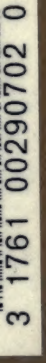
THE
INDUSTRIAL CONFERENCE



HELD AT SURAT,

December 1907.

FULL TEXT OF PAPERS

READ AT AND SUBMITTED TO IT.

Price Re. One.

Madras:
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CONTENTS.

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RESOLUTIONS PASSED AT

The Third Indian Industrial Conference

Held at Surat on the 30th December 1907.

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I. Industrial Survey.

That this Conference expresses its sense of satisfaction that an Industrial Survey has been carried out in the United Provinces and is being carried out in the Central Provinces and Berar, and in the Baroda State; and it would urge other Provincial Governments in British India and the Governments of other Indian States to carry out at an early date Industrial Surveys of the territories within their jurisdiction, as exact and detailed information would afford facilities for the introduction of a sound system of technical education and the well-ordered development of indigenous industries.

II. Technical and Commercial Education.

That this Conference re-affirms the Resolution on Technical and Commercial Education passed at the last Conference.

That this Conference thanks the Government of the United Provinces for the action taken by them with a view to introduce a fairly comprehensive system of Technical Education in those Provinces and would express the hope that other Provincial Governments will be pleased to convene representative conferences, such as the recent Naini Tal Conference, to devise measures for the spread of Technical Education in their respective Provinces. And this Conference further expresses the hope that the Government of India would provide adequate funds for giving effect to the recommendations of the Naini Tal Conference and carrying out similar schemes in other Provinces.

That this Conference, while appreciating the action taken by the Governments of some Indian States to encourage Technical Education, urges that further steps should be taken in the same direction in all Indian States.

That this Conference welcomes the growth of public interest in Technical Education as shown by the action taken by certain local and municipal boards and private associations in promoting it, and it strongly urges on the leaders of the people the necessity of taking practical steps for providing increased facilities for it by starting institutions and founding scholarships to encourage technical studies in India and abroad.

III. Agricultural Education.

That this Conference records its sense of appreciation of the action taken and contemplated by the Government in regard to the establishment of Agricultural Colleges in the several Provinces, and would urge that in view of the importance of a wider spread among the cultivating and landholding classes of a practical knowledge of the principles of scientific agriculture and modern methods, Government would be pleased to establish Experimental and Demonstration Farms as widely as possible, and to start vernacular schools in connection with them, one at least in every district.

IV. Agricultural Banks.

That this Conference begs to call the attention of Government to the urgent need of promoting the establishment of Agricultural Banks to help co-operative credit societies and to advance loans directly to agriculturists on reasonable rates of interest, and further begs to suggest that the advice and co-operation of representative members of the Indian community may be enlisted in devising a suitable scheme to secure this object.

V. The Mining Industry.

That this Conference expresses its sense of satisfaction at the successful formation of the Tata Iron and Steel Company, Limited, with the help entirely of capital raised in India.

That this Conference invites the attention of capitalists in India to the urgent need of developing and fully utilising the mineral resources of the country and trusts that, in view of the ultimately lucrative character of the industry, they will make organised efforts in that direction.

That this Conference is of opinion that special consideration should be shown to Indian enterprise and initiation by the Government and preferential treatment given to it.

VI. Cotton Spinning and Weaving Industry.

That this Conference records its sense of satisfaction at the stimulus the Spinning and Weaving industry have received from the Swadeshi movement and it urges the bestowal of increased attention on cotton cultivation, the erection of spinning and weaving mills at suitable centres, and the revival of the hand-loom weaving industry on a commercial basis, as essential to the success of the movement.

That this Conference urges the Government to remove the restrictions retarding the expansion of the industry and to provide facilities for affording practical instruction in weaving by the establishment of weaving schools at every important weaving centre.

VII. The Sugar Industry.

That this Conference notices with concern the increase in the imports of foreign sugar, and is of opinion that to arrest the steady decline of the indigenous industry it is absolutely necessary to encourage the cultivation of healthier and more prolific varieties of cane, to employ greater care in cultivation, to use more economical processes for extracting the juice, and, above all, to adopt the most modern and efficient methods of refining.

That this Conference urges the Government to provide more extensive irrigational facilities, to allow the utilisation of bye-products, and, further, to consider the desirability of imposing a duty upon imported sugar in order to protect the indigenous industry.

VIII. Appointment of Office-Bearers and Provision of Funds for the Year 1908.

That this Conference re-appoints Rao Bahadur R. N. Mudholkar as General Secretary and Mr. C. Y. Chintamani as Assistant Secretary, and it appeals to the public for a sum of Rs. 10,000 for meeting the expenses for the next twelve months.

THE INDUSTRIAL CONFERENCE.

WELCOME ADDRESS

BY

PROF. T. K. GAJJAR,

Chairman of the Reception Committee of the Third Industrial Conference, Surat, 1907.

Brother-Delegates, Ladies and Gentlemen.—Before I proceed to discharge the duties assigned to me by the Reception Committee of the Third Industrial Conference, I must offer my apology for my inability to do justice to the responsible work entrusted to me. I have often been invited by kind-hearted friends to speak on the topics connected with my favourite lines of work. I have, however, been obliged to decline the invitations, as I have always felt myself diffident about venturing on public platforms. I have no hereditary aptitude for the art of public speaking, being born of an artisan family, and have, therefore, contented myself with doing whatever other work lay within my power. But the citizens of Surat—the place of my birth—nominated me to the proud privilege, for which I am thankful to them, of according to you all—the representatives of Industrial India—a hearty welcome worthy of the city which was the greatest industrial and commercial centre on this side of India under the Moghuls, and I could not decline the nomination. It was here at Surat that our present rulers got a footing as traders after roaming over seas, and it was here that they established the factory which developed, in the course of centuries, into a great Empire. Surat then was in the zenith of her glory.

Skill, intelligence, enterprise and commerce combined to shed lustre over it. But alas! now its glory has gone and its energy and activity have declined. The world-renowned arts of Surat now lack the spirit of progress and linger behind the advances of Science. At this place then, gentlemen, I give you a most cordial welcome.

It is in the fitness of things that this Conference should meet at a place which furnishes an object-lesson of our present economic situation and which should consequently inspire and stimulate the sacred work we have undertaken. It was a happy idea of the Benares Exhibition Committee to organise, in connection with the Industrial Exhibition, an Industrial Conference. In doing so they took the practical step without which, according to the penetrative observation of the Hon. Dr. Rash Behari Ghose, exhibitions were useless. The practical genius of the great Ranade also had perceived the necessity of industrial conferences, which were consequently held in Poona in the years 1891–92–93. But this movement did not continue after the elevation of Mr. Ranade to the bench of the Bombay High Court. Its spirit lay dormant. It was reserved for a Gujarati colonist of Upper India, the Hon. Munshi Madho Lal, with the able co-operation of Mr. R. N. Mudholkar, to revive the movement and secure the co-operation and sympathy of all workers—whether official or non-official—in the cause of India's industrial progress. The Conference was launched at a very opportune moment, a moment when India experienced travails caused by the birth of far-reaching movements—a moment when the Swadeshi movement swept over the whole continent, welcomed and supported by all people,—rich or poor, literate or illiterate.

The national spirit embodied in the sessions of the Indian National Congress gave a tangible shape in 1901 to our industrial endeavours by the institution of an Industrial Exhibition at Calcutta under the organising talent of the Hon. Mr. J. Chaudhri. The sessions that followed organised these shows on a more or less grand and comprehensive scale. But it must be said they were not pervaded with the spirit and insight which advanced industrial nations have manifested in the exhibitions held by them. Instead of making arrangements to show the processes of manufacture our raw products pass through in foreign countries, or suggesting lines of development for our existing industries, we collected samples of articles manufactured in India to give an opportunity to the agents of foreign manufacturers to take minute notes of them and prepare their cheap machine-made imitations to replace our manufactures in our own market. These remarks will, I hope, be borne in mind when such aims and exhibitions are organised in future.

The short time at our disposal has not enabled us to exhibit Indian-made articles on these grounds. We have tried to meet this deficiency by holding a small but excellent exhibition of handlooms, including some from Surat itself. This is the first time, therefore, that our Conference meets without its parent institution. This break, let us however hope, will conduce to a modification of the ideals of future exhibitions.

Brother-delegates, we have assembled here to deliberate with a view to take practical steps for the vital question of the industrial regeneration of ourselves, on which all other questions—political, social, religious—depend to a greater or less extent. This platform of science and industry makes room for all classes of the people to meet together, laying aside personal ambition, political animosity, religious prejudices and State officialism,

so that they could all combine in an unanimous effort to raise every class in society to a higher condition of personal excellence and usefulness, and extinguish class distinctions by diffusing equal education. We have taken in hand this most vital question and we cannot allow any further time to pass by, without organised action, to raise our nation to the rank from which it has fallen.

I may now crave your indulgence for a brief reference to the great problems on which the industrial efficiency of a nation depends. Keeping aside the political, geographical and sociological factors, we may touch the economic factors which have been repeatedly pointed out in lucid and definite language as being available in our country. Our fertile lands, rich mines, vast forests and hidden treasures, the natural forces pent up in the mighty waterfalls of the rivers that irrigate India—the capital hoarded in temples and invested in non-industrial transactions—the abundant labour that can be obtained on easy terms—have not arrested the decay and poverty with which we are overwhelmed. Our ignorance and apathy, and the influence exerted by foreign manufacturers on our fiscal policy, have reduced us to such a state.

For the last so many years we have been working for the progress of our nation, but, I must say, without a proper grasp of the methods and aims of that progress. We have neglected the lines of the solution of economic problems followed by the foremost nations of to-day. Some of our national problems would ere now have been solved to a great extent, if systematic technical education along with general education had been introduced throughout India. Japan adopted technical education 25 years after our benign Government initiated the present educational system in India, and during such a short period she has become

a comparatively trained nation, trained to think, trained to do the best along any line that may turn up and has grown into a world-power whose friendship and goodwill are sought by other nations. But what has been our fate? Our indigenous industries have been crippled by foreign competition or have languished for want of a proper application of the modern industrial methods. The nation that proudly called herself the workshop of the world, allowed our country to be degraded into one of the chief markets of the world. Foreign syndicates make use of India's natural forces to deprive her of mineral wealth, in the absence, among other causes, of enterprise and adequate training on the part of the people.

For example, the Mysore Government is generating electric power in the Cauvery at a tremendous outlay of its people's money and has leased it to a foreign syndicate to exploit the mineral wealth of the State in return for a small royalty. The resources of the State are doubtless developed thereby, but its people have not been profited to the extent they ought to have been, and have not acquired any aptitude for scientific mining or for making use of the natural forces.

What is thus happening in Mysore also operates more or less all over the country. The Indian Government is trying to develop the mineral resources of India, but it must be borne in mind that the development of a country is quite different from that of its people. The exploitation of America, Africa and Australia has resulted in the extinction or serfdom of the original inhabitants.* The present Amir of Afghanistan

* "If," adds Mr. Clark, "the Government would grant railway and mining concessions to foreigners, the country would develop rapidly, for its mines alone would attract many prospectors and, if found to be as extensive as currently believed, much capital would follow. The Government and people, however, are united in opposing any concessions to foreigners."—*The Indian Trade Journal*, Dec. 12, 1907.

fully realises this difference and does not grant concessions to foreign capitalists to work the rich mineral deposits in his country, but engages foreign experts to train his subjects to develop the resources of the country themselves. This shows that the Amir cares more for the permanent interests of his subjects, than for the temporary gain to his treasury from concessions to foreign syndicates on easy terms.

The charge of this neglect of duty, however, does not wholly attach to our Government. We must share it in part, because the pioneers of modern industries in India have not combined their energies together to devise ways and means for organising a system of technical education managed by and for them.

We shut our eyes to the benefits other nations have reaped through an efficient educational system in their countries. Our very bones and marrow (oilseeds) are exported to fertilise other lands, and our corn is exported to feed others when our people barely get one meal per day. Our raw products are sent to foreign countries and imported as manufactured goods. Thus the large margin of profit that should have served to feed our own brethren goes to enrich the foreign manufacturer.

All this happens under our own eyes. Not being provided with the modern industrial facilities and mental equipment, we have been reduced to a state of helplessness and we suffer ourselves to be impoverished and our country to be exploited by foreigners.

I cannot omit to mention in this connection the work the Government and some of our enlightened people have done in this direction. Our rulers have in their own way and in accordance with their light and interest fostered education, general and technical, have carried on economic and industrial investigations,

have organised departments deemed necessary for the industrial expansion of modern times—undertaken experiments and convened conferences for the development of the resources of India. But the people of this country have themselves availed but little of these surveys of the reports and monographs published by the Government or of the results of its experiments and investigations, because they were never taught the modern methods of handling industrial questions.

In the same way, the large sums subscribed by our people were utilised by the Government for educational purposes in accordance with the prevalent ideas about education. Had a portion of these sums been spent in educating our artisans, farmers and capitalists in the ways and means pursued by the people of Europe and America, we would not have been made dependent on others for the necessaries of our life. Our Princes introduced facilities for technical studies in their States, but their measures were not carried out in the right patriotic spirit which demands in educationists earnestness, completeness and foresight, especially in a country like India, rich in resources and abounding in people addicted to conservative and exploded methods of work and unaware of the progressive and scientific methods of advanced nations.

Lord Reay's famous resolution on technical education fell into desuetude because persons entrusted to carry it out did not possess the essential qualification just mentioned. The resolution aimed at making Sir J. J Art School a central institute for art industries, the V. J. T. Institute one for mechanical industries, and the Poona College of Science one for scientific and technological studies. But when Mr. Chatfield was interpellated in the Bombay Legislative Council as to the fate of the resolution, his

reply was to the effect that the problem of industrial training was being solved by the Baroda Technical School.

The Kalabhavan of Baroda was instituted when H. H. the Gækwar initiated his enlightened policy for the advancement of his subjects. General education, the foundation of all technical education, was made free and compulsory in one division of the State, *i.e.*, in Amreli, and by this time it is extended to all the divisions. Three trade schools were also opened. A State museum was established and a system of industrial loans was instituted on the lines of the culture system of Java suggested by the great Ranade. This liberal policy encouraged me to organise the Kalabhavan which had for its ideals the Zurich and Charlottenburg Technical Schools. It undertook to impart instruction in such subjects as would not only serve the present industrial needs of the people, but enable them to start new industries. After making some preliminary remarks, I shall refer to the work done by it in this direction.

The industry that occupies a prominent place in our commercial life is the mill industry. Its commercial and mechanical sides are attended to, but, until recently, no thought was devoted to the development of its chemical and artistic aspects. Our technical schools are partly responsible for the neglect of these important factors in mill industry. With the single exception of the Kalabhavan, they rested satisfied with the provision of instruction, which the existing needs of the industry required and took no steps to introduce studies necessary for its further development. The V. J. Technical Institute is now arranging for instruction in dyeing and textile chemistry twenty years after the Kalabhavan took up the subjects at Baroda.

The Kalabhavan had a great share in the introduction of the dyeing industry in India. When our vegetable colours were

driven out from the world's market, which they had held for centuries, by the marvellous colours modern chemistry had extracted from coal-tar; when our dyers and weavers were reduced to poverty, their occupations having been taken up by others, there was no recourse left but to make use of these new colours and not to pay unnecessarily for the process of dyeing carried on outside India. Germany, the home of these chemical dyes, was anxious to secure a market for them in India. Our mill industry also needed a healthy growth and development. These considerations led me to suggest to the great colour manufacturers of Germany to train students and instruct native dyers in the use of their dyes if they desired India to become one of their great consumers. They appreciated the suggestion and acted upon it, and started their first laboratory in this very city and commenced to instruct students and native dyers in the processes connected with dyeing. When Mr. J. N. Tata heard about this, he at once communicated with me and made up his mind to append a dye-house to his mill, with the help of dyers trained in my private laboratory at Baroda. Even a costly laboratory set of dyeing apparatus was presented to his mill through me by the German manufacturers. Dyeing schools were soon after opened at Ahmedabad, Delhi, Cawnpore, Amritsar and other places under my supervision and several trained dyers were sent round as travelling agents. There are now several laboratories in Bombay connected with German offices where students are trained. These are the educational methods the Germans adopted for their purely commercial purposes, and the result is the present remarkable revival in our dyeing industry. My friend Mr. Tulsiram, who introduced dyeing into Madura, informed me, at the time of the last Bombay Congress, that 47,000 Sorathi settlers have been blessing the trained

dyer sent by me to Madura some years back, and the Glasgow turkey-red yarn manufacturers had to send their agents to Madura to enquire why all the imports were stopped and what were the methods of dyeing adopted there. Since that time an extensive use of coal-tar colours is made in India, and thus is saved to her the margin of profit swallowed by Lancashire and Glasgow. The dyers and the experts of these German firms were assisted by the students of the Kalabhavan in developing the dye-houses of our mills. They are saving the mill industry from stagnation, are giving remunerative work to thousands of workmen and showing productive investments of capital. They are successfully working the dye-houses which costly foreign experts failed to do. Had it not been for these pioneers to whom the flourishing conditions of mills is indebted to a great extent, our manufacturers would not have been enabled to meet the demands the Swadeshi movement is making on them.

We live in a time when new ideas are spreading. For instance, many believe—and their number is on the increase—that since Government cannot be expected to promote our industries by a policy of protection, we should promote them ourselves by means of a consumers' league to boycott foreign articles. Now I do not wish to assert either that boycott is altogether impracticable or it is altogether useless. What I do wish to point out is that boycott can never by itself solve an industrial problem. For instance, the wood agriculturists of England boycotted indigo, branding it "Devil's Drug" and the Legislature also came to their aid by passing the harshest laws to punish those who imported it. But the use and import of indigo went on in England until modern chemistry produced the colouring matter artificially and at less cost. Scientific knowledge, technical

skill, and industrial enterprise and organisation—these are the true remedies, the only positive forces we can rely on to develop our industries.

It has been pointed out above that the expansion of mill industry has not been attended with the parallel development of the chemical industries. Many raw products await chemists to transform them into articles of use and commerce. Take for instance, the varieties of seeds our land produces from year to year. They are sent to foreign countries to provide us with their oils and derived products. If we started oil mills, a group of chemical industries will come into existence and utilise the by-products. You are not unaware of the new and unexpected avenues of industries, which the chemistry of by-products opens up in the West. For the last twenty years I have been preaching the great future that lies in store for oil industry in our country. The dazzling prospects that the textile industry holds forth, however, leaves little room for it to attract capitalists and manufacturers.

Another disadvantage we suffer from—the lack of chemical knowledge—is seen in mining and metallurgical operations. We have been quarrying mineral deposits and exporting them to Europe because we do not know how to make them into articles of use. The minerals that demand chemical treatment are not touched but only those which can be readily and easily transhipped to Europe. The gigantic scheme of the late Mr. J. N. Tata to work iron ores, which have been allowed to remain undisturbed until now, will, no doubt in course of time, bring about a steady progress in our metallurgical undertakings and stimulate the growth of an extensive mining industry.

"The feature which stands out most prominently in a survey of the mineral industries of India is the fact that practi-

cally nothing has been done to develop those minerals, which are essential to modern metallurgical and chemical industries, while most striking progress has been made during recent years in opening out deposits from which products are obtained suitable for export, or for consumption in the country, by what may conveniently be called direct processes."

"In this respect India of to-day stands in contrast to India of a century ago. The European chemist, armed with cheap supplies of sulphuric acid and alkali and aided by low sea freights and increased facilities for internal distribution by a spreading network of railways, has been enabled to stamp out, in all but remote localities, the once flourishing native manufactures of alum, the various alkali compounds, blue vitriol, copperas, copper, lead, steel and iron, and seriously to curtail the export trade in nitre and borax. The high quality of the native-made iron, the early anticipations of the processes now employed in Europe for the manufacture of high-class steels and the artistic products in copper and brass gave the country a prominent position, in the ancient metallurgical world."

"With the spread of railways, the development of manufactures connected with jute, cotton, and paper, and the gradually extending use of electricity, the demand for metallurgical and chemical products in India has steadily grown. Before long the stage must be reached at which the variety and quantity of products required, but now imported, will satisfy the conditions necessary for local production of those which can be economically manufactured only for the supply of groups of industries."

What line of action does this extract from the new "Imperial Gazetteer" suggest to us? What steps are necessary to develop our mining industry on a scientific basis? Instruction in mining and metallurgy either in the existing colleges or in an Institute

of Mining, will alone lead to the fulfilment of prospects our rich mineral deposits hold forth. By its means another great staple industry will come into existence and supply the people of India with commercial activity and remunerative work and repay the cost of education thousand-fold.

