are appended.

ENCLOSURES.

(1)

Section reports.
ADMINISTRATION.

The accounts for the year arranged according to official sub-heads are given in table I of the appendix.

It will be seen that the total nominal cost of maintaining the department is Rs. 2.95 lakhs as against Rs. 3.70 lakhs last year. From these figures have to be subtracted capital expenditure of a recoverable character which amounted to Rs. .71 lakh as against Rs. 1.40 lakhs last year.

The actual cost to Government, therefore, amounts to only Rs. 2.24 lakhs as against Rs. 2.30 in 1914-15 and Rs. 2.34 lakhs in 1913-14.

The official figures are mixed up and they do not differentiate between capital and revenue expenditure. Special accounts are maintained in order to determine the relative cost of each branch of work of the department.

According to these accounts, the cost of running the Department of Industries, that is, the cost of direction is .43 lakh as against .40 lakh in the previous year. Technical education has cost only .87 lakh as against 1.01 lakhs in the previous year; Bureau, very nearly Rs. 12,000 which also includes charges on account of the Industrial Exhibition; Consulting Engineering Department, Rs. .22 lakh as against Rs. .23 lakh in 1914-15; Boring Department Rs. .20 lakh as against Rs. .24 lakh in 1914-15; Workshop Rs. .06 lakh as against Rs. .15 lakh in 1914-15; Experimental Branch Rs. .39 lakh as against Rs. .32 lakh in 1914-15.

The total net cost of the various branches of the department is only Rs. 2.22 lakhs as against Rs. 2.33 lakhs in 1914-15, that is to say, Rs. .11 lakh less than the previous year. The marked decrease of about Rs. 9,000 in Workshop expenditure during the year is mainly due to the introduction of a new system of working accounts.

EDUCATION—INDUSTRIAL SCHOOLS.

General.—Apart from the Government Technical Institute, Madura, there were 37 Industrial Institutions under the control of the department as against 35 last year. The temporary dyeing classes attached to the Technical Institute, Madura, were closed as there was no demand for them, mainly due to the stoppage of dyestuffs. Three new schools were temporarily recognised during the year out of which one was closed before the close of the year for want of funds. The O.E.L.M. (late H.E.L.M.) Industrial School, Nayudupet, was revived during the year under the management of the Ohio American Evangelical Lutheran Mission.

The 37 recognised institutions may be roughly classified as follows:—

Carpentry Schools—where Carpentry is the principal subject taught	16
Lace Schools—where needle craft is the principal subject taught	15
Printing Schools—where printing, book-binding, etc., are the principal subjects taught	2
Agricultural School	1
Blind Boy's School for weaving	1
Weaving Schools	2
Total	37

In nine of the above-mentioned 16 carpentry schools mechanical engineering is also taught as a subsidiary subject.

The establishment of a weaving school by the Local Board at Berhampur is under correspondence. Pending the approval of the Code of Regulations for Technical Education many of the managers of unrecognised schools have deferred submitting their applications for recognition while some others have postponed starting new schools which they have under contemplation.

Statistical information regarding the schools is given in Tables II and III of the Appendix.

There were 1,916 pupils under instruction on the 31st March 1916 as compared with 1,876 on the corresponding date in the previous year. Some of the Mission Schools lost strength during the year owing to the fact that they had to limit work in the workshop for want of sufficient orders from outside and further owing to the fact that the help they used to get from the Mission Funds stopped or was reduced owing to the war. Some other schools however gained strength and the loss in the former case was more than covered by the gain in the latter so that the total shows a slight increase over that of the previous year.

The different subjects taught in industrial schools and the number of pupils under instruction in each are given in Table II. From a perusal of the statement it will be observed that 607 fall under the head Carpentry, 605 Needle crafts, 269 Mechanical Engineering, 214 Printing, 701 Weaving and other subjects.

One hundred and fifty-six scholarships—4 in the Advanced Class, 27 in the Intermediate, 39 in the Elementary, 43 in D Standard and 43 in C Standard—were sanctioned to deserving pupils in Industrial Schools during the year as against 177 in the previous year. The total amount paid under this head during the year was Rs. 5,395-12-6 as against Rs. 5,242-8-5 in the previous year. The slight increase in the amount paid during the year in spite of the decrease in the number of scholarships sanctioned is due to the fact that many of the scholarship holders did not discontinue their studies as in the case of previous year.

The amount of teaching grant paid during the year was Rs. 33,273 as against Rs. 29,610 in the previous year. The increase is due to two reasons. Some of the deserving Mission Schools applied for special help owing to the stoppage of their usual remittances and schools ordinarily drawing funds from Belgium and North France were specially assisted. Further two schools were newly aided.

The amount of building grant paid during the year was Rs. 4,203 as against Rs. 6,920 in the previous year. In G.Os. Mis. Nos. 301, dated 15th March 1915, and 395, Educational, dated 14th April 1915, Government sanctioned, as a special case, Rs. 7,000, the total amount required for the provision of additional accommodation for the St. Joseph's Industrial School, Bellary, as the management expressed their inability to contribute any part of the cost of the building. Rupees 6,000 has already been paid in advance and the building is almost complete. During the year building grants were also sanctioned to the Anjuman-i-muaf-i-Ahl-i-islam Industrial School, Madras, (Rs. 1,400) and the Andra Jatheeya Kalasala, Masulipatam (Rs. 1,900). The plans and estimates amounting to Rs. 19,650 for a new building for the Vellore Anjuman Industrial School are under the consideration of Government.

The amount of furniture and special grants paid during the year, as will be seen from Table III, was Rs. 6,104-5-0 as against Rs. 9,147-6-6 in the previous year. No grants under this head were paid to schools the development of which is under consideration and this accounts for the decrease in the amount spent during the year.

The management of the H.E.L.M. Industrial School, Nayudupet, and the G. M. Lace Making class, Gudur, have been taken over by the O.E.L. Mission and that of the L. M. Girls' Industrial School, Kempstown (Trichinopoly), by the Church of Sweden Mission.

Some very fine exhibits for the Peoples Park Exhibition were contributed by Industrial Schools and certificates of merit were awarded to the Wesleyan Mission Industrial School, Karur, for its black wood furniture, the St. Joseph's Industrial School, Tindivanam, for its inlaid work, the American-Advent Mission Industrial School, Veicheri, for wood carving, the S.P.G. Girls' Industrial School, Edayangudi, for its lace work, and the Andra Jatheeya Kalasala, Masulipatam, was awarded a gold medal for the scientific instruments exhibited by it.

In connection with munition manufacture a few lathes were lent to the munition authorities at Perambur by the St. Joseph's Industrial School, Coimbatore, the Chengalvaraya Naicker's Technical Institute, Madras, and the Government Technical Institute, Madura. Men for the manufacture of shells were also spared by the latter two schools. Father Perrin of the first named school was recalled to the French Colours during the year and Mr. Hudson of the Velacheri school has gone to do Y.M.C.A. work in Mesopotamia.

TECHNOLOGICAL INSTITUTIONS.

The Technical Expert (Dr. Marsden) reports with regard to the dyeing branch—

"One of the immediate effects of the declaration of war was the almost complete stoppage of dye-stuffs, the manufacture of which has hitherto practically been a German monopoly. Until the supply of dye-stuffs could be re-established there was clearly little object in trying to provide instruction in the technique of dyeing and it was felt that this question could be left in abeyance until the completion of the Madura Technical Institute buildings. During the early part of the year therefore the Dyeing Expert devoted his attention more particularly to the investigation of indigenous dye-stuffs with a view to ascertain whether these could in any way replace German synthetic dyes. The first investigation made was with a number of different varieties of safflower received from the Economic Botanist, Pusa. These were found to vary enormously in dye-stuff content and, from the market prices (bazaar) which were being charged for the flowers it was patent, bearing in mind the fugitive character of the dye and the tediousness of the operations required to prepare it for dyeing, that it would not find much application in practice.

Owing to the Leather Expert's departure for active military service, Dr. Marsden was requested to take charge of the Leather Trades school in Madras in addition to his other duties and arrived in Madras early in July.

Meantime, stringency in the matter of dyes had become most pronounced and numerous enquiries were received as to materials which might be employed in place of the imported ones. Although enquiries were instituted in many directions with respect to the old-time materials, replies came in very slowly and it soon became evident that, if only on the score of quantity, these materials could do little to relieve the situation. Further these materials furnished no possibility of effectively dyeing a range of shades such as Indian dyers had been accustomed to. It was explained to dyers that it would only be possible to use indigenous materials such as turmeric, safflower and annatto for bright shades and where no degree of fastness was essential. Where fastness was of moment they might find indigo, catechu and (for black) tannin materials and iron salts useful.

Communications were forwarded to some of the dye-making firms in England informing them of the demand for dyes here and the market awaiting them, but the Government demands for munitions and machinery had reacted upon all other industries, and the shortage of labour, the demand from their home customers and the impossibility of carrying out the contemplated extension of works prevented dye manufacturers from holding out any hope of supplies being forwarded to India. It is true that some dyes have been exported under the licence scheme of the Board of Trade, but these have been purchased by agents in England and then exported on Indian account. Owing to the extent of the requirements, they have not however altered the position materially.

Then the release of the S.S. *Barenfels* under the orders of the Prize Court of *Alexandria* gave a prospect of a supply for a short time to Madras and it was finally agreed that the Madras Government should have the option of purchase. The difference however between the prices at which the agents of the Prize Court will let the cargo go and those which the dyers are prepared to pay is so great that the question had to be carefully considered.

Meantime, however the investigation of indigenous dye-stuffs was being proceeded with. District Officers were circularised early in the year and a representative collection of Indian dye-stuffs was slowly collected. When collection was complete it was arranged in collaboration with Mr. Chatterton that Dr. Marsden should go to the Indian Institute of Science to test them practically.

The results of the investigation were definite and, in the words of Mr. Chatterton, may be thus summed up. 'Nothing useful can result in attempting to resuscitate vegetable dyeing on cotton' owing to

- (1) the extreme cost of vegetable dyeing;
- (2) the scarcity of dyeing materials;
- (3) the change in the tastes of the people who are accustomed to buy bright colours and regard the vegetable dyes on cotton as too dull and sombre."

The Dyeing Expert was preparing to undertake the analysis of Indigo samples on the suggestion of the Director of Agriculture when the embargo on exports of wood pulp created a serious position in the paper-making and using trades. As the Dyeing Expert possessed a considerable knowledge of the chemistry of pulp manufacture and as moreover the position was critical and there was no one else to send, it was arranged that Dr. Marsden should attend to the pulp work. The Department of Industries had already undertaken to conduct experiments with bamboo at the Punalur mills and to assist in the development of the work. Dr. Marsden was deputed to visit the Titagarh Mills, Calcutta, to discuss the question of pulp-making from bamboo and then proceed to Punalur. It is unfortunate that the state of the plant there after its long stand is not good and breakdowns are to be expected. One such breakdown occurred through a wooden conveyor being dried out, patching was hopeless and only after 14 days, owing to the position and difficulty of obtaining supplies at short notice, could the work be resumed. Owing to the demand for newspaper it may be advisable to attempt more than was at first contemplated, and see whether besides pulp for paper-makers the plant cannot be utilised for the manufacture of common paper at a profit and thus assist somewhat in relieving the strain.

LEATHER TRADES SCHOOL.

The Assistant Leather Expert reports as follows:—

"The new building for the Leather Trades school at Washermanpet was completed early in 1915. In order to bring the session into line with the sessions in other technological colleges the school was not reopened until June although facilities were given previously for practical work to any student desiring to avail himself thereof.

The session started with six students and it had only just begun when the Principal was called away on active service. Dr. Marsden was transferred from Madras temporarily to look after the school until other arrangements could be made. So far as practical work is concerned, Messrs. Chambers & Co. kindly agreed to their Head Tanner, Mr. Mason, attending the school, taking classes and giving practical instruction on the technical side. The instruction in Chemistry, Mechanics, Book-keeping and Laboratory work was under the direct supervision of Dr. Marsden. To deal with the first subject a Chemistry graduate was appointed. Instruction in Engineering was given by the Engineering staff of the department and for Book-keeping a special man was engaged.

Two of the six students decided to postpone their course until the Leather Expert's return from active service. One other student seems to have joined the class under the impression that attendance would constitute an easy path to Government employment. When his mind was disabused on this point his attendance ceased. The remaining students continued throughout.

The arrangements made on the Leather Expert's departure were provisional and enquiries were instituted for a man who could exercise whole-time superintendence over the Leather Trades school. In due course Government sanctioned the appointment of Mr. K. Raghava Kurup. Mr. Kurup underwent preliminary training in the old Government Chrome Tannery and then proceeded to England where he completed the course at the Leather Sellers Technical College, London. After taking his diploma there he was employed for some time in works in England and accordingly possesses a considerable amount of practical experience of both European and Indian methods. In view of the pressure of work generally in the department throughout the year there was not much opportunity for doing research work at the Leather

Trades school. Mr. Guthrie continued his investigations on tanning materials until he proceeded on leave. Since his arrival Mr. Kurup has taken up the question of glue.

The first year course provided in the school is mainly of a generally scientific character. Accordingly there was not much tanning done. A certain number of applications were received for tanning work on a small scale and in so far as this work was of an instructive character it was accepted to provide the practice the first year students required. In the second year course more extensive arrangements will have to be made for the supply of raw material, but no particular difficulty is anticipated.

The course of instruction for students also included regular visits to the hides markets and tanneries in company with the Foreman who had previously been in the employ of one of the largest hostile firms now liquidated. His knowledge and experience of the market is particularly good.

In the original design of the Leather Trades school the buildings now constructed were intended to accommodate only the tannery proper. Class room accommodation was to be found in the general trades school which was to be constructed on an adjacent site. This trades school has not yet been built and to begin with, the class room instruction was given in the tannery itself. Accommodation is however limited. Now that the second year students are to arrive, it is not clear how work can be continued unless further accommodation is provided."

GOVERNMENT TECHNICAL INSTITUTE, MADURA.

The Superintendent, Madura Technical Institute, reports as follows:—

"During the year under report two instructors and the store-keeper were confirmed in their appointments. One died and was replaced.

The drawing classes were opened during the year to the industrial students.

Attendance.—

Year.	Number on rolls.	Average daily attendance.	Average number on rolls.	Admission during the year.	Withdrawals during the year.						Number of working days.
					Dismissed for irregular attendance or absence.	Left on account of ill-health.	Left before completing their course.	Number died.	Others who such as taken to other workshops.		
1914-15	56	36.72	62.12	38	17	2	15	1	* 1	270	
1915-16	56	40.18	68.01	49	28	2	18	1	† 2	279	
									Total, 49		

* Was transferred to workshop section as a cooly.

† Were taken in the Perambur Workshops in connection with munition work.

From the above table it will be seen that there is an increase in the daily average attendance and average number on rolls during the year when compared with the previous year. When the new mechanical workshop is ready, there will be accommodation for a larger number of students. Excluding the one casualty and two students sent to Perambur for munition work, 18 students left before completing their course, and 28 were dismissed for irregular attendance and absence. The indifference of parents and guardians is, in most cases, the cause of irregular attendance and consequent dismissal.

In course of time when parents begin to realize that their sons will not be readmitted and cannot get work when fully qualified workmen are available, they may perhaps consider the question of career a little more seriously. As explained in the last report, it was not possible to separate the practice and workshop sections for want of space. As students are working wherever space can be found, in tiled and thatched sheds, supervision and control is extremely difficult.

Examinations.—Thirty students applied for Government Technical Examinations during the year and 22 of them have passed giving a percentage of 73.3 against 54.5 of the previous year.

Subject	Grade.	Number appeared.	Number passed.
Machine drawing	Elementary	2	1
Do. do.	Intermediate	2	2
Do. construction	Elementary	3	1
Do. do.	Intermediate	2	1
Fitter's work	Elementary	7	4
Do.	Intermediate	3	3
Mechanics	Elementary	1	1
Blacksmith's work	Intermediate	1	1
Metal work	Do.	1	2
Cabinet-making	Elementary	2	2
Do.	Intermediate	6	6
Total		30	22

Working hours.—There has been no change in the working hours.

Library.—No addition was made during the year.

Tools and appliances.—Rupees 1,849-13-3 were spent under this item during the year.

Buildings.—The Public Works Department commenced the construction of the new buildings in the month of August 1915. At the end of March the mechanical workshop had all its door and window frames in position and the walls raised five feet all round. The iron work for this building is being made at the Public Works Workshop, Madras, and the woodwork by the Institute. If the iron work is received in due time, this block will be completed by the end of July. The block No. 3 for weaving has gone up to basement level: this block will probably be ready by the end of 1916. The concrete for foundations has been laid for the main building block No. 2 and work on the basement is being continued. Earth-filling of the site is also in progress. The sinking of a large well for the water-supply of workshop has been taken in hand.

Finance.—The total expenditure during the year was Rs. 27,046-18-10. The total receipts during the year were Rs. 10,187-6-8. The net cost, taking these figures, is Rs. 16,859-7-2 and the average cost per student is Rs. 301-1-0 against Rs. 363 in the previous year.

General.—The class for oil-engine driving was continued during the year and proved very popular. There are 13 men under training. The demand for motor mechanics and drivers continues, but for want of space and appliances classes cannot as yet be opened.

Some machinery and four turners were sent to the Perambur works for munition work in November 1915. At the Institute itself arrangements have been made for turning base plates for 13 pounder shells."

CONSULTING ENGINEERING DEPARTMENT.

As pointed out in last year's Administration Report, the outbreak of war led to a marked decline of industrial enterprise. This was attributable, in the first instance, to the stringency of the money market but to this difficulty has now been added another, viz., the shortage of machinery. Most of the manufacturing engineering firms in England have been taken over by Government for munitions purposes and the output of other kinds of manufactures is practically at a standstill. Stocks are being depleted and intending buyers are likely to have to wait a very long time for their plant, unless the manufacture of machinery is taken up in India itself. A beginning has been made in this direction by some of the local engineering firms. Messrs. Massey & Co. have started the manufacture of rice hullers and pumps, Messrs. George Brunton & Co., of oil engines, Messrs. Oakes & Co. of decorticators and other manufacturers may follow suit.

The prices of plant have risen and are fluctuating rapidly. Estimates prepared and quoted one day, do not hold good for the next. The ryot cannot be sure of what his venture will cost him. In the circumstances many ryots prefer to wait until things become more settled.

A change of policy on the part of many firms has also caused a good deal of inconvenience. Owing to the shortage of supplies, firms are stopping hire-purchase transactions. Small capitalists have come to rely on this system of business and its suspension has eliminated them from the market altogether.

It will be clear that industrial development is, at present, labouring under considerable difficulties and until conditions become more normal, no great expansion can be looked for.

The expenditure on the Consulting Engineering Department (excluding the Boring Department) was Rs. 32,500 and the receipts were Rs. 10,000, the net cost being therefore Rs. 22,500. The number of investigations is about the same as last year and compounding fees increased by rather more than 20 per cent. The net expenditure was Rs. 1,250 less than last year having returned practically to the figure for 1911-12.

The inspection fees collected (136) are about the same as last year and compare not unfavourably with those of the ante-war period, enquiries from North Arcot, Chingleput and Tinnevely districts making up almost 50 per cent of the total number. But this year there was a great difference between the number of applications for advice and the actual orders for machinery. Ordinarily one would expect at least 50 per cent of the investigations to mature. But this year the percentage is only 39, showing clearly the extent to which existing conditions have discouraged private enterprise.

Of the 136 applications dealt with 60 are for pumping plants and 76 for industrial plants. The former class of enquiries come mostly from North Arcot, Coimbatore, Tinnevely and the Ceded districts: on the industrial side the bulk of the enquiries are for rice hullers. But whilst hitherto Tanjore and Kistna districts were monopolizing this industry, the demand is spreading to South Arcot, Chingleput and Tinnevely. Enquiries for ginneries are also becoming more numerous, especially in the Tinnevely district.

The V.R.M. Ginning factory at Kadambur was extended by the addition of another 33 h.p. engine and 4 gins. M.R.Ry. Venkataswami Nayudu of Avalnatham, M.R.Ry. Sinnayya Pillai and M.R.Ry. Ganabatha Pattar of Kalugumalai started ginneries in the Tinnevely district this year. At Trichinopoly a beginning has been made in this direction by M.R.Ry. Sourimuthu Reddiyar, a ryot of Turaiyur. The rest of the enquiries are of a varied character. A few ground-nut decorticating machines and oil mills were purchased by ryots of the Gooty and Tanjore sections and enquiries for flour mills were received from Chingleput and Cuddalore. One ryot near Kodakkānal sent in an enquiry on tea-making plant estimated to cost about Rs. 25,000 and Rai Bahadur A. Sethurama Ayyar of Nidamangalam, a leading agriculturist of the Tanjore district, is erecting a disintegrating machine for bonereal.

Most of the plants put down follow the general lines hitherto followed. Several projects of special interest have been under investigation during the year. These are from Kistna and Coimbatore districts, and contemplate the use of larger pumping units than those hitherto used. A good deal of interest is being evinced in the utilization of the drainage water of deltas for irrigation purposes. A Government scheme of the latter kind is under preparation and is intended ultimately to irrigate 8,000 acres on the lower Godāvāri. The proposed lands lie on both sides of the Yenamadurru drain in the Losangutlapadu and Dirunsumari villages of Bhimavaram taluk and the plant is to be erected on the right bank of the drain. At present the scheme is limited to deal with an area of 400 to 500 acres, but the design is such as to enable it to be expanded when required and the old Ganjana plant has been removed to this spot for re-erection. Applications from several private individuals for permission to irrigate smaller plots have also been received during the current year. One Venkatavarasimha Raju of Bhimavaram has applied for permission to irrigate 500 acres by employing a 33 h.p. gas engine and 14-inch centrifugal pump and the Raja of Devarakotah intends irrigating two such plots of 300 to 400 acres. Messrs. Abd-ul-rahman and Abd-ul-rasool have applied for similar installations at Kosura village of Divi taluk. All these enquiries come from Kistna district. Pallappa, Kottappa and two others from Chinnaganjam of Bapatla taluk, Guntur district, have applied for permission to irrigate 500 acres. An interesting

example of a central power scheme is also under investigation for M.R.Ry. Vellingiri Gounder of Vellakinar. This enterprising ryot owns a considerable area of about 500 acres in the Coimbatore district and proposes to put in a central plant to drive 18 motor pumps on 25 wells.

In Tanjore a new type of vertical spindle pump is being experimented with on behalf of M.R.Ry. K. G. Srinivasa Mudaliyar of Mannargudi.

Three interesting applications from the same district, one by Mr. Nagappa Manniyar of Mannargudi and the others by M.R.Ry. T. N. Srinivasa Raghava Achari and M.R.Ry. Kuppuswami Ayyar of Kumbakonam are also worthy of note as the supply there is entirely sub-artesian and drawn from a great depth. The springs are so strong that it is possible to employ a comparatively large pump without fear of exhaustion.

The most marked development in the Engineering department during the year has been that connected with the system of compounding fees. The number of compounding fee payers from the Tanjore district constitute more than 25 per cent of the total figure and those from Kistna district about 13 per cent. The number rose to 286 as against 196 last year, indicating that the service rendered by the department is becoming more generally appreciated. But there is still room for considerable expansion when it is remembered that there must be at least 800 to 1,000 plants scattered about the districts.