We have to blame our Government for not rousing itself to the necessity of creating a great Institute of Mining. The great work it is carrying on for the improvement of agriculture should be supplemented by some efforts in this direction, because all chemical industries depend upon agriculture and mining. Its agricultural improvements will take time before they are universally adopted throughout India, but provision of instruction in mining and of facilities for the working of mines will give a stimulus to the prosperity of India and check impoverishment and destitution to which villages after villages have fallen victim through the changing conditions of the times.

We are fortunate in having big Native States to look after our interests. If our Government does not shake off its tardiness, let us appeal to the great ruling princes of India to set apart a portion of their revenues to supply this great want. The money spent on it will be repaid by the enhancement of their revenues caused by the industries which will spring up in connection with the working of the mineral wealth which lies imbedded in their territories or in British India.

In this connexion I have great pleasure to announce to you that H. H. the Thakore Saheb of Morvi intends to establish a Technical Institute in his State. It will provide instruction in technological chemistry and in mining and metallurgy for which there is a great field and demand in India. The institute will provide higher standard of studies than that provided for at the Kalabhavan.

Kathiawad and Cutch contain great possibilities of development for some chemical industries. The valuable deposits of salt and iron pyrites there hold forth bright prospects for the manufacture of soda and sulphuric acid—the two great pillars of chemical industries. The people of Kathiawad and Cutch do not lack enterprise. Let some of them divert their energies from the cotton trade and go in for these industries. If they do so, the favourable geographical position, rich geological formations and the patriotic interests of the chiefs will, within a decade, transform the two peninsulas into a great manufacturing centre and drive out for ever the recurring famines which depopulate and paralyse some of the Native States.

For want of time, I have to leave off reference to important industries such as tanning, brewing, glass and porcelain and many others which have a great future before them.

Indigenous Indian industries are characterised by the simplicity of tools and implements employed by the workers. The labour unit of Indian industry is small and the capital required for working that unit successfully is also small. Time has brought us, whose industries possess these characteristics, face to face with modern achievements of Western science, and its multifarious inventions in the mechanical, chemical and electrical branches. So on the one hand we have to produce on a large scale and to adopt the factory system, but on the other hand we have also to rescue our small industries, and make them, with the help of modern science, a source of prosperity to our country. The question of cottage or village industries is one of the vital questions of our national life. There is some possibility of solving it, according to Professor Hobson,* if a cheap produc-

* "Science in Public Affairs."

tion of electric energy owned or controlled by the public can be cheaply distributed throughout India.

Let our industrial and political leaders concentrate their energies on the proper handling of a problem like this and solve it once for all. Many of the disadvantages we suffer from would thus find a remedy. Let our activities profit by the lesson the industrial history of the West has to teach to the world, that huge combinations for the maintenance of artificial prices, huge and lying advertisements and gross adulteration of manufactured products get rid, according to Prof. Duncan,* of the *efficiency* in manufacturing operations by which every business should naturally stand or fall. Let us not proceed on lines which have brought in their train misfortune and disaster. Instead of blindly following in the footsteps of Western manufacturers, let us adopt their latest methods of work, and introduce the systems devised to nullify the evil and disastrous consequences of those prevalent now. Let us bear in mind that the dominant factor of industrial success is just *simple efficiency*, by which I mean a combination of economy and progress in manufacturing operations. If we do this we shall not be handicapped in the competitive race of commerce but we shall be ahead of Western countries in proportion as we develope the nascent skill of our people and to the extent we make use of our resources.

We have undertaken a grave responsibility in meeting in such conferences from year to year. The destinies of India hang on the practical results of our deliberations. Consequently, I may be permitted to suggest some lines capable of leading us to the desired goal. We must not only apply ourselves to the study of the industrial conditions prevalent in

* "Chemistry of Commerce."

India and elsewhere, but should come to a definite conclusion as to the means and methods to be adopted to improve our condition in consonance with the highest developments of modern science. We should bring about the creation of all the facilities in India which the artisans, manufacturers and capitalists possess in the West. Economic and industrial museums* planned on the models of Europe and America, should be established in every important commercial and industrial centre. Our annual exhibitions may form a nucleus from which the future museums may grow in conformity with local conditions and requirements. A collection of samples of foreign manufactures should be placed side by side with that of home-made articles, so that local artisans may have the benefit of cultivating their taste in the proper direction by comparative study. Their heads should be patriotic Indians who possess sufficient experience of the needs and resources of India; they will furnish the requisite information and help to our people to go in for new productive industries. It is unnecessary to add that commercial bureaus must follow as a corollary to museums. The reports prepared at these institutions should not only be published in scientific and technical English which takes for granted a good deal of training, information and knowledge on the part of the readers, but also in the vernaculars and in a form devised to attract the attention of our people and to interest them in their contents, thereby inducing them to embark on the introduction or creation of new and profitable industries.

Our ancient guilds known as the Mahajanas in Gujarat have suffered disintegration with the permeation of British influence in India. The services they performed as social and commercial forces were great, but now they have fallen into

* Refer to Professor Gajjar's Museum Notes.

disuse. It is time that new guilds should be organised to meet the requirements of the times. They shall have to attend to the organisation of their industries, the creation of facilities in the shape of museums, bureaus, technical institutes, industrial banks, etc., to guard the interests of industrial centres and communities and to undertake industrial surveys in special directions. Our Conference will render a very important service to the industries of India, if it takes up the question of the formation of guilds seriously.

Only the Government has the means to carry out general industrial surveys. If they are properly carried out and their results placed within the reach of the teeming millions of India, the British Government will confer a great benefit on them. Our native princes may also be approached to come forward to help our industrial advancement by instituting economic surveys in their States. Our industrial development will be stimulated if surveys of particular industries are carried out instead of planning a general survey of the whole country. H. H. the Gaekwar entrusted me, some years ago, with the work of making a survey of the dyeing and calico printing industries. This survey was of considerable help to me in my subsequent work for the memorial of dyeing industries.

Before putting suggestions on the last but important problem of our industrial regeneration, I have a pleasant duty to perform. Our Conference has been fortunate enough in securing as its President my friend Dewan Bahadur Ambalal Sakarlal Desai, who is a distinguished alumnus of the Bombay University, a staunch political leader of Gujarat and one of the captains of her flourishing mill industry.

His high intellectual attainments, varied experience of life, keen and penetrative grasp of our national problems will, I am

sure, give a practical shape to our deliberations. The Industrial Conference is a practical offshot of the Indian National Congress. We, who have assembled here to-day, are all practical men and naturally anxious to work; we are idealists too; the industrial efficiency and expansion of India will be of the realisation of our ideals, if we put our shoulders to the wheel and work day and night for the amelioration and progress of our country.

Ladies and gentlemen, I have laid great stress on technical education and again I revert to it because it is the liver of industrial progress to which our activities must be seriously and vigorously applied. We must organise a national system of technical education with the help of industrial guilds which will formulate technical courses to meet local needs, start institutions where instruction in them can be provided and to raise funds to equip and finance such institutions. Let us all—all the workers in the onward march of India—rally round the banner of Education and leave no stone unturned to increase the brain-power of our nation. Let us not wait for the Government initiation in this matter. We must take our destinies into our own hands and the Government is sure to help us, when we help ourselves. Let us study the national forces of England, Germany and America in order to be enlightened as to the means and measures we should take for the regeneration and development of our industries. Without universal education, there is no salvation for us. We must undergo an intellectual revolution; our outlook of life and our present conception of mundane duties must be modified, if we want to remain as a nation and a nation full of youth and prosperity as in the days of yore. "Educate, educate, educate," must be the cry heard on all sides. Listen to the words of wisdom the present Secretary for War in England utters.

"Science," says the Rt. Hon'ble Mr. Haldane, "is essential to victory whether the struggle be in the arts of war or in those of peace. Organisation is the key to success; organisation depends on steady thinking, and thinking depends on ideas, ideas which give birth to ideals. For inspiration as well as guidance, those engaged in enterprise of every kind look more and more to the trained mind. They are forced to do so..... We are learning that nothing can be accomplished on a large scale without the indispensable preliminary of first taking thought. And we are learning that the taking of thought requires at every turn, not only the expert,* but the highest type of expert knowledge." Then he goes on to show the great importance talent has attained in the modern world.

While speaking at Wakefield on October 17 at a public meeting held in connection with the Wakefield Education Guild, he said that "Higher education is of great value to those engaged in industrial pursuits; in fact, it is of value to the whole nation. Learning for learning's sake is a great text, and it does not shut out the utilitarian side. The profits of industrial enterprise go to the man of brains, to the man with the power of direction. This shows that it is vital to those engaged in industrial enterprises that they should have command of science and as much knowledge as they can get. Unless knowledge is spread among the people, there cannot be equality of opportunity. There is only one leveller, only one man who does anything substantial to make people equal, and that is the schoolmaster. Education in this country will never be right until the elementary school, the secondary school, and the university are linked together. The British people, perhaps, need education more than any other nation. We are very prosperous; we are very self-reliant; we have magnificent energy; if we had not, we should have been distanced in the race. But we are competing against science and the increasing science which science gives. We are being more and more handicapped in the race and it is our own individual powers that have enabled us

* Science in Public Affairs.

still to get to the goal in front of our competitors. Let us learn, before science makes still further advances and before they are appropriated by foreign nations, to bring ourselves at least up to this level."

Shall we rouse ourselves to the consciousness of the urgent need India stands in for trained skill and scientific thought? Shall we fritter away our energies, miss our opportunities, waste our resources in worthless and idle quarrelings for personal glorification, in listlessness and inaction, in the practice of ideals detrimental to our progress and take no steps to diffuse universal scientific education leading to a stupendous moral and intellectual revolution? Shall we remain satisfied with our industrial degradation and dependence and the increasing poverty of the masses, to be crushed in the struggle for existence and to be cursed and condemned by our posterity for the disgraceful legacy we'll bequeath to them? Shall we rely upon our rulers, when, as Mr. Haldane observes, they are themselves outstripped by Germany, America and other countries which have taken the fullest advantages of the progress of modern knowledge? It ought not to be so. We must make up our mind to found institutions for technical education and thereby raise our material condition. No progress is possible in the absence ,of material prosperity. No moral development, no intellectual achievements have taken place in countries where the material condition of the people is at a low level and where, consequently, life is a bundle of pessimism, inertia and apathy. We must not rest until temples dedicated to Sarasvati and Visvakarma, *i.e.*, colleges and polytechnics outnumber all the temples, mosques and churches which minister to the spiritual needs of the people. Our religious charities must be directed towards supplying us with brain-power. On brain-power depends the regeneration of India, her prosperity and integrity,

and also her salvation. I have great faith in it and have devoted the best years of my life to the imparting of education. I have always looked upon it as the great panacea for all the misfortunes we groan under.

The earnestness, sacrifices and martyrdom of some of our people have ushered in a new era in the history of our nation. We are all pulsating with a new life, new ideals and new vigour. Let us sanctify the birth of this new life by providing for universal education in India. Let us not wait for large funds but begin with whatever sum we get from our people. Let earnest and influential workers come forward to persuade our native chiefs, merchant princes and our middle classes to set apart a portion of their revenues and incomes for educational purposes in the same way as they do to satisfy the religious cravings. Education is a religious duty and let us gird up our loins to perform it to the best of our abilities.

I again accord you all a most cordial welcome to Surat on behalf of the Reception Committee. Surat has caught the spirit of the times and embarked on industrial activity. Let the same spirit inspire us to fulfil the mission which has brought us together. Let us thoroughly and systematically carry out the conclusions we arrive at. We have the necessary means present in abundance in our land; we have capable men in our ranks; we have guidance offered by the history and experience of England and other nations; why should we then hesitate to work out our industrial salvation? If we neglect the present opportunities, we shall have to pay a very heavy toll in future for mere existence. Let this dismal and depressing prospect spur us on to action, to stimulate and accelerate our industrial progress. If we will, we shall bring about our regeneration. With knowledge, with self-confidence, with determined action and with united endeavour in the sacred cause of our motherland, let us, ladies and gentlemen, resolve to work out our own regeneration.

PRESIDENTIAL ADDRESS

BY

DEWAN BAHADUR AMBALAL S. DESAI,

Late Chief Justice, Baroda State.

Gentlemen,—I thank you sincerely for asking me to preside at this important Conference. I cannot claim the practical experience of trade and industries possessed by my worthy predecessor, nor the literary eminence and broad econmic outlook of Mr. Romesh Chandra Dutt, the first President. My connection with industries is indirect, and my studies in Indian Economics are somewhat recent. I beg, therefore, that you will be good enough to take an indulgent view of any shortcomings in the observations that I offer for your consideration.

The fundamental facts of our economic situation are well-known : (1) Widespread and chronic poverty among a large proportion of the population ; (2) dense ignorance of the masses; (3) an abundance of raw materials ; (4) absence of scientific and technical knowledge, and practical skill ; (5) a low state of commercial enterprise ; (6) a large deficiency of capital. The question that we are called upon to consider is how to evolve a state of widespread industrialism out of the conditions just postulated.

Some of the remedies suggested are those that have proved efficacious elsewhere ; viz., a wide provision of elementary education ; foundation of technical schools and scientific institutes ;

establishment of commercial schools, and acquisition of scientific and technical knowledge by students sent abroad. All these are comprised under one comprensive head,—Education. The efforts made till now to supply it have been spasmodic and feeble. But strong, systematic, and sustained exertions are indispensable. They ought to be continually reinforced by a strong national spirit, that is determined to achieve success at all costs, and is immovably steadfast in the pursuit of its high national aim of securing our industrial regeneration.

In the meanwhile, we must depend for our immediate progress on our resources as they now exist. Our merchants are indeed mostly ignorant of the intricate ramifications of modern industrial conditions, their vast extent, and the foundation on which they ultimately rest. Happily there arise now and then above our economic horizon a few persons of the towering eminence of the late Mr. Jamsedji Tata; and commercial enterprise on a considerable scale has existed in Western and North-Western India from time immemorial. Our traders have penetrated into East Africa, Persia, Turkey, and eastwards into China and Japan. Merchants of Gujerat have recently gone to England and opened agencies there for the purchase of British machinery and mill-stores. Hindu pearl merchants have lately established firms in Paris and London. The Indian Specie Bank of Bombay has quite recently opened a Branch under Indian management in the heart of the British Empire. It is to such agencies that we must look for the immediate help that we require in the shape of commercial enterprise.

CAPITAL.

Next to the want of commercial enterprise and industrial knowledge, the thing that stands in the way of our industrial

growth is the absence of the requisite capital. Nay it may be asserted that the want of capital is now our chief desideratum. It is true that the capital now employed in our cotton industry amounts to nearly 30 *crores* of rupees. But if we remember our final aim, viz., to clothe ourselves wholly with home-made fabrics, we must confess that we have only made a fair beginning for a general regeneration of our industry. The great problem awaiting a practical solution is that of raising the necessary funds.

The question admits of a satisfactory solution, provided our best minds apply themselves to the task. The Rupee debt of the Government of India held in India amounts to Rs. 105 *crores*; and of this Rs. 55 *crores* are held by Indians. It may not be possible to divert all this into the channels of trade and industry, but even if we could secure for the latter purpose $\frac{1}{4}$th of it, say Rs. 14 *crores*, the impetus imparted to our industries would be very great. It is to be wished that Indian publicists will earnestly endeavour to create a public opinion in favour of the diversion. That it is quite within their power, I have no doubt. The higher returns of trade and industries ought to prove a strong argument in favour of the change.

There is another and a cognate source which may well be tapped by our enterprising men. The amount deposited in the Postal Savings Banks was for the year 1904-05, Rs. 14 *crores*. Nearly 13 *crores* out of this sum were purely private Indian savings. Now if we could succeed in getting even a half of this sum, say Rs. 6 *crores*, for our commercial purposes, an amount of strength would be imparted to our industrial activity, of which we have at present no adequate conception.

The best way of fulfilling the latter purpose, as well as that of getting at the money now locked up in Government Promissory Notes, would seem to be the establishment of Banking insti-

tutions all over the land. Efforts on a small scale have already been made, notably in Poona, Ahmedabad, Benares, Lucknow, Lahore and other places. But these are tiny beginnings of very large potentialities. There is no reason why every town of importance should not have a Bank of its own. These small institutions may establish connections with the bigger ones at large commercial centres, and the whole capital of the country will be thus utilised to the best advantages.

It may be here stated in passing that it is not at all a difficult thing for men of character to inaugurate such establishments. In fact, the great thing to be remembered is that there is no department of business for which Indians of the middle classes are better fitted by heredity, and past traditions, than that of Banking. Practical Bank management requires just those qualities in which we excel and which we have cultivated for generations, viz., patience, calculation, foresight, thrift and the like. We have further a natural advantage over our foreign rivals in this respect, viz., we possess an intimate acquaintance with local conditions, and with individual solvency.

A satisfactory beginning has already been made as regards large Banking institutions. Bombay has started two large Banks; Madras has launched its National Bank and Calcutta is following in the wake. These institutions have already proved of great value to trade; our Indian genius for banking is so far full of promise. We want now a network of small Banking establishments which will act as feeders to the bigger Banks. One of the principal functions of these small Banks will be to inspire confidence in the poorer population, and to attract the sums that now lie idle or concealed underground owing to distrust and ignorance. Education alone can finally remove the

economic blindness which favours hoarding. But small well-managed Banks can do a great deal in the meanwhile.

It is clear, however, to all who take a comprehensive view of the present industrial situation, that Indian productive industry requires more capital than all the ways just mentioned can be expected to secure. The question arises, whether we should resort to foreign countries for loanable capital, or prefer to wait till our resources grow equal to our wants. There is a strong feeling among a section of our people that foreign capital should be shunned. Similar was the feeling of some Japanese patriots formerly. The sentiment is natural. But our interests require that we should look at the matter from a purely business point of view. From this standpoint, the only reasonable rule of conduct to follow is that we should freely borrow money of foreigners for industrial purposes. The Government of India has been long doing this for railway construction. Very powerful nations go to the markets of London and Paris for war loans, or for naval construction, and also for industrial development. There is no reason why we should not do the same.

The Honourable Mr. Vithaldas, my worthy predecessor in this chair, urged the same view. "We cannot," he said, "do "without foreign capital. It will be extremely short-sighted to "reject it on sentimental grounds. We must avail ourselves "of it, but we must take care that we do not pay for it more "than other nations." This is sound advice. In this respect we might follow the example of our fellow-subjects of Canada. Patriotic Canadians welcome the advent of American brains and money in the development of Canada; but they naturally prefer that the work now being done by the capitalists of the United States should be shared in a vastly greater degree than now by those of their own countrymen who have money to invest.

THE SWADESHI MOVEMENT.

The new propaganda termed the *Swadeshi* movement requires some remarks. The aim of this movement is the establishment of new industries in India, by means of Indian capital, if possible, so that the Indian people may be, as far as is practicable, self-contained and independent of the foreign imports that now flood the land.

The justification of the movement consists in the fact that the country has been impoverished during the last century by the inroads of outside manufactures on its old industries, so that it is now unable to supply its population even with the necessaries of life. The foreign goods now imported are not, economically speaking, indispensable. The materials of many of them are produced in the country, and an ample supply of labour is ready to hand. The *Swadeshi* movement ultimately seeks to call into existence the directing capacity, the technical skill, and the requisite capital, so that our own labour and money may convert our raw materials into the commodities which we now import.

There is a general consensus of opinion that the endeavour to establish new industries in India is very laudable in itself. The Government of India favours it. Every new factory established, every banking institution created, every steamship launched, is hailed by men of all shades of opinion. Scholarships for obtaining technical instruction outside the country are given, to a small extent, by the Government of India, to a larger extent by public bodies and public spirited citizens, while many enterprising and high-spirited youths go abroad at their own expense to acquire high technical proficiency. So far there is no radical difference of opinion.

Honest and patriotic men all over the country are trying their best to induce our countrymen to abjure the use of foreign

goods altogether, in favour of indigenous ones of the same description. These earnest efforts, which are gradually spreading over all parts of the land, are viewed differently by different persons. So far as the methods are accompanied by unlawful acts of violence and intimidation, they deserve to be severely condemned. But unlawfulness apart, there is nothing in them that any honest man can seriously object to. The economic ideas of men differ in many points and a difference on this one is allowable. But no candid man ought to stigmatise these patriotic efforts as dishonest. They are perfectly legitimate.