BORING DEPARTMENT.

During the year under review the number of hand boring sets was 30. Two special temporary ones—called “relief sets”—were also introduced. Two power drills and three exploders were in operation. Eight low speed (liquid fuel) pumping engines and six high speed (kerosine) engines were also made available for hire. The total depth bored through was 24,750 feet as against 23,000 last year, and the number of borings was 495 as against 645, during 1914-15. The number of successful borings was however 400 out of 495, i.e., 80 per cent, whereas the previous percentage was only 72. The falling off in total depth is due to various causes. For one thing the average depth per boring was 50 feet in 1915-16 as against 43 feet in 1914-15. The result was a greater percentage of successful borings but a reduction in the number of feet bored. Again most of the lathes in the departmental workshops were working munitions and there was some congestion in consequence. Finally considerable difficulty was experienced in obtaining raw material. Stores, for instance, ordered last July have not yet been delivered. Local supplies were frequently inadequate and the supply of pipes to the sets was interfered with.

In spite of these difficulties a very marked economy has been effected in the working of the department.

This is attributable very largely to the system of standardisation that has been adopted. During the last two years a great deal of labour has been devoted to the proper standardisation of sets and the accumulation of spares. This work is now beginning to show results.

Three years ago the net cost of boring was Rs. 32,000. Without any alteration in the rules the amount of boring last year increased 50 per cent and the cost decreased 25 per cent. This year the amount has fallen slightly and the cost has fallen another 20 per cent. The expenditure for the year was about Rs. 42,500 and receipts Rs. 25,000 giving a net expenditure of Rs. 17,500 which is the lowest figure for the last five years. The reduction and economy in the expenditure is solely attributable to the improved system of accounts introduced this year.

The boring done this year, as usual, furnished many interesting results. In Vizagapatam, several strong springs have been struck in rock. In one case the water was under considerable pressure and rose almost to the surface. In another case (Anakapalli) the power drill was employed and, after going through 160 feet in rock, it struck a spring which also rose almost to the surface. At Peddagumalur, in the same district, fresh water was discovered 78 feet below ground level in rock. The result of these successes has been to cause a considerable increase of boring work in this section.

In Bezwada borings are mostly in alluvium, but there were one or two cases of remarkable increase in supply which deserve mention. In one case, the boring was made in a well in which there was absolutely no sign of water. After boring 26 feet, the well filled up completely. In another case, the boring was begun in a well 40 feet deep which contained only a muddy sediment. After another 30 feet had been bored a subterranean spring was reached which raised the water level in the well 27 feet bringing it within 10 feet of ground level.

In Chingleput no remarkable springs were struck but a rather curious result of putting down bore holes in certain wells was not to increase the quantity of water but to improve the quality.

In Cuddalore, the Ponnaiyar basin has been fairly well developed already. Wells are numerous and a large number of them are sub-artesian. There was not therefore very much demand for boring in these parts. An interesting fact was the discovery of sub-artesian springs at Panruti which lies outside the recognised sub-artesian area.

The Tanjore district furnishes the most startling results. At Nedumkollai at a 70 feet depth a sub-artesian spring was struck which yielded a supply of 200 gallons a minute. At Srinivasanallur a spring of slightly smaller supply was struck at about the same depth. At Srinivasapuram an artesian supply was tapped at a depth of 157 feet. In Tirutturaipundi a smaller spring was discovered 2 feet deeper. At Madrimangalam and Tirukarugavur, sub-artesian springs of moderate strength have been tapped and engines are to be installed to pump water for the purpose of preparing seed beds in case gravity irrigation fails.

During the year borings were also undertaken for the Local Fund department at Thanbukottai, about a mile from the sea. Several salt springs were struck in the course of boring and, when a depth of 170 feet had been reached without success, it was suggested that the boring should be abandoned. The Local Fund department were, however, recommended to persevere and another 10 feet further down struck a strong artesian spring which rose 5 feet above ground level.

These borings all indicate the presence of a hitherto unsuspected sub-artesian basin extending southwards from the Cauvery. If the indications are correct, the supply will prove of inestimable value to the dry lands lying south of the delta.

A case which must be classed as a failure is worth recording as furnishing some idea of what a strong artesian current is like. At Nelpathur a boring was carried to a depth of 85 feet when a spring was struck which was unfortunately saltish. It shot up 25 feet into the air and discharged fossilised fish scales, large quantities of gas smelling like sulphuretted hydrogen and hundreds of carloads of sand. The bore had been sunk in the owner's house, who, to begin with, seems to have been rather pleased at securing a private geyser of his own. But the continued discharge of fish scales and poison gases after a time got on to his nerves, whilst the constant flow of sand made him apprehensive regarding the safety of his foundations. He accordingly caused the bore to be plugged and is now searching for water elsewhere—so far without result.

In the other sections nothing of particular note is to be recorded except in the Rāmnād district where a 60 feet boring at the bottom of a well 34 feet deep and ordinarily dry, filled it to within 20 feet of the surface.

The ryots for whom departmental service have been rendered have generally appreciated the assistance rendered by the department and conformed to rules. The departmental rules are based on the principle of fair dealing.

The total borings put down up to date number 3,333. These are tabulated in the ordinary manner in Tables viii and ix.

The department now owns 14 pumping engines and these were popular as ever. They were mostly employed for irrigation and the construction of wells. In Madura one engine was utilised for drainage and bridge work and in Nellore for mica mining operations. The demand for the plant very much exceeds the number of engines available and it will probably be necessary to increase the number during the year.

Further, it has been found necessary to revise the scale of fees for the services rendered by this department and proposals have been submitted to Government for the sanction of revised scales.

EXPERIMENTS AND DEMONSTRATIONS.

PERIPATETIC WEAVING PARTY NO. I.

The Superintendent, Peripatetic Weaving party No. 1, reports as follows:—

"This party has been in existence for three years, and by the end of the year, the work done covered the whole of the Presidency south of Salem and Tanjore. At the beginning of the year work was in progress in Sattur and Srivilliputtur taluks. The party then moved to Aruppukottai where demonstration work was begun in May 1915. Aruppukottai is one of the biggest weaving centres in the Presidency with 4,447 looms, almost the whole of which are employed in weaving coarse women's cloths of coloured yarn. No flyshuttle looms had been used for the weaving of these cloths and the party after giving some effective demonstrations, were able to introduce 48 slays and a few dobbies in the town. Later on, a few more of these appliances are reported to have been made locally after the patterns introduced by the party. After leaving Aruppukottai, the demonstration party visited the weaving centres in Madura district except the town of Madura itself. Seeing that Madura is to be the future headquarters of the weaving school, special demonstrations there were regarded as unnecessary. Demonstrations were held in all the taluks in the district excluding Melur which was passed over as too unimportant from the weaving point of view. As a result 41 slays and a few dobbies were introduced. The party left Madura district by the beginning of November and took up Tanjore next, the intervening district of Trichinopoly having been finished during the first year of its work. The Superintendent and his maistri were engaged on work connected with the Park Fair Exhibition for the next month and a half. Regular work was not commenced in Tanjore till about the end of January 1916. Before the close of the official year, only a small percentage of the numerous weaving centres in the district had been visited. Thirty slays have been introduced in the district so far.

About 80 per cent of the looms in the districts are devoted to the manufacture of cloths of coloured cotton and the cry is for colours. In nearly every village that the Superintendent visited, he observed that a certain percentage of weavers had either already left or were leaving their occupation and were in search of other employments owing to colour famine. In these circumstances, demonstrations of improved weaving appliances, though regarded as satisfactory did not create that amount of enthusiasm which under normal conditions they would have done. In several places in Tanjore district attempts are being made to revive the old system of dyeing the yarn with nuna root (*Morinda citrifolia*).

The production of webbing for which arrangements were made during the previous year was continued during the year on a slightly extended scale. It is hoped that in course of time the manufacture of webbing will establish itself as a new cottage industry. A feature of the year which deserves some notice is the demand made on the Superintendent for slays and shuttles by certain villages in the district of Coimbatore which had been visited by the peripatetic party nearly three years ago. Eight slays and 74 shuttles have been ordered and supplied. That as many as 74 shuttles and 8 slays have been ordered from less than half a dozen villages is a sufficient testimony of the value of the work done by the party.

Demonstrations were given of the dobby where considered necessary. As regards the jacquard, the only places in which demonstrations are likely to prove of real value are Madura and Tanjore. The former has been left out for reasons already stated; in the latter demonstrations are being arranged. During the year, demonstrations were given of the jacquard machine at Tiruppur in connection with the cattle show held at the place.

As last year the Superintendent has continued to collect and collate a considerable amount of statistical information regarding the weaving industry. He also believes that he has been able to create in the weaving community a desire to develop some sort of trade organization.

Enquiries and appliances for technical advice were received and dealt with as usual."

PERIPATETIC WEAVING PARTY No. II.

The Superintendent, Peripatetic Weaving Party No. 2, reports as follows:—

"Up to the end of this year most of the Kistna and a large part of the Gōdāvari district have been covered.

During the year the party visited Narsapur, Bhimavaram and Tanuku taluks of the Kistna district and Razole and part of Rajahmundry taluks of the Gōdāvari district.

The weavers in these two districts were in a comparatively advanced condition and had adopted fly shuttle looms to such an extent that there was little opportunity for introducing any more. In the whole of Kistna district about 6,000 looms were counted of which 4,000 were fitted with fly shuttle slays. Warping mills were also becoming popular. Although the type of mills employed is not very good the use of these mills is a step in the right direction. Advice was given regarding the improvement of mills and a considerable number of dobbies was introduced. As the work is done at present, border weaving always requires an extra assistant and the work is very slow. The demonstrations made seem to have impressed the weavers: the assistant is not required; the design work is mechanical, requiring little attention and the production is nearly double. In spite of these advantages the weavers are somewhat slow in adopting dobbies, and this apparently for two main reasons; firstly, on account of the shortage of coloured yarn and secondly on account of the natural secretiveness of the class. In Duggulur (Bhimavaram taluk), for instance, six dobby designs were demonstrated and each design was taught to each of six weavers in the hope that they would spread their information. Nothing of the kind however, occurred, as each man kept the information he had obtained to himself and refused to divulge it. To teach these six weavers six patterns each, 36 demonstrations were therefore necessary. Indeed it was found that public demonstrations although they created a certain amount of interest and attracted large crowds led to little result, and that the only way of getting anything actually done was by giving individual demonstrations.

Apart from 47 dobbies the party also introduced a number of fly shuttles, special healds, warping mills, two frame looms, four tape looms and one silk twisting machine besides seven sets of English healds and reeds.

In Narsapur towel and silk weaving were introduced by means of improved appliances. From the beginning of October to the end of January the Superintendent was in Madras in connection with the exhibition and there prepared special appliances which were subsequently exhibited. One was a swivel slay for weaving book-marks in colour: the other a solid border slay. The latter mechanism is an entirely novel one."

SUGARCANE STATION, SINGANAILLUR.

This sugar factory was originally situated at Uppilpalayam about a mile and a half north-west of Singanailur. When the mill was first put down by Mr. Chatterton, there was a good deal of sugarcane cultivation going on, but since then the area has decreased. What is more, the site selected was very unfortunate from the point of view of transport. There was only one road and large stretches of betel and paddy cultivation made it extremely difficult to bring cane across country. Last year the supply of cane was inadequate and this year the cultivation is less still. Seeing no prospect of the condition improving, the Director decided to shift the mill bodily a few miles down the road. The work was done very expeditiously by the Supervisor, Coimbatore, and the factory was ready for work on the 20th of August. In ordinary years, this would have been in ample time to catch the season, but this year the canes were cut earlier than usual and the season had begun about ten days before the factory opened.

The factory continued work until 28th December 1915, that is, 108 full working days of 10 hours. Altogether, 1,075 pothies of jaggery were produced, giving an average of 10 pothies per working day. These figures are enormously in advance of

anything previously obtained. It had been hoped to work double shifts, that is 24 hours a day, but this was abandoned owing to the difficulty of arranging night labour. Some trouble was experienced in the keeping the megass dry as the showers during the year appeared to be more frequent and persistent than usual. On three or four days, work had to be stopped in the mill on account of rain and on one or two days, after heavy showers, ryots could not bring in their canes in time and the mill had to be stopped owing to shortage of supplies. On the whole, however, the way in which work was organised left little room for improvement. I do not think the figures of output can be improved on nor do I think that the working charges can be materially reduced except in respect of fuel. Wet megass does not burn at all well and as there was no storage accommodation, it used to get extremely wet necessitating the purchase of dry fuel. In my opinion, it should have been possible to save Rs. 200 on working expenses on the fuel item. Actual accounts showed receipts amounting to Rs. 3,179 and expenditure to Rs. 1,831 leaving a gross profit of Rs. 1,348 for the season. Under ordinary circumstances, we might expect the plant to work another 10 days and the fuel expenses to be reduced by Rs. 200. In this case, the gross profit would be about Rs. 1,650. The success of the Singanailur mill this year has been most striking. I am informed that at least 26 country mills have shut down since the arrival of the power mill.

As regards costs, ryots generally agree that the departmental rate of Rs. 3 a pothi is a little lower than their own (provided the lead is not too far) and they freely admit that the quality of the jaggery made is superior to what they can obtain in the country mill: also that they get about 10 per cent more yield from their canes. Whether this is due to the superior honesty of the departmental Supervisor or to the efficiency of the mill, I cannot tell. Anyhow, the working this year has given great satisfaction to all ryots.

SUGARCANE STATION, CHITTAWADIGAI.

The factory at Chittawadigai occupies a prominent position on the road between Chittawadigai and Hospet facing the village and the market. The factory was completed this year in accordance with the departmental standard designs and consists of a roofed-in boiling house, jaggery making shed, store shed, cane shed and engine house.

Sugarcane cultivation is somewhat scattered and as a large area lies on the other side of the irrigation channel a bridge had to be built across the channel to facilitate carriage. The village of Chittawadigai is alternately malarious and plague infected and for these reasons it is very difficult to get coolies. During the cane season, a certain amount of labour comes in from other districts but it is unreliable as the men have a habit of running away when the repayment of advances becomes due.

Apart from labour difficulties, the difficulties associated with the introduction of any new form of machine are considerable and the experience gained from last year's working made it clear that local sugarcane owners would require a good deal of persuasion before they would send in their canes, the more so since cane crushing is a powerful vested interest.

In the light of local difficulties of this kind which, it was thought, a local individual could deal with very much better than a departmental supervisor from Madras, it was considered desirable to accept the offer made by the village munsif to take over the plant for the season and arrange for the supply of cane and labour. An arrangement was accordingly entered into between the department and the munsif that the plant should be under the control of the departmental supervisor but that the munsif should pay working expenses and keep the takings, the rate for the latter being fixed at departmental rates. The munsif was to pay Rs. 250 a month hire for the plant.

The factory was started early in January and run up to end of April. On the whole it was worked for 75 full working days and turned out 667 pothies of jaggery. It is estimated that the rate of hire charged made the transaction a financial balance for the contractor. But during the current year conditions were unfavourable. The

contractor, being devoid of experience, made a considerable number of mistakes and failed to arrange for an adequate cane supply. Moreover, work was begun very late. The fact that the contractor is anxious to lease the installation on the same terms as before, namely, Rs. 250 a month, for the next year shows that his experience of the year's working has been favourable both as regards costs and quality.

The plant appears also to have been appreciated by local ryots and several unsolicited testimonials were given to the supervisor on the completion of the work. According to these, ryots consider that they get a greater yield of jaggery by mill crushing and they admit that the jaggery fetches about Rs. 2 more than the country jaggery in the market. During the operation there was a certain amount of argument regarding the way in which jaggery was to be prepared. Cane crushers asserted that summing causes them 5 per cent loss in yield. It was considered by the supervisor that the increased value of summed jaggery more than outweighed this loss and in the end this view was accepted. Again there was a general demand for a reduction in rates, which however the supervisor had strict orders not to agree to. The departmental rate has been Rs. 3 a pothi from the beginning and must remain at this figure.

The departmental profit on this plant was four months' hire—Rs. 1,000.

PENCIL FACTORY.

The Supervisor, Pencil Factory (M.R.Ry. C. S. Ramachandra Ayyar) reports as follows:—

"On the termination of the expert's services, I paid a short visit to the S.I.D. Factory at Kalighat, Calcutta (separate report already submitted) and returned to Madras early in April.

Soon after my return to Madras, I was ordered by the Director to take up the graphite problem in detail at the Indian Institute of Science. A few experiments on the Tuni graphite which had been the material so far employed, showed that the material was of an extremely low grade. The ordinary graphite employed by pencil makers in America and Europe is said to contain about 85 per cent carbon while material for high grade pencils should contain not less than 95 per cent carbon. The Tuni material, even after a careful levigation process, contained only about 30 per cent carbon. Apart from its low carbon value, the material was found to contain a very high percentage of quartz and iron oxide, two very objectionable impurities. For these reasons the material which the expert had selected was rejected and I left Bangalore to look for some other deposit.

In June after a good deal of hunting round, I came upon the desired Pidakonda mine. Tests on samples showed that notwithstanding the impurities which occurred freely in this ore also, it was much superior to the other and would probably serve for making fairly decent pencils. The mine has two shafts, a tunnel shaft and well shaft, and we are obtaining our present material from the former though the latter is reported to contain much better material.

Working the well shaft requires regular mining operations. Owing to the restricted staff and want of experience, the well shaft was left alone and the tunnel shaft only was developed. About 20 tons of the crude ore have been collected and a process of refining the ore has been evolved with a view to utilizing the major portion of the ore.

The method of refining graphite is kept secret in factories. The expert could not teach us much about it and so we had to discover a process for ourselves. Numerous methods of refining the mineral were tried with varying success until the 'reversed floatation' method was discovered. This has proved satisfactory and is described at length in a bulletin. The present procedure is as follows:

The crude ore is crushed in a disintegrator fitted with a 16 mesh. The powder is passed through a 100 sieve, the residue being screened through a 50 and 30 mesh. The fractions are separately treated, bigger material being returned to the 'devil'. The sifted material (62 per cent carbon) is soaked in liquid fuel, one

gallon per every 35 lb. of ore powder and intimately mixed. The mixture is thrown into a tub and agitated with the result that the finer impurities are in a state of colloidal suspension while the coarser sand is at the bottom. The peculiarity in the separation lies in the fact that the sand particles do not get bound together but fall into separate crystals while the fine mineral particles adhere to each other forming lumps. This characteristic property is useful in separating the graphite from the gangue. The suspended impurities are thrown out from time to time while the coarser impurities are washed out through a sieve. Having removed the impurities, the mixture is burnt off and used in the composition for making pencils. The excellence of this method consists in the fact that the waste of mineral is more or less negligible and a high degree of purity is attainable by repeated washing.

During the experimental period at Bangalore I was handling a powder made out of a few selected lumps of the crude ore to obtain results regarding the manipulation. The powder contained 89 per cent carbon and this formed the basis for my experiments. Before attempting to make a composition I obtained the graphite value of certain well known pencils and made a qualitative determination of other ingredients. It was clearly established that in all these pencils (1) about 50 per cent carbon was present, (2) a binding material in the form of a plastic clay was employed with more or less absolute freedom from silica and other frits, (3) a flux was employed, and (4) a final bath of the leads (superior grades) in hot wax or oil was resorted to in order to impart a smooth feel on paper. With these preliminary ideas to go on I began a series of experiments to determine the influence of binding, flux, etc., on quality. These experiments are fully described in a bulletin. Useful preliminary results were obtained even as early as August 1915, but I extended my stay at Bangalore to improve my methods and also to study the question of colour leads and aniline pencils.

So far as red and blue coloured pencils are concerned, I think that I have discovered the method of manufacture, but details still remain to be elaborated. As it is at present impossible to get the chemicals required, the manufacture of coloured leads has to be kept in abeyance, but the result of my trials leads me to believe that even though my results are in some respects defective, I shall be able to produce leads of the required quality with a little more practice.

I also investigated the manufacture of copying leads. At the commencement of the war we obtained a small supply of methyl violet but this, being intended for cotton dyeing purposes, was mixed with dextrine which had to be separated before it could be employed for pencils. By a very tedious costly and laborious process I obtained a small quantity, a few grammes, freed from dextrine. The leads made out of this were comparable with any of the foreign makes.

The next investigation I undertook was to discover the nature of the coloured varnish employed in many German and Austrian pencils. On this point also the 'expert' had been unable or unwilling to give me any assistance. Results of tests and analyses showed that shellac and aniline were the main ingredients entering into the finish. It was also found that resinous material was objectionable and commercial shellac had to be refined before use. The vehicle employed must obviously be alcohol. A few trials were made with mineral colours which were not successful. A few pencils were lacquered, but this finish proved too expensive. Stains were also experimented with. Diamond green and magenta proved satisfactory.

On the 1st December I came back to Madras on the orders of the Director with a view of applying the results of my experiments practically. At this point, however, Government orders were received which necessitated a suspension of work until further grants were allotted.

Meantime arrangements had been made for setting up the factory on proper working lines. About the middle of the year the Director ordered the removal of pencil machinery from Cocanada to Madras and erected it next to the Leather Trade School. A large machine shed was built and by the side of a small store shed was erected a disintegrator to crush the mineral. To the rear of the engine room of the Leather Trade School, two sawing machines capable of dealing with the requirements

of the Pencil Factory were erected and kept busy sawing slats till work stopped. The factory requires a very large number of tools and spares that are not ordinarily available, and many of which were found to be missing. Some were obtained after long correspondence; others cutters, springs, tables and various odd items had to be made. The most difficult of all was the making of cutters of proper strength and dimensions and this was successfully done at the Public Works Department Workshops. The other springs, tables, feed rollers, missing parts of various machines with sufficient spares were made at the departmental workshops.

So far, we have produced pencils of low quality which will sell in the open market at the price paid for Japanese pencils. The results of work obtained so far give every reason to suppose that the industry can be established in the Presidency on a sound commercial basis, but this opinion can only be proved by actual trial. By the death of the late foreman, Mr. Sorabjee, the factory has lost a very valuable man. He was an excellent foreman and had a good practical experience, having been connected with the work from the very beginning.

It is possible to realise from the above what a large amount of push and energy has had to be exerted in all directions. At the end of the year, Government sanctioned a further allotment and a start was made on a small scale. It was necessary to limit production to a very small output as the operation of a large number of machines with untrained hands would have involved excessive waste of materials and labour. Accordingly only a few men were employed at the machines and shown how to operate them. Results will be reported later.⁷

PUNALUR PAPER MILL.

The greater part of the year was spent in dispute between the two claimants to the ownership of the mill and no practical work could be attempted. Repairs were undertaken and an endeavour made to clean up the mill. In this luxurious climate, during a long period of idleness, the mill premises had become a sort of a sleeping beauty's castle and the departmental supervisor found it as difficult of entry as Prince Beautiful. With two rival claimants guarding the castle his activities were also much hampered, and it was only after long and patient exertion, coupled at last with an ultimatum by the Director, that serious work could be started. The condition of the plant was very bad. Not only had it been seriously affected by weather and exposure but a large number of the more important brass parts had been removed from time to time by souvenir hunters and the machines were accordingly rendered temporarily useless.