But the statement may be ventured that even, from an economic point of view, they are not only justifiable but urgently needed. The protection of new or nascent industries by means of high import duties, and by bounties is held to be allowable by some of the highest authorities of the free trade school of Political Economy. If the State in India had been identified in economic interests with the Indian people, some measure of protection might have been adopted by it long ago. But the Government of India being the representative in India of free trade, Britain is not at liberty at present to afford economic protection in any form to Indian industries. The people of India ought, therefore, to step into the vacuum, and do by *voluntary protection* what the State might have achieved in an easier way by tariffs and bounties. Thus the *Swadeshi* propaganda is, in essence, an endeavour to reinforce the cause of Indian industries by enlisting the Indian patriotic sentiment on its behalf. It is difficult to see how any objection can exist against such a move. Organised voluntary efforts are specially needed now in all departments of national activity. The *Swadeshi* movement is the application of this principle to that of national industrial regeneration.

In finally determining the utility of the movement our view need not be restricted to the free trade formulæ of English economists. Almost all the independent nations of Europe and America are at the present day encouraging their own industries by means of high tariff barriers and bounties. Germany and America are the two most prominent instances before us. Why should not Indians do by voluntary effort what these two nations are doing by the collective action of their States?

That this line of conduct is correct is proved by actual experience. The Finance Minister in his Budget statement last March recognised that the *Swadeshi* movement had resulted in the contraction of imports of cotton goods to the tune of more than a *crore* of rupees, indigenous manufactures having replaced them. An impetus is given to the handloom industry in Bengal and elsewhere, such as it had not felt for nearly a century, and large numbers of our countrymen have obtained a living thereby. There is an all-round industrial revival due to the *Swadeshi* propaganda. Fifteen Banks with a total capital of nearly 4 *crores* have sprung into existence. Five navigation companies with a capital of 121 *lakhs* have been started. 22 new cotton mills with a capital of nearly 2 *crores* have been established. Two jute mills, several oil-pressing mills, sugar factories, and mining and mineral companies, besides many that are not known, have been launched. (These figures are taken from R. B. Lala Baijnath's speech at the U. P. Conference.) In the department of cotton spinning and weaving, the number of spindles has risen from 50 to 60 *lakhs* and of looms from 45 to 60 thousand. These gratifying results are largely attributable to the *Swadeshi* propaganda, and to the *Swadeshi* spirit which it has aroused. In the face of these results, it is not reasonable to cavil at the *Swadeshi* movement.

There are well-meaning people who urge that the propaganda imposes an extra burden on the poor, or that it deteriorates taste and workmanship. Now, it is not always true that any extra burden is suffered by our poorer countrymen on account of the *Swadeshi* movement. In several cases, the propaganda has been only the means of advertising widely Indian goods of admirable quality and cheapness which were languishing for want of support. In some cases the preference for our own goods has indeed implied a small and often imperceptible sacrifice. But all protection implies such a sacrifice. When a State imposes a high tariff against foreign imports to bolster up a nascent industry, the sacrifice is equally real. Why should it be grudged because it is voluntarily borne? As to taste and quality, it is not always the case that the Indian article is inferior to the foreign. Often the reverse is the fact. The element of durability again is generally in favour of our products, and often goes far to counterbalance the loss in point of superficial finish. Lastly, there is no ground for the fear that patronising crude articles will cause a permanent deterioration of our workmanship. Such patronage can, at the best, be very temporary, and competition among our own producers is bound, in the long run, to keep up the quality. The poor ultimately gain by the extended employment that arises for their labour.

Of the four elements of national manufacturing prosperity, viz., raw materials, technical skill, capital, and demand, the demand is the dominating factor which gives direction, shape and substance to productive activity. Now, our resources in raw materials are abundant. Technical skill can be created gradually, and for our immediate purposes we can rely upon importing it from outside. I have already dwelt upon the question of augmenting our capital. As to demand, it is very extensive in

India. Thus all that is necessary to do at present is to make the demand flow in such a way that it may fertilise native industries instead of foreign ones. All the foremost nations of the world are endeavouring at present to get wider and wider markets for their goods. Their political action is largely governed by this policy. In their mutual jealousy and competition they insist on an open door for all—notably in the vast Asiatic countries. The ordinary weapon used by these nations, is that of making their goods cheap to the consumer, of lessening the cost of transport by subsidising shipping lines, of practising economies in production and utilising scientific inventions. They rely in the last resort on an appeal to the *avarice* of the foreign consumer.

Now, it is permissible to inquire why a nation situated like ours, and deprived of all means of enforcing its will by collective action, may not seek to extend its industries by appealing to a higher sentiment than avarice, viz., patriotism. Even royal personages have commended such an appeal and enforced it by their example.

RAILWAY TRANSPORT.

The question of a cheap and quick transport of our manufactured goods and machinery from one part of the country to another has not received the attention it deserves. It is, however, of vital importance to the growth of our industries. The utter collapse of the carrying capacity of the principal railway lines last season is fresh in our minds. It caused enormous losses to traders and producers and a serious dislocation of all commercial arrangements. A sufficient supply of rolling stock on each line is a *sine qua non* of railway efficiency, and ought to be insisted on. Smooth working arrangements for interchange of waggons between

the various lines are also badly needed. The railway staff ought to be imbued with the spirit of business. The Railway Board has succeeded indeed in effecting a few minor improvements, but is still far from coming up to the expectations of business-men. The delay in the despatch and handling of goods after arrival are often scandalous. For example, it generally takes 8 days before goods loaded in Bombay reach the hands of the consignees at Ahmedabad, which is only 300 miles from Bombay. The loading and unloading arrangements at bye-stations are defective, and add to the delay. Mr. Morley made a boast that the railway rates in India are very cheap. They may be cheap. But there is great room for improvement still. Now it costs nearly 15 Rs. (all charges included) per bale of yarn or cloth sent from Ahmedabad to Cawnpore or Calcutta; while it can be sent to the latter place by rail and sea combined for nearly half the sum. The railways yield a large surplus revenue after deducting interest and wear and tear of the fixed capital. Why should not this surplus be utilised to reduce the freight charges on all internal manufactures? A reduction in freights acts on trade like fresh capital or a new market. It is as new blood to a living organism. It is by cheap and quick transport that America has achieved her industrial pre-eminence. Indian manufactures need very cheap freights and rapid transport. I would commend this point to the earnest consideration of the Conference.

UNIFORM WEIGHTS AND MEASURES.

Somewhat akin to the question of cheap railway freights and quick transport is that of having for the whole country a common currency, and common weights and measures. The existence of important Native States, some with a standard coin of their own, accounts for the difficulties that confront us in the

way of getting a common medium of exchange. Political considerations are here interwoven with the economic problem. Maharaja Sayaji Rao of Baroda has generously adopted the British coin; and it is to be hoped that equally broad views will influence the counsels of Gwalior, Hyderabad and the Rajputana States in this important matter. It is the poor people of the Native States and travellers that suffer most from the existence of a separate local currency. There is less reason, however, for maintaining the present confusing labyrinth of weights and measures. Big traders can always protect their interests; and it is the poor and the ignorant that suffer most. The necessity of developing the domestic commerce of our vast country makes the question of a common currency and common weights and measures one of national importance.

AGRICULTURAL INDUSTRY.

I will now, with your permission, proceed to offer a few remarks on some of our leading industries, and among these, Agriculture first demands our attention. It stands at present at the head of all our other industries. An extension of purely industrial occupations will no doubt reduce its relative magnitude. But it will be a long time before its place becomes secondary, as in England. It behoves us, therefore, to pay special attention to it. The greatest impediments to its growth are—(1) the ignorance of the peasant; (2) his heavy indebtedness; (3) the irregularity of the rainy seasons; (4) the absence of irrigational facilities; and (5) the land policy of the Government. The charge of blind conservatism brought against our cultivator is not fully justified. He has always shown a readiness to produce crops that pay him best, and due regard being had to his indebtedness he cannot be expected to do more. The Government of India have of late taken some steps to improve the returns of agricul-

ture. But, as usual, they have begun at the top instead of at the bottom. Something more is needed than having big central institutions or associations. Big central associations have failed in Bengal and cannot expect a better fate elsewhere. The theory that knowledge will filter down to the peasant in his village from the central institution or bureau is not supported by actual experience. There are thick impervious strata intervening, which prevent the desired percolation. The villager ought to be approached in his home and placed in possession of the knowledge which he lacks. For this village committees should be formed, and model farms ought to be established for every small group of villages. Trained Indian experts ought to be brought into direct contact with the peasant. Lastly, the interposition of the Revenue agency ought to be sedulously shunned. As regards the peasant's indebtedness, a further expansion of the Co-operative Credit Associations ought to be encouraged. In the matter of irrigation, large works are good in their way, but the old system of having a good storage tank for every village deserves to be revived. Free education, and that of the right sort, must be placed within the reach of the agricultural population. Finally, the present land policy of periodical settlements must be abolished, and a permanent land tax ought to be fixed.

THE COTTON INDUSTRY.

The cotton industry is next in importance, but stands on a different footing altogether. We get almost all the raw material for it in our own country, and spare some of it for foreigners. Egyptian and American cotton is now annually imported in small quantities, and these imports will increase during the present year. The cultivation of the new Sind cotton promises, thanks to the liberal initiative and help of the Bombay Government, to give great impetus to our staple industry. Our Mill-

owners' Association may fairly be expected to show a practical appreciation of the efforts of Government by offering prizes to growers of long-stapled cotton in other parts of the country. Meanwhile, it is agreeable to note that the cotton industry is now on a firm basis, though we are yet far behind our legitimate place in the production of cotton fabrics. The system of paying the managing agents huge commissions calculated on the outturn alone is happily getting into public disfavour, and a more sensible one is gradually taking its place. The labour supply is unsatisfactory from a variety of causes, plague being the main one. The public can now justly demand that the excise duties on cloth which have trebled during the last 10 years and now amount to nearly 30 *lakhs* of rupees per annum should be abolished. The increasing revenue from excise on cotton cloths involves a new danger to the industry to which the attention of all publicists might be invited. At present the interests of Lancashire form the sole pretext for the impost. But if the revenue from it grows at the present rate, considerations of finance are likely to be utilised for its continuance. It will be said that the amount is too large to be at once remitted. This is an additional reason for taking concerted action now to get this obnoxious tax removed. At the same time we have a right to expect that the industry shall not be allowed to be threatened with new artificial restrictions on any grounds whatever. Whilst on the subject we must thankfully acknowledge that the composition of the Factory Commission now sitting is quite satisfactory. We may be permitted to hope that the interests of India alone will dominate its final recommendations.

IRON, COAL AND MANGANESE.

It is a pleasing feature of the new industrial spirit that Indian merchants are turning their attention to the mining of

coal and manganese. It is gratifying that recently a few coal and manganese concerns have been launched by Indians with Indian capital. Ignorance had hitherto hindered our progress. To ensure future progress it would be well if steps were taken to train Indian experts in Geology, Mining and Metallurgy. The suggestion put forward last year by the Hon'ble Mr. Vithaldas, viz., that all companies formed outside India for mining should be compelled by Government to reserve a portion of their stock for Indian investors, is worthy of consideration. The difficulty lies in the fact that rich foreign capitalists are satisfied with a smaller return than Indian investors, and that the latter generally fight shy of uncertain investments. The Tata Iron Works mark an epoch-making advance in mining and metallurgy, and are pregnant with very far-reaching results.

THE SUGAR INDUSTRY.

The United Provinces of Agra and Oudh supply half the home-grown sugar. But it is now becoming clear that our sugar production is losing ground in competition with that of Java, Mauritius, and Germany. The *Swadeshi* agitation is trying to enlist the religious scruples of the people in favour of native sugar, but the practical question of extending the indigenous industry remains unsolved. Perhaps Mr. Hadi's new way of making sugar may aid in the solution. More irrigation works may hasten the desired result. The difficulty of getting sugarcane all the year round is at the root of the question. It is not easy to suggest a remedy. The refinement of molasses, however, pays fairly well, if the manufacture of rum as a bye-product is permitted by the State. Our patriotic countrymen are, however, in earnest, and Madras is going to have a sugar factory soon.

JUTE AND SILK.

The jute and silk industries are at present confined to Bengal, but the jute mills are financed and managed by Europeans. We, on this side of India, are unable fully to understand the latter phenomenon. There is no reason why awakened Bengal should not claim a share in this thriving industry. In the article of silk, Bengal has a practical monopoly, though Kashmir is preparing itself to enter the lists. Praiseworthy efforts are made in Mysore to produce silk on a commercial basis. Mahraja Sayaji Rao, the enlightened ruler of Baroda, has taken the question in hand for the benefit of Gujerat. A Deccan Brahmin who has returned from Japan after studying sericulture in all its branches has, it is stated, started a small and successful factory of his own in the Konkan. It is to be hoped that his bold example will find enterprising imitators elsewhere.

LEATHER AND PAPER AND OTHER INDUSTRIES.

The leather industry is gradually spreading, though no impression seems to have been made on the imports as yet. The efforts of Mr. Chatterton, of Madras, in this direction are deserving of great praise. But the field for leather manufactures is still very extensive, for we export skins and hides of the value of Rs. 14 *crores*. A factory at Navsari and another at Bombay, both lately started, are doing good business. There is no reason why every province should not have a leather factory of its own. The new Alembic Chemical Works at Bombay mark a valuable departure, which is pregnant with important results in the immediate future. The glass works at Umballa, Dehra Dun and Bankipur are among the offspring of the new *Swadeshi* spirit in British India. Cheap railway freights are especially necessary in the case of

glassware. Enamelled ware and pottery have been taken in hand by patriotic Bengali gentlemen, and the Victoria Technical Institute at Bombay trains young men in enamelling. Surgical tools of excellent finish are now produced locally in Bombay and sold at a reasonable price. A tobacco factory near the same place must be reckoned among the progressive works of the year. There is, of course, abundant room for these industries all over the country.

HOME INDUSTRIES.

The question of creating home-industries for our rural areas is one deserving of serious consideration. For more than 6 months in the year almost the whole agricultural population of unirrigated tracts is absolutely without any employment. It might greatly improve their material condition if some handicrafts suitable to their needs could be successfully introduced into our rural areas. The handloom may answer the purpose in many cases. Knitting and lace-making also suggest themselves. The matter is very important, and suggestions or papers dealing with it ought to be invited.

EDUCATION.

No review of national industries can be complete without a reference to the subject of Education. I have touched upon the deficiency of the labour supply for factories. Agriculture makes the same complaint. Plague is no doubt one of its principal causes, but there are others of a deeper kind. The labourer in the principal industrial centres gets higher wages than he can dispose of according to his present ideas. He is, very ignorant and his wants are few. He squanders a considerable proportion of his earnings on liquor and also on flimsy foreign finery. If he still has money left he deliberately absents himself from work till his pocket is

again empty. In the meanwhile, his dwelling continues to be insanitary, his load of debt remains undiminished, and his food also remains the same as before. It is absolutely necessary, if his condition is to be really elevated, that he should receive a sound elementary education. It is the duty of the State as well as of the rich to provide this as extensively as possible. From an industrial point of view, it is as much needed as from any other. The quality of this ought to be such as will make him physically robust, and mentally and morally equal to his foreign competitor.

The need of technical education on a broad scale is now equally acknowledged. The Government might be reasonably expected to take the lead, but the question is a national one and the whole nation ought to combine to provide it. It is our own problem, and we should apply our shoulders to the wheel to bring about the desired result. The difficulty of getting the funds is not so great as is imagined. How to begin is practically a more difficult matter than the raising of funds. Each province, in fact each district, ought to decide the lines of industry for which it will provide industrial and technical training for itself. Bengal, for instance, might select the industries of silk, jute, tea, and indigo; the United Provinces sugar, glass, and woollen manufactures; Bombay cotton, and woollen, and so forth. The manufacture of leather ought to be taught in all the provincial schools. Similarly mechanical engineering, electrical engineering, and industrial chemistry might form the subject-matter of instruction in all our technical schools. The point to be constantly kept before the eye in all these endeavours is that there ought to be a living connection between the technical school of a district or province and its actual or projected industries. When each province has at least one technical school of its own it will be time

to think of a big and all-embracing polytechnic institute for the whole of India. Further, all industrial progress ultimately depends on scientific knowledge. It is to be hoped that the Tata Research Institute will serve as the head reservoir that will perpetually replenish all the technical institutions of the country with the freshest achievements of science and art.

The requirements of the productive industry will be met by a provision for a course of education as just indicated, but to complete our national equipment industrially, a school or college providing a full commercial course is very much needed. Among the subjects that may be taught in such an institution may be included national and cosmopolitan political economy, private and public international law, commercial law, the commercial policy of the leading nations, one or two foreign languages, commercial and political geography, and statistics of trade and commerce, agriculture, manufactures, and mining; and lastly currency.

CONCLUDING REMARKS.

The usefulness of this Conference is now placed beyond question. It effectually focusses the interest of the public in our industries which are a matter of vital importance to the whole nation. The very able papers written by gentlemen possessing special expert knowledge which this Conference has been the means of evoking, form by themselves a mine of valuable information. The Directory of Indian Goods, which may be claimed as the special work of our indefatigable Secretary and his staff, is a production of great practical utility. By making it the medium of advertisement for our producers and *Swadeshi* consumers, its scope will be greatly enlarged. The exhibition of Indian products, which has been abandoned this year for unavoidable reasons, will, it is hoped, always form an adjunct to our

annual gathering. It is a question whether the annual exhibition may not be taken up by the Conference, of course with the help and active co-operation of the Congress Reception Committee. The idea that the Exhibition is a mere show is not borne out by facts. Producers exhibiting their goods have obtained a degree of publicity for them which would have been otherwise hardly attainable. Further, it makes the materials for a comprehensive directory of Indian goods easily accessible. While a considerable proportion of the visitors must be sight-seers, there is always an important but increasing minority who benefit by it even commercially. A few foreign rivals may perhaps derive advantage from it. But industrialism is now an international race, in which the fittest will win. At the same time, we are always ready to adopt suggestions for making it widely beneficial.

It will be well if each separate province is able to have its Industrial Conference as the United Provinces had lately. There is much that is common to all the provinces, besides certain matters that are more or less local. It is for the National Industrial Conference to deal with the general topics, and also to offer suggestions even to local Conferences.

While the lines of work hitherto pursued may be continued with advantage, it will arouse and sustain general interest, if practical aims are associated with our labours. The prizes for an improved handloom are very appropriate. The Conference may similarly encourage the acquisition of specialised practical knowledge in directions suggested by those who are in touch with industries. The encouragement may take the shape of scholarships, of prizes for proficiency in advertised subjects, or for monographs on particular industries that now await practical action. For these and other purposes that may be named, large

funds are needed. Is it patriotic to wish them to come from outside sympathisers ? *Can* they come from other people ? Has any nation ever been industrially regenerated by external help ? There are many here who, I am sure, would proudly spurn the idea of receiving such assistance. Let us never forget that nations are made by themselves. In this as in all our other activities, self-help and self-sacrifice ought to be our watch-words. Let every patriotic Indian who feels the existing poverty of his country honestly contribute his mite, and exert his best to get others to do the same. To quote His Highness Maharaja Sayaji Rao's words : "To help in the industrial movement of the present day is a duty which devolves on all equally." Let us then earnestly act in this spirit, and ample funds will be always at our disposal.

THE SCOPE AND METHOD OF AN INDUSTRIAL SURVEY.

BY

A. C. CHATTERJEE ESQ., I. C. S.

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The organisers of this Conference have done me the honor to request me to contribute a paper on the need of an Industrial Survey. It has seemed to me, however, that it would be supererogatory labour to expatiate before the members of this Conference on the necessity of an industrial survey of the different parts of India at the present time. The need has already been emphasised by many conferences and associations. Much attention has also been devoted to the subject by the imperial and the various provincial Governments. At the instance of the Government of India a series of industrial monographs containing a great mass of valuable information has been compiled and published in each province. Many years ago, under the directions of the Madras Government, Mr. Havell collected and published some very instructive notes on the many indigenous industries of that Presidency. Within the current year the present writer has been commissioned by the Government of the United Provinces to conduct an industrial survey. A similar appointment has recently been made by the Central Provinces administration and I believe the Government of Bengal is taking steps in the same direction.

Much misconception, however, exists in the popular mind regarding the scope and method of an Industrial Survey. According to some only the indigenous or hand-industries should

come within the purview of such an inquiry. Others again would limit it entirely to art industries. A great many persons appear to be of the opinion that the government should publish a list of articles manufactured in each town and District with the names of the manufacturers or their agents so that it might be easy for dealers or ardent Swadeshis to ascertain whence their needs could be met. Another class of persons desire that the technical processes of the various industries should be carefully studied and described for the the benefit of those who desire to start such business themselves. It is hardly necessary to point out that it is beyond the capacity of any individual to conduct a survey of the kind last indicated. The industrial monographs referred to above partly meet the want. It has, however, to be borne in mind that in all progressive industries, the processes are constantly undergoing change and where they are stationary, the industry is either in a stagnant or in a declining condition. A monograph published to-day will not be of every much use ten years hence. Nor is it a legitimate function of the State to publish a trade directory of the sort asked for by many people. Directories already exist for all industries conducted on European lines and it ought to be possible for private enterprise to supply the need regarding indigenous industries, art or otherwise. Such a directory will have to be published very year or at very frequent intervals. It may also be observed that a Government publication may do serious injury to interested parties by the omission or inclusion of particular names.

We are thus confronted with the question what should be the aim of an industrial survey. To my mind its ultimate object ought to be to indicate the economic possiblities of the province. Briefly, we should study the resources of the Province in soil and raw products, labour both skilled and unskilled, capital, communi-

cations and facilities for trade. We have then to ascertain the wants of the people in the shape of finished articles, or in economic language the demand that exists among consumers. The surveyor has then to endeavour to find out whether the demand is or can be locally met, and also to suggest what would be the best method of utilising the surplus raw products of the province.

I may be permitted to go a little more into detail. In studying the industrial condition of a tract, it is imperative to take stock first of all of the raw products, both actual and potential. Such products may be either mineral or agricultural. Thus in the plains of the United Provinces we find there is neither coal nor any metal such as iron, tin, or manganese. We may therefore at the very outset neglect the feasibility of organising industries like the iron works initiated by the illustrious Mr. Tata. On the other hand it will appear that there is lime in many places and there are extensive tracts producing the saline efflorescence known as *reh* as well as sajji (a crude carbonate of soda largely mixed with sulphate of Soda). The question at once presents itself why caustic Soda is not manufactured out of these products. Again for cotton, a dry well drained soil is usually considered necessary. Very little cotton is grown in Eastern Bengal, and one studying the industrial possibilities of that province would be wise to exclude from immediate consideration the desirability of organising on any large scale the industry of cotton spinning. His time will be for the present fully taken up with the solution of the problem why the jute grown at home cannot be locally converted into fabrics instead of being exported to Calcutta, Dundee and New York. Again the forests in the mountainous regions of the United Provinces have large tracts of pine trees. In an

industrial survey the point will arise whether any industrial use can be made of these trees, for instance, in the manufacture of turpentine or as wood for matches.

The next point to bear in mind is the labour supply. In many industries it is the most serious difficulty of all. Attempts have been made in various parts of India to manufacture glass according to modern methods. Most of these attempts have ended in failure. In some cases the want of success is partly attributable to an injudicious location of the industry at a site where raw materials were not available except at prohibitive prices. In all instances of failure, however, the chief cause of disaster has been the want of skilled labour both superior and inferior. Nor is the question of unskilled labour unimportant. Perhaps the best site for a wood pulp factory in the United Provinces would be in Jaunsar Bawar in the hilly part of the Dehra Dun district, where spruce and silver fir trees are found in abundance and water power will also probably be available. Intending capitalists will, however, have to consider very carefully the question of labour supply; for the tract is very sparsely populated.

The question of capital can never be neglected in an industrial survey of any part of the country. Each industry will have to be considered in detail and a careful study will have to be made whether production on a large scale is necessary or mere hand-power will suffice. For hand industries, the great difficulty of the industrial or cottage worker is that he lives from hand to mouth and has not enough capital either to buy his raw materials or to be able to stock a sufficiently large quantity or variety of goods to take full advantage of the selling market. He is therefore altogether in the grip of the money lender. I have no desire to disparage the function of the

money lender in the economic organisation of a country, but where you have to compete with foreign goods produced on an enormous scale, the interest on capital being merged in profits, it will be difficult to hold your own with the present system. A very large extension of the co-operative movement is necesary among the industrial population of this country and my humble opinion is that there are greater possibilities in industrral co-operation than even in agricultural co-operation.

The question of co-operation is also intimately associated with the organisation of trade in other respects. Many of our smaller industries are at present languishing for want of adoption of modern methods of advertising and marketing. There is no agency whatever for placing the producer in touch with the consumer. Tastes are continuously varying among consumers. Our craftsmen suddenly find that a particular stuff that had a great sale is a glut in the market. There is no one to tell them what is the style of goods which is now in demand and what articles the craftsmen should produce to suit the altered conditions of the trade. In an industrial survey an attempt should be made to determine if any such agencies can be established for the different industries. I need hardly say that in a matter like this a very great deal can be effected by a non-official organisation like the present Conference and smaller societies affiliated to it.

Facilities of communication cannot also be excluded from the purview of an industrial survey. For every industry you must see that all the raw materials are easily procurable and that the finished commodities can be economically transported to the market where the best prices are obtainable. Thus, to take the example of a match factory again, the ideal location

will be in the heart of the forest where the raw wood is most abundant. You have, however, to think of the cost of carriage, not only of the machinery and chemicals that will be necessary (coal may be neglected as wood fuel will probably be available) but of the finished matches to the large entrepots. One of the most interesting and difficult questions that have cropped up in connection with my inquiries in the United Provinces is that relating to Railway freights. Many of the existing industries complain that it is hopeless for them to find a market for their produce in the large towns on the seaboard because railway freight even at the lowest rates over long distances in the country is higher than sea freight from competing countries like Japan and Germany.

So far I have dealt with the problem from the point of view of production. Reference, however, must be made to the question of consumption. I think in the present stage of our industrial development it may be taken as an axiom that our first endeavour should be to manufacture for the home market. A full discussion of this point will involve references to cost of carriage from one country to another, protective tariffs and other matters that are not immediately relevant.

A glance at the trade returns of India will convince anyone that there is a considerable leeway to make up in the home market before thinking of foreign markets. We should therefore carefully analyse the traffic returns of the province and observe what articles at present imported from outside could be manufactured with raw materials obtainable locally. About fifteen years ago the importation of cigarettes into India was limited to high grade and expensive tabacco. When the Government of the United Provinces decided to abolish the tobacco farm at Ghazipur, it was because locally grown tobacco was not

suitable for the manufacture of superior cigars and cigarettes. As everyone knows there is now a very large consumption in the country of very cheap and inferior cigarettes. As a result of an industrial survey inquiries will have to be made whether the tobacco grown in different parts of India can be utilised for the manufacture of this style of cigarettes. Again large imports take place every year of varnish for various purposes. The materials for the manufacture of varnish exist in the country in the form of lac and mahwa (*brssia latifolia*) flowers as a base for the distillation of industrial alcohol. The industrial survey we contemplate will raise the question whether varnish cannot be economically manufactured in the country.

It will be found after a cosideration of the traffic returns that many of the raw products of the province cannot be sufficiently utilised to meet the demand of local consumers. The United Provinces in a normal year produce more wheat than the people of the province care to consume. Some of the wheat is exported to Calcutta and Rangoon and is there milled into flour. It should be one of the points for study in an industrial survey what are the obstacles to the milling of the flour locally and its export—the industry of milling will not only employ local labour but retain for local consumption the chaff—a valuable cattle food. Similarly enormous exports have been taking place in recent years from the cotton districts of India of cotton seed to Europe. There the seed is crushed, the cake is utilized as cattle food or manure and the oil is consumed for soap as well as edible purposes. In an industrial survey, the question of the export of cotton seed will naturally be discussed and it will be for agricultural and industrial experts to decide whether if cotton seed be crushed locally, a home market cannot be found for cake or oil or both, otherwise whether it will not be more

economical to employ local labour and export the cake and oil instead of the raw seed.

I have now indicated briefly what may be considered to be the scope of an industrial survey of any part of this country. It will be seen that the work cannot be accomplished in a hury nor without the co-operation or collaboration of a large number of people. Whoever is entrusted with the compilation of the central data will have to delve deep in the large mass of Government publications, like census reports, provincial and imperial trade and traffic statistics, district gazetteers, industrial monographs, scientific publications like agricultural ledgers and bulletins, reports of the scientific departments, and last though not least the monumental Dictionary of Economic Products of Sir George Watt. He will need to make a close study of the principal markets and trade centres of the province and he should have a knowledge of the smaller marts as well. He will have to spend many days in the industrial centres, both for the large and the small industries. He must be in touch with the capitalist as well as the labourer and able to appreciate the difficulties of both. In the end he can make mere tentative suggestions which actual business men only can test and accept or reject. In such an undertaking he needs and merits the help and assistance of all interested in the industrial welfare of the country.

THE COAL MINING INDUSTRY OF INDIA.

BY

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The earliest records of Coal Mining in India come from Bengal and it is the vast deposits of this valuable mineral in Bengal which to-day is responsible for $\frac{7}{8}$ths of the entire output of the country. Valuable deposits are also worked at Singareni in the Madras Presidency and also at Margharita in Assam, but in the former case the quality does not approach the best qualities of Bengal and in the latter case the Coal although of a high quality is so crushed by geological changes in the strata as to lose much of its value. The latter Mines are also distant from the great Commercial centres and from the sea-board. It is therefore mainly the development of the Coal Fields of Bengal that is responsible for the great progress made in Industrial and Railway enterprise in India. The History of the Bengal Collieries as revealed in the Records which have come down to us reads like a romance. The Raneegunge Coal Field was the scene of the earliest operations and in the neighbourhood of Raneegunge itself the Seams of Coal are in such profusion, of such thickness and so readily accessible by reason of their slight inclination and proximity to the surface that their working in the early days of the last Century proved a comparatively simple task for the untrained worker. It is impossible to avoid the conclusion that these rich deposits have been so placed in order to suit the primitive conditions of the Country and the Native Worker.

The Records of the oldest Company now working extend back to 1827, and it was about this date that Capital was brought in to work the seams of Coal on a systematic plan. All Bengal Collieries are worked on what is known as the pillar and stall system by which Coal is left in pillars to support the roof, these pillars being eventually taken out and the surface allowed to fall in. The development of Coal Mining in India has been greatly encouraged by the interest taken in it and the practical assistance given by the Geological Survey Department of India. India has been fortunate in securing a long line of eminent Geologists who have worked quietly but with far-reaching effects towards the development of the Mineral Resources of the country. In the old half-yearly Reports of the Bengal Coal Company an interesting report is recorded over the signature of Thomas Oldham (Geological Survey of India). Mr. Oldham strongly urged the introduction of the panel system as used in the North of England. (See Appendix.). It is a pity that this system is not more in vogue at the present time, as in many of the existing Mines large areas are standing on pillars, and in many cases the area is much too large to be consistent with safety.

Where the Coal is outcropping, Inclines are run into the beds or seams of Coal following the dip or inclination of the seams. As the depth of the Coal from the surface increases, vertical shafts are sunk, and the depth of these shafts varies from 80 to 600 ft. Most of the Modern mines are equipped with Machinery and Plant of an up-to-date type and in at least one Colliery electrical underground haulage and pumping has been stalled with excellent results. Electricity is so flexible a power that it is destined to play a great part in the future of Indian Mining, and it is with the aid of Electricity that the

Labour problem is about to be seriously attacked. It is strange that in a country teeming with population the main difficulty in the way of increasing the output of Coal, (and thus incidentally retarding industrial and Railway development) is the human factor, but in spite of India's millions, the supply of Labour is woefully short of requirements. It may be that underground employment is not altogether to the taste of every individual, but I fear the real explanation is not distaste for any particular employment but an inherent distaste for Work of any sort. This feature is not confined to the East but where the unit of labour in the East is only 1/5th of the value of his confrere in the West it will be seen that the problem so far as India is concerned is by no means easy of solution. The average outturn of Coal per man per day in the United Kingdom is 2½ tons, in India it works out at ½ a ton, and in America with the aid of Mechanical Coal-cutting plant the average is fully 5 tons. It is natural therefore that great hopes are placed on the introduction of suitable mechanical coal-cutting plant into India.

With improved conditions for the labouring classes of India and the gradual raising of their standard of living, it may be possible to inculcate a desire for greater luxury which would bring with it a desire to earn and save more money.

The Coal Fields are divided geologically into two Series, known as "The Raneegunge" and "The Barakur." The Raneegunge is the younger and the Barakur the older and deeper Series. The Ironstone Shales divide the two Coal measures and the Metamorphic Rocks underlie them, so that the limits of each particular Coal Field is clearly defined.

As regards the quality of Indian Coal a comparison with Welsh Coal will give some idea of the calorific value of the former

The Admiralty Standard of Welsh Coal is approximately as follows :—

Fixed Carbon . .	75
Volatile Carb . .	22
Ash & Moisture	3
	100

Fair average analysis of good Bengal Coal is as follows :—

	Raneegunge Series.	Barakur Series.
Fixed Carbon	54	60
Volatile Carb	34	26
Ash	10	12
Moisture	2	2
	100	100

The striking feature between the Raneegunge and Barakur qualities is the high volatiles and comparatively low fixed carbon in the former as against the high Fixed Carbon and comparatively low Volatiles in the latter. The competition for popularity among consumers between the two grades of Coal is very keen, the high volatile coal being very suitable where rapid steam raising is essential. The above are merely proximate analysis of the Coal. It is in the ultimate analysis that a close comparison of the respective values can alone be made. Methane or Marsh Gas (C. H. 4) is the most valuable constituent to be desired in Coal for the volatile matter, and so long as the volatile matter consists of "Methane," the more volatile matter in the coal the better it should be. Oxygen is deleterious as it combines with the Hydrogen and forms water. Ash by analysis is generally doubled when actual practical consumption is in question.

The present annual output of Coal for the whole of India is only 9 million tons, of which Bengal contributes $8\frac{1}{2}$ million tons and the Industry employs a labour force of over 100,000 persons. The annual export of Coal from Calcutta averages about $2\frac{1}{2}$ million tons and quite 50% of this is shipped to Indian Ports for consumption in the country itself. With the increasing expansion of the Railways and industrial enterprise the consumption of coal has reached a point which the Coal Industry is finding it difficult to keep pace with, and there is no doubt that this—the finest of all Swadeshi Industries—has a magnificent future before it. With the advent of the Steel Works the potentialities are so great that it would be difficult to forecast future developments with any degree of accuracy. Ship-building would naturally follow the manufacture of Steel plates and India might become the Workshop of the East.

The dormant energy of "Coal" awaits the commands of India's millions and signs are not wanting that a great Industrial awakening is in store for India. If the active energy of this useful commodity is fully reflected in the energy of her people, India will take her proper place among the nations of the Earth. The Orient has slumbered long centuries—

> "She heard the thundering legions pass,
> "Then plunged in thought again."

But "thought" which has been merely productive of further thought is not sufficient. It is in the practical application of thought—its conversion into practical energy—on which the future of the country depends. Will her people rise to the occasion and draw upon the vast fund of potential Wealth and Energy which Nature has so lavishly provided her with? She *can* do so and it is the ardent hope of all well-wishers of India that she *will* do so.

THE ARTS AND INDUSTRIES OF TRAVANCORE.

BY

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According to Ruskin, "Life without Industry is guilt, and Industry without Art is brutality. . . . but beautiful art can only be produced by people who have beautiful things about them, and leisure to look at them." This ideal was understood and maintained long ago in India from the times of the Puranic Rajahs of old.

The arts and manufactures of India which from time immemorial have brought fame and wealth from far off regions have remained the wonder and admiration of the world to this day. Whatever might have been the origin and whatever the uses of the traditionary Arts and Industries of India and their place in the industrial and economic life of her people, there can be no manner of doubt that history has given its impartial verdict in favour of their superlative beauty and excellence of workmanship. Western scholars have not failed to note this fact from a comparative study of the history of India with that of other countries and have given to the world the results of their observation in terms of sympathy and genuine admiration. In speaking of the Indian Arts and Manufactures, Sir W. W. Hunter observes :—

"In architecture, in fabrics of cotton and silk, in goldsmith's work and jewellery, the people of India were then unsurpassed."

Dr. Buist, Editor of the *Bombay Times*, speaking of the history of Indian Industry says in his 'Notes on India' :—

" The carving of its wood work, the patterns, colours and texture of carpets, shawls and scarfs, admired for centuries, have since the Great Fair of the world, been set forth as patterns for the most skilled artificers of Europe to imitate. From the looms of Dacca went forth those wonderful tissues that adorned the noblest beauties of the Court of Agustus Cæsar, bearing in the Eternal city the same designation sixteen centuries ago as that by which cotton is still known in India; and the abundance of Roman coin and relics up to our time occasionally exhumed yet preserve traces of the early commercial connection between the two most wonderful nations in the world—those of the Cæsars and the Moghuls."

This capacity for artistic excellence which has continued to exist more or less to this day is not confined to any particular locality, but is to be found everywhere in India. The indigenous industries are carried on all over the continent. In every village until quite recently all the traditional industries were found thriving. The village community of India was a body corporate in which the artisans played an important part. The whole community was provided for, every man in it had his ordered place and profession. It was the stronghold of the traditional arts and industries. The occupations were hereditary and all persons following the same professions in course of time, crystallised into the several castes. When the arts and industries passed out of the village, the caste system still afforded the best defence against the encroachment of foreign fashions. By its tenacity and exclusiveness, the caste system has preserved the artisan classes from contamination and degeneracy, and the experience of ages gained in doing the same kind of work from father to son in endless chain of succession, has stamped a hereditary capacity for artistic work in our artisan classes. So much so that "the mere touch of their fingers trained for 3,000 years to the same manipulations is sufficient to transform whatever foreign work is placed for imitation in their hands, 'into something rich and strange' and characteristically Indian."

Though the indigenous industries were thus fostered and sustained, it was chiefly through the encouragement given by the ruling princes and chiefs and the cultivated tastes of the common people that the arts of India were brought to perfection. Every native ruler entertained a large number of excellent master-workmen in his palace. They had their salary and their daily rations for their lives from the exchequer and were provided with the materials for their work. It was under such court patronage that the arts and industries grew and attained a high degree of perfection. As was justly remarked by Coleridge.

"The darkest despotisms on the continent have done more for the growth and elevation of the fine arts than the English Government. A great musical composer in Germany and Italy is a great man in society and a real dignity and rank are conceded to him. So it is with a sculptor, or painter or architect.....In this country, there is no general reverence for the fine arts; and the sordid spirit of a money-amassing philosophy would meet any proposition for the fostering of art, in a genial and extended sense, with the commercial maxim *Laissez faire*."

Since the advent of the European nations there came a change over the country; and when the country passed under British rule the overwhelming importation of the European manufactures which followed in their wake worked immense ruin on the hereditary native craftsmen. Under the British rule which secures the freest exercise of individual energy and initiative, the restraints imposed by caste exclusiveness became considerably relaxed to the marked detriment of those handicrafts, the perfection of which depended on the hereditary processes and skill. The foreign rulers of India patronised the European manufactures even at the expense of native industries. The Native rulers and nobles also imitated the ruling class in their tastes and filled their palaces and mansions "with flaming Brussels carpets, with Tottenham-court furniture, with cheap Italian Mosaics, with French oleographs, with Austrian lustres

and with German tissues and cheap brocade." The village artisans neglected by the ruling classes and chiefs and nobles and unable to hold their own against the fierce and merciless competition of the Western manufacturers, were forced to abandon their hereditary occupations and turn to agriculture or mass together in hundreds and thousands in squalid and insanitary surroundings to assist in the manufacture of goods with the aid of machinery recently imported into India.

There can be no question that machinery will eventually kill some of our handicrafts, but there are others to which manual labour is best suited, and these will thrive and bring up a contented and fairly prosperous class of artizans if they are sufficiently patronized by the higher and middle classes.

That Travancore has long been famous for the excellent workmanship of her artizans may be gathered from the following extract from a letter addressed to His Highness the late Maharajah by Col. H. P. Hawkes, President of the Madras Committee of the London Exhibition of 1886 :—

"We feel that the best and most striking exhibits will come from Travancore. Your ivory carving is beyond doubt the best in all India. Your jewelry is approached by none that I have seen. The steel work inlaid with gold is peculiarly interesting and judging from the photograph Your Highness is good enough to send me, your wood carving must be very fine."