Only in February was it possible to start making regular experiments. It may be explained that the object of this experiment is to discover fundamental data of production with regard to pulp manufacture and initially the intention was merely to manufacture pulp from bamboo.

When work was actually undertaken, further difficulties appeared. One of the boilers was so obviously unsafe that it had to be abandoned altogether whilst the other was not safe beyond 80 lb. equivalent to about 60 on the digesters. This pressure is insufficient for the proper boiling of bamboo. The Donkey pump made a good deal of noise but did not feed the boiler and had to be replaced entirely. The self-regulating valve of the stuff boiler gave way when pressure was applied, the stuff shoots crumbled away, the joints in the rag boiler blew out and a number of similar little troubles cropped up. These were duly overcome but it was found that the pulp produced under the conditions described did not bleach readily and was not therefore in much demand as pulp. It seemed simpler therefore to convert the pulp into brown paper straight away and by sale at least recoup a certain part of the cost of the experiment.

The old paper machinery was accordingly brought into commission again. Here again the depredations of time and the night watchman were only too apparent, and for several weary weeks Dr. Marsden struggled with the problem of making paper with a felt consisting mainly of holes until spares arrived. These made a great difference and quite a good quality of brown paper is now being produced.

So far as the main object of the experiment is concerned, the first thing we are attempting to ascertain is the quantity and cost of raw material available and its equivalent cost in the dry state. The second point is to find what proportion of pulp is obtainable from a given quantity of dry raw material. The third point is to investigate the treatment of pulp. So far, complete results have not been obtained on any one of these points. But a good deal of raw material has already been treated and it is becoming possible to form approximate estimates of the quantity and cost. The Travancore Government have very kindly granted the mill 1,000 tons of bamboo free of seigniorage charges and in connection with the collection of this quantity, the forest authorities are making a very careful study of the cost which should prove very valuable when completed.

The war has stopped the supply of bleach, but here again a substitute was obtained. Dr. Sudborough very kindly lent us the electrolytic bleach apparatus from the Indian Institute of Science and by this means a considerable quantity of hypochlorite can be made. To try and avoid the expense of caustic, experiments are also being instituted with a form of Castner-Kellner cell. If these prove successful, they will lead to a 50 per cent reduction in costs.

(2)

TABLE I.—Government account.

Number.		1914-15.		1915-16.	
		Receipts.	Expenditure.	Receipts.	Expenditure.
		RS.	RS.	RS.	RS.
1	Direction		36,381		37,266
2	Madura Technical Institute (Mechanical Engineering Branch)	7,013	26,922	9,680	27,013
3	Dyeing Expert		11,756		13,496
4	Leather Expert	70	20,149	187	11,525
5	Peripatetic Weaving Party No. I	2,264	7,618	876	6,065
6	Do No. II	83	1,403	541	3,430
7	Sugarcane experiments	2,628	12,071	3,635	11,576
8	Motor-tractor demonstration				1,975
9	Ganjana demonstration				1,092
10	Lime brick experiments			743	22,388
11	Oil expeller demonstration			1,548	2,962
12	Bureau of Industrial Information				(a) 11,374
13	War experiments (pencil, glass, oil mills and miscellaneous)		60,473	123	36,316
14	Grant-in-aid and scholarships		51,140		48,840
15	Pumping and boring	(c) 38,664	(d) 1,68,017	(b) 40,429	1,77,920
16	Construction of tannery		35,456		
	Total	50,142	4,20,246	57,762	3,92,814

(a) This includes a sum of Rs. 6,334 incurred on account of the Industrial exhibition during the year.

(b) This figure represents actual receipts; from this a sum of Rs. 3,969 has been refunded, the refunds being included under expenditure.

(c) This figure includes a sum of Rs. 377 being the receipt on account of oil-expeller demonstration. The actual receipt of the pumping and boring operations is only Rs. 30,277 and from this a sum of Rs. 3,390 has been refunded, the refunds being included under expenditure.

(d) This figure includes expenditure on motor-tractor, oil-expeller and Ganjama demonstration.

TABLE II.—Statistics relating to industrial schools for 1915-16.

District.	Name of Institution.	Boys* or Girls*.	Number on rolls on 31st March 1916.	Drawing.		Mechanical Engineering.		Carpentry.	Printing and Binding.			Weaving.	Seda crafts.			Dyeing.	Tailoring.	Oil-engraving.	Bam work.
				Technical.	Free-hand outline.	Private work.	Blacksmith's work.		Other branches.	Civil Engineering.	Joinery.		Cabinet-making.	Other branches.	Compositors' work.					Other branches.	Cotton-weaving.	Lace-making.	Kimberley.	Other branches.	Agriculture.
	<i>Revenue Schools.</i>																		
	<i>First and Second classes.</i>																		
Madras ..	Madras Government Technical Institute	Boys ..	56	38	3	37	21	13											
Comblatore	Comblatore St. Joseph's Industrial School	Do. ..	75	34	4	15			19		26	36							
Trichopoly ..	Kannu Velayudam Mission Industrial School	Do. ..	59	64	4		3		47	16	4								
Madras ..	Madras Changanarayana Nair's Technical Institute	Do. ..	207	61		104	4	14		15		6							
Madras ..	Madras Government Technical School	Do. ..	207	61		104	4	14		15		6							
Madras ..	Tindivanam St. Joseph's Upland Industrial School	Do. ..	40	15	40		4		38	92									
Madras ..	Madras Anjuman-Arabi-Abul-Halim ..	Boys ..	124	24		1													
Trichopoly ..	Nareeth Art Industrial School for Boys	Boys ..	57			8			24	13		20							
Tanjore ..	Tanjore St. Francis Xavier's Industrial School	Do. ..	56						9	13		24	10						
Trichopoly ..	Pattar All Saints Boys' Industrial School	Do. ..	41	37		7			41			4							
Valmiki ..	Vellore Anjuman-Ikha-Abul-Hanuth	Do. ..	57	42	7				29	40	6								
Madras ..	Sydnah O.E.H.M. Industrial School ..	Do. ..	12	12		17	3		12		12								
Nellore ..	Manikuppam Andra Jathanya Kusaala	Do. ..	73	21		9													
Trichopoly ..	St. Aloysius' Industrial School, Viragipattanam	Do. ..	9																
	Total	Literary.	907	222	57	182	43	27	174	330	22	1	64	42					
			6																
	<i>Third class.</i>																		
Chingelput ..	Melkoteppanm United Free Church Mission Agricultural	Boys ..	9																
Madras ..	Madras Government Press Technical School	Do. ..	187									40	147						
The Nigriti ..	Onitsoanant Government Free Technical School	Do. ..	88										38						
Madras ..	Kijikupp Church of Scotland Mission Industrial classes	Boys ..	77										28	39					
Chingelput ..	Chingelput United Free Church Mission Lace school	Boys ..	38										33	5					
Kannadur ..	Kannadur United Free Church Mission Handloom	Do. ..	14										3	11					

[illegible]

TABLE III.—Statistics relating to industrial schools for 1915-16.

Returns not received.

Discontinued.

Closed before 31st March.

TABLE IV.—Statement of investigations made, 1915-16.

Year.	Number.
1902-03	1
1903-04	10
1904-05	24
1905-06	21
1906-07	40
1907-08	51
1908-09	33
1909-10	41
1910-11	64
1911-12	111
1912-13	134
1913-14	152
1914-15	136
1915-16	818

TABLE V.—State loans.

Year.	Number.	Amount. Rs.
1904-05	1	8,000
1905-06	4	12,500
1906-07	8	23,500
1907-08	6	16,500
1908-09	13	33,000
1909-10	12	30,350
1910-11	8	21,950
1911-12	14	36,500
1912-13	22	52,600
1913-14	17	38,500
1914-15	9	21,000
1915-16	3	5,400
Total	117	2,99,800

TABLE VI.—Loans sanctioned during 1915-16.

Number.	Name of applicant.	Place.	District.	Amount.
1	Messrs. Subbaya Goundan and Marimutha Goundan.	Muthusickenpatti	Madura	Rs. 2,600
2	M.R.Ky. Bhagava Ayyar	Korapat village	North Arcot	2,600
3	K. Kuppam Ramakrishnappa	Addanarai village	Cuddapah	400
Total				5,400

Note.—Excluding a special loan to Mr. Vellingiri Gounder.

TABLE VII.—Statement showing the number of compounding fee payers.

	Godavari section.	Kistna section.	Chingelput section.	South Arcot section.	Nellore section.	Chintalavolu section.	Tiruchinopoly section.	North Arcot section.	Tanjore section.	Tinnevely section.	Cuddalore district or Guindy section.	Total.
1909-10	7	8	8	2	3	3	1	2	1	2	1	28
1910-11	4	7	7	1	1	2	3	1	1	1	1	30
1911-12	1	9	6	5	2	8	2	2	2	2	1	39
1912-13	7	11	16	1	13	9	11	10	10	1	1	80
1913-14	1	6	7	16	16	12	8	31	16	2	1	117
1914-15	4	7	17	18	35	20	16	58	21	10	16	205
1915-16	5	30	17	21	33	22	19	64	21	14	21	250

TABLE VIII.—Statement showing details of borings made in the different divisions from the beginning of operations.

Divisions.	Fresh wells.			Existing wells.			Total number of borings.	pises supply sunk.	Total feet bored through.
	Success-ful.	Failure.	Total.	Success-ful.	Failure.	Total.			
GODAVARI.									
From the beginning to 31st March 1915	53	49	102	17	16	33	135	30	11,618
From April 1915 to 31st March 1916	26	13	39	1	3	4	43	3	4,364
Total	79	62	141	18	19	37	178	33	16,982
KISTNA.									
From the beginning to 31st March 1915	163	35	198	60	27	87	295	28	11,671
From April 1915 to 31st March 1916	121	11	132	27	7	34	169	6	7,040
Total	284	46	330	87	34	121	461	33	18,911
NORTH ARCOT.									
From the beginning to 31st March 1915	18	21	39	14	72	86	125	6	2,680
From April 1915 to 31st March 1916	3	1	4	4	4	8	12	..	275
Total	21	22	43	18	76	94	137	6	2,955
BELLARY.									
From the beginning to 31st March 1915	1	3	4	..	2	2	6	..	148
From April 1915 to 31st March 1916	10	1	11	1	4	5	16	..	520
Total	11	4	15	1	6	7	22	..	668
NELLORE.									
From the beginning to 31st March 1915	15	16	31	47	32	79	110	13	4,908
From April 1915 to 31st March 1916	..	..	..	6	1	7	7	1	1,073
Total	15	16	31	53	33	86	117	14	5,981
COIMBATORE.									
From the beginning to 31st March 1915	7	9	16	95	69	164	180	2	3,520
From April 1915 to 31st March 1916	..	..	..	13	9	22	32	..	828
Total	7	9	16	108	78	186	202	2	4,348
SOUTH ARCOT.									
From the beginning to 31st March 1915	62	45	108	50	37	87	195	2	9,148
From April 1915 to 31st March 1916	2	1	3	4	2	6	9	2	585
Total	64	47	111	54	39	93	204	4	9,733
CHINGELEPUT.									
From the beginning to 31st March 1915	249	201	450	349	261	610	1,060	201	46,466
From April 1915 to 31st March 1916	18	9	24	18	3	21	45	12	3,370
Total	264	210	474	367	264	631	1,105	213	49,776
TINNEVELLY.									
From the beginning to 31st March 1915	107	25	132	326	57	383	515	..	14,944
From April 1915 to 31st March 1916	7	..	7	64	7	71	78	8	2,803
Total	114	25	139	390	64	454	593	8	17,747
TIRUCHINOPOLI.									
From the beginning to 31st March 1915	20	7	27	57	62	119	146	5	3,955
From April 1915 to 31st March 1916	45	2	47	11	15	26	73	..	1,772
Total	65	9	74	68	77	145	219	5	5,727
TANJORE.									
From the beginning to 31st March 1915	38	12	50	16	5	21	71	21	5,927
From April 1915 to 31st March 1916	5	3	8	13	3	16	24	8	2,135
Total	43	15	58	29	8	37	95	29	8,062
ABSTRACT.									
Total borings from the beginning of operation to 31st March 1915.	733	424	1,157	1,031	650	1,681	2,838	308	115,110
Total borings from 1st April 1915 to 31st March 1916.	234	41	275	162	58	220	405	39	24,750
Total	967	465	1,432	1,193	708	1,901	3,243	347	139,860

TABLE IX.—Statement showing the number of borings put down in several taluks of the Presidency during the year 1915-16.

District.	Taluk.	Number of borings done.	Total.
Visagapatam	Sarasiddhi	27	38
	Anakapalle	3	
	Vijayanagaram	6	
	Viravilli	2	
Godavari	Tuni	1	1
Ganjam	Berhampur	4	4
Kistna	Nuzvid	5	144
	Ellore	115	
	Bewada	20	
	Tanuku	2	
Guntur	Narasapur	2	22
	Guntur	2	
	Tenali	12	
	Bapatla	8	
Nellore	Kandukur	4	7
	Nellore	3	
Chingleput	Ponnéri	19	45
	Tiruvallur	5	
	Sidhapur	21	
South Arcot	Cuddalore	8	9
	Villupuram	1	
Tanjore	Kumbakonam	2	24
	Papanasam	2	
	Mayavaram	5	
	Shiyali	2	
	Tanjore	1	
	Tirattarappundi	1	
	Pattukkottai	2	
	Neppattam	5	
	Mannargudi	1	
	Nanniam	1	
Trichinopoly	Masiri	12	73
	Trichinopoly	11	
	Kozur	11	
	Udaiyarpalayam	39	
Tinnevely	Nanguneri	6	34
	Srivakuntam	9	
	Tinnevely	5	
	Tiruchendur	5	
Ramanad	Tenkasi	5	39
	Ambasamudram	4	
Madura	Sivaganga	12	5
	Aruppukottai	27	
Coimbatore	Madura	3	30
	Tirumangalam	2	
Malabar	Coimbatore	9	2
	Golichettipalayam	3	
	Erode	8	
	Palghat	2	
North Arcot	Vellore	1	4
	Gudiyattam	3	
Salem	Salem	8	8
Anantapur	Gooty	2	2
Kurnool	Kurnool	4	4
Cuddapah	Proddatur	10	10

TABLE X.

Trades.	Number of factories.	Horse power.				Total excluding horse power of boiler.
		Steam.		Oil or gas.	Others.	
Engine.	Boiler.					
<i>Section I.—Agriculture and irrigation.</i>						
1. Agriculture .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
2. Fish irrigation .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
3. Lift irrigation	701	.. ..	.. ..	8,671	.. ..	8,671
<i>Section II.—Mines and quarries.</i>						
4. Gold mines	3	.. ..	820	.. ..	.. ..	.. ..
5. Mica	9	51	487	189	.. ..	51
6. Manganeses	2	149	60	.. ..	.. ..	288
7. Magnetite	1	.. ..	60	.. ..	.. ..	.. ..
8. Quarries	2	12	65	10	.. ..	12
9. Salt mines	4	40	62	.. ..	.. ..	50
10. Others .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
<i>Section III.—Iron, steel and engineering trades.</i>						
11. General engineering trade	45	486	4,948	269	.. ..	755
12. Harbour shipbuilding trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
13. Railways (Carriage and Locomotive)	16	373	.. ..	980	.. ..	1,353
14. Tool and implement trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
15. Blacksmith's trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
16. Small arms trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
17. Other iron and steel trades .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
<i>Section IV.—Metal trades other than iron and steel.</i>						
18. Brass and copper trades .. ..	.. ..	.. ..	.. ..	137	.. ..	137
19. Metal trade (other than iron)	2	.. ..	.. ..	.. ..	10	10
20. Precious metals and jewel trade	1	.. ..	.. ..	.. ..	.. ..	.. ..
21. Other trades .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
<i>Section V.—Textile trades.</i>						
22. Cotton trade (Power)	223	14,105	16,399	2,468	1,150	17,728
23. Cotton trade (Hand Loom) .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
24. Jute and hemp trade	8	1,355	1,462	.. ..	.. ..	1,355
25. Woollen and worsted trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
26. Silk trade	1	35	.. ..	.. ..	.. ..	35
27. Lace trade	10	189	761	3	.. ..	192
28. Fibre trade	3	.. ..	69	.. ..	.. ..	.. ..
29. Bleaching and dyeing trades	3	3	22	4	.. ..	7
30. Other textile trades	3	.. ..	.. ..	.. ..	.. ..	.. ..
<i>Section VI.—Clothing trades.</i>						
31. Clothing and millinery trade .. ..	.. ..	.. ..	.. ..	8	.. ..	.. ..
32. Boot and shoe trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
33. Hat and cap trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
34. Other trades .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
<i>Section VII.—Food, drink and tobacco trades.</i>						
35. Grain milling trade (Rice Mills)	479	3,169	7,161	6,866	.. ..	9,026
36. Bread and biscuit trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
37. Confectionery and preserve trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
38. Butter and cheese trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
39. Fish-curing trade	1	15	20	.. ..	.. ..	19
40. Tea trade	4	163	3,752	358	.. ..	511
41. Sugar trade	12	19	237	61	.. ..	80
42. Brewery and distilling trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
43. Cattle food trade	2	39	160	30	7	68
44. Aerated waters	9	12	35	11	.. ..	23
45. Tobacco trade	3	416	938	249	49	744
46. Coffee trade	48	38	173	389	64	491
47. Tea trade	29	.. ..	207	.. ..	.. ..	.. ..
48. Other trades	2	.. ..	.. ..	.. ..	.. ..	.. ..
<i>Section VIII.—Chemical and allied trades.</i>						
49. Chemicals, coal tar products and cordite trades	3	44	633	37	560	581
50. Seed crushing trade (Oil)	32	195	846	459	27	681
51. Soap and candle	2	12	67	.. ..	.. ..	12
52. Bone crushing trade	8	46	162	60	.. ..	106
53. Other trades (Petroleum) .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
<i>Section IX.—Paper printing and allied trades.</i>						
54. Printing and book-binding trade	39	83	206	273	70	432
55. Other trades (Pencil)	1	.. ..	22	.. ..	.. ..	.. ..

TABLE X—cont.

Trades.	Number of factories.	Horse power.				Total excluding horse power of boiler.
		Steam.		Oil or gas.	Others.	
		Engine.	Boiler.			
<i>Section X.—Leather canoes and india-rubber trades.</i>						
56. Leather trade (Tanning and Dressing) ..	4	29	64	10	..	39
57. Saddlery and harness trade ..	1	12	..	..	..	12
58. Other trades ..	..	..	..	..	..	..
<i>Section XI.—Timber trades.</i>						
59. Timber trades ..	15	62	15	117	8	187
60. Carriage, cart and waggon trades ..	7	..	35	15	106	121
61. Brush and basket trade ..	..	..	..	..	..	..
62. Other trades ..	..	..	..	..	..	..
<i>Section XII.—Clay, stone, building and contracting trades.</i>						
63. Brick and tile trades ..	26	498	1,282	68	..	566
64. China and earthenware trades (Pottery) ..	1	7	17	..	..	7
65. Cement trade ..	2	900	570	10	5	915
66. Public Works Department ..	..	..	..	..	..	..
67. Others ..	..	..	..	..	..	..
<i>Section XIII.—Miscellaneous trades.</i>						
68. Ivory, bone and fancy articles ..	..	..	..	..	..	..
69. Musical instruments ..	..	..	..	..	..	..
70. Others ..	..	..	..	..	..	..
<i>Section XIV.—Public utility services.</i>						
71. Municipal undertakings ..	17	1,748	866	409	..	2,155
72. Electric light (Private Company) ..	13	4,810	1,877	252	..	5,062
73. Canals and docks ..	..	..	..	..	15	15
74. Post and Telegraph offices ..	1	..	..	..	..	..
75. Telephones ..	..	..	..	..	..	..
76. Others ..	..	..	..	..	..	..
Grand total ..	1,792	26,114	44,179	22,373	2,017	52,604

Order—No. 1051, Home (Education), dated 4th October 1916.

Recorded.

2. The Government note the good work done by the Department of Industries during the year under difficult conditions, some of which are mentioned in paragraph 35 of the report, and their thanks are due to Mr. Tressler who has, since the close of the year, left for military duty. The Government also note with appreciation the work of the officers in regard to whom Mr. Tressler has borne testimony in paragraph 36 of his report.

(True Extract)

P. RAJAGOPALA ACHARIYAR,
Secretary to Government.

To the Director of Industries.
" the Honorary Director of Fisheries.
" the Revenue Department.
" the Public Works Department.
" the Public Works Department (Irrigation).
" the Home (Miscellaneous) Department for Presidency Administration Report.
" K. T. B. Tressler, Esq. (C/o Secretary to the Government of India, Army Department).
Editors' Table.

HOME (EDUCATION) DEPARTMENT.

NOTES CONNECTED WITH G.O. No. 1051, HOME (EDUCATION),
DATED 4TH OCTOBER 1916.

[SUBJECT.—Administration report of the Department of Industries for 1915-16.]

From the Director of Industries, dated 29th July 1916, No. A. 11.

The report does not call for any lengthy remarks. Reports on the various experiments carried on by the department have been received from time to time and the report contains a précis of these reports. The portions where the Director refers to schemes pending with the Government are noted on below.

2. Paragraphs 4 and 5 and paragraph 34 of the report.—In these paragraphs the Director refers to the proposals submitted by him at different times for the strengthening of his establishment. It is submitted that these were till recently lying over pending the assumption of charge by Mr. Couchman of his special duty in the department. He has since stated that he would submit revised proposals after he has been in charge of the department for some time and gained experience.

3. In paragraph 4 the Director also complains about want of adequate accommodation for his office. It is submitted that sanction was accorded last year to the

G.O. 1506 W., 14th August 1915. acquisition of site for the Director's office.

But the acquisition was subsequently deferred pending decision of the question whether any of the military buildings and sites which, it was stated, would fall vacant, might not be made available for the Director's office. This question has not yet been decided and it is understood that the Public Works Department propose to take this up only after a decision is arrived at on the larger question of locating all the public offices at Chepauk. Mr. Couchman will presumably address the Government if any urgent action is necessary.

4. Accommodation for the leather trades school.—At the end of his report the Assistant in the leather trades school (who is in charge of the school in the place of Mr. Guthrie, the leather expert) refers to the want of class room accommodation at the school. It is stated that when the original design for the school building was prepared it was hoped that accommodation would be found in the general trades school which was to be located on an adjacent site. The Government have decided not to construct buildings for the latter school for the present. The question of securing rented accommodation for it is separately under consideration. It is for orders whether the Director may be asked to submit separate proposals in regard to additional accommodation for the leather trades school.

5. Last year all those portions of the report wherein the Director referred to pending questions were omitted and the paragraphs were so modified as to include only such portions as recorded what had been actually sanctioned. It is for orders whether similar alterations may be made in this report also before publication.

Please see Private Secretary to His Excellency the Governor's note on page 7 and the notes on pages 8 and 9 of notes to G.O. 1090, 1st October 1915.

6. As the report covers the activities of the department in the pumping and boring section also, the file may be sent to the Revenue Department for remarks.

S.K.—9-8-16.

N.K.—28-8-16.

Submitted that so far as this department is concerned, the report may be recorded and proposals for the additional accommodation required for the leather trades school may be called for.