Such excellence has been due to the liberal encouragement and patronage of the rulers of the land. The occupants of the throne of Travancore have as a rule been personages of great learning and culture, and not a few of them have themselves been votaries of the arts they developed and patronized.

TRAVANCORE MUSIC.

Music according to Herbert Spencer is the finest of the Fine Arts. As one of the Fine Arts, it received special patronage through successive Hindu dynasties and was practised and

cultivated by *Pandits*, Princes and Princesses and by the well-to-do householders. Religion bound up as it is with everything in India naturally exercised a most powerful influence upon music as upon other arts. "I have hardly any festivity in the country," said the last Justice Sir T. Muthuswammy Aiyar, "domestic or national in which an important part is not assigned to music."

According to Mr. Day, a great authority on South Indian Music, Travancore owes to the influence of Tanjore much of its excellence in music and other fine arts.

The school of music in vogue in Travancore is the *Carnatic*. The Hindustani school has also been practised, but it has not taken a deep root here. It is now enjoyed only as a rarity. Besides these two systems, there is yet a third, known as *Soupanam*. It is an indigenous style of music peculiar to Malabar and Travancore at present and is apparently a trace of the once prevalent Dravidian music. Hindu music has from time immemorial been patronised by the Sovereigns of Travancore. The names of many musicians who adorned the Court of Rama Varma Kulasekhara Perumal Maharajah are still remembered. That illustrious sovereign himself was a great musician and his compositions are still sung not only in Travancore but in countries beyond it. The most celebrated musicians of the day in Southern India, viz., Maha Vaidyanatha Iyer and Raghavier were pets at his Court. His nephew and successor Rama Varma G. C. S. I., was another great musician and singer.

PAINTING.

"Painting" it has been well said, "is the intermediate somewhat between a thought and a thing." The history of painting in Travancore is the history of the revolution effected

in India in that branch of the fine arts through the labours of Western artists, an advance which has been kept up here by the genius of local talent.

That painting had reached a high state of excellence in India is clear from the old Sanscrit poets and dramatists. In Kalidasa's 'Sakuntala', Dushyanta paints the picture of his banished Queen.

Travancore has picked up the opportunity of internal peace, which British rule has given us, for the development of her arts. She has produced several painters of merit. And the recent Census of 1901, gave 919, as the number of painters for this little State.

The first impetus to painting on modern lines in Travancore was given by that talented Maharajah who has already been referred to above as the great musician and patron of music. His Highness invited one Alagari Naidu, the best painter of the day, from Madura and the trained young Raja Raja Varma of Kilimanur (the great Indian artist's uncle) and several others in the art of painting. Ravi Varma, whose fame now extends to Europe and America, received his early training from his uncle.

For painting to be truly successful in India, "it must be national painting." The success of Ravi Varma's pictures has proved the truth of this statement. He was ably assisted by his late brother C. Raja Raja Varma who was equally distinguished in the art, and by his sister, yet unknown to fame. Ravi Varma's paintings won prizes in the following Exhibitions :—

(1) Fine Arts Exhibitions of Simla, Bombay, Poona and Madras.

(2) The International Exhibitions of Vienna and Calcutta

(3) The Indian and Colonial Exhibition of London.

(4) The World's Exhibition at Chicago.

ARCHITECTURE.

The prevailing style of architecture is the Dravidian. Though the Dravidians were enthusiastic builders and embarked on the most splendid undertakings, yet all their efforts were devoted to the single service of Religion. The earlier specimens of the temples constructed on this style are the most perfect and the changes have been from bad to worse. Besides the temples in the Dravidian style, thare are a large number of temples in Travancore, built on a model peculiar to Malabar. In architectural grandeur they cannot be compared with the lofty structures of the East Coast.

The construction of private buildings differs considerably from that on the East Coast. The typical 'Nayar' house is situated in a large compound enclosed by a wooden fence or mud wall with thatched roof which is renewed every year, thus avoiding the expense of re-building the wall often owing to the heavy rains. The extent of the compound varies with the affluence of the owner, but is large enough in the villages. Though it is considerably less in the towns, it is impossible to find a 'Nayar' house without a decent compound. The gateway opening into the compound is surmounted by an imposing structure called '*Padippura*,' a framework of wood thatched or tiled, sometimes very attractively and artistically done. The house stands in the North-eastern portion of the compound mostly facing towards the east. At the south-western corner lies the *Kavoo* or grove of trees, dedicated to the abode of snakes—a portion considered sacred. To the east of the *Kavoo* is the bathing tank with the *Kulappura*, a cool shed forming a canopy over the steps of the tank affording facilities for privacy and protection from the inclemency of the weather. There is also a splendid garden containing everything needed to secure to the

owner all the necessaries of life. The cocoanut, the jack, the areca, the plantain and the mango trees are the most important ones to be found in every garden. The pepper vine is invariably seen clinging to these trees. Edible roots, such as tapioca, are to be found growing amid the clusters of trees and a tall *pezhu* fence at one corner bears the betel leaf vine. In the midst of this garden stands Nayar house, on an elevated basement, generally 3 feet in height. As one enters the premises, the first thing that greets the eye is a well-built ante-chamber, the southern portion of which is an open hall with an ornamental plank ceiling above. At the northern end is a fine snug wooden room 10 ft. square. Both these are used by the *Karanavan* or chief member of the family who receives visitors there. Beyond this is the big open yard called *Mittam* surrounded by a cluster of buildings. It is an oblong space not less than 30 × 40 ft. and is kept scrupulously neat. To the west of the open yard is the main house. The central portion of the main house is known as the 'Arappura', a strong building entirely made of wood to secure the valuables of the house. It has only one door on the east made of massive *anjili* plank fastened by one or two terrific looking iron locks known as the *Nazhipootu*. The door leads to an open verandah in front bordering on the *Mittam* more than 6 ft. broad and of the same length as the *Arappura* itself. The plank ceiling of the verandah is elaborately carved. Behind the *Arappura* is a big *Nalukettu*, the number varying according to the opulence of the Tarawad. These are provided with numerous comfortable rooms for all the women and children of the family, and *Karanavan* seldom visits these parts of the house. On the north side is the kitchen, a detached building with an open hall for dining say 40 × 12 or 15 ft. In front of the kitchen to its east, is the well, from which

water for drinking and cooking is drawn. The cattle-shed of the house is situated generally to the south or south-east of the main house. *Tekketu* is a small building situated to the south of the main building and kept sacred for puja to the family deity. Every house has also a *Matám* where the Brahmin visitor is lodged and fed.

SCULPTURE.

Sculpture and architecture always go hand in hand and it is by the delicately sculptured images of Gods and Goddesses in the temples that the architectural beauty of the shrines is judged. In the temple of Sri Padmanabha at Trivandrum there is abundant evidence of excellent sculpturing on stone.

CARVING.

The art of carving has been known in Travancore for a long time. It is as ancient as the temple architecture, and a naturalistic style has sprung up in Travancore. Carving in stone has already been referred to in connection with sculpture.

The most common substance on which the workman can exercise his skill is wood, of which Travancore has an abundant supply. Wood carving has long been practised in Travancore in connection with the construction of temples in indigenous Malabar style and the construction of houses and other buildings. In the making of cars, palankeens and *Vahanams* required in temple services and processions and always richly, minutely and delicately carved, the carpenter displays his consummate skill and high workmanship. Teak is the most popular wood, but sandalwood with its fragrant smell being valuable is generally selected to show the delicate touches of the carpenter's tool.

When ivory carving was first introduced into Travancore is not exactly known. From the evidence that exists in the form of ivory works, such as palankeens, images of gods, and

representations of plants and animals, we are led to infer that carving in ivory must have been, if not indigenous, at least as old as the Aryan colonization of Malabar.

The most important work in ivory was a throne made for that great Maharajah who reigned between 1829 and 1847. This is an excellent piece of workmanship and still adorns the old Durbar Hall at Trivandrum. His Highness' successor, Maharajah Martanda Varma exhibited a still greater interest in the furtherance of the Art, and in 1851, His Highness was enabled to present to Her Majesty the Queen an ivory throne elaborately carved and set with jewels. It was exhibited in the great Exhibition of London of that year and was much admired. It is a beautiful work, thoroughly Indian in design and well worthy of the purpose for which it was intended. It has now found a fitting place in the State rooms in Windsor Castle.

Ivory carving is done in the Trivandrum School of Arts for the decorations of many articles of ordinary use such as the backs of brushes, hand glasses, combs, book racks, walking sticks, umbrella handles, &c. The required ivory is obtained from the State Forests themselves.

Besides wood and ivory, well executed designs are carved in cocoanut shells. The colour of the shell when polished is a fine dark brown, which becomes darker with age. The clean shells are subjected to elaborate carvings and mounted with silver, gold or Ivory.

WEAVING.

Next in importance to agriculture is the weaving Industry, and among all the materials of our textile fabrics, cotton undoubtedly holds the first place. For a long time it has been cultivated, spun and manufactured locally, and every village has had families of weavers and spinners who supplied all local

demands and needs. But cotton spinning has nearly ceased to exist as almost all weavers now use only imported twist.

The Izhavas, Saliars and Patnools are the chief castes engaged in weaving, but there are also a few other castes who follow this profession.

The weaving of silk and woollen fabrics is unknown in Travancore.

FIBRES.

PLANTAIN FIBRE.

The existence of fibre in the common plaintain has probably been known in India from ancient times, but it attracted public notice only during the Crimean War, when owi g to the stoppage of the importation of Russian hemp into England the Indian Government ordered an enquiry into the capabilities of Indian fibres. But nothing important was done in regard to plantain fibre owing to the abundance of other fibre-yielding plants and also to want of some simple and efficient machine for extracting the fibre. A few years ago the Government of Travancore deputed one of its officers to Ootacamund to acquaint himself with the methods of extracting the fibre, but for want of a suitable machine, much good did not result from this mission. When weaving was introduced into the School of Arts, the Government procured through its Forest Department fibres extracted from plantains grown in the State and asked the superintendent of the School of Arts, Trivandrum, to test them with a view to ascertain their fitness for weaving purposes. A few experiments were made and the results of these experiments are noted below.

1. Of the 29 varieties of plantains grown in Travancore, the fibres yielded by 12 were found to be the best for weaving cloths of fine texture and those of the remaining ones were only

fit for coarse weaving and cordage. The fibres are silky in colour and glossy and sufficiently strong for a thread.

2. A few native and taning colours were tried and found successful in dyeing the fibre fast.

3. Washing with alkali commonly used by native washermen and with soda and soap were tried in the fibre and the fabric woven with it. These were found only to increase the strength and pliability of the material.

4. The fibre was found to possess peculiar advantages over other known varieties of fibres used for textile purposes. It possessed an almost exact resemblance to silk in the polish of the thread, which it is found to retain after it is dyed with any colour or boiled or washed.

5. The fibre needs no spinning operation like other fibres. It is ready for the loom after its extraction from the raw sheaths of the plantain trees.

The machinery for extracting the fibre used in the Trivandrum School of Arts is simple in structure, comparatively cheap and easily portable being small and light. It can be carried to the plantain gardens where the trees are cut and would thereby save large expenditure in transit of the raw material. The frame work is in teak. The scraping blade and the squeezing flutted rollers are fitted parallel to each other at the top and are worked by two separate strong steel springs controlled by foot levers. The additional mechanism for squeezing with the flutted rollers which work in advance of the scraping operation gives greater pliability to the plantain sheaths and renders the extraction of the fibre much easier. The fibre thus obtained can consequently retain the full length of the sheaths available, little or no breakage occurring in the process of extraction.

The machine-made fibre industry yields a good profit. An enterprising Indian of Tanjore who took the trouble of having some samples of the fibre extracted by him sent to London, found them valued from £ 25 to £ 35 a ton. He estimates the cost of extracting the fibre at Rs. 55 per ton, and allowing another Rs. 35 for putting the same on the market, or Rs. 90 altogether per ton, he calculates the profits at nearly £ 20 to £ 25 per ton. He states also that an acre of plantain garden yields one ton of fibre on an average. It has to be remembered that it has been usual hitherto to throw away the sheaths after reaping the produce, and if this refuse should yield so much as £ 20 per acre, the industry should be a very paying one.

Plantain trees of different varieties are grown abundantly all over the State, and in fact almost every Malayali house has its own plantain trees behind it in the garden. The extraction of the fibre is only a simple process and as it does not affect the edible and valuable portion of the plantain tree there is a vast field open for a new and paying industry which our capitalists will do well to put in hand before foreign capital steps in.

COCOANUT FIBRE OR COIR.

Malabar has been rightly called the "land of the palms" and of these the cocoanut palm is the most important and widely cultivated. The cultivation of the cocoanut tree and the preparation of its various products seem to be occupations specially suited to the Malabar Coast, its dense population, its minutely sub-divided holdings and its easy water-carriage to the market. Each man here lives under his own palm trees and every traveller by boat on the lagoon can see the domestic labour going on at each threshold, the whole family busy in

severing the husk from the nut, in spinning the fibre into yarn and so on. Of the several industries connected with the cocoanut, the coir industry is the most important. The thick pericarp or outer wall of the fruit yields the valuable coir fibre of commerce. The fibre is tough, elastic, springy, easily manipulated within certain limits and eminently suited for manufactures where lightness, cleanliness and great indestructibility are required. It will stand water, it is almost impervious to wind and wave, or to damp and rain. Care should be taken to cut the cocoanut at the proper season. The fibre is much impaired by waiting for the nuts to arrive at maturity. The fibre is weak when cut earlier than is necessary, and if later, it becomes coarse and hard and requires a longer soaking and is more difficult to manufacture. The best season is to cut the nut in the ninth or tenth month. When the cocoanuts are cut, the husk is separated from the nut and thrown into pools of fresh water and soaked for nearly two months. Travellers in boats can see heaps of these thrown into the back waters all along the way and easily recognize them from the offensive smell emanating from the rotten material in those places where the cocoanut abounds. When thoroughly soaked the fibrous parts are easily separated from the wood by beating with a stick, resembling an ordinary ricepounder, but not so long, known as *Kuttuvadi*. This beating is invariably done by women. After separation the fibres are mixed and with the help of a rough country machine locally known as *rattu* (wheel) ropes are twisted. This is also largely done by women. The Izhavas are largely engaged in this business and their women are very dexterous in rope making. Of the uses to which the coir is capable of application, the following extract from a pamphlet issued by an English trader will give a fair idea :—

"Coir is found suited to the production of a variety of articles of great utility and elegance of workmanship. It was at first only used for stuffing mattresses and cushions, but its applications have been enlarged and its value greatly increased by mechanical processes. Instead of being formed into rough cordage only and mats made by hand by means of ingeniously constructed machinery the fibre is rendered sufficiently fine for the loom and matting of different textures and coloured figures is produced while a combination of wool in pleasing designs gives richness and the effect of hearth rugs and carpeting brushes, and brooms for household and stable purposes, matting for sheep-folds, pheasantries and poultry yards, church cushions, hammocks, cordage of all sizes and strings for nursery men and others for tying up trees and other garden purposes, nose-bags for horses, mats and bags for seed-crushers, oil pressure and candle manufactures are only a few of the various purposes to which the fibrous coating of the cocoanut is now applied."

Coir string is universally employed in other parts of India in the construction of bamboo houses. To these properties has to be added its great power of withstanding moisture on account of which it is in great demand for maritime purposes.

ARECANUT FIBRE.

Besides the plantain and cocoanut fibres, the arecanut fibre is also used in the School of Arts, Trivandrum, as a substitute for wool, in the manufacture of carpets. When dyed, it is hardly distinguishable from wool, and in fact, carpets woven with it look better and finer than woollen carpets while they are considerably cheaper. The discovery of the uses of this fibre is very recent and the work is at present confined only to the School of Arts, Trivandrum.

OIL-PRESSING.

Next to coir making, oil-pressing, especially the manufacture of cocoanut oil, is the most important industry in the State. The cocoanut oil manufactured in Travancore is considered better in quality than that produced in other countries. Mr. Mackenzie, the late Resident in Travancore and Cochin observed that a ton of cocoanut oil from here fetches in the London market a few pounds more than that exported from any other country.

The oil is nearly white in colour and is largely used by the people of Malabar in cooking. It has a very agreeable smell and preparations made with it do not get spoiled while they taste better and keep longer. The oil is also used as medicine either by itself or boiled with other ingredients and for burning lamps and anointing the body. It is said to promote the growth of hair. The fat yielded by the cocoanut oil is largely used in Europe for the manufacture of candles and according to 'Max,' in the *Capital*.

"Experiments made in the Philippines show that the oil can be made to produce a high quality of illuminating gas free from tar." The uses of cocoanut oil are thus manifold.

The method of preparing it is as follows:—The ripe kernel of the cocoanut is cut off the skull and dried either by exposure to the sun or by artificial means. It is then known as copra. The copra is cut into thin slices which are put into the Presses and oil is extracted therefrom. The apparatus of a native oil-press is very simple. It is made of the trunk of a large tree (either tamarind or jack) or a block of a stone, which is hollowed into the form of a mortar and planted on a raised ground. In this a big pole works as a pestle round and round. A wooden beam about 16 ft. long pressing at one end closely against the foot of this mill with loud creaking noise has an arm projecting upwards at about a third of its length, which is attached to the head of the pestle. The mill is driven by men or oxen yoked at the farther end of the beam who pull it round and round. Every village has a few of these country mills and accordingly they are to be found scattered throughout the country. In addition to these country mills, machines for extracting oil

worked by steam power have been recently introduced ; there are three of them established at Alleppey ; a mill has been newly started at Quilon.

Gingelly-oil is the next in importance. This is usually procured by giving the sesamum seeds frequent washings in cold water at first until all the brownish coloured matter is removed and they look quite white. They are then spread to dry in the sun, after which oil is pressed from them in the same way as cocoanut in country mills. The oil has healing properties. It is used for burning lamps and anointing. Some use it for cooking purposes. This, however, is the custom of the Tamils not the true Malayali.

The laurel or *Punnakka* oil which comes next in importance is expressed from the seeds of the laurel tree. It is used mostly for burning lamps, but it gives a dim light.

The castor-oil is another important kind of oil. It is made from the large or small varieties of *Ricinus Communis*. It is an excellent laxative and is generally administered as a purgative. Oil that is made for burning lamps is expressed in the mills, but for medicinal use it is prepared by boiling.

The *Pultailom* or lemon-grass oil is in great demand in Europe. It has a very pungent taste and a strong odour of lemon. This industry may be said to have monopolised the trade in lemon grass oil in European markets.

Veppa Ennai, the oil of the seeds of the margosa is of great medicinal value. The following oils also are used as medicines. Peacock oil, Deer oil, Serpent oil, Pig oil or ghee and fish oil.

METAL WORK : PRECIOUS METALS.

Gold and silver are superbly wrought. The making of native ornaments gives the goldsmiths ample scope for the

display of their artistic skill, and their workmanship is much admired.

A gold girdle or Oddyanam made in Travancore the other day was the admiration of the Madras ladies, and they were positive in their statement that no Madras goldsmith could have shown such finish in work. The Oddyanam is a waist-belt worn by young women and this one was a small ornament weighing about £ 10 sterling, but the finish and the polish in it were unsurpassble; and yet this was the work of a goldsmith who earned only a rupee a day.

All the rich temples of Travancore have a large number of gold and silver vessels. The big *Vahanams* of gold and silver of Sri Padmanabhaswamy's pagoda at Trivandrum amply testify to the great claim that Travancore has for artistic work in gold and silver.

BRASS, COPPER AMD BELL-METAL.

Almost all the household vessels in a high class or middle class Hindu family are of brass, copper or bell-metal.

In Travancore, bell-metal, cauldrons and copper cooking pots are made on a colossal scale as they are in great demand for the feeding-houses attached to the temples. Some of those in use in Trivandrum are so large that each can contain condiments to feed 5,000 persons at a time and so deep that a boy can swim in them if filled with water.

IRON AND STEEL.

Iron and steel are chiefly used for making agricultural implements, knives, razors, locks &c. Superior knives on the English model are manufactured in Travancore. The D. P. W. workshop does casting work in iron; lamp-posts, pipes and other articles are cast there. Most of the lamp-posts used in lighting the town of Trivandrum are those made in the workshop.

CARPENTRY.