As regards the editing of the report, portions enclosed in red chalk brackets may, subject to approval, be omitted as in the previous year. These passages occur in paragraphs 4, 5, 6, 9, 20, 25, 29, 31 and 34 of the report. Revenue will presumably deal similarly with paragraphs 10 to 13 relating to the Pumping and Boring section.

C. RAMANUJA ACHARI—24-8-16.

I have read the report with some care and made such alterations—in red ink—as appeared to me necessary. His Excellency's sanction will be taken in due course to these changes. In the meantime will Revenue please note on the portions of the report which concern it? After receiving Revenue's remarks I shall make my own and circulate the file for orders to His Excellency and Honourable Member (Revenue).

P. RAJAGOPALA ACHARIYAR—1-9-16.

REVENUE DEPARTMENT.

Paragraphs 10-13 on pages 5-7 of report and paragraph 16 on page 7 relate to this department. The former deals with the pumping and boring operations and the latter with the Gunjana project. The following facts may be mentioned in the Government review of the report:—

(i) Special rules for the grant of loans for the erection of pumping installations were published during the year; but the hire purchase system referred to in paragraph 3 of the last year's review has not been introduced.

(ii) Revised rules for the levy of fees for work done in connection with the pumping and boring operations have also since been issued.

(iii) The transfer of the control of the pumping and boring operations to the Agricultural Department is being effected, an Agricultural Engineer on Rs. 450 in the scale Rs. 400-25-800 and an Assistant Agricultural Engineer on Rs. 200 in scale Rs. 200-12½-400 having been appointed.

G.O. 1646, Revenue, 18th July 1916.

G.O. Mis. 1854, Revenue, 15th August 1916.

A.H.A.T.—9-9-16.

2. Passages within red square brackets in paragraph 10, page 5, and third sub-paragraph under paragraph 12 on page 6 and page 19 of report may, if it is submitted, be deleted.

R.R.—5-9-16.

C.R.—7-9-16.

It is stated in paragraph 16 at page 7 of the report that arrangements have been made for the transfer of the Gunjana plant. The proposals for the transfer of the plant have not been approved by Government. The Board of Revenue stated in reference, dated 3rd April 1916, that Mr. Tressler's proposals would be scrutinised in consultation with the Collector of Kistna, the Director of Agriculture and the Chief Engineer for Irrigation and that a final report would be submitted to Government in due course. The Board's report is awaited—vide Official Memorandum No. 634-B./16-1, dated 14th April 1916. No remarks are called for on paragraph 16.

B.M.R.—8-9-16.

T.S.R.—8-9-16.

The statements in paragraph 16 seem rather premature, seeing that Government have not passed orders on the future location of the plant. The last sentence might

Adapted.

P.R.—21-9-16.

go out in the Editors' Table copy, and the penultimate sentence will then run "proposals for its establishment elsewhere have been called for and a scheme is now under preparation."

A. H. A. TOLD—9-9-16.

I agree with the Under Secretary as regards paragraph 16.

Adapted.

P.R.—21-9-16.

I would suggest the elimination of a sentence in paragraph 4 underlined in blue pencil.

Adapted.

P.R.—21-9-16.

In paragraph 6, everything except the first sentence seems needless and might well go.

Adapted.

P.R.—21-9-16.

In paragraph 12, I think that the eliminations suggested are suitable, except that I would retain the word "partly" or substitute "largely."

I don't see any harm in the last part of paragraph 10 and would retain it.

Adapted.

P.R.—21-9-16.

The passage on page 20 marked in blue pencil might go.

No other comments occur to me.

I note that Honourable Member (Revenue) will see the report.

J. P. BEDFORD—8-9-16.

HOME (EDUCATION) DEPARTMENT.

Submitted with reference to the Secretary's note on page 2 supra.

S.K.—11-9-16.

N.K.—12-9-16.

C. RAMANUJA ACHARI—13-9-16.

Mr. Tressler's report has been carefully edited by Mr. Bedford and myself and I think that it is now in a form which can go out to the public. There can be little doubt that the Department of Industries did good work during the year, notwithstanding many difficulties. Please see paragraph 35 of the report. In addition to the difficulties of getting machinery, providing sufficient funds and securing an adequate and suitable staff, there was the further serious difficulty that latterly the Government felt it not safe to give Mr. Tressler that free hand which the head of a department like that of Industries should, I think, have, if we are to get the best out of it. Taking all circumstances into consideration, I think that the record of last year's work—as shown in the report and its enclosures (the latter are interesting and worth perusal)—is one on which we can look back with satisfaction.

I think that it is neither necessary nor desirable to issue a detailed review. There is no need to repeat (in the review) what the Director has stated in the report. And in regard to the points about which there have been differences of opinion between Mr. Tressler and the Government it would be unseemly to deal with them in a Government Order going out to the public. It will be seen that the corrections (all in coloured ink) made by myself and Mr. Bedford have eliminated from the report those passages which are either not quite accurate or make needless references to contentious matters.

The report may, I think, be recorded with the remark that the Government recognise that good work was done by the department under difficult conditions, some of which are mentioned in paragraph 35 of the report, and that the thanks of the Government are due to Mr. Tressler who has, since the close of the year under report, left for military duty.

A word of appreciation may also be added in regard to the officers of the department to whose good work Mr. Tressler has borne testimony in paragraph 33 of the report.

P. RAJAGOPALA ACHARIYAR—21-9-16.

P[ENTLAND]—24-9-16.

A. G. C[ARDEW]—25-9-16.

Let me have draft Government Order sharp. [The office should be particularly careful to see that the corrections made in the report (and enclosures) by His Excellency, Mr. Bedford and myself, all come in].

P. RAJAGOPALA ACHARIYAR—27-9-16.

A draft order is submitted for approval. The Secretary's orders in regard to the editing of the report for the press are noted.

2. Attention is solicited to memorandum No. 1176-1, Public, dated the 20th February 1912, in which it is laid down that the thanks of the Government will be accorded to an officer only in acknowledgment of services of exceptional merit. Please see also the Hon'ble Sir Harold Stuart's note, dated the 18th February 1912 (written as Chief Secretary), on page 2 of notes thereto.

E.A.H.—29-9-16.

This is exceptional.

P.R.—3-10-16.

February 1912 (written as Chief Secretary), on page 2 of notes thereto.

S.K.—28-9-16.

N.K.—28-9-16.

E. A. HARVEY—29-9-16.

It is not for us to revise an order passed by His Excellency and the Honourable Member (Revenue). I have corrected the draft. Let me have clean copy sharp please.

P.R.—3-10-16.

Clean copy of draft is submitted.

S.K.—3-10-16.

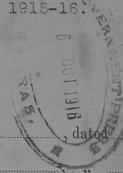
N.K.—3-10-16.

Issue.

P.R.—3-10-16.

[G.O. No. 1051, Home (Education), dated 4th October 1916.]

Recording the administration report of the Department of Industries for the year 1915-16.



READ AGAIN G.O. No. 191.

" " " " 191.

READ ALSO:-

C. No. 2862, From the D.I., No. A.11, dated the 29th July 1916.

" " " " 191.

" " " " 191.

ORDER.

Press

No. 1051, dated 4-10-1916.

Recorded.

3. The Government note the good work done by the Department of Industries during the year under difficult conditions, some of which are mentioned in paragraph 35 of the report, and their thanks are due to Mr. Tressler who has, since the close of the year, left for military duty. The Government also note with appreciation the work of the officers in regard to whom Mr. Tressler has borne testimony in para. 36 of his report.

To

The Director of Industries.
" Hony. Director of Fisheries.
" Revenue Department.
" Public Works Department.
" Home (Mis.) Dept. for
" Presidency Admn. Report.

K. T. R. Tressler, Esquire.
(Cp Secretary to the Govt of India)

Government of Madras.

HOME DEPARTMENT.

(EDUCATION)

In approval

SK

1870/11

Per

Rev. Mr. P. S. S. S.

18

G.O. No. 1051, 4th October 1916

57
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Department of Industries

Recording the administration report of the — for the year 1915-16.

GOVERNMENT OF MADRAS

HOME DEPARTMENT

(Education)

READ—the following paper :—

Letter—from K.T. B. TRESSLER, Esq., Acting Director of Industries.
To—the Secretary to Government, Educational Department.
Dated—Madrās, the 20th July 1916.
No.—A-11.

I have the honour to submit herewith my administration report for the year 1915-16.

2. The year under review has been an extraordinary one owing to the prevalence of a state of war and the work of the department has had to be carried on in the face of difficulties of an exceptional character.

3. Military requirements have made certain calls on the department. As mentioned in my previous report, Mr. Wills, my Personal Assistant, took a commission in the Flying Corps in March last. Mr. Guthrie, the Leather Expert, followed him to Mesopotamia with a commission in the Artillery three months later. Three men from the workshop also proceeded on active service. When the manufacture of munitions was begun in India, the department and the schools controlled thereby placed 14 machine tools at the disposal of the munition authorities, whilst the departmental motor-tractor was employed for some months in carrying about shells. In this connection I have to mention the patriotic assistance rendered by the trustees of the Chengalvaraya Naicker's Technical Institute, the St. Joseph's Industrial School, Coimbatore, and others.

Recruiting was also undertaken for mechanics for Mesopotamia and about 150 names were collected. At the moment of going to press I have further received a notification posting me to the Sappers and Miners.

4. Military requirements have led to a curtailment of civil expenditure. Since the reorganisation of the department in April 1914, I have been asking for extra staff, both superior and subordinate, and adequate accommodation. During the year the cost of direction increased by only 2½ per cent. On the other hand, the revenue receipts increased by 15 per cent and the total revenue expenditure fell slightly. The net revenue cost of the department for the year was about 2.24 lakhs as compared with 2.3 in the previous year.

5. The cost of maintaining the department has been steadily falling ever since I took over sole charge nearly three years ago. Increased receipts and reduced working expenses in the semi-commercial branches no doubt contribute to this economy, but a reduction in costs for the department as a whole, in spite of the large expansion of work of an unremunerative character in the experimental department and the Bureau, can only indicate one thing, viz., "overloading" somewhere or other. I have now been running the Department of Industries practically single handed for three years, and I accordingly requested Government early in the year to take steps to put the department on a definite footing. Government have now decided to appoint a member of the Indian Civil Service for the purpose of formulating proposals for the reorganisation of the Department of Industries.

6. As a first step towards this reorganisation, orders were issued for the transfer of the Pumping and Boring Department from my control to that of the Director of Agriculture.

7. The department at present consists of seven sub-departments, viz., (1) Administration, (2) Education, (3) Engineering, (4) Boring, (5) Workshop, (6) Experiments and Demonstrations, (7) Bureau. I am in direct charge of practically all of them.

ADMINISTRATION.

8. As already stated Mr. Wills and Mr. Guthrie have gone on active service. In the place of Mr. Guthrie, Dr. Marsden was, as a temporary measure, transferred from Madura to superintend the work of the Leather Trades School and provide the scientific instruction. For the practical work Messrs. Chambers & Co. were kind enough to permit me to utilize the services of their head tanner Mr. Mason. At the same time steps were taken to introduce a more permanent arrangement and towards the end of the year Mr. Raghava Kurup (a former pupil of mine at the Sembium Tannery) was appointed Assistant Superintendent to take charge of the tannery pending Mr. Guthrie's return.

During the year two supervisors took two months' leave; one subsequently went sick again and was granted three months' extension. Seeing that the supervisors of this department who had reverted to the Public Works Department had all secured an increase in pay, I could not stand in M.R.Ry. K. Ranganatha Ayyangar's way when he also asked to be allowed to revert to the Public Works Department. M.R.Ry. K. Ranganatha Ayyangar was one of the original departmental supervisors and the development of the pumping operations in the southern districts has been very largely due to his intelligent efforts.

As the amount of plant in the charge of the department is rapidly increasing, it was considered desirable to obtain an expert Superintendent for the workshop, and Government sanctioned such an appointment in the place of the Sub-Engineer's post reserved in the Public Works cadre for this department. Mr. Apte, Superintendent of the Chengalvaraya Naicker's Technical Institute, Madras, was appointed to this post in January.

A Superintendent for the Bureau of Industrial Information on a pay of Rs. 100-5-125 was also sanctioned in January.

Owing to pressure of work I was unable to do very much touring and the only outside functions I attended were the Tiruppur Cattle Show and the Industrial Conference at Nellore. In Madras I read certain papers and arranged the industrial section of the exhibition held at the People's Park.

During the year I prepared a Pumping Manual which has been submitted to Government for consideration. I have also written a companion volume, viz., a Boring Manual.

I invented an integrating gas-engine indicator. An improved solid border slay has also been invented and the practical details are being worked out by the Superintendent, Peripatetic Weaving Party No. 2. Further, a method of graphite refining which is believed to be entirely original has been evolved and one of the supervisors is engaged in elaborating the method.

In connection with the shortage of dyestuffs Dr. Marsden proceeded to Bangalore for a month and a half to carry on certain investigations there. He subsequently went to the Titagarh Paper Mills to investigate and study the process of pulp manufacture and later proceeded to Punalur to supervise manufacture there.

My personal assistants and the Superintendent of the Bureau visited various local exhibitions and shows and delivered lectures. Mr. Subrahmanyam Ayyar, the weaving assistant, also wrote several technical articles for the press.

EDUCATION.

9. During the year the Code of Regulations regarding technical education prepared by me was under the consideration of Government. It was returned for revision towards the end of the year and a revised draft has been resubmitted. The appointment of an Inspector of Industrial Schools was sanctioned by the Secretary of State two years ago, but no appointment has yet been made.

Schemes for the establishment of industrial teaching centres at Coimbatore, Vizagapatam and Tindivanam were worked out but had to be deferred owing to shortage of funds. A similar scheme for the establishment of an industrial school at Cocanada was sanctioned. The preliminaries of this scheme have been settled and plans and estimates are under preparation.

As regards Government institutions, the Madura Technical Institute was begun last August and it is hoped that part of the premises will be ready for occupation this summer.

A scheme for the establishment of a Trades school in Madras was also submitted. But Government ordered that in the first instance the classes should be temporarily held in hired premises. At present it is next to impossible to get any machinery and, so far, I have been unable to discover temporary accommodation of a suitable character in a suitable locality. The scheme is therefore in abeyance for the time being.

Pending the sanction of the new Technical Education Code the existing industrial school system was not interfered with and continued unchanged. During the year three new schools were temporarily recognised and one was closed owing to lack of funds. The number of recognised institutions on the 31st March was 37.

The State Technical Scholarship for the study of Electrical Engineering in England was awarded to Muliyl Karuven. As in previous years six scholarships were offered at the Victoria Technical Institute, Bombay. But as before, the majority of applicants did not satisfy the conditions laid down by Government and only two scholarships have actually been awarded.

CONSULTING ENGINEERING—(PUMPING).

10. During the year the number of applications for assistance and advice was the same as in the previous year. The supply of engines from England has become very uncertain and firms, being able to dispose of the whole of their limited stocks for cash, generally refuse to sell on hire purchase. Two years ago proposals were submitted to Government for the introduction of a State hire purchase system similar to that introduced by Mr. Chatterton in Mysore. No orders were passed on these proposals during the year, and as most ryots are unable to find ready cash, such engines as are available usually go to firms of standing who can make cash payments, rather than to ryots who often cannot.

But apart from the question of plant and payment, the fact has to be recognised that during the prevalence of war conditions, ryots are somewhat chary of investing money. Towards the end of the year there were signs of reviving confidence and if the loan rules are sanctioned, and the supply of engines improves, I anticipate a considerable expansion of work during the coming year.

It is gratifying to note that two firms in this Presidency are seriously considering the local manufacture of oil engines.

11. The appended table gives, in an abstract form, the number of factories of different kinds in the Presidency at the end of the year. As compared with last year, progress has not been up to average for the obvious reason that the war has caused a curtailment of investment and expenditure. The sections under which the greatest progress is shown are Section I—Agriculture and Irrigation, Section VII—Food, Drink and Tobacco trades, Section VIII—Chemical and allied trades and Section V—Textile trades. The increase in Section I is mainly due to pumping plants, in Section VII to rice mills, in Section VIII to oil mills and Section V gineries.

Section	Trades.	Number of factories.	Horse-power.				Total excluding horse-power of boiler.
			Engine.	Boilers.	Oil or gas.	Others.	
I—Agriculture and irrigation		701	..	..	8,671	..	8,671
Do. II—Mines and quarries		21	252	1,484	149	..	401
Do. III—Iron, steel and engineering trades		61	859	4,948	1,249	..	2,108
Do. IV—Metal trades other than iron and steel		3	..	..	137	10	147
Do. V—Textile trades		248	15,687	18,693	2,475	1,150	19,312
Do. VI—Clothing trades		1	..	..	8	..	8
Do. VII—Food, drink and tobacco trades		595	2,872	12,899	7,974	120	10,966
Do. VIII—Chemical and allied trades		41	297	1,207	556	527	1,880
Do. IX—Paper, printing and allied trades		31	83	222	273	76	432
Do. X—Leather, canvas and India rubber trades		5	41	64	10	..	51
Do. XI—Timber trades		2	62	50	132	114	308
Do. XII—Clay, stone building and contracting trades		27	1,405	1,869	78	5	1,488
Do. XIII—Miscellaneous trades		..	..	..	..	..	..
Do. XIV—Public utility services		31	6,556	2,743	661	15	7,232

12. Of the 136 applications dealt with by the department about one-half were connected with power pumping and the other with industrial plant. As explained in last year's administration report, the department is discouraging the installation of plant in places where it would constitute reduplication of existing plant and interference with established enterprise. For this reason the erection of rice hulling plants in Tanjore, which constituted so marked a feature of departmental work two years ago, has been almost entirely stopped. On the other hand several schemes on novel lines have been taken up. In Tanjore a new type of vertical spindle pump has been introduced and is being tried; and a large central electric power scheme is being worked up for an enterprising ryot in the Coimbatore district.

The special feature of this year's work is the development of the compounding fees system. The principal difficulty the small machinery owner has to face is the maintenance and supervision of his plant. The compounding system was originally introduced in order to give ryots an opportunity of having their plant regularly inspected by a departmental officer. During the year the scheme was amplified and the department now arranges for the supply of spares also when desired. This innovation has made the compounding fee system much more popular and the number of fees collected has increased by 20 per cent as compared with last year.

Excluding a special loan of Rs. 25,000, only three Government loans were sanctioned during the year and were of the value of Rs. 5,400. During the last three years loans have gradually been falling from Rs. 52,500 to the present figure. The reasons for this falling off are largely due to war conditions. The reduction in the loan disbursements constitutes a good indication of the present financial situation.

Considerable economies were effected in this department during the year. Whereas the total receipts fell slightly, the expenditure was reduced still more and the cost of this department shows a reduction of 5 per cent on last year's figures.

BORING DEPARTMENT.

13. In the Boring Department the total depth bored through was about 25,000 feet which is somewhat less than the previous year. The number of borings was nearly 500 which also shows a slight reduction as compared with last year's figures. On the other hand the number of successful borings has increased to 80 per cent as against a little over 70 per cent previously. The reduction in depth and number is due largely to the fact that ryots are being encouraged to persevere with their borings instead of giving them up. The average depth of borings during the current year was 15 per cent greater than last year. Boring work was carried on during the current year under great difficulties as the greater part of the departmental workshop machinery was engaged on war work and delays in the execution of repairs occurred in consequence. Further the supply of lining pipes has been erratic and work has frequently been held up owing to lack of pipes. Even now orders sent to Europe eight months ago are still unfulfilled.

In the circumstances the reduction of costs in this department is remarkable. The cost of drilling 100 feet deep has been reduced to less than half of what it was two years ago.

The departmental plant—chiefly pumping engines—has been in constant use during the year. Although the department now has 14 engines available for hire, the demand exceeds the supply and there is a long waiting list. Engines have to be rushed out again almost as soon as they come to the workshops and consequently the difficulties of maintenance are greatly enhanced.

Careful working accounts have been maintained during the last two years, and it is now possible to determine exactly what departmental service actually costs. In the light of these figures it was found that the charge for a certain class of service was insufficient and proposals were submitted to Government for the revision of the scale of fees.

WORKSHOP.

14. A considerable amount of up-to-date plant was sanctioned by Government for the purpose of enabling the departmental workshop to cope with the ever increasing demands made thereon. The machinery was received just before the great munition

movement and had not been in the country more than a month before it was requisitioned for munition purposes. Government sanctioned its loan to the Perambur Workshops for the time being and the shops had to do the best they could with the balance of plant left. By dint of over-time and extra pressure all round, they managed to keep up more or less with the demands made upon them.

The shops show increased receipts and reduced expenditure, but I am afraid the former have been secured by overcharging the other departmental branches. In the circumstances under which the workshop has had to work during the past year a certain amount of loss must be expected.

EXPERIMENTS AND DEMONSTRATIONS.

15. In this department 11 of the 12 experiments begun last year were continued. Of these, seven are of an ordinary routine character and the other five represent experiments undertaken more particularly on account of the war conditions.

During the year no further experiments were sanctioned by Government.

The two *Peripaletic Weaving Parties Nos. 1 and 2* continued their work during the year. M.R.Ry. N. Subrahmanya Ayyar in charge of Party No. 1 toured in the south of the Presidency and M.R.Ry. N. M. Sundaram in charge of Party No. 2 in the north.

The progress of these parties as evidenced by results continues to be satisfactory. (Vide appendix.)

16. *No. 3. Gunjana project.*—This project was again worked this year, but on representations being made, Government passed orders that the project should be closed and the plant removed. Proposals for its establishment elsewhere have been called for and a scheme is now under preparation.

17. *No. 4. Motor tractor.*—As it is possible to use this plant for ploughing purposes only during certain seasons of the year, attempts were made to see whether it could not be used for haulage work during the off season. After the close of the ploughing season the tractor was overhauled previous to its being sent to Coimbatore in accordance with an application by the Forest Department. Before it was despatched, however, it was claimed for munitions work and was employed for several months in Madras in hauling shells. After that the Forest Department application had to be dealt with and forest work kept it engaged until the end of the year. Owing to these demands on the tractor for haulage purposes it has not been available for ploughing purposes during the year.

A report on mechanical traction embodying the experience obtained in these trials is being published in bulletin form.

18. *Nos. 5 and 6. Singanallur and Hospet sugar stations.*—After a great deal of uphill work these stations have proved a great success during the year. At Singanallur 10,750 maunds of jaggery were manufactured and manufacture showed a gross profit of Rs. 1,348.

At Hospet difficulties connected with labour and supplies of cane have been experienced from the first, chiefly owing to the unhealthy character of the locality and the lack of enterprise on the part of the local ryots.

When therefore an application was received from the village munsif of Chittavadi for the hire of the plant, specially favourable terms were offered. The hire was fixed at the low figure of Rs. 250 a month, and this brought in a revenue of Rs. 1,000; 6,370 maunds of jaggery were manufactured.

19. *No. 7. Lime brick plant.*—In G.O. No. 1472, Educational, dated 23rd December 1914, Government sanctioned the purchase of a plant for the manufacture of bricks from lime and sand. The plant has been erected in the premises of the South Indian Industrials who have undertaken to supply all raw materials at cost price. Here, as in all cases where questions of machinery arise, the delivery of plant has not been completed owing to the pressure of munitions work at home. Some extra machinery has however been borrowed from the Public Works Department and with the aid of this, bricks are being manufactured and utilised for the construction of the oil mill. Commercial data cannot now be given as the present plant is of a make

shift character and the cost of operation is therefore considerably higher than it should be. Information has however been received that the missing items are being shipped and a bulletin will shortly issue describing the results of trials.