In the construction of temples and houses, the native carpenter plays an important part. The *Tachchusastram* or the science of carpentry prescribes in minute detail the rules of construction. The chief or head carpenters who prepare designs for buildings and have charge of the execution of the works, know the whole of that science by heart. They are therefore the supreme authorities "on the dimensions of the rooms, the height and dimensions of the door frames, the inclination of the rafters and their number for the roof, the area of the open yards, the position of the beams and their sections;" and indeed for every trifling detail to be followed in the construction. The abundance of good building timber found in the forests of Malabar and their extensive use in the indigenous style of architecture gives ample scope to the carpenter to display his ingenuity. The splendid wood carving for which Travancore is deservedly famous, which has already been referred to, owes its excellence to the dexterity and extensive technical knowledge possessed by the carpenters.

BOAT-BUILDING.

A regular succession of lakes and backwaters connected by navigable canals and running in a paralell direction with the coast for a considerable length is a most remarkable feature of the Malabar coast. Almost all the important and busy towns in Travancore and Cochin are situated along this line of water communication and as might be expected every description of merchandize as well as the whole produce of the country is easily conveyed through backwaters in boats.

In marshy tracts and in most parts of North Travancore water is the only highway of communication and a *Vallam* or canoe is thus an indipensable adjunct to every house. Men,

women and children go in these from one house to another or to the market or to their respective avocations in the fields or elsewhere.

It is thus clear that there is a large demand for boats in the country. Accordingly we find that a large number of people are engaged in their construction or repair. The boats are of various sizes, from the small fishing boat, 8 to 10 ft. in length and 2 ft. in breadth, to the large handsomely fitted up and richly carved cabin boats used by Royalty and other high personages. Teak, *Anjili* and *Tambagan* are the most important trees used in their construction, *Anjili* being the best and most popular.

MINING-INDUSTRY.

There has been no geological survey of the State. The only minerals now worked are the plumbago and mica. The plumbago has been pronounced to be of inferior quality, though two mines are being worked by the Mrogan Crucible Company. The company pays a royalty of Rs. 4 to 6 per ton to Government, according to the quality of the ore and in 1079, M. E. (1903–1904 A. D.) the Sirkar realize a royalty of Rs. 11,134.

Mica is found at the bed of several tanks and in many places in the forests where water stagnates. But the quantity is small and the quality poor.

Besides these two, iron ore is largely met with; but there has been no organized attempt to undertake work in this line on a large scale.

Gold ore was found some years ago and tested, but it was thought not paying.

There can be no doubt that Travancore has a large mineral wealth, but the mineral resources of the State have not been

exploited as yet. The Government have now in their service two young men recently trained in England in mining and these youths are now engaged in exploiting the country. It is hoped that their labours will lead to the discovery of abundant and valuable mineral resources.

MANUFACTURE OF SALT.

Salt is a Government monopoly in Travancore as in British India, and in order to meet the wants of the people, salt is being manufactured by private contractors under an arrangement with the Sirkar according to which the expenses of the manufacture are borne by the manufacturers themselves. But the State carries out all the public works necessary for the general maintenance and improvement of the pans. The manufacturers sell all the salt manufactured by them to the Sirkar at a fixed rate. Locally made salt is as good as the foreign stuff. Not long ago a private contractor was permitted to manufacture salt locally and very recently a company of private traders has been formed. It has already begun work with 100 pans and the produce is said to be of very good quality. At a recent conference of salt officers, held under the presidency of the Dewan of Travancore, it was resolved that the State should eventually be made independent of foreign salt by encouraging home manufacture. The future of the salt manufacturing industry is thus full of promise.

POTTERY, BRICKS AND TILES.

Pottery is a very ancient and important industry. In the Hindu lore, the profession is sanctified by Brahma the Creator being designated the chief potter. There are no houses in the country even of the poorest classes which do not use earthen pitchers, water jars, cooking pots, frying pans, dishes and other vessels made by the potter. There is, thus, an immense

demand for these in every village and the potter is, by virtue of his calling, an important factor in the village organization.

The potter's wheel is a very simple and rude contrivance, and of this primitive wheel comes everyday in every part of India, some of the finest pottery. It consists of a horizontal fly-wheel 2 or 3 feet in diameter loaded heavily with clay round the rim and put in motion by the hand. Once set spinning, it revolves for 5 or 10 minutes with a perfectly steady motion. The clay to be moulded is heaped in the centre of the wheel and the potter squats down on the ground before it. When a few vigorous turns are given, away spins the wheel round and round still and silent as a sleeping top, when at once the shapeless mass of clay begins to grew under the potter's hand into all sorts of faultless forms, which are then carried to be dried and baked as fast as they are thrown away from the wheel. Any polishing is done by rubbing the baked jars and pots with pebble. The Indian potter shows thoroughly artistic work in his creation and the red earthenware pottery of Travancore is one of the principal varieties of fancy pottery in which artistic effect is sought to be produced. Some very fine pottery is being made in the Trivandrum School of Arts.

The round tube-like hollow tiles of the East Coast, used only in South Travancore, are also made in the potter's wheel. But the indigenous variety of tiles peculiar to Malabar are manufactured in the same manner as the bricks. The semi-solid clay prepared according to the *recipe* known to every potter is spread on level ground and allowed to dry for two or three days. It is then cut into the required sizes and shapes by a sharp-edged piece of wood or other instrument and left to dry a little more. The bricks of tiles are then collected and headed into a kiln

constructed in the form of a rectangle with a number of holes on all the sides. Dry twigs and firewood are strewn at the top and at the bottom of the heap and also one or more layers inside it are burnt. After sufficient burning they are removed and are ready for use.

TODDY DRAWING.

Toddy is a saccharine juice obtained by excision of spadix or young flowering branch of the palmyra, cocoanut, date, sago, and other palms of which the first two are the most important. The process of drawing toddy is as follows. When the spadix is a month or a month and a half old, the toddy drawer begins his work by binding the sheath to prevent its expansion, after which he cuts about an inch off the end and then gently hammers the flowers, which are thereby exposed, with the handle of the knife or a piece of hard wood or bone. Finally he binds up the end with a broad strip of fibre. The hammering is repeated both morning and evening for 8 to 15 days, a thin slice being cut away on each occasion till the spadix is ready to yield toddy which can be easily recognized by the chattering of birds, crowding of insects and other unmistakable signs. When ready, the end of the spadix is fixed into a small pot and a small strip of leaf is pricked into the flower to catch the oozing liquor and to convey the drops without wasting clear into the vessel. The juice exudes and drops into the earthen pot. It is collected every morning when the vessel is emptied and replaced as before and this is repeated daily until the tree is exhausted and yields no more. The yield will be about half a gallon a day in the beginning but will gradually decrease, and after a period of about 40 or 50 days stop. The juice of the cocoanut tree is sweet toddy. In the early morning it is a pleasant drink, but it ferments towards night and is intoxicating.

Palmyra toddy is, though agreeable, inferior to the cocoanut toddy. It is very intoxicating and is largely drunk by the lower classes after a hard day's work in the fields or topes.

SUGAR, MOLASSES AND JAGGERY.

Coarse brown or black sugar is made by boiling down over a slow fire the juice or toddy drawn from the palmyra, the cocoanut or other palms. Jaggery is the hardened lump of the thick waxy syrup which is obtained by boiling for a considerable time toddy with powdered lime.

If sugar has to be extracted, the boiling ceases a little earlier than is required for the making of jaggery, and when it is warm, it is placed in baskets and allowed to drain. The watery portion that drops into a pan placed below is Mollasses.

CADJAN, MAT AND RATTAN WORK.

Cadjan umbrellas are a peculiarity of this coast, and no other part of Southern India produces similar ones. They are cheaper, last longer, stand rougher ware, and give more protection agsinst sun and rain than cloth umbrellas, which are, however, fast displacing them, partly owing to the advantage of their being folded and partly to the fashion of the day. Cadjan fans are also largely used during the hot weather and they are very cheap. Cadjan leaves are also woven into rough mats.

Mats of North Travancore are made from the reed called '*Korai*' but only rough mats are so made. The leaves of the *Pandanus* are woven into very fine mats which are prized highly for their smoothness.

The rattan work of Travancore is noted for its skilled workmanship. The Neduvangad hills yield very good canes, and the Koravars all along the base are great experts in rattan work. They make boxes, plates, baskets and other useful

articles. Wurkalay (Janardhanom) and the surrounding places are famous for this kind of workmanship.

The abundance of material and the superior intelligence of the true Malabar population are two great factors in favour of our industries, and it may therefore be safely predicted that a great future of industrial development and prosperity awaits Travancore before long.

AGRICULTURAL DEVELOPMENT IN BOMBAY, AND THE WORK OF THE DEPARTMENT OF AGRICULTURE.

BY

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In an Industrial Conference like the present, concerned as it is with the development of every industry throughout the country, there is none which claims more attention and more thought than agriculture. It does this by virtue of its size, for it remains and will remain for many years, if not for ever, the premier industry of India. It claims attention also because of its essential importance, for on its success (as we know to our sorrow during these present months) depends not merely the development of the country but even the very existence of the people. It claims the best thought of India, too, because it is capable of improvement in so many places and in so many ways. Such being the case, I have no hesitation in bringing before you to-day a little of the past history of the Agricultural Department in Bombay, and also something of the programme of experiment and effort which I hope will be carried out in this Presidency in the near future.

We are as most here well know, faced on this side of India with a variety of agricultural conditions almost without parallel in any province in the country. On the one hand, we have areas of as great rainfall as almost any in India, on the other we have areas of absolute desert. We have large districts with some of the deepest and best soil in the country as for instance

much of that round the very town in which we are met to-day, but we have also districts containing chiefly bare upland soils in which the greatest efforts can only produce a minimum crop. We have on the one hand, agriculture of the very highest type, comparing well with the best and most intensive cultures of the west, such as I, myself, have seen within a few miles of our meeting-place to-day, and on the other, we have the most primitive methods in vogue, capable, I am confident, even without any greater outlay of capital than at present, of being so improved as to give on the same land crops very much greater in amount and also in quality. It would, therefore, appear to be of exceeding advantage, if it were possible to form a central body which could bring the better methods already in use in some parts of the province to the notice of the people and into their practice in another, and also which could at the same time discover improvements on any system at present in vogue, whether by importation of European methods, seeds, implements, or manures, or by working out what was needed locally on the spot where they are required.

Such a central body is the Department of Agriculture. It was founded in response to a recommendation of the Famine Commission of 1880, after the most severe famine from which Bombay had suffered for fifty years. During the twenty-five years which have succeeded its formation it cannot be said that the Department has wholly fulfilled its functions. No one looking back could consider it an unqualified success. It has, except in one or two areas and in one or two subjects, failed to get into touch with the actual agriculturists in the field. It has not always succeeded in adapting its recommendations to special local conditions, and this has occasionally brought its suggestions into disrepute. Its ex-

perimental work, too, has often had only an exceedingly local application. But with all its drawbacks, it can look back on a very considerable amount of success. And when the indifference to development generally felt in its earlier days, both by Government and by private people, is taken into account, as well as the lack of a trained agricultural staff, its influence, and the benefit derived from its operations are probably much greater than might have been anticipated. The Bombay Department of Agriculture has had the huge advantage of the presence during a considerable part of this period, of one of the most practical agriculturists whom we have had in India,—I mean Mr. Mollison—who has now become Inspector-General of Agriculture for the whole country.

I might indicate to you a few of the lines in which successful work has been done. The most striking recent success, and one which if properly followed up, may lead to enormous consequences, has been the introduction of Egyptian cotton into Sind. As you know, Indian cotton as a whole is coarse and of short staple, at any rate when compared with the best of that produced elsewhere. Efforts, time, and gain, have been made to introduce better types of plant from America and other cotton-growing countries, but on any large scale they have uniformly failed. A few plants have however often succeeded in establishing themselves and after disappearing from notice for many years, reappear as a new and good type of indigenous cotton. But no direct successful introduction of a long staple cotton had taken place until Egyptian cotton was brought to Sind about five years ago. The result of this introduction is known to many here. So far as growth and the maintenance of staple is concerned, there is no longer much doubt that the canal tracts of Sind are admirably suited to the

growth of Egyptian cotton. Though there has been some difficulty with insect pests (and more particularly with the cotton bollworm) yet there appear signs that this will be got in hand; and what other obstacles still remain before Egyptian cotton is an established crop, there do not in the main concern its feasibility, but rather the character of the Sind cultivators and their methods, and the need for capital and skilled working of the lands.

So much for exotic cotton. But there appears to be a much greater field for carrying our best Indian types to areas where they are not known. The carrying of Broach cotton seed to certain parts of the Dharwar district in the south of the Presidency is an illustration of this and it promises to be very successful. Considerable quantities of Broach seed, as a result, are now annually being taken to the new district, and it is well within the reach of probability that in the comparatively near future, that best indigenous cotton of India may be obtained in large quantities from Dharwar.

But an equally important result seems to have been obtained in the improvement of the Broach cotton itself on our experimental farm in the neighbourhood of Surat. Here, by carefully combining different strains of Broach cotton, a type has been produced which seems to be an improvement on that in general cultivation. After the next season, if all is well, a small quantity will be available for distribution to growers for experiment, and it is to be hoped that it will then fulfil all the promise which it gives.

It is well known that cotton, in any district, without selection, is bound to fall off in staple and hence in value. Except in certain areas, such selection has not been carried out by the cultivators of the crop, and this is perhaps one of the

causes of the general reputation that cotton has obtained of rapidly deteriorating in India. In recent years, with the extension of machine ginning, there has been another factor causing deterioration, in the inevitable mixing of varieties which takes place at the gin. The best cultivators, of course, retain enough cotton for seed and hand gin it at home; the best cultivators also have learnt to keep up their type by selection, but these are comparatively few. Instruction in the principles of selection of cotton for seed has been, hence, repeatedly given on our farms, and will be given often, if not regularly, in future. So it is hoped and believed that we shall assist in securing the maintenance, if not the improvement, of the cotton staple and the yield of the crop.

The activity of the Department has not only been shown in connection with cotton. I feel that some of the most important results have been in the sugar-cane industry, especially in the Nira Canal district in the Deccan. Here, where the yield and quality of the sugar-cane is very high, Mr. Mollison was able to show how equal yields could be obtained by the use of cheaper and yet better manures, as by the substitution of safflower cake for more expensive cake manures, by the use of nightsoil obtained from Poona city, and by the use of less water and less manure of any sort than the cultivators were in the habit of applying. Not only this, but having found a particularly good iron mill in use in the Poona district, its employment was spread throughout the country, while the efficient method of preparing gur from the sugar-cane juice in use at the same spot has been demonstrated by expert sugarmakers in a number of parts of the Presidency.

Previous to the experiments of the Department there was a prejudice against using sewage as a manure for sugar-cane. Now

it has been proved to give excellent results both as regards purity and yield of sugar. At present there are not many sewage or sewage effluent farms in India, but, as they extend, the fact that first class sugar-cane can without doubt be grown on them is a fact of primary importance.

Turning to other crops, it may fairly be claimed that improved varieties of wheat, showing greater resistance to disease (rust) have been spread over the wheat-growing parts of Bombay: that similar work has been done for tur, one of the principal pulse crops of the Presidency; while with groundnuts not only have varieties yielding more nuts and richer nuts been introduced, but others also adapted for growing in districts where the late or early rainfall is not completely certain.

One of the most valuable pieces of work the Department has ever done was the saving of perhaps the most valuable breeds of Gujerati cattle, the *Kankreji* breed—in the famine of 1899–1900. This was essentially Mr. Mollison's work, done, I belive, with the help of many private gentlemen of whom Lord Northcote was the leader, and now the Chharodi cattle farm founded for this purpose, has become a centre for producing and spreading the bulls of this breed. At the same time the initiative has been taken, on this side of India at any rate, in the production of essentially good milking breeds of cows. Some of these have been developed, and bulls of these breeds are also being spread over the country where a call for them has occurred and in as great number as is yet available.

I am not sure whether to the Department, or to Mr. Mollison in particular, is not due in part the development of the now large dairying industry in Baroda and Gujerat. Now, as is well known, the bulk of the cream used in Bombay and from which Bombay butter is made, is separated in Gujerat and then

sent daily by a long railway journey to the capital. This is an industry capable of immense improvement and great development, and every effort will be given to bringing this about.

Such is a rapid survey of some of the salient points in agricultural development in which the Department of Agriculture has had a hand, and in most instances a predominating hand. It may be said that the improvements are small compared with the money and energy expended. I confess it. But the future promises much greater things. There is now a staff more highly trained than ever before and constantly increasing, a Government fully alive to the importance of the work, and a better knowledge of what is needed by those who cultivate the land.

In the near future the work which has been so successful in the past will by no means be laid aside. The improvement of seed, of cotton, wheat *tur*, millets, and the like, will still be one of the chief and most valuable lines of work. The difficulty that the poverty of many of the *raiyats* is such as not to allow them to select their own seed will have to be met. How this will be done I do not yet know, but something will most certainly be done. Closely allied to the production of improved varieties by selection is their introduction from abroad, as well as that of new crops, and to these matters a good deal of attention will be given in the coming years.

To me personally the most vital question in the agriculture of the Bombay Presidency, and one which forces itself particularly on the attention in this famine year, is the economy of water in and on land. It is valuable to extend irrigation canals and systems,—perhaps the most valuable work that has been done in India for forty years. But, so far as it goes, it is equally if not more valuable if one can increase say by ten, twenty, or even possibly by thirty per cent. the land

which any particular canal can irrigate. Can this be done? At present I hardly care to express an opinion. But I will say that there are a good many facts which lead me to the conclusion that it is not altogether beyond the reach of possibility. At any rate we are going to make experiments on the subject, and if we can only succeed in extending the area which is secure from drought by a small amount, the Department of Agriculture will have justified its existence over and over again. Side by side with this question lies another,—the retention of the small quantities of rainfall in the soil so as to make irrigation unnecessary, or, if not unnecessary, to make less irrigation suffice. Some success has been obtained in this line in America, and there seems at least a possibility of doing the same in many of our agricultural tracts. At any rate we are going to do our best to find out how most effectively to take advantage of the small quantity of rain that falls.

Another matter of importance is the question of the rotation of crops. There is an extraordinary unity in the way in which the same crops are grown after one another in most parts of Western India. There are endless variations which might be introduced, and it may be that our investigations will lead to the discovery of alterations which will prove of exceeding benefit.

With regard to insect pests, I must own that our Department has been able to do comparatively little. The locust has continued unchecked or nearly so: the cotton bollworm, it seems possible, may now be treated with some effect: the sugar-cane borer—source of endless damage—has been beyond our skill. But all these are under close study here or by Mr. Lefroy at Pusa, and it is not beyond probability even, that these and other equally serious pests may be made to yield. We have several men in the department whose knowledge of and experience in

economic entomology is considerable, and any method, which promised at all well, will, you may be sure, not be neglected.

We intend, too, to cautiously introduce and recommend the use of artificial manures. Hitherto these have not been economical. Value for value, local oilcakes and similar manures have been far cheaper. But as the price of these is continually on the rise, it will not be long before the use of artificial manures will probably pay, more especially as in all probability they will, in many cases, decrease rather than increase in price. Sulphate of Ammonia, one of the most important of them, will shortly be a local product: crude saltpetre is already cheap enough to compete with local materials, and others can and will be tried and, if advisable, recommended. In the meantime, tests are being made on a number of our experimental farms so that we shall be able to recommend the best not only for each soil but for each rotation of crops.

The question of improved implements is another of vital importance, and in no connection more than in that of raising water. Extensive experiments in the use of oil engines are being carried out in Madras of the results of which we shall make full use both for demonstration and further experiment. Improvements in instruments for actually working the land are slowly spreading as it is, and their spread will be encouraged and recommended.

Such are the more important parts of our experimental programme, that is to say our programme so far as search for better crops, better methods, better manures, and better implements is concerned. "But when all these are found," I am asked, "how do you bring these to the knowledge and to the door of the cultivating *raiyat*." It is here, I own, that agri-

cultural departments almost all over India, (and not in India alone) have failed almost more than in anything else. They have been getting results which have been pigeon-holed instead of being brought into practice, and this has certainly in a measure happened in Bombay. I feel it is a case of overcoming this difficulty, or, as a department, failing abjectly to fulfil our proper sphere.

Hence an enormous amount of attention has been given lately to devising methods for meeting the actual condition of things. As a result a number of methods have been inaugurated of which I, perhaps, may now give you a short sketch.

First and foremost, there has been initiated and in a measure developed a College of Agriculture at Poona, in which the highest and best training in scientific agriculture that we know how to give will be provided. No expense has been spared in the building or equipment, and I am ambitious that the course there given will ultimately be equal to that at an English or European University. Speaking as Principal, I may say that I shall be satisfied with no less. Thus we shall be able to send out, either as Government servants in the agricultural or other departments, or as workers on or managers of their own lands, a body of men who will be apostles of a better agriculture to every corner of the country. Already a considerable number of men of just the type we want are coming to the college,—men who after their course will be able to command respect as agriculturists wherever they may go,—and these will gradually increase in number as the years go by.

Second only to this in importance, and perhaps in its own way quite as important, will be the short courses for agriculturists for instruction in specific improvements in the local agriculture, to be held at the many local farms of the

Department. These farms are scattered all over the country. There are two in Gujerat, two in the Deccan, one in Khandesh, one in the Southern Mahratta country, and one in Sind. Already we give training in seed selection. I believe training in the near future may be given in better methods of dairying in Gujerat: in protecting wheat and millets from smut at Dharwar, &c., and so on. These short courses for training in special points will be continued and extended,—I think with every prospect of advantage.

For this purpose we are developing a class of men who are to be known as Divisional Inspectors. These men are agriculturists by birth and training: they will be selected from the senior men among our best college students, and they will be able to carry out the courses at the experimental farms. They will, in addition, go round the country in their division, and become, if possible, the confidants of the *raiyats*, and not being connected with any revenue department they will probably be able to do so. Thus they will, from *taluka* to *taluka*, be able to bring suggestions to the doors of the cultivators themselves. They will have power to suggest modifications of practice to *raiyats* and offer to supply seed or manures or lend implements where the demonstration of a new variety, a new manure, or a new implement would be of advantage.

Wherever possible such a man would work through a local agricultural association, formed in the village or taluka which he visits. Such local agricultural associations are still few in number, but are growing fast. They form another bond between the Department and the cultivators. They give the first news of a plant disease or an insect pest, and indicate that they want help. They select the best men to whom new seed, new manures, or new implements are sent for demonstration. They

are the body to whom agricultural information is sent, whether published in the form of leaflets or through the vernacular agricultural press. They organise local shows to which the Department lend every assistance, and generally form a centre for the improvement of agriculture. To such associations the Department will be of every help it possibly can.

I have just spoken of local shows. These have been held in a few places, but will probably be developed to a considerable extent, through the working of local agricultural associations. On a larger scale every support will be given to great exhibitions such as that held in Bombay three years ago to which selected cultivators were taken from all parts of the Presidency, and all the new crops, implements and so on, on view there, were explained to them, with, from all I have heard, immense advantage. For the discussion of the larger problems of agriculture, and also of the work done by the Department, annual or biennial conferences are to be held in some large centre in future. The last took place in Ahmedabad only a few weeks ago. Nearly all those most interested in agricultural development in the province attended, and to me, at any rate, the Conference has given valuable ideas and an impetus in the work I have undertaken in Bombay that can hardly be measured.

Such are the methods at present in operation and in view. They are no donbt inadequate, and still a gap remains which time and enthusiasm and energy and co-operation only can fill up. But the idea that pervades the Department now, I believe, and which must pervade it, if it is to be of the use we want it to be, is that it succeeds just in so far and no more as the agriculture of the presidency is improved. Of all things I do not want it to be thought of as a Government institution standing apart from the people. We want it to be useful, and, in my own mind, only by its usefulness can the expense, the energy, and the time required for maintaining the Department be justified.

LIFT IRRIGATION.

BY

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My object in presenting this paper to the Industrial Conference is to draw attention to the advance which has recently been made in the Madras Presidency in the scientific study of subterranean water and well irrigation, and to place at the disposal of those interested in the improvement of the agriculture of India the information which has been gathered in the Irrigation Pumping Department during the four years it has been at work.

Although wells and subterranean water are worthy of the attention of Engineers, it is a matter of regret that in India they have been very much neglected in the past and that the cultivators have been left almost entirely to their own resources. In 1882, Captain Clibborn, who was afterwards Principal of the Roorkee Engineering College, submitted a long report on well irrigation in the North-West Provinces and Oudh, arriving at the result that

well irrigation is only profitable under favourable conditions and that there is reason to believe that in most districts cultivators have already very fully availed themselves of their opportunities.

In Bombay, Mr. F. D. Campbell, an Executive Engineer of the Public Works Department of that Presidency, spent some months on special duty and as the final result of his enquiries formulated the opinion that

nothing can be done to introduce new or cheaper systems of well construction or of lifts than those which the ryot is already familiar with

Much later in 1896, in a report on water-lifts recording the results of some experiments on the efficiency of various systems of water-lifting, I wrote

steam-pumping machinery is utterly beyond the means of the ryots, and the force of the wind is too uncertain, and in general in India, it is too weak to be profitably utilised by windmills even of the most modern type. Animals are, therefore, the only source of power available, and water-lifts in the future must continue to be, as they always have been, worked by cattle. Moreover, the Indian agricultural population are so singularly devoid of even the most rudimentary mechanical skill, that it is absolutely necessary that machines intended for their use should be designed to work without complicated gearing of any kind.

At that time it seemed as though the last word had been said on the subject of well irrigation, as all the attempts to improve on indigenous methods of lifting water had led to no decisive results, and the engineers who tackled the problem retired baffled by the difficulty of providing a water-lift of superior efficiency to the native water-lifts without incurring too great an initial outlay and without forcing the cultivator to use a machine too complex for his comprehension and beyond the resources of the ordinary village artisans when it needed repair. Further, the opinion was generally held throughout the Madras Presidency that few wells could be found which would yield sufficient water to keep even small pumps of modern construction at work for a sufficient time to make it worth while to instal them. It was assumed that the cultivator must keep his bullocks for agricultural work and that in their off time they could be employed working mhotes or the wells and that such work practically cost nothing.

In 1900, in an article on "Underground water-supply," I wrote:

Underground water has never in India been studied properly by engineers or geologists and wells are sunk in a happy-go-lucky manner to a haphazard depth. They are constructed with primitive appliances and at small cost. Expectations are not usually great and as they are generally realized the people are content. The depth of the well is

limited by the fact that the primitive methods of sinking in vogue among the ryots prevent them going more than a few feet below the hot weather level of the water. With an engine and pump to keep the well dry much greater depths might be attained and possibly the supply of water enormously increased.

And again in 1902, in an article on "Well Irrigation" the following passage occurs:

In the south of India well-sinking is a very primitive business and the better the supply of water, generally the shallower the well. A ryot wants a well and having selected a spot which he thinks suitable, he sets to work and either sinks a hollow cylinder of brickwork into the ground till water in sufficient quantity to satisfy his expectations is reached, or he excavates a big rectangular hole in the disintegrated rock which forms the sub-soil and goes on deepening it till the inflow of water is greater than can be dealt with by the modest water-lifting appliances at his disposal. Year after year, in the hot weather when the water-level is low, he may increase the depth by adding to the number of mhotes on the well, and in this way many valuable water-yielding wells have been sunk. Let us suppose, however, that the unwatering of the well in the hot weather is accomplished by a powerful engine and pump, the work of excavating will be easy and the depth may be rapidly increased till either the inflow is greater than can be dealt with or practical considerations indicate that it is not worth while to go any deeper.

These remarks were consequent upon experience with the working of oil engines. For small powers they had been found to be inexpensive reliable motors, that required no great amount of skill to run them. Even with kerosine oil as the fuel, it was obviously practicable to employ them for lifting water under favourable conditions, but when later on it was found that there was no difficulty in using the much cheaper liquid fuel which is imported into India, the possibilities of their employment were vastly increased. It was not very difficult to convince the Government of Madras in the Irrigation Department that experiments in this direction were well worth trying and that in fact the time had arrived when the question of well irrigation might again be taken up with some prospect of doing useful work and of evolving means of making much greater use for irrigation purposes of subterranean water than had been pre-

viously possible. Moreover, increased experience in the management of indigenous industrial work had led me to think that the mechanical inaptitude of the people of this country can be cured if proper means for training them are provided.

One of the causes of the poverty of the people of India is the little use they make of mechanical appliances and efforts should be made to effect a change in this direction. The great rise in the price of food-stuffs, accompanied as it is by an equivalent or even greater rise in the wages of the labouring classes, has brought many of the wealthier agriculturists to a similar conclusion, and it is certain that in the next few years a great advance will be made by the substitution of oil and gas engines for bullock-power in many of the processes for preparing agricultural produce for the market. It is necessary that this opinion should gain ground and be more widely accepted and that mechanical engineers should be induced to devote their ingenuity and skill to providing simple machines capable of being driven by engines of a few horse-power, for such operations as extracting oil from seeds, the juice from the sugar-cane, hulling paddy or grinding wheat. It is true that most of these operations can be carried out in an extremely satisfactory manner if the scale of working is only sufficiently large, but the day for big enterprises of this kind has not yet arrived, and for the present it is desirable to provide special machinery which can be worked on a small scale and which can be purchased and set in operation with the comparatively small amount of capital which as yet is available among individuals. Co-operative enterprise is still a thing of the future, and till that is realized, our efforts must be directed to providing for the small capitalist.

It is true that there are many machines for doing this kind of work already on the market, but save in the case of sugar

mills I do not think that any of them are quite satisfactory and their use is not extending as rapidly as would be the case if they were better adapted to the work they have to perform. Fortunately for lifting water the centrifugal pump is almost ideally suited to the work which it has to perform. Its first cost is small, it is extremely simple and fairly efficient and combined with the oil-engine there is likely to be a wide field for its employment in this country.

It must not, however, be imagined that the oil-engine and centrifugal pump will replace, to any appreciable extent, the indigenous methods of lifting water. According to the latest returns (for the year 1905–1906), there are in the ryotwari tracts of the Madras Presidency upwards of 628,400 wells in good working order and a further 61,000 out of repair. The number in the zamindaris is not known, but the total for the whole Province may well be over three-quarters of a million. To lift water from these wells either the picottah or the country mhote is used, the number of special forms of water-lift being absolutely insignificant. Only a small percentage of these wells yield water sufficient to keep more than a single mhote or a single picottah at work. Not that many of them could not be made to yield a much larger supply of water, but the owners either have not enough land to use the water on or are too poor to provide the labour necessary to lift the water.

The idea is generally prevalent that native methods of lifting water are extremely cheap since the cattle must be kept under any circumstances, but careful investigation shows that it is only true within certain limits and those limits have already been reached. Well cultivation is carried on to the utmost extent possible under the existing conditions and if any great extension is to take place in the immediate future, it

must be by supplying the ryots with additional power for lifting water. At the same time the cost of that power must be very much less than that they now pay for any work done in the way of lifting water which is beyond the capacity of the cattle they keep for general agricultural purposes.

It is therefore a most important matter that we should endeavour to ascertain the actual cost of lifting water by native methods and at the outset it may be conceded that within the limits already referred to the ryot can lift water fairly cheaply. The question is what he will have to pay, and what does he pay, for lifting water when cattle have to be kept specially for work, or when he has to hire cattle. Five and twenty years ago at the Agricultural College Farm, Saidapet, Mr. Benson, as the result of long and careful trials, came to the conclusion that the cost of keeping a pair of good cattle amounted to 12 annas per day and that they were capable of lifting 240 cubic feet of water to a height of 25 feet for 8 hours a day. Or, in other words, 4,000 cubic feet of water could be raised one foot for one anna, or an acre inch of water could be raised 25 feet for Rs. 1-6-8. In the last 25 years rates have risen very considerably and the cost of lifting water has increased, so that under the conditions of Mr. Benson's estimate it is hardly likely that 3,000 cubic feet can now be raised one foot for one anna.

Simple as the problem may seem, it is extremely difficult to find out how much work is done by a pair of cattle under normal conditions. Any attempt at an experiment interferes with the normal conditions, the efficiency is temporarily increased and better results are obtained than are possible without some kind of special supervision. Two years ago I made some enquiries in the Chingleput District and I found that a fair day's work for a single mhote was as follows :

On a lift of 20 feet, using a bucket holding 20 gallons of water, 30 lifts per hour would be made for 9 hours a day. The minimum cost of keeping the cattle was Rs. 15 a month and the usual rate for hiring them was Re. 1 per day. Taking the minimum figure this works out at 2,160 cubic feet lifted one foot for one anna. These figures are corroborated by some data collected by the late Mr. H. A. Moss, who was Executive Engineer in the same district. In a report on "Wells and Well Irrigation in the Chingleput District" he states :

> Water is usually raised by picottah when the lift is 15 feet and under, when more, bullock mhotes are used. The cost of raising water for about 6 to 10 feet is about 4 pies per thousand cubic feet per one foot lift. From 10 to 15 feet the cost comes to about 5 pies and from 15 to 20 feet it is about 6 pies per thousand cubic feet per one foot lift.

The Chingleput District is in no way exceptional and the figures obtained will more or less apply to the rest of the country. Any great exactitude is impossible, but it will not be far from the truth than to put the cost of lifting water either by means of the picottah or the mhote at one anna for every 2,000 cubic feet lifted one foot. Under favourable conditions and with water-lifts specially adapted to the work better results than this can be obtained. For instance in South Arcot, where there is an abundant water-supply at about 15 feet below the surface of the ground, double mhotes worked with a rotary whim are largely in use and are very much more efficient than the ordinary water-lift in other parts of the country. It is not, however, with the extremely favourable cases that we have to deal. If lift irrigation is to be extended largely the conditions will generally be more difficult to deal with than has hitherto been the case and the means provided must be capable of working under a fairly wide range of conditions.

During the last four years, through the agency of the Irrigation Pumping Department, we have been gradually intro-

ducing the use of oil-engines and pumps for irrigation work and have tried them under a great variety of conditions, many of them being extremely unfavourable and none of them ideal. I do not propose to burden this paper with technical details as evidence regarding the statements which will be made is furnished in full in the various official reports which from time to time are issued by the Department. In an appendix to this paper is givena complete list of such reports.

Oil-engines and pumps are only economical and their employment therefore can only be recommended when the quantity of water to be dealt with is fairly large. If a well yield a thousand cubic feet a day, it will give ample employment for a mhote, but to make it worth while to instal an engine and pump the yield should be not less than 10,000 cubic feet a day for the greater part of the year. It is true that engines and pumps are working, and working at a profit, where the supply falls below this limit, but the circumstances are more or less special and it is doubtful if they could be repeated indefinitely. The following figures taken from the administration report of this year show what has actually been the cost of working at a number of installations :—

	Number of cubic feet of water lifted one foot for one anna.	
	1906-07.	1905-06.
Melrosapuram	3,900	..
Kadiampatti	4,013	6,400
Villupuram	3,230	5,800
Cuddalore	9,370	6,750
Saidapet	8,300	4,126
Katalai	..	6,500
Bezwada	3,340	3,200

In the report for last year it was shown that under very favourable conditions a small oil-engine and pump, dealing with 216,000 gallons of water per day on a lift of 25 feet, could raise 135,000 cubic feet one foot for one anna. This may be considered a maximum seldom if ever attained under actual working conditions. The figures given in the table fall very far short of the ideal, but the worst are as good as the best that can be obtained from cattle-power and the best show that water can be lifted at from one-third to one-fourth the cost of doing it by cattle. The larger the scale of pumping operations, the more cheaply can each unit of work be done whilst the indigenous methods of lifting water are only applicable on a very small scale and would utterly break down if any attempt were made to use them for lifting large quantities of water.

In the report by Mr. Moss already alluded to some information is given regarding the duty of water. He says:

> The cost of irrigating paddy from wells alone is expensive especially when the rainfall is at all deficient. On the other hand the return per acre from well-irrigated paddy is much more than from that irrigated by tanks and channels. It is generally half as much again and may be even twice as much, six months paddy usually requires 40 waterings of about 2,000 cubic feet per acre. The cost from a well about 15 feet deep may be taken at one rupee per watering. If the land is far from the well it will be more, owing to the loss by absorption. If the rainfall is bad, 60 waterings would be required and the outturn without the rain is always deficient. As the water in the well will be low the return to the ryot is very small and paddy is not worth cultivating under such circumstances.
>
> Four months paddy requires usually 30 waterings at a cost of about Rs. 30. The cost of watering is less than that for 6 months paddy but the return in grain is less.

The average area irrigated by a well is about 3 acres and as paddy requires more water than any other crop grown under wells, it is obvious that the average yield of the wells is less than that which can be deduced from observations on paddy cultivation. Taking Mr. Moss's figures we find that 1,333 cubic feet of water per day are required for 3 acres of paddy. It is therefore

probable that the average yield of the wells in this Presidency is not more than 1,000 cubic feet per day and in many cases it is certainly less than this. In the large irrigation systems where the distribution of water is under proper control, the duty of water is from 90 to 100 acres per cubic foot per second ; that is to say, a continuous flow of one cubic foot per second will irrigate from 90 to 100 acres of land. The water used by the ryot yields a duty of 195 acres or practically twice as much and this is probably the best result that can be obtained as we may be fairly certain that the accumulated experience of many generations of paddy growers instinctively prevents the Indian cultivator from using too much water. In the note on " Irrigation by pumping from a well at Melrosapuram " published as an Agricultural Bulletin the data collected at that station are furnished which corroborate this estimate. The high figures at Melrosapuram are largely due to the use of masonry channels for conveying the water from the well to the field. Even to the ryot the loss of water by soakage from his channels is a serious matter, though the land to be irrigated is close to the well. To the man who uses an oil-engine and pump it is still more important as the length of channel is much greater, and generally it may be assumed that the larger the irrigation system and the greater the area deriving its water from one source of supply the larger will be the percentage lost from the canals and the distributaries themselves.

The cost of lifting water for irrigation by mechanical means depends very largely upon the continuity of the supply and the number of days during the year on which water is supplied. Interest and depreciation bulk very largely in the total cost of running the plant and an economical result can only be obtained when the percentage of working hours is large. The

ryot in one way or another pays from Rs. 5 to Rs. 8 a month for the irrigation of an acre of land. In most cases this heavy charge is not severely felt, as it is met by the utilisation of what would otherwise be bye-products, but as soon as these bye-products are exhausted the full cost is felt and the ryot realises that it is impossible to grow the ordinary crops at a profit. With oil-engines and pumps the cost of irrigation varies considerably and for small schemes of from 20 to 40 acres it may be taken that the irrigation will cost from Rs. 1-8-0 to Rs. 3 per month. The larger the scheme the lower the cost of irrigation will be ; the best result being that which will probably be obtained in the Divi Island Pumping Scheme where 50,000 acres of land are to be irrigated and where the water may have to be lifted to a maximum height of 10 feet. It is estimated that the working expenses will not amount to more than Rs. 2 per acre for the season or an average of about 8 annas per acre per month. As a lift irrigation scheme the Divi Pumping Project is exceptional in regard to the size of the plant and the extent of the area irrigated, but in many places along the coast similar schemes of a smaller character are practicable, and where the lift does not exceed 10 or 12 feet paddy cultivation may be carried on profitably. For the most part, however, pumping will not be under such favourable conditions, the lift will usually be greater, the supply irregular and the plant much smaller. Even if paddy cultivation pays, there is no reason why it should be encouraged, as other and more valuable crops can equally well be grown. People who have the enterprise to install engines and pumps generally take a great deal of interest in the cultivation under them, and as usually they have some command of capital, the tendency is to go in for intense cultivation and to grow crops which yield a

very much larger profit per acre than can possibly be obtained when the common food-grains are cultivated. So far sugar-cane, plantains and groundnuts have yielded the best results, but large profits are also made in the cultivation of tobacco, turmeric and the ordinary garden crops. A supply of water which can be relied upon all the year round is practically wasted if it is not utilized for crops which require water the whole year through. These are the crops which yield the largest return to the cultivator, partly because the extent to which they can be grown is limited, and partly because their cultivation necessitates the possession of a considerable amount of capital. With a perennial supply of water under engines and pumps the gross return from the cultivated area ought to be never less than Rs. 100 an acre, and it often amounts to two or three times this sum.

When the Experimental Pumping Department was first started the impression generally prevailed among those who were best acquainted with the agricultural conditions of the country that the scope for its operations would be extremely limited, because of the difficulty of finding sites where a sufficient water-supply could be obtained combined with landholders in the neighbourhood who would have sufficient capital to avail themselves of it. The fact that there are now about 100 pumping plants at work in the Madras Presidency is evidence that there is a much wider field for their employment than was anticipated, and the investigations which have been carried on, before installing these plants, have put us in possession of a large amount of information of a most satisfactory character. Certainly there will be absolutely no difficulty whatever in irrigating hundreds of thousands of acres by engines and pumps if only the capital required to lift the water can be

found, and the ryots can be taught to make use of the water in a proper way.