The foregoing experiments are those which were undertaken before the outbreak of war. The ones hereafter enumerated all owe their origin to war conditions.

20. *No. 8. Pencil manufacture.*—A great deal of progress was made in this industry during the year. Last year an expert was engaged. In a comparatively short space of time, he got the plant into working order and turned out pencils with a reasonable finish. The graphite used was not however satisfactory, and the wood supplies had not been ascertained. During the current year therefore these two important commercial factors were investigated. To begin with, 34 or 40 different species of wood were collected and tested, and of these 8 were selected and tested in bulk. The bulk trials showed that several varieties which at first appeared suitable possessed drawbacks which made them unfit for pencil-making purposes. Of the 8 selections 3 species were finally chosen and the supplies of these species were investigated with reference to their commercial characteristics, viz., quantity and price. As the best price that can be paid for timber is 10 annas a cubic foot delivered, it is evident that the question of price is one that requires a great deal of consideration. Since most timber in India is not gregarious the problem of supply in commercial quantity is one that offers considerable practical difficulties. Ultimately, it was found that in one species adequate supplies could be obtained from three circles at a commercial figure.

The graphite problem proved an equally difficult one. When it is remembered that a minimum 75 per cent purity is required and that the ore available in South India only averages about 30 per cent purity and that further the graphite and silica (with which it is mixed) have almost the same specific gravity, the nature of the problem will be appreciated.

A supervisor was deputed to go to the Indian Institute of Science and he spent several months there studying the problem. None of the known methods of refining proved of the slightest value, and, finally, an entirely novel method of refinement was introduced. The supervisor in charge of the experiment also made trials with red, blue and copying leads and achieved satisfactory results. Copying leads are coloured with methyl violet which, being a German dye, is not at present available.

Preliminary investigations were complete early in December. I have now received funds which will enable me to place a certain number of pencils on the market.

The experiments made are published in the departmental bulletins.

21. *No. 9. Glass manufacture.*—The three essentials in glass manufacture are (a) a furnace of high efficiency capable of giving a temperature of not less than 1,500 centigrade; (b) a knowledge of the composition of glass; (c) practical experience in the manipulation of the metal.

The furnaces in the old glass factory were in several ways defective and, during the year, experiments were made with regenerative oil furnaces. In Madras oil fuel is more satisfactory from the commercial and practical point of view than coal. In Europe the reverse holds true; hence European experience of coal fired furnaces is not of very much use in dealing with the furnace problem under Indian conditions. Information was collected as far as possible from various furnace makers, but this did not prove of much value for the reasons stated and we were thrown back on direct experiment. Towards the end of the year a satisfactory form of oil furnace was evolved.

As regards the composition of glass, formulae are usually treated as a trade secret. On the outbreak of war an English chemist was placed on special duty to analyse the various kinds of glasses and to determine their composition. These analyses have been secured by me and a considerable number have been practically tested with the materials locally available. Some of them have been found unsatisfactory: others have proved good.

The commercial manufacture of glass in the existing factory will involve considerable structural alterations and a good deal of rebuilding. As the factory was only leased, it was considered undesirable to make these alterations and Government were requested to acquire the property. This was done at the end of the year and a new furnace is now under construction.

In connection with the practical side of glass-blowing, I have instituted several enquiries regarding a glass expert. But all the private reports received have been unfavourable with one exception. When this individual was addressed, it was found that he had gone on active service.

A fairly large exhibit of bottles made in the glass factory was shown at the People's Park Exhibition.

Further particulars of the experiments made are published in the departmental bulletin No. 25.

22. *No. 10. Paper pulp.*—Last year the owner of a defunct paper mill applied to the department for assistance to revive his mill and arrangements were made to overhaul his plant. The work was carried on under difficulties as there was another claimant for ownership who raised objections to anything being done. After trying vainly for nine months to get the parties to come to some arrangement, I at last had to inform them that unless a final arrangement was immediately arrived at I should have to withdraw from the undertaking altogether. This threat led to an agreement between the parties but only after nearly a year of valuable time had been wasted. Work was begun in February.

As a preliminary, Dr. Marsden visited the Titagarh Mills to study the processes there. He subsequently proceeded to Punalur to take charge of the mills. Owing to the fact that during the period of idleness the mill had been systematically despoiled, a large number of important parts were found to be missing, other important parts of the machinery had been badly damaged so that work was carried on under difficulties. Nevertheless pulp-making has now been started. Great assistance was rendered both by the Indian Institute of Science in lending me valuable plant and by the Travancore Government in granting me the use of 1,000 tons of bamboos free of seigniorage charges.

The mill has not run sufficiently long during the year to furnish adequate data and it would be premature therefore to express an opinion.

23. *No. 11. Oil-pressing.*—On the outbreak of war orders were placed for a large oil-pressing plant to be erected in Madras. This plant was to consist not only of presses but was to include also the apparatus required for refining the oil made. The experiment is perhaps the most important one now being under investigation. Part of the plant is delivered, but the manufacturers' works have been taken over by the English Government, and, in spite of the best efforts of the India Office, it has been impossible to secure delivery of the complete plant.

Land has been acquired: such of the plant as has been delivered is being erected and the buildings are approaching completion. Delivery is still hoped for, but until effected, nothing more can be done.

24. *Anderson expellers.*—Experiments with the Anderson expeller were continued during the year. A considerable amount of work was done in groundnut and after that experiments were made with different kinds of seeds. Reports on the expeller and the tests of seeds are being prepared in bulletin form. The second expeller which had been erected in Cuddalore for the purpose of helping to tide over the groundnut crisis was removed from there during the year as the demand for oil became slack and arrangements have been made for transferring it to the Northern Circars where it is likely to be of more general value.

25. *No. 12. Soap manufacture.*—Soap may be regarded as a bye-product of oil-pressing. Government have given a grant of Rs. 75,000 to Sir Frederick Nicholson to deal with this problem. At present I am not doing anything in this matter. I am however in touch with the Director of Industries and Commerce in Mysore who is making independent investigations on the subject.

BUREAU.

26. During the year the Bureau has been organized as far as is possible with the limited staff and accommodation available. A considerable library has been collected and samples of various industrial products of the Presidency are being accumulated.

With a view to co-ordinating the work with that of the Central Bureau controlled by the Director-General of Commercial Intelligence, Calcutta, the Superintendent was sent to Calcutta to study the system followed in that Bureau. It is hoped that the information which the Madras Bureau will now be able to place at the disposal of the Commercial Intelligence Department will be of value.

Enquiries received in the Bureau are rapidly increasing, and now amount to about half the correspondence in the department, equivalent to about 7,000 letters annually. An attempt has been made to register the information accumulated and records have been started so far as is possible with the staff now available.

One of the most important functions of the Bureau is to maintain accurate working accounts of all the experiments undertaken in the experimental branch with the view of obtaining "fundamental data of production." From the Bureau also emanate the circular enquiries regarding the availability and cost of raw material or manufactured goods. The collection of this information involves a large amount of work: the file relating to pencil timber, dye-stuffs, etc., have already reached large dimensions, but this information, as it is completed, is written up in the form of bulletins. Of these about 20 have been produced during the year.

27. A considerable number of investigations of a scientific character were undertaken in the Bureau during the year. In the Bureau all the boring results are co-ordinated and registered. Some time back Government sanctioned the appointment of two surveyors to connect up well levels for the purpose of an underground water survey. Work has been begun in the Chingleput and Tanjore districts. For a part of the former district an underground water map has been prepared and for the latter district one is in the process of preparation. Of other enquiries, that conducted by Dr. Marsden on the commercial value of indigenous dyestuffs was the most important. Numerous samples of indigenous materials were collected. The collection took six months. Dr. Marsden then proceeded to the Indian Institute of Science to work them up. A complete range of yarn dyed with such indigenous dyes as were available were exhibited at the People's Park Exhibition. This research has been further described in a departmental bulletin. Later on the services of Dr. Marsden were placed at the disposal of the Director of Agriculture to devise means to combat the prevalent practice of indigo adulteration.

28. During the year Government sanctioned the purchase of an electric testing plant for the purpose of testing the efficiency and value of different kinds of machinery. As in the case of most other investigations involving the use of plant, the plant has not yet been fully delivered. When it is received (and if accommodation can be found) it will be possible to carry out a series of experiments on the mechanical merits of different classes of machinery. Meantime certain tests have been made on a new form of oil-crushing plant, and experiments on decorticators are also contemplated when accommodation becomes available.

29. During the year a start was made with the investigation of the mineral resources of the Presidency, and some promising samples were sent in by the departmental supervisors.

Several specific minerals had to be studied in connection with the experiments actually being undertaken. Thus, for purposes of pencil manufacture, it was found necessary to investigate the supplies of china clay in the Presidency. In connection with the paper and glass experiments enquiries were made regarding the availability of sodium carbonate. Considerable deposits of the former kind of varying degrees of purity have been tested, but, in the matter of carbonate, the result has so far been disappointing.

30. One of the most important events of the year was the Industrial Exhibition held in Madras in connection with the People's Park fair at Christmas. In this exhibition the industrial section was organized by the Department of Industries and appears to have attracted a considerable amount of interest. The working model of

the water-power scheme in particular seemed to take the public fancy, though the educational side of this exhibit was not perhaps adequately appreciated. It caused quite a sensation as a side show and disputes were by no means infrequent for the possession of points of vantage from which to watch the electric train coming out of the tunnel. Working exhibits of pencil manufacture were also shown, but the departmental glass furnace in which it was proposed to manufacture bottles was stopped at the last moment. Two improved looms were also shown in operation and one of these was awarded a medal. Working exhibits of improved button machinery was also arranged by the department in collaboration with Mr. Bose, a local manufacturer of these goods. Exhibits by private engineering firms were limited to articles made in this country and, with the exception of the Crossley engine used for motive purposes, the whole of the machinery exhibited in the firms section was of "swadeshi" manufacture.

31. Another investigation that has been engaging the attention of this department is that of tinning or otherwise preserving Indian fruits. The position of the carpet industry was examined. The problem of manufacturing buttons was also gone into.

32. Apart from investigation, a certain amount of practical industrial work of a minor character is also done in the Bureau. An example of this kind is the scheme which was inaugurated last year to meet the demand for cotton-wobbling. Although the work is being carried on on a comparatively small scale, it has yielded very gratifying results. The weavers engaged have been earning good wages and, even allowing a fair sum to cover the cost of departmental supervision and control, there still remains an appreciable margin of profit. The venture has not yet reached a state of maturity, but it is hoped in the near future that it may be converted into the nucleus of a co-operative society.

33. A considerable part of the work of the Bureau has been in connection with commercial enquiries which have to be regarded as semi-confidential. If, for instance, a merchant has the idea of utilising some raw material not previously employed and makes enquiries regarding supplies and so on, it is only fair that his intentions should not be made public. Again a considerable number of confidential Government inquiries were received and dealt with. These, although of great interest, obviously cannot be discussed here.

34. Hitherto the Bureau has been in a singularly strong position to obtain local information on commercial matters owing to the existence of a large departmental district staff which could be called upon to report on all matters of interest. This staff is now to be transferred to the Agricultural Department, and it is not at present clear how information can be collected in future. Proposals have been submitted for the creation of a staff of industrial inspectors.

35. To summarise. The year's work has been carried on under considerable difficulties. War conditions, the impossibility of obtaining machinery from Europe, financial stringency and lack of staff and accommodation have tended to intensify the natural difficulties under which pioneer work of any kind always labours. In these circumstances, industrial education has practically remained *statu quo*. The pumping and boring work remains at about last year's level but with increased receipts and with very materially decreased expenditure. The workshop is much the same as before. In the experiment and demonstration line, the sugar mills have reached the demonstration stage and shown a very considerable profit during the year: the rest of the experiments have not yet reached the commercial stage but considerable progress has been made in most of them. The pencil industry would have been transferred to demonstration in December had funds been available. The bulletins will also give some idea of the progress made in the other industries. The Bureau work has developed during the year.

36. Before leaving the department, I desire to bring to the notice of Government the amount of help which I have received from the members of the staff under circumstances of exceptional difficulty. Owing to pressure of work office hours have often to be considerably extended and public holidays sometimes sacrificed. This extra work the office has cheerfully performed. On the executive side I wish particularly to mention Mr. J. Narayanamurti, my Personal Assistant, who has done extremely

useful work and has stuck to the department although his juniors who have reverted to the Public Works are drawing Rs. 50 more pay. Mr. Ranga Achari, who is my Assistant in the Pumping and Boring Department, has shown himself useful and reliable. Mr. Narasimha Ayyar, Superintendent of the Bureau, has done extremely well in organising his section and introducing the departmental system of accounts, whilst Mr. Ramachandra Ayyar, the Pencil Expert whom I am training, has worked with great application and zeal throughout the year and has obtained a very sound knowledge in pencil manufacture. Reports of the various sections are appended.

ENCLOSURES.

(1)

Section reports.
ADMINISTRATION.

The accounts for the year arranged according to official sub-heads are given in table I of the appendix.

It will be seen that the total nominal cost of maintaining the department is Rs. 2.95 lakhs as against Rs. 3.70 lakhs last year. From these figures have to be subtracted capital expenditure of a recoverable character which amounted to Rs. .71 lakh as against Rs. 1.4 lakhs last year.

The actual cost to Government, therefore, amounts to only Rs. 2.24 lakhs as against Rs. 2.30 in 1914-15 and Rs. 2.34 lakhs in 1913-14.

The official figures are mixed up and they do not differentiate between capital and revenue expenditure. Special accounts are maintained in order to determine the relative cost of each branch of work of the department.

According to these accounts, the cost of running the Department of Industries, that is, the cost of direction is .43 lakh as against .40 lakh in the previous year. Technical education has cost only .87 lakh as against 1.01 lakhs in the previous year. Bureau, very nearly Rs. 12,000 which also includes charges on account of the Industrial Exhibition; Consulting Engineering Department, Rs. .22 lakh as against Rs. .23 lakh in 1914-15; Boring Department Rs. .20 lakh as against Rs. .24 lakh in 1914-15; Workshop Rs. .06 lakh as against Rs. .15 lakh in 1914-15; Experimental Branch Rs. .39 lakh as against Rs. .32 lakh in 1914-15.

The total net cost of the various branches of the department is only Rs. 2.22 lakhs as against Rs. 2.33 lakhs in 1914-15, that is to say, Rs. .11 lakh less than the previous year. The marked decrease of about Rs. 9,000 in Workshop expenditure during the year is mainly due to the introduction of a new system of working accounts.

EDUCATION—INDUSTRIAL SCHOOLS.

General—Apart from the Government Technical Institute, Madura, there were 37 Industrial Institutions under the control of the department as against 35 last year. The temporary dyeing classes attached to the Technical Institute, Madura, were closed as there was no demand for them, mainly due to the stoppage of dyestuffs. Three new schools were temporarily recognised during the year out of which one was closed before the close of the year for want of funds. The O.E.L.M. (late H.E.L.M.) Industrial School, Nayudupet, was revived during the year under the management of the Ohio American Evangelical Lutheran Mission.

The 37 recognised institutions may be roughly classified as follows:—

Carpentry Schools—where Carpentry is the principal subject taught	16
Lace Schools—where needle craft is the principal subject taught	15
Printing Schools—where printing, book-binding, etc., are the principal subjects taught	2
Agricultural School	1
Blind Boy's School for weaving	1
Weaving Schools	2
Total	37

In nine of the above-mentioned 16 carpentry schools mechanical engineering is also taught as a subsidiary subject.

The establishment of a weaving school by the Local Board at Berhampur is under correspondence. Pending the approval of the Code of Regulations for Technical Education many of the managers of unrecognised schools have deferred submitting their applications for recognition while some others have postponed starting new schools which they have under contemplation.

Statistical information regarding the schools is given in Tables II and III of the Appendix.

There were 1,916 pupils under instruction on the 31st March 1916 as compared with 1,376 on the corresponding date in the previous year. Some of the Mission Schools lost strength during the year owing to the fact that they had to limit work in the workshop for want of sufficient orders from outside and further owing to the fact that the help they used to get from the Mission Funds stopped or was reduced owing to the war. Some other schools however gained strength and the loss in the former case was more than covered by the gain in the latter so that the total shows a slight increase over that of the previous year.

The different subjects taught in industrial schools and the number of pupils under instruction in each are given in Table II. From a perusal of the statement it will be observed that 607 fall under the head Carpentry, 605 Needle crafts, 269 Mechanical Engineering, 214 Printing, 701 Weaving and other subjects.

One hundred and fifty-six scholarships—4 in the Advanced Class, 27 in the Intermediate, 39 in the Elementary, 43 in D Standard and 43 in C Standard—were sanctioned to deserving pupils in Industrial Schools during the year as against 177 in the previous year. The total amount paid under this head during the year was Rs. 5,395-12-6 as against Rs. 5,212-8-5 in the previous year. The slight increase in the amount paid during the year in spite of the decrease in the number of scholarships sanctioned is due to the fact that many of the scholarship holders did not discontinue their studies as in the case of previous year.

The amount of teaching grant paid during the year was Rs. 33,273 as against Rs. 29,610 in the previous year. The increase is due to two reasons. Some of the deserving Mission Schools applied for special help owing to the stoppage of their usual remittances and schools ordinarily drawing funds from Belgium and North France were specially assisted. Further two schools were newly aided.

The amount of building grant paid during the year was Rs. 4,203 as against Rs. 6,920 in the previous year. In G.Os. Mis. Nos. 301, dated 15th March 1915, and 395, Educational, dated 14th April 1915, Government sanctioned, as a special case, Rs. 7,000, the total amount required for the provision of additional accommodation for the St. Joseph's Industrial School, Bellary, as the management expressed their inability to contribute any part of the cost of the building. Rupees 6,000 has already been paid in advance and the building is almost complete. During the year building grants were also sanctioned to the Anjuman-i-mufid-i-Ahl-i-islam Industrial School, Madras, (Rs. 1,400) and the Andra Jatheeya Kalasala, Masulipatam (Rs. 1,900). The plans and estimates amounting to Rs. 19,650 for a new building for the Vellore Anjuman Industrial School are under the consideration of Government.

The amount of furniture and special grants paid during the year, as will be seen from Table III, was Rs. 6,104-5-0 as against Rs. 9,147-6-6 in the previous year. No grants under this head were paid to schools the development of which is under consideration and this accounts for the decrease in the amount spent during the year.

The management of the H.E.L.M. Industrial School, Nayudupet, and the G. M. Lace Making class, Gudur, have been taken over by the O.E.L. Mission and that of the L. M. Girls' Industrial School, Kempstown (Trichinopoly), by the Church of Sweden Mission.

Some very fine exhibits for the Peoples Park Exhibition were contributed by Industrial Schools and certificates of merit were awarded to the Wesleyan Mission Industrial School, Karur, for its black wood furniture, the St. Joseph's Industrial School, Tindivanam, for its inlaid work, the American Advent Mission Industrial School, Veicheri, for wood carving, the S.P.G. Girls' Industrial School, Edayangudi, for its lace work, and the Andra Jatheeya Kalasala, Masulipatam, was awarded a gold medal for the scientific instruments exhibited by it.

In connection with munition manufacture a few lathes were lent to the munition authorities at Perambur by the St. Joseph's Industrial School, Coimbatore, the Chengalvaraya Naicker's Technical Institute, Madras, and the Government Technical Institute, Madurai. Men for the manufacture of shells were also spared by the latter two schools. Father Perrin of the first named school was recalled to the French Colours during the year and Mr. Hudson of the Velacheri school has gone to do Y.M.C.A. work in Mesopotamia.

TECHNOLOGICAL INSTITUTIONS.

The Technical Expert (Dr. Marsden) reports with regard to the dyeing branch—

“One of the immediate effects of the declaration of war was the almost complete stoppage of dye-stuffs, the manufacture of which has hitherto practically been a German monopoly. Until the supply of dye-stuffs could be re-established there was clearly little object in trying to provide instruction in the technique of dyeing and it was felt that this question could be left in abeyance until the completion of the Madurai Technical Institute buildings. During the early part of the year therefore the Dyeing Expert devoted his attention more particularly to the investigation of indigenous dye-stuffs with a view to ascertain whether these could in any way replace German synthetic dyes. The first investigation made was with a number of different varieties of safflower received from the Economic Botanist, Pusa. These were found to vary enormously in dye-stuff content and, from the market prices (bazaar) which were being charged for the flowers it was patent, bearing in mind the fugitive character of the dye and the tediousness of the operations required to prepare it for dyeing, that it would not find much application in practice.

Owing to the Leather Expert's departure for active military service, Dr. Marsden was requested to take charge of the Leather Trades school in Madras in addition to his other duties and arrived in Madras early in July.

Meantime, stringency in the matter of dyes had become most pronounced and numerous enquiries were received as to materials which might be employed in place of the imported ones. Although enquiries were instituted in many directions with respect to the old-time materials, replies came in very slowly and it soon became evident that, if only on the score of quantity, these materials could do little to relieve the situation. Further these materials furnished no possibility of effectively dyeing a range of shades such as Indian dyers had been accustomed to. It was explained to dyers that it would only be possible to use indigenous materials such as turmeric, safflower and annatto for bright shades and where no degree of fastness was essential. Where fastness was of moment they might find indigo, catechu and (for black) tannin materials and iron salts useful.

Communications were forwarded to some of the dye-making firms in England informing them of the demand for dyes here and the market awaiting them, but the Government demands for munitions and machinery had reacted upon all other industries, and the shortage of labour, the demand from their home customers and the impossibility of carrying out the contemplated extension of works prevented dye manufacturers from holding out any hope of supplies being forwarded to India. It is true that some dyes have been exported under the licence scheme of the Board of Trade, but these have been purchased by agents in England and then exported on Indian account. Owing to the extent of the requirements, they have not however altered the position materially.

Then the release of the S.S. *Barenfels* under the orders of the Prize Court of *Alexandria* gave a prospect of a supply for a short time to Madras and it was finally agreed that the Madras Government should have the option of purchase. The difference however between the prices at which the agents of the Prize Court will let the cargo go and those which the dyers are prepared to pay is so great that the question had to be carefully considered.

Meantime, however the investigation of indigenous dye-stuffs was being proceeded with. District Officers were circularised early in the year and a representative collection of Indian dye-stuffs was slowly collected. When collection was complete it was arranged in collaboration with Mr. Chaterton that Dr. Marsden should go to the Indian Institute of Science to test them practically.

The results of the investigation were definite and, in the words of Mr. Chatterton, may be thus summed up. “Nothing useful can result in attempting to resuscitate vegetable dyeing on cotton” owing to

- (1) the extreme cost of vegetable dyeing;
- (2) the scarcity of dyeing materials;
- (3) the change in the tastes of the people who are accustomed to buy bright colours and regard the vegetable dyes on cotton as too dull and sombre.”

The Dyeing Expert was preparing to undertake the analysis of Indigo samples on the suggestion of the Director of Agriculture when the embargo on exports of wood pulp created a serious position in the paper-making and using trades. As the Dyeing Expert possessed a considerable knowledge of the chemistry of pulp manufacture and as moreover the position was critical and there was no one else to send, it was arranged that Dr. Marsden should attend to the pulp work. The Department of Industries had already undertaken to conduct experiments with bamboo at the Punalur mills and to assist in the development of the work. Dr. Marsden was deputed to visit the Titagarh Mills, Calcutta, to discuss the question of pulp-making from bamboo and then proceed to Punalur. It is unfortunate that the state of the plant there after its long stand is not good and breakdowns are to be expected. One such breakdown occurred through a wooden conveyor being dried out, patching was hopeless and only after 14 days, owing to the position and difficulty of obtaining supplies at short notice, could the work be resumed. Owing to the demand for newspaper it may be advisable to attempt more than was at first contemplated, and see whether besides pulp for paper-makers the plant cannot be utilised for the manufacture of common paper at a profit and thus assist somewhat in relieving the strain.

LEATHER TRADES SCHOOL.

The Assistant Leather Expert reports as follows:—

“The new building for the Leather Trades school at Washermanpet was completed early in 1915. In order to bring the session into line with the sessions in other technological colleges the school was not reopened until June although facilities were given previously for practical work to any student desiring to avail himself thereof.

The session started with six students and it had only just begun when the Principal was called away on active service. Dr. Marsden was transferred from Madurai temporarily to look after the school until other arrangements could be made. So far as practical work is concerned, Messrs. Chambers & Co. kindly agreed to their Head Tanner, Mr. Mason, attending the school, taking classes and giving practical instruction on the technical side. The instruction in Chemistry, Mechanics, Book-keeping and Laboratory work was under the direct supervision of Dr. Marsden. To deal with the first subject a Chemistry graduate was appointed. Instruction in Engineering was given by the Engineering staff of the department and for Book-keeping a special man was engaged.

Two of the six students decided to postpone their course until the Leather Expert's return from active service. One other student seems to have joined the class under the impression that attendance would constitute an easy path to Government employment. When his mind was disabused on this point his attendance ceased. The remaining students continued throughout.

The arrangements made on the Leather Expert's departure were provisional and enquiries were instituted for a man who could exercise whole-time superintendence over the Leather Trades school. In due course Government sanctioned the appointment of Mr. K. Raghava Kurup. Mr. Kurup underwent preliminary training in the old Government Chrome Tannery and then proceeded to England where he completed the course at the Leather Sellers Technical College, London. After taking his diploma there he was employed for some time in works in England and accordingly possesses a considerable amount of practical experience of both European and Indian methods. In view of the pressure of work generally in the department throughout the year there was not much opportunity for doing research work at the Leather

Trades school. Mr. Guthrie continued his investigations on tanning materials until he proceeded on leave. Since his arrival Mr. Kurup has taken up the question of glue.

The first year course provided in the school is mainly of a generally scientific character. Accordingly there was not much tanning done. A certain number of applications were received for tanning work on a small scale and in so far as this work was of an instructive character it was accepted to provide the practice the first year students required. In the second year course more extensive arrangements will have to be made for the supply of raw material, but no particular difficulty is anticipated.

The course of instruction for students also included regular visits to the hides markets and tanneries in company with the Foreman who had previously been in the employ of one of the largest hostile firms now liquidated. His knowledge and experience of the market is particularly good.

In the original design of the Leather Trades school the buildings now constructed were intended to accommodate only the tannery proper. Class room accommodation was to be found in the general trades school which was to be constructed on an adjacent site. This trades school has not yet been built and to begin with, the class room instruction was given in the tannery itself. Accommodation is however limited. Now that the second year students are to arrive, it is not clear how work can be continued unless further accommodation is provided.¹

GOVERNMENT TECHNICAL INSTITUTE, MADURA.

The Superintendent, Madura Technical Institute, reports as follows:—

"During the year under report two instructors and the store-keeper were confirmed in their appointments. One died and was replaced.

The drawing classes were opened during the year to the industrial students.

Attendance.—

Year.	Number on rolls.	Average daily attendance.	Average number on rolls.	Withdrawals during the year.							Number of working days.
				Admission during the year.	Dismissed for irregular attendance or absence.	Left on account of ill health.	Left before commencing their studies.	Number died.	Otherwise such as taken to other workshops.		
1914-15	56	39.02	52.12	38	17	2	15	1	1	270	
1915-16	56	40.18	54.01	49	29	..	18	1	2	273	
									Total, 49		

* Was transferred to workshop section as a coolie.

† Were taken in the Perambur Workshop in connection with munition work.

From the above table it will be seen that there is an increase in the daily average attendance and average number on rolls during the year when compared with the previous year. When the new mechanical workshop is ready, there will be accommodation for a larger number of students. Excluding the one casualty and two students sent to Perambur for munition work, 18 students left before completing their course, and 28 were dismissed for irregular attendance and absence. The indifference of parents and guardians is, in most cases, the cause of irregular attendance and consequent dismissal.

In course of time when parents begin to realize that their sons will not be readmitted and cannot get work when fully qualified workmen are available, they may perhaps consider the question of career a little more seriously. As explained in the last report, it was not possible to separate the practice and workshop sections for want of space. As students are working wherever space can be found, in tiled and thatched sheds, supervision and control is extremely difficult.

Examinations.—Thirty students applied for Government Technical Examinations during the year and 22 of them have passed giving a percentage of 73.3 against 54.5 of the previous year.

Subject	Grade.	Number appeared.	Number passed.
Machine drawing	Elementary	2	1
Do. do.	Intermediate	2	2
Do. construction	Intermediate	2	1
Do. do.	Intermediate	2	1
Fitter's work	Elementary	7	4
Do. do.	Intermediate	3	2
Mensuration	Elementary	1	1
Blacksmith's work	Intermediate	1	1
Metal work	Do.	1	1
Cabinetmaking	Elementary	2	2
Do.	Intermediate	6	6
Total		30	22

Working hours.—There has been no change in the working hours.

Library.—No addition was made during the year.

Tools and appliances.—Rupees 1,849-13-3 were spent under this item during the year.

Buildings.—The Public Works Department commenced the construction of the new buildings in the month of August 1915. At the end of March the mechanical workshop had all its door and window frames in position and the walls raised five feet all round. The iron work for this building is being made at the Public Works Workshop, Madras, and the woodwork by the Institute. If the iron work is received in due time, this block will be completed by the end of July. The block No. 3 for weaving has gone up to basement level: this block will probably be ready by the end of 1916. The concrete for foundations has been laid for the main building block No. 2 and work on the basement is being continued. Earth-filling of the site is also in progress. The sinking of a large well for the water-supply of workshop has been taken in hand.

Finance.—The total expenditure during the year was Rs. 27,046-13-10. The total receipts during the year were Rs. 10,187-6-8. The net cost, taking these figures, is Rs. 16,859-7-2 and the average cost per student is Rs. 301-1-0 against Rs. 363 in the previous year.

General.—The class for oil-engine driving was continued during the year and proved very popular. There are 13 men under training. The demand for motor mechanics and drivers continues, but for want of space and appliances classes cannot as yet be opened.

Some machinery and four turners were sent to the Perambur works for munition work in November 1915. At the Institute itself arrangements have been made for turning base plates for 13 pounder shells.²

CONSULTING ENGINEERING DEPARTMENT.

As pointed out in last year's Administration Report, the outbreak of war led to a marked decline of industrial enterprise. This was attributable, in the first instance, to the stringency of the money market but to this difficulty has now been added another, viz., the shortage of machinery. Most of the manufacturing engineering firms in England have been taken over by Government for munitions purposes and the output of other kinds of manufactures is practically at a standstill. Stocks are being depleted and intending buyers are likely to have to wait a very long time for their plant, unless the manufacture of machinery is taken up in India itself. A beginning has been made in this direction by some of the local Engineering firms. Messrs. Massey & Co. have started the manufacture of rice hullers and pumps, Messrs. George Brunton & Co., of oil engines, Messrs. Oakes & Co. of decorators and other manufacturers may follow suit.

The prices of plant have risen and are fluctuating rapidly. Estimates prepared and quoted one day, do not hold good for the next. The ryot cannot be sure of what his venture will cost him. In the circumstances many ryots prefer to wait until things become more settled.

A change of policy on the part of many firms has also caused a good deal of inconvenience. Owing to the shortage of supplies, firms are stopping hire-purchase transactions. Small capitalists have come to rely on this system of business and its suspension has eliminated them from the market altogether.

It will be clear that industrial development is, at present, labouring under considerable difficulties and until conditions become more normal, no great expansion can be looked for.

The expenditure on the Consulting Engineering Department (excluding the Boring Department) was Rs. 32,500 and the receipts were Rs. 10,000, the net cost being therefore Rs. 22,500. The number of investigations is about the same as last year and compounding fees increased by rather more than 20 per cent. The net expenditure was Rs. 1,250 less than last year having returned practically to the figure for 1911-12.

The inspection fees collected (136) are about the same as last year and compare not unfavourably with those of the ante-war period, enquiries from North Arcot, Chingleput and Tinnevely districts making up almost 50 per cent of the total number. But this year there was a great difference between the number of applications for advice and the actual orders for machinery. Ordinarily one would expect at least 50 per cent of the investigations to mature. But this year the percentage is only 39, showing clearly the extent to which existing conditions have discouraged private enterprise.

Of the 136 applications dealt with 60 are for pumping plants and 76 for industrial plants. The former class of enquiries come mostly from North Arcot, Coimbatore, Tinnevely and the Ceded districts; on the industrial side the bulk of the enquiries are for rice hullers. But whilst hitherto Tanjore and Kistna districts were monopolizing this industry, the demand is spreading to South Arcot, Chingleput and Tinnevely. Enquiries for gineries are also becoming more numerous, especially in the Tinnevely district.

The V.R.M. Ginning factory at Kadambur was extended by the addition of another 33 h.p. engine and 4 gins. M.R.Ry. Venkataswami Nayudu of Avalnatham, M.R.Ry. Sinnaya Pillai and M.R.Ry. Ganabatha Pattar of Kalugumalai started gineries in the Tinnevely district this year. At Trichinopoly a beginning has been made in this direction by M.R.Ry. Sourimuthu Reddiyar, a ryot of Turaiyur. The rest of the enquiries are of a varied character. A few ground-nut deoorticating machines and oil mills were purchased by ryots of the Gooty and Tanjore sections and enquiries for flour mills were received from Chingleput and Cuddalore. One ryot near Kodaikanal sent in an enquiry on tea-making plant estimated to cost about Rs. 25,000 and Rai Bahadur A. Sethurama Ayyar of Nidamangalam, a leading agriculturist of the Tanjore district, is erecting a disintegrating machine for bonemeal.

Most of the plants put down follow the general lines hitherto followed. Several projects of special interest have been under investigation during the year. These are from Kistna and Coimbatore districts, and contemplate the use of large pumping units than those hitherto used. A good deal of interest is being evinced in the utilization of the drainage water of deltas for irrigation purposes. A Government scheme of the latter kind is under preparation and is intended ultimately to irrigate 8,000 acres on the lower Godavari. The proposed lands lie on both sides of the Yenamaduru drain in the Losangulapadu and Dirusumari villages of Bhimavaram taluk and the plant is to be erected on the right bank of the drain. At present the scheme is limited to deal with an area of 400 to 500 acres, but the design is such as to enable it to be expanded when required and the old Ganjana plant has been removed to this spot for re-erection. Applications from several private individuals for permission to irrigate smaller plots have also been received during the current year. One Venkatanarasimha Raju of Bhimavaram has applied for permission to irrigate 500 acres by employing a 33 h.p. gas engine and 14-inch centrifugal pump and the Raja of Devarakotah intends irrigating two such plots of 300 to 400 acres. Messrs. Abd-ul-rahman and Abd-ul-rasool have applied for similar installations at Kosura village of Divi taluk. All these enquiries come from Kistna district. Pallappa, Kottappa and two others from Chinnaganjam of Bapatla taluk, Guntur district, have applied for permission to irrigate 500 acres. An interesting

example of a central power scheme is also under investigation for M.R.Ry. Vellingiri Gounder of Vellakinar. This enterprising ryot owns a considerable area of about 500 acres in the Coimbatore district and proposes to put in a central plant to drive 18 motor pumps on 25 wells.

In Tanjore a new type of vertical spindle pump is being experimented with on behalf of M.R.Ry. K. G. Srinivasa Mudaliyar of Mannargudi.

Three interesting applications from the same district, one by Mr. Nagappa Manniyar of Mannargudi and the others by M.R.Ry. T. N. Srinivasa Raghava Achari and M.R.Ry. Kuppuswami Ayyar of Kumbakonam are also worthy of note as the supply there is entirely sub-artesian and drawn from a great depth. The springs are so strong that it is possible to employ a comparatively large pump without fear of exhaustion.

The most marked development in the Engineering department during the year has been that connected with the system of compounding fees. The number of compounding fee payers from the Tanjore district constitute more than 25 per cent of the total figure and those from Kistna district about 13 per cent. The number rose to 236 as against 196 last year, indicating that the service rendered by the department is becoming more generally appreciated. But there is still room for considerable expansion when it is remembered that there must be at least 800 to 1,000 plants scattered about the districts.

BORING DEPARTMENT.

During the year under review the number of hand boring sets was 30. Two special temporary ones—called “relief sets”—were also introduced. Two power drills and three exploders were in operation. Eight low speed (liquid fuel) pumping engines and six high speed (kerosine) engines were also made available for hire. The total depth bored through was 24,750 feet as against 23,000 last year, and the number of borings was 495 as against 645, during 1914-15. The number of successful borings was however 400 out of 495, i.e., 80 per cent, whereas the previous percentage was only 72. The falling off in total depth is due to various causes. For one thing the average depth per boring was 50 feet in 1915-16 as against 43 feet in 1914-15. The result was a greater percentage of successful borings but a reduction in the number of feet bored. Again most of the lathes in the departmental workshops were working munitions and there was some congestion in consequence. Finally considerable difficulty was experienced in obtaining raw material. Stores, for instance, ordered last July have not yet been delivered. Local supplies were frequently inadequate and the supply of pipes to the sets was interfered with.

In spite of these difficulties a very marked economy has been effected in the working of the department.

This is attributable very largely to the system of standardisation that has been adopted. During the last two years a great deal of labour has been devoted to the proper standardisation of sets and the accumulation of spares. This work is now beginning to show results.

Three years ago the net cost of boring was Rs. 32,000. Without any alteration in the rules the amount of boring last year increased 50 per cent and the cost decreased 25 per cent. This year the amount has fallen slightly and the cost has fallen another 20 per cent. The expenditure for the year was about Rs. 42,500 and receipts Rs. 25,000 giving a net expenditure of Rs. 17,500 which is the lowest figure for the last five years. The reduction and economy in the expenditure is solely attributable to the improved system of accounts introduced this year.

The boring done this year, as usual, furnished many interesting results. In Vizagapatam, several strong springs have been struck in rock. In one case the water was under considerable pressure and rose almost to the surface. In another case (Anakapalli) the power drill was employed and, after going through 160 feet in rock, it struck a spring which also rose almost to the surface. At Peddagumalur, in the same district, fresh water was discovered 78 feet below ground level in rock. The result of these successes has been to cause a considerable increase of boring work in this section.

In Bezwada borings are mostly in alluvium, but there were one or two cases of remarkable increase in supply which deserve mention. In one case, the boring was made in a well in which there was absolutely no sign of water. After boring 26 feet, the well filled up completely. In another case, the boring was begun in a well 40 feet deep which contained only a muddy sediment. After another 30 feet had been bored a subterranean spring was reached which raised the water level in the well 27 feet bringing it within 10 feet of ground level.

In Chingleput no remarkable springs were struck but a rather curious result of putting down bore holes in certain wells was not to increase the quantity of water but to improve the quality.

In Cuddalore, the Ponnaiyar basin has been fairly well developed already. Wells are numerous and a large number of them are sub-artesian. There was not therefore very much demand for boring in these parts. An interesting fact was the discovery of sub-artesian springs at Panruti which lies outside the recognised sub-artesian area.

The Tanjore district furnishes the most startling results. At Nedunkollai at a 70 feet depth a sub-artesian spring was struck which yielded a supply of 200 gallons a minute. At Srinivasanallur a spring of slightly smaller supply was struck at about the same depth. At Srinivasapuram an artesian supply was tapped at a depth of 157 feet. In Tirutturaipundi a smaller spring was discovered 2 feet deeper. At Madrimangalam and Tirukarugavur, sub-artesian springs of moderate strength have been tapped and engines are to be installed to pump water for the purpose of preparing seed beds in case gravity irrigation fails.

During the year borings were also undertaken for the Local Fund department at Thanbukottai, about a mile from the sea. Several salt springs were struck in the course of boring and, when a depth of 170 feet had been reached without success, it was suggested that the boring should be abandoned. The Local Fund department were, however, recommended to persevere and another 10 feet further down struck a strong artesian spring which rose 5 feet above ground level.

These borings all indicate the presence of a hitherto unsuspected sub-artesian basin extending southwards from the Cauvery. If the indications are correct, the supply will prove of inestimable value to the dry lands lying south of the delta.

A case which must be classed as a failure is worth recording as furnishing some idea of what a strong artesian current is like. At Nelpathur a boring was carried to a depth of 85 feet when a spring was struck which was unfortunately saltish. It shot up 25 feet into the air and discharged fossilised fish scales, large quantities of gas smelling like sulphuretted hydrogen and hundreds of cartloads of sand. The bore had been sunk in the owner's house, who, to begin with, seems to have been rather pleased at securing a private geyser of his own. But the continued discharge of fish scales and poison gases after a time got on to his nerves, whilst the constant flow of sand made him apprehensive regarding the safety of his foundations. He accordingly caused the bore to be plugged and is now searching for water elsewhere—so far without result.

In the other sections nothing of particular note is to be recorded except in the Ramnad district where a 60 feet boring at the bottom of a well 34 feet deep and ordinarily dry, filled it to within 20 feet of the surface.

The ryots for whom departmental service have been rendered have generally appreciated the assistance rendered by the department and conformed to rules. The departmental rules are based on the principle of fair dealing.

The total borings put down up to date number 5,333. These are tabulated in the ordinary manner in Tables viii and ix.

The department now owns 14 pumping engines and these were popular as ever. They were mostly employed for irrigation and the construction of wells. In Madura one engine was utilised for drainage and bridge work and in Nellore for mica mining operations. The demand for the plant very much exceeds the number of engines available and it will probably be necessary to increase the number during the year.

Further, it has been found necessary to revise the scale of fees for the services rendered by this department and proposals have been submitted to Government for the sanction of revised scales.

EXPERIMENTS AND DEMONSTRATIONS.

PERIPATETIC WEAVING PARTY No. I.

The Superintendent, Peripatetic Weaving party No. 1, reports as follows:—

“This party has been in existence for three years, and by the end of the year, the work done covered the whole of the Presidency south of Salem and Tanjore. At the beginning of the year work was in progress in Sattūr and Srivilliputtur taluks. The party then moved to Aruppukottai where demonstration work was begun in May 1915. Aruppukottai is one of the biggest weaving centres in the Presidency with 4,447 looms, almost the whole of which are employed in weaving coarse women's cloths of coloured yarn. No flyshuttle looms had been used for the weaving of these cloths and the party after giving some effective demonstrations, were able to introduce 48 slays and a few dobbies in the town. Later on, a few more of these appliances are reported to have been made locally after the patterns introduced by the party. After leaving Aruppukottai, the demonstration party visited the weaving centres in Madura district except the town of Madura itself. Seeing that Madura is to be the future headquarters of the weaving school, special demonstrations there were regarded as unnecessary. Demonstrations were held in all the taluks in the district excluding Melur which was passed over as too unimportant from the weaving point of view. As a result 41 slays and a few dobbies were introduced. The party left Madura district by the beginning of November and took up Tanjore next, the intervening district of Trichinopoly having been finished during the first year of its work. The Superintendent and his maistri were engaged on work connected with the Park Fair Exhibition for the next month and a half. Regular work was not commenced in Tanjore till about the end of January 1916. Before the close of the official year, only a small percentage of the numerous weaving centres in the district had been visited. Thirty slays have been introduced in the district so far.

About 80 per cent of the looms in the districts are devoted to the manufacture of cloths of coloured cotton and the cry is for colours. In nearly every village that the Superintendent visited, he observed that a certain percentage of weavers had either already left or were leaving their occupation and were in search of other employments owing to colour famine. In these circumstances, demonstrations of improved weaving appliances, though regarded as satisfactory did not create that amount of enthusiasm which under normal conditions they would have done. In several places in Tanjore district attempts are being made to revive the old system of dyeing the yarn with nuna root (*Morinda citrifolia*).

The production of webbing for which arrangements were made during the previous year was continued during the year on a slightly extended scale. It is hoped that in course of time the manufacture of webbing will establish itself as a new cottage industry. A feature of the year which deserves some notice is the demand made on the Superintendent for slays and shuttles by certain villages in the district of Coimbatore which had been visited by the peripatetic party nearly three years ago. Eight slays and 74 shuttles have been ordered and supplied. That as many as 74 shuttles and 8 slays have been ordered from less than half a dozen villages is a sufficient testimony of the value of the work done by the party.

Demonstrations were given of the dobby where considered necessary. As regards the jacquard, the only places in which demonstrations are likely to prove of real value are Madura and Tanjore. The former has been left out for reasons already stated; in the latter demonstrations are being arranged. During the year, demonstrations were given of the jacquard machine at Tiruppur in connection with the cattle show held at the place.

As last year the Superintendent has continued to collect and collate a considerable amount of statistical information regarding the weaving industry. He also believes that he has been able to create in the weaving community a desire to develop some sort of trade organization.

Enquiries and appliances for technical advice were received and dealt with as usual."

PERIPATETIC WEAVING PARTY No. II.

The Superintendent, Peripatetic Weaving Party No. 2, reports as follows:—

"Up to the end of this year most of the Kistna and a large part of the Gōdāvari district have been covered.

During the year the party visited Narsapur, Bhimavaram and Tanuku taluks of the Kistna district and Razole and part of Rajahmundry taluks of the Gōdāvari district.

The weavers in these two districts were in a comparatively advanced condition and had adopted fly shuttle looms to such an extent that there was little opportunity for introducing any more. In the whole of Kistna district about 6,000 looms were counted of which 4,000 were fitted with fly shuttle slays. Warping mills were also becoming popular. Although the type of mills employed is not very good the use of these mills is a step in the right direction. Advice was given regarding the improvement of mills and a considerable number of dobbies was introduced. As the work is done at present, border weaving always requires an extra assistant and the work is very slow. The demonstrations made seem to have impressed the weavers: the assistant is not required; the design work is mechanical, requiring little attention and the production is nearly double. In spite of these advantages the weavers are somewhat slow in adopting dobbies, and this apparently for two main reasons; firstly, on account of the shortage of coloured yarn and secondly on account of the natural secretiveness of the class. In Duggular (Bhimavaram taluk), for instance, six dobby designs were demonstrated and each design was taught to each of six weavers in the hope that they would spread their information. Nothing of the kind however, occurred, as each man kept the information he had obtained to himself and refused to divulge it. To teach these six weavers six patterns each, 36 demonstrations were therefore necessary. Indeed it was found that public demonstrations although they created a certain amount of interest and attracted large crowds led to little result, and that the only way of getting anything actually done was by giving individual demonstrations.

Apart from 47 dobbies the party also introduced a number of fly shuttles, special healds, warping mills, two frame looms, four tape looms and one silk twisting machine besides seven sets of English healds and reeds.

In Narsapur towel and silk weaving were introduced by means of improved appliances. From the beginning of October to the end of January the Superintendent was in Madras in connection with the exhibition and there prepared special appliances which were subsequently exhibited. One was a swivel slay for weaving book-marks in colour: the other a solid border slay. The latter mechanism is an entirely novel one."

SUGARCANE STATION, SINGANAILLUR.

This sugar factory was originally situated at Uppilipalayam about a mile and a half north-west of Singanailleur. When the mill was first put down by Mr. Chatterton, there was a good deal of sugarcane cultivation going on, but since then the area has decreased. What is more, the site selected was very unfortunate from the point of view of transport. There was only one road and large stretches of betel and paddy cultivation made it extremely difficult to bring cane across country. Last year the supply of cane was inadequate and this year the cultivation is less still. Seeing no prospect of the condition improving, the Director decided to shift the mill bodily a few miles down the road. The work was done very expeditiously by the Supervisor, Coimbatore, and the factory was ready for work on the 20th of August. In ordinary years, this would have been in ample time to catch the season, but this year the canes were cut earlier than usual and the season had begun about ten days before the factory opened.

The factory continued work until 28th December 1915, that is, 108 full working days of 10 hours. Altogether, 1,075 pothies of jaggery were produced, giving an average of 10 pothies per working day. These figures are enormously in advance of

anything previously obtained. It had been hoped to work double shifts, that is 24 hours a day, but this was abandoned owing to the difficulty of arranging night labour. Some trouble was experienced in the keeping the megass dry as the showers during the year appeared to be more frequent and persistent than usual. On three or four days, work had to be stopped in the mill on account of rain and on one or two days, after heavy showers, ryots could not bring in their canes in time and the mill had to be stopped owing to shortage of supplies. On the whole, however, the way in which work was organised left little room for improvement. I do not think the figures of output can be improved on nor do I think that the working charges can be materially reduced except in respect of fuel. Wet megass does not burn at all well and as there was no storage accommodation, it used to get extremely wet necessitating the purchase of dry fuel. In my opinion, it should have been possible to save Rs. 200 on working expenses on the fuel item. Actual accounts showed receipts amounting to Rs. 3,179 and expenditure to Rs. 1,881 leaving a gross profit of Rs. 1,348 for the season. Under ordinary circumstances, we might expect the plant to work another 10 days and the fuel expenses to be reduced by Rs. 200. In this case, the gross profit would be about Rs. 1,650. The success of the Singanailleur mill this year has been most striking. I am informed that at least 26 country mills have shut down since the arrival of the power mill.

As regards costs, ryots generally agree that the departmental rate of Rs. 3 a pothi is a little lower than their own (provided the lead is not too far) and they freely admit that the quality of the jaggery made is superior to what they can obtain in the country mill; also that they get about 10 per cent more yield from their canes. Whether this is due to the superior honesty of the departmental Supervisor or to the efficiency of the mill, I cannot tell. Anyhow, the working this year has given great satisfaction to all ryots.

SUGARCANE STATION, CHITTAWADIGAI.

The factory at Chittawadigai occupies a prominent position on the road between Chittawadigai and Hospet facing the village and the market. The factory was completed this year in accordance with the departmental standard designs and consists of a roofed-in boiling house, jaggery making shed, store shed, cane shed and engine house.

Sugarcane cultivation is somewhat scattered and as a large area lies on the other side of the irrigation channel a bridge had to be built across the channel to facilitate carriage. The village of Chittawadigai is alternately malarious and plague infected and for these reasons it is very difficult to get coolies. During the cane season, a certain amount of labour comes in from other districts but it is unreliable as the men have a habit of running away when the repayment of advances becomes due.

Apart from labour difficulties, the difficulties associated with the introduction of any new form of machine are considerable and the experience gained from last year's working made it clear that local sugarcane owners would require a good deal of persuasion before they would send in their canes, the more so since cane crushing is a powerful vested interest.

In the light of local difficulties of this kind which, it was thought, a local individual could deal with very much better than a departmental supervisor from Madras, it was considered desirable to accept the offer made by the village munisif to take over the plant for the season and arrange for the supply of cane and labour. An arrangement was accordingly entered into between the department and the munisif that the plant should be under the control of the departmental supervisor but that the munisif should pay working expenses and keep the takings, the rate for the latter being fixed at departmental rates. The munisif was to pay Rs. 250 a month hire for the plant.

The factory was started early in January and run up to end of April. On the whole it was worked for 75 full working days and turned out 667 pothies of jaggery. It is estimated that the rate of hire charged made the transaction a financial balance for the contractor. But during the current year conditions were unfavourable. The

contractor, being devoid of experience, made a considerable number of mistakes and failed to arrange for an adequate cane supply. Moreover, work was begun very late. The fact that the contractor is anxious to lease the installation on the same terms as before, namely, Rs. 250 a month, for the next year shows that his experience of the year's working has been favourable both as regards costs and quality.

The plant appears also to have been appreciated by local ryots and several unsolicited testimonials were given to the supervisor on the completion of the work. According to these, ryots consider that they get a greater yield of jaggery by mill crushing and they admit that the jaggery fetches about Rs. 2 more than the country jaggery in the market. During the operation there was a certain amount of argument regarding the way in which jaggery was to be prepared. Cane crushers asserted that summing causes them 5 per cent loss in yield. It was considered by the supervisor that the increased value of summed jaggery more than outweighed this loss and in the end this view was accepted. Again there was a general demand for a reduction in rates, which however the supervisor had strict orders not to agree to. The departmental rate has been Rs. 8 a pothi from the beginning and must remain at this figure.

The departmental profit on this plant was four months' hire—Rs. 1,000.

PENCIL FACTORY.

The Supervisor, Pencil Factory (M.R.Ry. C. S. Ramachandra Ayyar) reports as follows:—

"On the termination of the expert's services, I paid a short visit to the S.I.D. Factory at Kalighat, Calcutta (separate report already submitted) and returned to Madras early in April.

Soon after my return to Madras, I was ordered by the Director to take up the graphite problem in detail at the Indian Institute of Science. A few experiments on the Tuni graphite which had been the material so far employed, showed that the material was of an extremely low grade. The ordinary graphite employed by pencil makers in America and Europe is said to contain about 85 per cent carbon while material for high grade pencils should contain not less than 95 per cent carbon. The Tuni material, even after a careful levigation process, contained only about 30 per cent carbon. Apart from its low carbon value, the material was found to contain a very high percentage of quartz and iron oxide, two very objectionable impurities. For these reasons the material which the expert had selected was rejected and I left Bangalore to look for some other deposit.

In June after a good deal of hunting round, I came upon the desired Pidakonda mine. Tests on samples showed that notwithstanding the impurities which occurred freely in this ore also, it was much superior to the other and would probably serve for making fairly decent pencils. The mine has two shafts, a tunnel shaft and well shaft, and we are obtaining our present material from the former though the latter is reported to contain much better material.

Working the well shaft requires regular mining operations. Owing to the restricted staff and want of experience, the well shaft was left alone and the tunnel shaft only was developed. About 20 tons of the crude ore have been collected and a process of refining the ore has been evolved with a view to utilizing the major portion of the ore.

The method of refining graphite is kept secret in factories. The expert could not teach us much about it and so we had to discover a process for ourselves. Numerous methods of refining the mineral were tried with varying success until the 'reversed floatation' method was discovered. This has proved satisfactory and is described at length in a bulletin. The present procedure is as follows:

The crude ore is crushed in a disintegrator fitted with a 16 mesh. The powder is passed through a 100 sieve, the residue being screened through a 50 and 30 mesh. The fractions are separately treated, bigger material being returned to the 'devil'. The sifted material (62 per cent carbon) is soaked in liquid fuel, ore

gallon per every 35 lb. of ore powder and intimately mixed. The mixture is thrown into a tub and agitated with the result that the finer impurities are in a state of colloidal suspension while the coarser sand is at the bottom. The peculiarity in the separation lies in the fact that the sand particles do not get bound together but fall into separate crystals while the fine mineral particles adhere to each other forming lumps. This characteristic property is useful in separating the graphite from the gangue. The suspended impurities are thrown out from time to time while the coarser impurities are washed out through a sieve. Having removed the impurities, the mixture is burnt off and used in the composition for making pencils. The excellence of this method consists in the fact that the waste of mineral is more or less negligible and a high degree of purity is attainable by repeated washing.

During the experimental period at Bangalore I was handling a powder made out of a few selected lumps of the crude ore to obtain results regarding the manipulation. The powder contained 89 per cent carbon and this formed the basis for my experiments. Before attempting to make a composition I obtained the graphite value of certain well known pencils and made a qualitative determination of other ingredients. It was clearly established that in all these pencils (1) about 50 per cent carbon was present, (2) a binding material in the form of a plastic clay was employed with more or less absolute freedom from silica and other frits, (3) a flux was employed, and (4) a final bath of the leads (superior grades) in hot wax or oil was resorted to in order to impart a smooth feel on paper. With these preliminary ideas to go on I began a series of experiments to determine the influence of binding, flux, etc., on quality. These experiments are fully described in a bulletin. Useful preliminary results were obtained even as early as August 1915, but I extended my stay at Bangalore to improve my methods and also to study the question of colour leads and aniline pencils.

So far as red and blue coloured pencils are concerned, I think that I have discovered the method of manufacture, but details still remain to be elaborated. As it is at present impossible to get the chemicals required, the manufacture of coloured leads has to be kept in abeyance, but the result of my trials leads me to believe that even though my results are in some respects defective, I shall be able to produce leads of the required quality with a little more practice.

I also investigated the manufacture of copying leads. At the commencement of the war we obtained a small supply of methyl violet but this, being intended for cotton dyeing purposes, was mixed with dextrine which had to be separated before it could be employed for pencils. By a very tedious costly and laborious process I obtained a small quantity, a few grammes, freed from dextrine. The leads made out of this were comparable with any of the foreign makes.

The next investigation I undertook was to discover the nature of the coloured varnish employed in many German and Austrian pencils. On this point also the 'expert' had been unable or unwilling to give me any assistance. Results of tests and analyses showed that shellac and aniline were the main ingredients entering into the finish. It was also found that resinous material was objectionable and commercial shellac had to be refined before use. The vehicle employed must obviously be alcohol. A few trials were made with mineral colours which were not successful. A few pencils were lacquered, but this finish proved too expensive. Stains were also experimented with. Diamond green and magenta proved satisfactory.

On the 1st December I came back to Madras on the orders of the Director with a view of applying the results of my experiments practically. At this point, however, Government orders were received which necessitated a suspension of work until further grants were allotted.

Meantime arrangements had been made for setting up the factory on proper working lines. About the middle of the year the Director ordered the removal of pencil machinery from Cocanada to Madras and erected it next to the Leather Trade School. A large machine shed was built and by the side of a small store shed was erected a disintegrator to crush the mineral. To the rear of the engine room of the Leather Trade School, two sawing machines capable of dealing with the requirements

of the Pencil Factory were erected and kept busy sawing slats till work stopped. The factory requires a very large number of tools and spares that are not ordinarily available, and many of which were found to be missing. Some were obtained after long correspondence; others cutters, springs, tables and various odd items had to be made. The most difficult of all was the making of cutters of proper strength and dimensions and this was successfully done at the Public Works Department Workshops. The other springs, tables, feed rollers, missing parts of various machines with sufficient spares were made at the departmental workshops.

So far, we have produced pencils of low quality which will sell in the open market at the price paid for Japanese pencils. The results of work obtained so far give every reason to suppose that the industry can be established in the Presidency on a sound commercial basis, but this opinion can only be proved by actual trial. By the death of the late foreman, Mr. Sorabjee, the factory has lost a very valuable man. He was an excellent foreman and had a good practical experience, having been connected with the work from the very beginning.

It is possible to realise from the above what a large amount of push and energy has had to be exerted in all directions. At the end of the year, Government sanctioned a further allotment and a start was made on a small scale. It was necessary to limit production to a very small output as the operation of a large number of machines with untrained hands would have involved excessive waste of materials and labour. Accordingly only a few men were employed at the machines and shown how to operate them. Results will be reported later.¹²

PUNALUR PAPER MILL.

The greater part of the year was spent in dispute between the two claimants to the ownership of the mill and no practical work could be attempted. Repairs were undertaken and an endeavour made to clean up the mill. In this luxurious climate, during a long period of idleness, the mill premises had become a sort of a sleeping beauty's castle and the departmental supervisor found it as difficult of entry as Princee Beautiful. With two rival claimants guarding the castle his activities were also much hampered, and it was only after long and patient exertion, coupled at last with an ultimatum by the Director, that serious work could be started. The condition of the plant was very bad. Not only had it been seriously affected by weather and exposure, but a large number of the more important brass parts had been removed from time to time by souvenir hunters and the machines were accordingly rendered temporarily useless.

Only in February was it possible to start making regular experiments. It may be explained that the object of this experiment is to discover fundamental data of production with regard to pulp manufacture and initially the intention was merely to manufacture pulp from bamboo.

When work was actually undertaken, further difficulties appeared. One of the boilers was so obviously unsafe that it had to be abandoned altogether whilst the other was not safe beyond 80 lb. equivalent to about 60 on the digesters. This pressure is insufficient for the proper boiling of bamboo. The Donkey pump made a good deal of noise but did not feed the boiler and had to be replaced entirely. The self-regulating valve of the stuff boiler gave way when pressure was applied, the stuff shoots crumbled away, the joints in the rag boiler blew out and a number of similar little troubles cropped up. These were duly overcome but it was found that the pulp produced under the conditions described did not bleach readily and was not therefore in much demand as pulp. It seemed simpler therefore to convert the pulp into brown paper straight away and by sale at least recoup a certain part of the cost of the experiment.

The old paper machinery was accordingly brought into commission again. Here again the deprivations of time and the night watchman were only too apparent, and for several weary weeks Dr. Marsden struggled with the problem of making paper with a felt consisting mainly of holes until spares arrived. These made a great difference and quite a good quality of brown paper is now being produced.

So far as the main object of the experiment is concerned, the first thing we are attempting to ascertain is the quantity and cost of raw material available and its equivalent cost in the dry state. The second point is to find what proportion of pulp is obtainable from a given quantity of dry raw material. The third point is to investigate the treatment of pulp. So far, complete results have not been obtained on any one of these points. But a good deal of raw material has already been treated and it is becoming possible to form approximate estimates of the quantity and cost. The Travancore Government have very kindly granted the mill 1,000 tons of bamboo free of seigniorage charges and in connection with the collection of this quantity, the forest authorities are making a very careful study of the cost which should prove very valuable when completed.

The war has stopped the supply of bleach, but here again a substitute was obtained. Dr. Sudborough very kindly lent us the electrolytic bleach apparatus from the Indian Institute of Science and by this means a considerable quantity of hypochlorite can be made. To try and avoid the expense of caustic, experiments are also being instituted with a form of Castner-Kellner cell. If these prove successful, they will lead to a 50 per cent reduction in costs.

(2)

TABLE I.—Government account.

Number		1914-15.		1915-16.	
		Receipts.	Expenditure.	Receipts.	Expenditure.
		RS.	RS.	RS.	RS.
1	Director	7,043	36,331	..	37,355
2	Madura Technical Institute (Mechanical Engineering Branch).	..	25,922	3,580	27,918
3	Dyeing Expert	..	11,766	..	13,498
4	Leather Expert	70	20,149	187	11,525
5	Peripatetic Weaving Party No. I	2,254	7,618	876	6,055
6	Do. No. II	83	1,403	541	3,436
7	Sugarcane experiments	3,028	11,071	3,636	11,970
8	Motor-tractor demonstration	..	..	..	1,975
9	Ganjana demonstration	..	..	..	1,002
10	Lime brick experiments	..	..	743	22,358
11	Oil expeller demonstration	..	..	1,548	2,952
12	Bureau of Industrial Information	..	..	..	(a) 11,874
13	War experiments (pencil, glass, oil mills and miscellaneous).	..	60,473	122	35,116
14	Grant-in-aid and scholarships	..	61,140	..	48,840
15	Pumping and boring	(c) 38,954	(d) 1,58,017	(b) 40,439	1,17,920
16	Construction of tannery	..	36,436	..	..
	Total ..	50,142	4,20,246	57,702	3,52,914

(a) This includes a sum of Rs. 6,934 incurred on account of the Industrial exhibition during the year.

(b) This figure represents actual receipts; from this a sum of Rs. 3,959 has been refunded, the refunds being included under expenditure.

(c) This figure includes a sum of Rs. 377 being the receipt on account of oil-expeller demonstration. The actual receipt of the pumping and boring operations is only Rs. 30,277 and from this a sum of Rs. 3,390 has been refunded, the refunds being included under expenditure.

(d) This figure includes expenditure on motor-tractor, oil-expeller and Ganjana demonstration.

TABLE II.—Statistics relating to industrial schools for 1915-16.

District	Name of institution.	Boys or Girls.	Number on rolls on 31st March 1916.	Drawing	Mechanical Engineering.	Carpentry	Printing and book-binding.	Weaving.		Needle-work.	Agriculture.	Dyeing.	Tailoring.	Off-English driving.	Baiting work.			
								Cotton-weaving.	Other branches.									
Madura.	First and Second class.	Boys.	66	48	3	37	21	13		15								
		Do.	76	34	43	16				25	32	4						
		Do.	39	64	4	3	14	47		48								
		Do.	207	4		104		35		30								
		Do.	41	15	40	4		35		92								
		Do.	124	24				24		24								
		Do.	67			8		24		9	13							
		Do.	41	37	7			29		41								
		Do.	13	21	17	3		19		12	12	1						
		Do.	73	21														
		Do.	9															
		Total	807	322	97	182	43	27	19	174	320	22	1		6	22	12	
Chingleput.	Third class.	Boys.	9															
		Do.	187															
		Do.	38															
		Do.	143															
		Do.	19															
		Do.	31															
		Do.	25															
		Do.	135															
		Do.	804	181	26					40	149	26						
		Total	804	181	26					40	149	26						
		Madura.	Fourth class.	Boys.	35													
Do.	33																	
Do.	28																	
Do.	17																	
Do.	143																	
Do.	19																	
Do.	31																	
Do.	25																	
Do.	135																	
Total	804			181	26					40	149	26						
Madura.	Fifth class.			Boys.	31													
		Do.	18															
		Do.	67															
		Do.	143															
		Do.	19															
		Do.	31															
		Do.	25															
		Do.	135															
		Total	804	181	26					40	149	26						
		Madura.	Sixth class.	Boys.	31													
				Do.	18													
Do.	67																	
Do.	143																	
Do.	19																	
Do.	31																	
Do.	25																	
Do.	135																	
Total	804			181	26					40	149	26						
Madura.	Seventh class.			Boys.	31													
				Do.	18													
		Do.	67															
		Do.	143															
		Do.	19															
		Do.	31															
		Do.	25															
		Do.	135															
		Total	804	181	26					40	149	26						
		Madura.	Eighth class.	Boys.	31													
				Do.	18													
Do.	67																	
Do.	143																	
Do.	19																	
Do.	31																	
Do.	25																	
Do.	135																	
Total	804			181	26					40	149	26						
Madura.	Ninth class.	Boys.	31															
		Do.	18															
		Do.	67															
		Do.	143															
		Do.	19															
		Do.	31															
		Do.	25															
		Do.	135															
		Total	804	181	26					40	149	26						
Madura.	Tenth class.	Boys.	31															
		Do.	18															
		Do.	67															
		Do.	143															
		Do.	19															
		Do.	31															
		Do.	25															
		Do.	135															
		Total	804	181	26					40	149	26						
Madura.	Eleventh class.	Boys.	31															
		Do.	18															
		Do.	67															
		Do.	143															
		Do.	19															
		Do.	31															
		Do.	25															
		Do.	135															
		Total	804	181	26					40	149	26						
Madura.	Twelfth class.	Boys.	31															
		Do.	18															
		Do.	67															
		Do.	143															
		Do.	19															
		Do.	31															
		Do.	25															
		Do.	135															
		Total	804	181	26					40	149	26						
Kallakurichi.	Unrecorded Schools.	Boys.	31															
		Do.	18															
		Do.	67															
		Do.	143															
		Do.	19															
		Do.	31															
		Do.	25															
		Do.	135															
		Total	804	181	26					40	149	26						
Kallakurichi.	Unrecorded Schools.	Boys.	31															
		Do.	18															
		Do.	67															
		Do.	143															
		Do.	19															
		Do.	31															
		Do.	25															
		Do.	135															
		Total	804	181	26					40	149	26						
Kallakurichi.	Unrecorded Schools.	Boys.	31															
		Do.	18															
		Do.	67															
		Do.	143															
		Do.	19															
		Do.	31															
		Do.	25															
		Do.	135															
		Total	804	181	26					40	149	26						
Kallakurichi.	Unrecorded Schools.	Boys.	31															
		Do.	18															
		Do.	67															
		Do.	143															
		Do.	19															
		Do.	31															
		Do.	25															
		Do.	135															
		Total	804	181	26					40	149	26						
Kallakurichi.	Unrecorded Schools.	Boys.	31															
		Do.	18															
		Do.	67															
		Do.	143															
		Do.	19															
		Do.	31															
		Do.	25															
		Do.	135															
		Total	804	181	26					40	149	26						
Kallakurichi.	Unrecorded Schools.	Boys.	31															
		Do.	18															
		Do.	67															
		Do.	143															
		Do.	19															
		Do.	31															
		Do.	25															
		Do.	135															
		Total	804	181	26					40	149	26						
Kallakurichi.	Unrecorded Schools.	Boys.	31															
		Do.	18															
		Do.	67															
		Do.	143															
		Do.	19															

TABLE III.—Statistics relating to industrial schools for 1915-16.

District.	Name of institution.	Boys or Girls.	Number on rolls on the 31st March 1916.					Receipts.					Public funds.	Manager's contribution.	Total receipts (excludes expenditure).		
			Advanced.					Total.									
			Intermediate.	Standard D.	Standard C.	Standard B.	Standard A.	Miscellaneous receipts.	Excess.	Teaching and special.	Total.						
Madras	Recreation Grounds.																
	First and Second class.																
	Madras Government Technical Institute.	Boys.	9	4	4	4	34	56	10,187	6	8	16,829	7	2	4,755	15	27,066
	Combonore St. Joseph's Industrial school.	Do.	8	5	5	5	15	15	3,649	3	6	1,760	0	0	4,755	15	40,015
	Kannur Wesleyan Mission Industrial school.	Do.	9	14	19	25	55	69	39,049	11	6	18,829	7	2	324	8	38,722
	Chengalvayal Mission Industrial school.	Do.	12	19	25	55	69	184	13,674	4	2	1,624	8	6,000	8,120	4	35,022
	Kannur Wesleyan Mission Industrial school.	Do.	8	13	4	2	3	24	12,544	14	9	1,821	0	0	1,821	0	12,544
	North Arcot Wesleyan Mission Industrial school.	Do.	7	4	5	8	7	40	7,978	8	0	1,400	0	0	1,400	0	7,978
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
Tamilnadu	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
Malabar	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
Kannad	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
Kannad	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
Kannad	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
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	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
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	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
Kannad	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
Kannad	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	Madras Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,753
	North Arcot Wesleyan Mission Industrial school.	Do.	12	6	4	17	10	67	5,753	12	5	1,050	0	0	1,050	0	5,

TABLE IV.—Statement of investigations made, 1915-16.

Year.	Number.
1902-03	1
1903-04	10
1904-05	24
1905-06	21
1906-07	40
1907-08	51
1908-09	33
1909-10	41
1910-11	111
1911-12	64
1912-13	134
1913-14	152
1914-15	136
1915-16	818

TABLE V.—State loans.

Year.	Number.	Amount.
		RS.
1904-05	1	8,000
1905-06	4	12,500
1906-07	8	23,500
1907-08	6	18,500
1908-09	13	33,000
1909-10	12	30,350
1910-11	8	21,950
1911-12	14	36,500
1912-13	22	52,600
1913-14	17	38,500
1914-15	9	21,000
1915-16	3	5,400
Total	117	2,99,800

TABLE VI.—Loans sanctioned during 1915-16.

Number.	Name of applicant.	Place.	District.	Amount.
1	Messrs. Sabbaiya Goundan and Marimuthu Goundan.	Muthusickanpatti	Madura	RS. 2,560
2	M.R. R. Raghava Ayyar	Korapet village	North Arcot	2,560
3	R. R. R. Raghava Ayyar	Addamarai village	Cuddalore	400
		Total		5,460

Note.—Excluding a special loan to Mr. Vellingiri Gounder.

TABLE VII.—Statement showing the number of compounding fee payers.

	Godavari section.	Krishna section.	Chingapat section.	South Arcot section.	Nellore section.	Coimbatore section.	Trichinopoly section.	North Arcot section.	Tanjore section.	Tinnevely section.	Ceded district or Gooty section.	Total.
1909-10	7	8	2	3	3	1	2	1	27			
1910-11	4	8	3	10	1	1	1	1	33			
1911-12	1	9	6	5	8	2	2	2	35			
1912-13	1	11	6	13	9	11	19	10	91			
1913-14	1	6	7	18	1	16	12	8	31	16	2	117
1914-15	4	7	7	18	35	20	68	21	10	68	21	196
1915-16	5	30	17	21	23	22	19	94	21	14	236	

TABLE VIII.—Statement showing details of borings made in the different divisions from the beginning of operations.

Divisions.	Fresh wells.			Existing wells.			Total number of borings.	Pipes sunk.	Total feet bored through.
	Successful.	Failure.	Total.	Successful.	Failure.	Total.			
GODAVARI.									
From the beginning to 31st March 1915	53	49	102	17	16	33	135	30	11,618
From April 1915 to 31st March 1916	26	13	39	1	3	4	43	3	4,364
Total	79	62	141	18	19	37	178	33	16,982
KISTNA.									
From the beginning to 31st March 1915	163	35	198	60	27	87	295	28	11,871
From April 1915 to 31st March 1916	121	11	132	27	7	34	106	5	7,040
Total	284	46	330	87	34	121	401	33	18,911
NORTH ARCOT.									
From the beginning to 31st March 1915	18	21	39	14	72	86	125	6	2,680
From April 1915 to 31st March 1916	8	1	4	4	8	12	12	1	275
Total	21	22	43	18	80	98	137	7	2,955
BELLARY.									
From the beginning to 31st March 1915	1	3	4	2	2	4	6	1	148
From April 1915 to 31st March 1916	10	1	11	1	4	5	16	1	520
Total	11	4	15	3	6	9	22	2	668
NELLORE.									
From the beginning to 31st March 1915	15	16	31	47	32	79	110	13	4,908
From April 1915 to 31st March 1916	15	1	16	6	1	7	7	1	1,073
Total	15	16	31	53	33	86	117	14	5,981
COIMBATORE.									
From the beginning to 31st March 1915	7	9	16	95	69	164	180	2	3,520
From April 1915 to 31st March 1916	1	1	2	13	9	22	22	1	823
Total	7	9	16	108	78	186	202	3	4,343
SOUTH ARCOT.									
From the beginning to 31st March 1915	62	46	108	50	37	87	195	2	9,148
From April 1915 to 31st March 1916	2	1	3	4	2	6	9	2	685
Total	64	47	111	54	39	93	204	4	9,833
CHINGLEPUT.									
From the beginning to 31st March 1915	249	261	450	349	261	610	1,050	201	46,406
From April 1915 to 31st March 1916	15	9	24	18	3	21	46	12	7,770
Total	264	270	474	367	264	631	1,105	213	49,776
TINNEVELLY.									
From the beginning to 31st March 1915	107	25	132	326	67	383	615	1	14,944
From April 1915 to 31st March 1916	7	1	8	64	7	71	78	8	2,803
Total	114	26	139	390	74	464	693	9	17,747
TRICHINOPOLY.									
From the beginning to 31st March 1915	20	7	27	67	62	129	148	5	3,855
From April 1915 to 31st March 1916	45	2	47	11	15	26	73	1	1,772
Total	65	9	74	78	77	155	221	6	5,627
TANJORE.									
From the beginning to 31st March 1915	38	12	50	16	5	21	71	21	5,927
From April 1915 to 31st March 1916	5	3	8	13	3	16	24	8	2,126
Total	43	15	58	29	8	37	95	29	8,053
ABSTRACT.									
Total borings from the beginning of operation to 31st March 1915.	733	424	1,157	1,031	650	1,681	3,388	308	115,110
Total borings from 1st April 1915 to 31st March 1916.	231	41	275	162	68	230	495	39	24,750
Total	967	465	1,432	1,193	708	1,901	3,883	347	139,860

TABLE IX.—Statement showing the number of borings put down in several taluks of the Presidency during the year 1915-16.

District.	Taluk.	Number of borings done.	Total.
Vizagapatam	Sarvasiddhi	27	38
	Amkapolu	3	
	Vizianagaram	6	
	Viravilli	2	
Godavari	Tuni	1	1
Ganjam	Borhampar	4	4
	Nusvid	5	
Kistna	Eluru	115	144
	Bezuda	10	
	Tanuku	2	
	Narasapur	2	
Guntur	Guntur	2	22
	Tomali	12	
	Bapatla	8	
Nellore	Kandukur	4	7
	Nellore	3	
Chingleput	Pondur	19	45
	Tiruvallur	5	
	Saidpet	21	
South Arcot	Cuddalore	8	9
	Villupuram	1	
Tanjore	Kumbakonam	3	34
	Papanasam	6	
	Mayavaram	5	
	Sivayal	2	
	Tanjore	1	
	Tirattoraipundi	1	
	Patankottai	2	
	Nagapattinam	3	
	Mannargudi	1	
	Nannilam	1	
Trichinopoly	Masiri	12	73
	Trichinopoly	11	
	Karur	11	
	Udaiyarpalayam	39	
Tinnevely	Nanguneri	6	34
	Srivakuntam	9	
	Tinnevely	5	
	Tiruchendur	6	
Namnad	Tenkasi	5	12
	Ambasamudram	4	
Madura	Sivaganga	12	39
	Arappukottai	27	
Coimbatore	Madura	3	5
	Tirumangalam	2	
Malabar	Coimbatore	9	30
	Gothichipalayam	3	
	Erode	8	
North Arcot	Palghat	2	2
	Vellore	1	
Salem	Gudiyattam	3	4
Anantapur	Salem	8	8
Kurnool	Gooty	2	2
Cuddapah	Kurnool	4	10
	Proddatur	10	

TABLE X.

Trades.	Number of factories.	Horse power.				Total excluding horse power of boiler.
		Steam.	Oil or gas.	Others.		
		Engines.	Boilers.			
<i>Section I.—Agriculture and irrigation.</i>						
1. Agriculture .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
2. Fish irrigation .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
3. Lift irrigation	701	.. ..	.. ..	8,671	.. ..	8,671
<i>Section II.—Mines and quarries.</i>						
4. Gold mines	3	.. ..	820	.. ..	.. ..	.. ..
5. Mica	9	51	.. ..	189	.. ..	51
6. Mangano	2	142	487	.. ..	.. ..	288
7. Magnesite	1	.. ..	60	.. ..	.. ..	.. ..
8. Quarries	2	12	65	.. ..	.. ..	12
9. Salt mines	4	40	82	10	.. ..	50
10. Others .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
<i>Section III.—Iron, steel and engineering trades.</i>						
11. General engineering trade	45	486	4,948	269	.. ..	756
12. Harbour shipbuilding trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
13. Railways (Carriage and Locomotive)	16	373	.. ..	980	.. ..	1,353
14. Tool and implement trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
15. Blacksmith's trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
16. Small arms trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
17. Other iron and steel trades .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
<i>Section IV.—Metal trades other than iron and steel.</i>						
18. Brass and copper trades	2	.. ..	.. ..	.. ..	.. ..	.. ..
19. Metal trade (other than iron)	1	.. ..	.. ..	137	.. ..	137
20. Precious metals and jewel trade .. ..	.. ..	.. ..	.. ..	.. ..	10	10
21. Other trades .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
<i>Section V.—Textile trades.</i>						
22. Cotton trade (Power)	223	14,105	16,399	2,468	1,150	17,723
23. Cotton trade (Hand Loom) .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
24. Jute and hemp trade	8	1,355	1,462	.. ..	.. ..	1,355
25. Woollen and worsted trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
26. Silk trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
27. Luce trade	1	25	751	3	.. ..	25
28. Fibre trade	10	189	.. ..	.. ..	.. ..	192
29. Bleaching and dyeing trades	3	.. ..	69	.. ..	.. ..	.. ..
30. Other textile trades	3	3	22	4	.. ..	.. ..
<i>Section VI.—Clothing trades.</i>						
31. Clothing and millinery trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
32. Boot and shoe trade	1	.. ..	.. ..	8	.. ..	8
33. Hat and cap trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
34. Other trades .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
<i>Section VII.—Food, drink and tobacco trades.</i>						
35. Grain milling trade (Rice Mills)	479	2,169	7,161	6,856	.. ..	9,996
36. Bread and biscuit trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
37. Confectionery and preserve trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
38. Butter and cheese trade	1	.. ..	20	.. ..	.. ..	.. ..
39. Fish-curing trade	4	15	184	.. ..	.. ..	19
40. Ice trade	9	103	3,752	358	.. ..	511
41. Sugar trade	12	19	237	61	.. ..	80
42. Brewery and distilling trade .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
43. Cattle food trade	2	29	180	30	7	66
44. Aerated waters	3	12	85	11	.. ..	23
45. Tobacco trade	48	446	938	249	.. ..	744
46. Coffee trade	26	38	172	389	64	491
47. Tea trade	2	.. ..	207	.. ..	.. ..	.. ..
48. Other trades .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
<i>Section VIII.—Chemical and allied trades.</i>						
49. Chemicals, coal tar products and cerdite trades	3	44	632	37	500	581
50. Seed crushing trade (Oil)	32	195	346	459	27	681
51. Soap and candle	2	12	67	.. ..	.. ..	12
52. Bone crushing trade	8	46	162	60	.. ..	106
53. Other trades (Paper/Leum) .. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
<i>Section IX.—Paper printing and allied trades.</i>						
54. Printing and book-binding trade	29	83	206	273	76	452
55. Other trades (Pencil)	1	.. ..	22	.. ..	.. ..	.. ..

TABLE X—cont.

Trades.	Number of factories.	Horse power.				Total excluding horse power of boiler.
		Steam.		Oil or gas.	Other.	
		Engine.	Boiler.			
<i>Section X.—Leather cases and india-rubber trades.</i>						
56. Leather trade (Tanning and Dressing) ..	4	29	64	10	..	39
57. Saddlery and harness trade ..	1	12	..	..	..	12
58. Other trades ..	..	..	..	..	..	..
<i>Section XI.—Timber trades.</i>						
59. Timber trades ..	15	62	15	117	8	187
60. Carriage, cart and waggon trades ..	7	..	..	15	106	121
61. Brush and basket trade ..	..	..	..	..	..	..
62. Other trades ..	..	..	..	..	..	..
<i>Section XII.—Clay, stone, building and contracting trades.</i>						
63. Brick and tile trades ..	26	498	1,282	68	..	566
64. China and earthenware trades (Pottery) ..	1	7	37	..	7	915
65. Cement trade ..	2	900	570	10	5	..
66. Public Works Department ..	..	..	..	..	..	..
67. Others ..	..	..	..	..	..	..
<i>Section XIII.—Miscellaneous trades.</i>						
68. Ivory, bone and fancy articles ..	..	..	..	..	..	..
69. Musical instruments ..	..	..	..	..	..	..
70. Others ..	..	..	..	..	..	..
<i>Section XIV.—Public utility services.</i>						
71. Municipal undertakings ..	17	1,746	866	409	..	2,155
72. Electric light (Private Company) ..	13	4,810	1,877	202	..	6,009
73. Canals and docks ..	..	..	..	..	..	..
74. Post and Telegraph offices ..	1	..	..	..	16	16
75. Telephones ..	..	..	..	..	..	..
76. Others ..	..	..	..	..	..	..
Grand total ..	1,792	29,114	44,179	22,373	2,017	62,504

Order—No. 1051, Home (Education), 4th October dated 1916.

Recorded.

2. The Government note the good work done by the Department of Industries during the year under difficult conditions, some of which are mentioned in paragraph 35 of the report, and their thanks are due to Mr. Tressler who has, since the close of the year, left for military duty. The Government also note with appreciation the work of the officers in regard to whom Mr. Tressler has borne testimony in paragraph 36 of his report.

(True Extract)

P. RAJAGOPALA ACHARIYAR,
Secretary to Government.

To the Director of Industries.
the Honorary Director of Fisheries.
the Revenue Department.
the Public Works Department.
the Public Works Department (Irrigation).
the Home (Miscellaneous) Department for Presidency Administration Report.
K. T. B. Tressler, Esq. (C/o Secretary to the Government of India, Home Department.
Editors' Table.

Forwarded to the

(By Order)

Superintendent of the
Home Department.

Registrar

HOME (EDUCATION) DEPARTMENT.
[NOTES CONNECTED WITH G.O. No. 1051, HOME (EDUCATION),
DATED 4TH OCTOBER 1916.]

[SUBJECT.—Administration report of the Department of Industries for 1915-16.]

From the Director of Industries, dated 29th July 1916, No. A. 11.

The report does not call for any lengthy remarks. Reports on the various experiments carried on by the department have been received from time to time and the report contains a précis of these reports. The portions where the Director refers to schemes pending with the Government are noted on below.

2. Paragraphs 4 and 5 and paragraph 34 of the report.—In these paragraphs the Director refers to the proposals submitted by him at different times for the strengthening of his establishment. It is submitted that these were till recently lying over pending the assumption of charge by Mr. Couchman of his special duty in the department. He has since stated that he would submit revised proposals after he has been in charge of the department for some time and gained experience.

3. In paragraph 4 the Director also complains about want of adequate accommodation for his office. It is submitted that sanction was accorded last year to the G.O. 1506 W., 14th August 1915.

But the acquisition was subsequently deferred pending decision of the question whether any of the military buildings and sites which, it was stated, would fall vacant, might not be made available for the Director's office. This question has not yet been decided and it is understood that the Public Works Department propose to take this up only after a decision is arrived at on the larger question of locating all the public offices at Chepauk. Mr. Couchman will presumably address the Government if any urgent action is necessary.

4. Accommodation for the Leather Trades school.—At the end of his report the Assistant in the leather trades school (who is in charge of the school in the place of Mr. Guthrie (the leather expert) refers to the want of class room accommodation at the school. It is stated that when the original design for the school building was prepared it was hoped that accommodation would be found in the general trades school which was to be located on an adjacent site. The Government have decided not to construct buildings for the latter school for the present. The question of securing rented accommodation for it is separately under consideration. It is for orders whether the Director may be asked to submit separate proposals in regard to additional accommodation for the leather trades school.



NOTES to G.O. No. 1051 HOME (EDUCATION), 4TH OCTOBER 1916

5. Last year all those portions of the report wherein the Director referred to pending questions were omitted and the paragraphs were so modified as to include only such portions as recorded what had been actually sanctioned. It is for orders whether similar alterations may be made in this report also before publication.

6. As the report covers the activities of the department in the pumping and boring section also the file may be sent to the Revenue Department for remarks.

S.K.—9-8-16.

N.K.—23-8-16.

Submitted that so far as this department is concerned, the report may be recorded and proposals for the additional accommodation required for the leather trades school may be called for.

As regards the editing of the report, portions enclosed in red chalk brackets may, subject to approval, be omitted as in the previous year. These passages occur in paragraphs 4, 5, 6, 9, 20, 25, 29, 31 and 34 of the report. Revenue will presumably deal similarly with paragraphs 10 to 13 relating to the Pumping and Boring section.

C. RAMANUJA ACHARI—24-8-16.

I have read the report with some care and made such alterations—in red ink—as appeared to me necessary. His Excellency's sanction will be taken in due course to these changes. In the meantime will Revenue please note the portions of the report which concern it? After receiving Revenue's remarks I shall make my own and circulate the file for orders to His Excellency and Honourable Member (Revenue).

P. RAJAGOPALA ACHARIAR—1-9-16.

To the Revenue Department, a.c.

REVENUE DEPARTMENT.

Paragraphs 10-13 on pages 11-14 of report and paragraph 16 on page 8 relate to this department. The former deals with the pumping and boring operations and the latter with the Gunjana project. The following facts may be mentioned in the Government review of the report:—

(i) Special rules for the grant of loans for the erection of pumping installations G.O. 658, Revenue, 21st March 1916. were published during the year; but the hire purchase system referred to in paragraph 3 of the last year's review has not been introduced.

(ii) Revised rules for the levy of fees for work done in connection with the pumping and boring operations have also since been issued. G.O. 913, 26th April 1916.

(iii) The transfer of the control of the pumping and boring operations to the Agricultural Department is being effected, an Agricultural Engineer on Rs. 450 in the scale Rs. 400-25-800 and an Assistant Agricultural Engineer on Rs. 200 in scale Rs. 200-12½-400 having been appointed. G.O. 1646, Revenue, 18th July 1916. G.O. Mis. 1854, Revenue, 15th August 1916.

2. Passages within red square brackets in paragraph 10, page 8, and third sub-paragraph under paragraph 12 on page 4 and page 19 of report may, if submitted, be deleted.

R.R.—5-9-16.

C.R.—7-9-16.

A.H.A.T.—9-9-16.

It is stated in paragraph 16 at page 6 of the report that arrangements have been made for the transfer of the Gunjana plant. The proposals for the transfer of the plant have not been approved by Government. The Board of Revenue stated in reference, dated 3rd April 1916, that Mr. Tressler's proposals would be scrutinised in consultation with the Collector of Kistna, the Director of Agriculture and the Chief Engineer for Irrigation and that a final report would be submitted to Government in due course. The Board's report is awaited—vide Official Memorandum No. 634-B/16-1, dated 14th April 1916. No remarks are called for on paragraph 16.

B.M.R.—8-9-16.

T.S.R.—8-9-16.

The statements in paragraph 16 seem rather premature, seeing that Government have not passed orders on the future location of the plant. The last sentence might go out in the Editors' Table copy, and the penultimate sentence will then run "proposals for its establishment elsewhere have been called for and a scheme is now under preparation."

Adapted.

P.R.—21-9-16.

A. H. A. Tonn—9-9-16.

I agree with the Under Secretary as regards paragraph 16

Adapted.

P.R.—21-9-16.

I would suggest the elimination of a sentence in paragraph 4 underlined in blue pencil.

Adapted.

P.R.—21-9-16.

In paragraph 6, everything except the first sentence seems needless and might well go.

Adapted.

P.R.—21-9-16.

In paragraph 12, I think that the eliminations suggested are suitable, except that I would retain the word "partly" or substitute "largely."

I don't see any harm in the last part of paragraph 10 and would retain it.

Adapted.

P.R.—21-9-16.

The passage on page 10 marked in blue pencil might go.

No other comments occur to me.

Trust that Honourable Member (Revenue) will see the report.

J. P. BEDFORD—8-9-16.

To the Home (Education) Department

HOME (EDUCATION) DEPARTMENT.

Submitted with reference to the Secretary's note on page 2 supra.

S.K.—11-9-16.

N.K.—12-9-16.

C. RAMANUJA ACHARI—13-9-16.

Mr. Tressler's report has been carefully edited by Mr. Bedford and myself and I think that it is now in a form which can go out to the public. There can be little doubt that the Department of Industries did good work during the year, notwithstanding many difficulties. Please see paragraph 35 of the report. In addition to the difficulties of getting machinery, providing sufficient funds and securing an adequate and suitable staff, there was the further serious difficulty that latterly the

Government felt it not safe to give Mr. Tressler that free hand which the head of a department like that of Industries should, I think, have, if we are to get the best out of it. Taking all circumstances into consideration, I think that the record of last year's work—as shown in the report and its enclosures (the latter are interesting and worth perusal)—is one on which we can look back with satisfaction.

I think that it is neither necessary nor desirable to issue a detailed review. There is no need to repeat (in the review) what the Director has stated in the report. And in regard to the points about which there have been differences of opinion between Mr. Tressler and the Government it would be unseemly to deal with them in a Government Order going out to the public. It will be seen that the corrections (all in coloured ink) made by myself and Mr. Bedford have eliminated from the report those passages which are either not quite accurate or make needless references to contentious matters.

The report may, I think, be recorded with the remark that the Government recognise that good work was done by the department under difficult conditions, some of which are mentioned in paragraph 35 of the report, and that the thanks of the Government are due to Mr. Tressler who has, since the close of the year under report, left for military duty.

A word of appreciation may also be added in regard to the officers of the department to whose good work Mr. Tressler has borne testimony in paragraph 33 of the report.

P. RAJAGOPALA ACHARIYAR—21-9-16.
P[ENTLAND]—24-9-16.
A. G. CARDEW—25-9-16.

Let me have draft Government Order sharp. [The office should be particularly careful to see that the corrections made in the report (and enclosures) by His Excellency, Mr. Bedford and myself, all come in].

P.R.—27-9-16.

A draft order is submitted for approval. The Secretary's order in regard to the editing of the report for the press are noted.

2. Attention is solicited to memorandum No. 1176-1, Public, dated the 20th February 1912, in which it is laid down that the thanks of the Government will be accorded to an officer only in acknowledgment of services of exceptional merit. Please see also the Hon'ble Sir Harold Stuart's note, dated the 18th February 1912 (written as Chief Secretary), on page 2 of notes thereto.

This is exceptional.

P.R.—3-10-16.

February 1912 (written as Chief Secretary), on page 2 of notes thereto.

S.K.—28-9-16.

N.K.—28-9-16.

E. A. HARVEY—29-9-16.

It is not for us to revise an order passed by His Excellency and Honourable Member (Revenue). I have corrected the draft. Let me have clean copy sharp please.

P. RAJAGOPALA ACHARIYAR—3-10-16.

Clean copy of draft is submitted.

S.K.—3-10-16.

N.K.—3-10-16.

Issue.

P.R.—3-10-16.

[G.O. No. 1051, Home (Education), dated 4th October 1916.]

ORDINARY.

Sect. II-33-2-15.

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SPECIAL INSTRUCTIONS.

Department of Industries

Recording the administration report of the Department of Industries for the year 1915-16

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