The great obstacles to progress are the poverty of the people and the extraordinarily minute way in which the land is sub-divided. The smallest area which can be profitably cultivated by an engine and pump is from 15 to 20 acres, and the number of such holdings in one block is small. Still there are a sufficiently large number to enable a great deal of work to be done in exploiting this method of lifting water, and long before the possibilities of large holdings are exhausted, the owners of smaller holdings will perceive the advantage of combining together and by co-operation securing to themselves the benefits consequent upon this cheap method of lifting water. I do not think it is any exaggeration to say that the oil-engine and pump will prove, and in fact are proving, extremely potent agents in the development of the material resources of the country. Already in some of the rural tracts the ryots are familiar with them, recognise their merits and regard them as desirable things to possess; whilst those who have got them have been led to take a much deeper interest in agriculture than they did before and being intelligent men with capital, their farms are becoming the centres for the diffusion of improved agricultural practices throughout the country. I am in hopes that in the course of a year or two it may be possible to form an Agricultural Association every member of which will be the user of an oil-engine and pump, the main object of the Association being to encourage the extension of the use of such methods of lifting water and to supply the members with information which will enable them to make the best possible use of the water at their command. So far Agricultural Associations in this country are an

exotic growth and without official support few of them would be in existence. The Association I am contemplating will stand on a different footing, its members will all be agriculturists operating on a fairly large scale and keen to make the most of the capital they have put into their land.

The supplies of water sufficiently large to give employment for engines and pumps are mainly to be found in the Coast districts and along the margins of some of the big rivers. In such districts as Coimbatore, where well cultivation has reached its highest development on indigenous lines there are apparently not many places where wells can be sunk which will yield sufficient water to give employment to an engine and pump. Here and there there is one, but certainly not one in a hundred of the 75,000 wells in the district could furnish enough water to make it worth while to put in an oil-engine and pump. On the other hand in South Arcot, Chingleput and North Arcot abundant evidence has been obtained that over very considerable tracts of country the ordinary native wells can easily be improved so as to yield enormously greater supplies of water than have hitherto been drawn from them. In these districts the water mainly occurs in vast beds of coarse sand which form subterranean reservoirs of considerable but as yet quite unknown extent. In some cases the sand is covered by a comparatively thin layer of alluvial deposit and the water can be found by sinking wells from 15 to 20 feet deep. In other cases the sand lies at a considerably greater depth and is overlaid by impervious beds of clay which have to be pierced to get at the water. In the South Arcot District between Pondicherry and Cuddalore these beds are more than 200 feet below the surface of the ground, but the water is under pressure sufficient to force it up the boreholes and form true artesian wells. To the north of

Madras similar sand beds are found at a much smaller depth, but the pressure is not sufficient to constitute true artesian wells and the water has to be lifted in some way or other. Some 30 or 40 boreholes have been put down in the bottom of existing wells and have successfully tapped the sub-artesian water-supply. Most of the pipes are of 4″ diameter and the yield of the water varies from 50 to 200 gallons per minute. It is probable that in most cases a much larger flow could be obtained by either inserting a pipe of larger diameter or by deepening the well and lifting the water from a lower level so as to diminish the pressure against which the water is forced up from below. In one case two 7″ pipes have been put down and the yield of water is over 500 gallons a minute which is lifted out of the well by a 12 H.P. engine driving a 6″ centrifugal pump. In nearly every case these improved wells will yield sufficient water to justify the installation of engines and pumps, but as yet the people are too poor and too dubious about the continuance of the flow of water to do anything in this direction. In a year or two they will be in a better position to realize the value of the water beneath their lands and may then be anxious to avail themselves of any means whereby they can secure to a larger extent of land an unfailing supply of water.

In the tract of country to the south of Pondicherry many hundreds of boreholes have been put down and the water-supply derived from the artesian beds is very considerable and it is not improbable that to the north of Madras the development of sub-artesian water will be found to be of similar extent. In other places there is reason to suppose similar water-bearing deposits exist, but as yet they have not been explored and their capacity is entirely unknown. Where the water-bearing sands occur nearer the surface and where the surface slope of the country is

considerable they have been drained to some extent by 'spring heads' or *kasams*. These consist of a pond often of considerable size which has been excavated till the water-bearing sands are reached. From the pond a deep channel with a small bed-fall leads the water out on to the lower lands. This channel is generally a mile or two long and a good deal of the water drained from the pond must be lost on its way to the land. The supply in the pond is apparently maintained by percolation from the beds of sand which lie at a higher level. The sand in these *kasams* is usually very coarse and the flow of water apparently very free. As a rule in the hot weather they dry up altogether, or the water has to be lifted out of them by baling with picottahs or mhotes. Unquestionably the installation of engines and pumps would enable a very much larger body of sand to be drained of water and it is probable that in most cases a perennial supply of water could be obtained in place of the present supply which is only sufficient for a single crop.

Where the slope of the country is small it is obvious that irrigation by *kasams* is impracticable, but very extensive beds of coarse sand exist and have been tapped and tested in many places and at no very great cost it is practicable to put in wells which will yield from 200 to 300 gallons of water per minute. A considerable number of these have already been sunk and there is no doubt that they will steadily increase in number. It is impossible to say what area of land is underlaid by these water-bearing sands in the Madras Presidency, but it certainly runs into thousands of square miles and there is probably water sufficient for the irrigation of several hundred thousand acres. The withdrawal of large quantities of water will lower the level at which it is found, but there is fair ground for assuming that most of these sand deposits are in direct connection with the

main drainage lines of the country and every fresh which passes down an adjoining river will tend to restore the original water level.

There does not seem to be much hope that deep-seated artesian water-supplies will prove of value for irrigation. In the Gòdàvari District artesian water has been tapped in several places, by mining prospectors in the Polavaram Zamindari, by the Madras Railway at Ellore and by various people in the neighbourhood of Samalkota and Cocanada. At Ellore a borehole was put down to a depth of 430 feet and cost nearly Rs. 13,000, whilst the yield of water does not appear to have been much more than about 3,000 gallons per hour. Further details regarding the cost of artesian wells will be found in a note by Mr. E. W. Stoney, C.I.E., in the November number of the *Indian Engineer*.

The sandy beds of most of our rivers are probably the next most important source of water-supply and one which, as yet, has been but little made use of. The indigenous method of getting at the water is extremely ingenious, but it involves the expenditure of a very large amount of labour. Channels or ditches are dug in the beds of the rivers with a bedfall considerably less than that of the river. In the upper part of the channel the water from the surrounding sand drains into the channel, flows down it and is carried away through a cut in the river bank. In some districts "doruvu" wells are employed to some extent. They are wells sunk in or close to the river bank and derive their water-supply from the sand. Apparently the engineering work involved is beyond the ordinary ryot and such wells are not popular. Where they exist they require study and where they do not exist it is desirable to encourage them as much as possible.

It has always been assumed in the past that there was a slow flow of water beneath the sand in the river-beds and it was tacitly accepted that the spring channels probably drew off most of the available water as no large supply could ever be obtained at any one point. A careful review of the evidence furnished by the partial failure of several attempts to get at the water in the sandy beds of these rivers lead to an examination of the conditions under which spring channels work and it was then found that the prevailing ideas were erroneous and that there is no flow of water in the sand of a river-bed except between pool and pool, where the slope of the water plane in the sand may be very steep. Below a certain level the sand in the beds of rivers is saturated with water which remains motionless unless a local hydraulic gradient is established sufficiently steep to cause the water to flow. I do not propose to go into the evidence upon which these conclusions have been based, as it has already been published in this year's report. Every cubic foot of sand below the saturation level contains rather more than 2 gallons of water, so that a square mile of sand 10 feet deep is a reservoir containing over 550 million gallons of water, or sufficient for the irrigation of a thousand acres of land. Allowing for the fact that the sand in the river-beds is not always 10 feet deep and that it is impossible to extract all the water from the sand but without taking into account any water 20 feet below the level of the saturation line it is quite certain that for every square mile of river-bed we might have an equivalent of square mile of irrigation. The prablem which remains unsolved is how to get at this vast quantity of water. In this matter our experience is gradually increasing and one certain conclusion is that owing to the resistance which the sand offers to the motion of water it is impossible, except at great expense, to

collect any large quantity of water at one point. On the Hagari river we found it a simple matter to obtain 150 gallons a minute and for a moderate outlay * we are drawing 750 gallons a minute from the river-bed, but to obtain more water than this at our pumping station seems likely to prove a difficult matter. By sinking wells in the river-beds it is found that in most cases a comparatively small well will yield 300 or 400 gallons of water per minute so that, if a large quantity of water is to be withdrawn, a large number of wells should be sunk at a sufficient distance apart to prevent one well materially interfering with another. In many cases these wells can be sunk inside the river bank, in others quite close to the bank and when this is practicable the pumping work may be done by power distributed electrically. To get at the water in the middle of the river-bed when the bed is very wide is a much more difficult matter and may be considered for the present outside the range of practical engineering.

All the experience we have gathered so far points to the fact that with brick wells from 12 to 15 feet in diameter we can get enough water to supply a 4″ centrifugal pump with a depression of the water surface of 3 or 4 feet. Some day I think there will be a chain of such wells extending along both banks of most of our rivers and at intervals of about 10 miles there will be electric generating stations supplying current to electro-motors to drive these pumps.

The perennial flow of most of our rivers is already diverted by means of anicuts which in the upper reaches of the river, where the bed is rocky, are often very numerous. Still there are a few cases where the water-supply is wasted by being allowed to flow into the sandy expanses in the lower reaches of

* Rs. 2,300.

the rivers and the remedy is obviously to install engines and pumps. Of installations of this kind there are already one or two at work, and there would be more if permission to pumps could be obtained.

On the West Coast in Cochin and Travancore, there are extensive tracts of irrigated land formed by bunding off the backwaters and draining them. The system of irrigation is of great antiquity, but of late years it has been modified by the introduction of pumping machinery and there are a large number of steam and oil engines now employed in draining these lands. A great deal of enterprise has been exhibited in this work but not much engineering skill and unquestionably the Kole cultivation, as it is called, could be enormously improved by combining irrigation with drainage and by putting the operations in each section under one control.

In some of the swamps along the coast and in lakes like the Kolair, between the Kistna and Gòdávari rivers, there is a considerable body of fresh water which only requires to be lifted a few feet to render it available for the irrigation of the neighbouring lands. Years ago in the Kolair Lake and in the Lankas bordering on the Uppeteru river such cultivation was established under steam pumps and proved moderately remunerative, but gradually interest in the matter died out and the pumping stations were abandoned. The successful working of the oil engines has revived interest in the matter and pumping has re-commenced and may possibly be largely resorted to.

In connection with the development of this modern phase of lift irrigation, the improvement of existing wells is a matter of great importance and if only a small percentage are found suitable for working with oil engines and pumps, the absolute number will be large and they may become important inasmuch

as they will often occur in those tracts of country which are most liable to be affected by the vicissitudes of the seasons. Owners of wells have generally some vague idea of the quantity of water they will yield, but they have very little notion as to the quantity of water which a 3″ centrifugal pump will lift, and it frequently happens they want to set up pumps when the water-supply is quite inadequate. The most satisfactory way of investigating cases like this is to first of all ascertain the yield of the existing well towards the end of the hot weather and to put down an exploratory borehole to determine the nature of the surrounding rock. The borehole will generally furnish sufficient evidence to enable an opinion to be formed as to whether it is worth while to deepen the well. Sometimes the borehole taps fissures carrying water under pressure and materially increases the flow into the well; sometimes it reveals beds of porous rock which only require opening out to yield a copious supply of water. Where the rock is hard and the water is mainly found in fissures, the explosion of a charge of dynamite at the bottom of the borehole will sometimes materially improve the supply. As yet we have done very little work in this direction, but I am not without hopes, from the experience already gained, that when wells can be sunk to a much greater depth than has hitherto been the native practice, it will be found that the inflow will in many cases justify resorting to pumping machinery. Where we can keep our engines fully employed, which means wherever we can command from 150 to 200 thousand gallons of water per day, the depth from which it can be lifted before this becomes an unprofitable operation is much greater than is the case in ordinary well irrigation. With this the limit is about 40 feet whilst 150 feet will probably

be found practicable with oil engines and pumps. It is not so much the height to which the water has to be lifted as the risking of a large capital outlay in what must of necessity always be an uncertain undertaking which makes it at present doubtful whether sinking wells to any very great depth is to be encouraged. In some cases we have found that a very slight addition to the depth of a well enormously increases the inflow and it is just at this point that native well-sinkers have to stop as the unwatering of the well becomes an exceedingly difficult operation when only mhotes or picottahs can be employed. Where the water is contained in sand it is not difficult to frame an estimate of the cost of getting at a certain quantity of the water and we do so by putting down an exploratory borehole to ascertain the thickness of the deposit of sand, which sand is itself examined to determine the size of the grains of which it is composed, but with wells sunk in rock we are in no such satisfactory position. We have but little more knowledge and much less experience than the professional well-sinkers of the country, and we shall have to make many experiments before we can teach the people of this country anything. To this end we have recently ordered a portable petrol-pumping plant which can easily be carried about and can be put down any well and used either for baling during construction work or for observations on the rate of inflow. The Government of Madras have also sanctioned a sufficient sum of money for a systematic series of tests as to the advantage or otherwise of torpedoing boreholes sunk in hard rock. Our progress with wells of this type is not likely to be very rapid unless we can secure the interest and co-operation of the more intelligent men who are interested in the improvement of water-supplies for irrigation. Throughout the country there

is doubtless a good deal of empirical information, the collection and study of which would be of value. It would help us to make a better start, but I do not think it will carry us very far on our way as the water-supplies, which we are searching for, must lie at a much greater depth than is within the range of indigenous experience and to make them available we require an enormously greater supply of power than has ever been at the disposal of the owners of wells in the past.

The financial aspects of this method of lift irrigation have already been dealt with to some extent when we were discussing the relative cost of lifting water by the old and by the new methods, because in the figures given for the new methods a full and proper allowance has been made for interest and depreciation on the capital outlay involved in setting up a plant. In an appendix to this paper will be found figures giving the actual cost of a number of installations which have been set up. The cost per acre to be ultimately brought under irrigation varies considerably. It may be as low as Rs. 50 an acre or as much as Rs. 200 an acre, but obviously for high-class cultivation where the yield per annum may be valued at Rs. 400 or Rs. 500 an acre, it may pay very well to expend a great deal more than Rs. 200 per acre to get a good supply of water. In the Deccan under some canals near Poona as much as Rs. 50 per acre is the water-rate on land growing sugarcane, and in this Presidency many gardens and plantations could easily stand a water-rate of a similar amount. It would have afforded me very great satisfaction to have presented accurate figures regarding the working expenses and return on a number of farms where this new system of lift irrigation prevails, but no one cares to furnish them. There is, however, ample evidence that it is very profitable and the best indication that it

is appreciated is to be found in the fact that the rate of increase in the number of installations is greatest in those places where the number is already largest or where they have been longest at work. In ordinary years and under normal conditions, given a sufficient water-supply, there should be no difficulty in turning it to very profitable account, but often with oil-engines and pumps the greatest profit will be made in years when the season is unfavourable, scarcity prevalent and prices high.

In many cases, oil-engines and pumps may be used to supplement other sources of supply and convert agriculture of an uncertain type into one of great certainty. One of the earliest installations in this Presidency was erected on the banks of the Cauvery from which river the water-supply to the pump is derived. The lands ordinarily depend upon channels from the river for irrigation water, but this is extremely uncertain, and partial or total failure of the crops occurred at such frequent intervals that the owners of the land derived nothing from it and the ryots who cultivated it earned a precarious livelihood. Over a tract of 300 acres a 12″ pump has completely changed this. The natural water-supply may fail, but the pump is there to take its place and the whole area can be converted to perennial irrigation. The owner reports that during the last eighteen months 55 acres have been under plantain cultivation and have yielded a gross return of over Rs. 400 per acre, or about one and-a-half times the whole of the capital outlay on the pumping plant. In a good year the return from paddy cultivation would have been about Rs. 50 per acre and the net profit very small. Under plantains the net profit on the 55 acres must have been sufficient to pay 50 per cent. on the initial expenditure. The area under perennial irrigation, such as plantains or sugarcane, would have been much larger, but it

is restricted to 60 acres at this place by the Revenue authorities lest the water-supply to lands lower down the river should be interfered with.

From the figures given in the appendix it will be seen that the minimum cost of a pumping installation is about Rs. 2,000, and the actual out-of-pocket working expenses, being the necessary expenses for fuel, lubricating oil, stores and repairs, will be about Rs. 50 a month. The installation of engines and pumps is therefore a financial operation of considerable magnitude even with comparatively wealthy ryots. Very few, if any, have sufficient ready money, and a certain number of installations have been paid for by loans under the Agricultural Land Improvement Loans Act, such loans being usually repayable in twelve annual instalments. This method of financing these pumping schemes would be entirely satisfactory were it not for the difficulty which the borrowers experience in finding the necessary security. My experience is that the majority of loans applied for are rejected for this reason and it may possibly be desirable in the future to amend the Act so as to provide greater facilities for obtaining loans for the purchase of engines and pumps. If the machinery could be taken into account when assessing the value of the security for the loan, there would be no difficulty and loans would be freely applied for. Greater success has attended the sale of engines and pumps under the hire-purchase system which has been worked out by Messrs. Massey & Co. Under this method the would-be owner of the pump has to pay one-fourth of the money down and the balance in instalments generally extending over two or three years during which time he has to pay 8 per cent. interest on the balance debited to him. He is thus able to get his engine and pump for a comparatively small initial outlay and to pay the

balance out of profits accruing from the use of the pump. So far the system of working has proved satisfactory and it is probable that it will be resorted to very largely in the future when it becomes more generally recognised that irrigation under oil-engines and pumps can be made a very profitable business. Tne hire-purchase system is a very vicious one when applied to afford facilities for the purchase of unproductive goods by those who cannot afford them, but it has distinct merits in some cases and is an extremely simple method of financing small industrial undertakings as it provides the small capitalist with ready means to obtain money or the equivalent of money on fairly easy terms. It is possible that a great deal more might be done in this way if Government took the matter up, purchased the engines and pumps themselves and sold them on easier terms than private firms can do. The risk of loss will be very small as the engines and pumps would remain the property of Government till they are fully paid for, and they would never be sold except for use under conditions which will have to be investigated by the expert officers of Government and reported as satisfactory.

The number of oil-engines in use in this Presidency for minor industrial undertakings as well as for lifting water is growing rapidly and there has naturally sprung up a rather keen demand for men capable of driving the engines. The extreme simplicity of the oil-engine renders it possible to train fitters to look after them in a few days and there has never been any great difficulty about getting drivers, but a good fitter is rather wasted when put to drive a small oil-engine and his pay adds quite unnecessarily to the working expenses. In Madras we have started a school for Oil-engine Drivers where practical instruction is given in the driving of various kinds of oil-engines and the pupils are put through an elementary course of fitting

so as to enable them to take the engine to pieces, clean them and fit them together again. Anything more than this it is not considered necessary that a driver should know. If the engine really gets out of order it is better that it should be overhauled by a skilled mechanic and the driver in charge of it should be nothing more than a driver. A good many people, who have bought engines, have sent their men or servants up to this school to be trained, and after a course of instruction lasting from 3 to 6 months they are generally found quite capable of looking after the engine. In this way Oil-engine Drivers can be provided at a cost no greater to the owner than if he had to provide a man to look after a pair of bullocks. With large engines the saving in this direction is not a matter of much importance, but with small plants the fact that local men could be trained to do all the work that is necessary has tended much to increase the popularity of these engines. The Engine Driving school was originally started in the School of Arts, but it has now been taken over by, and forms part of, the Chengelroya Naiker's Technical Institute. The class is popular as the men who pass through it can always obtain work.

The fact that large monetary transactions are involved wherever oil-engines and pumps are set up and where the fuel for working them has to be purchased and paid for in cash has in a remarkable way led to a more definite appreciation of the monetary value of irrigation. This is still more emphasized by the rise in the price of food stuffs and the tendency to pay farm labourers in cash instead of in kind. The farm is no longer so self-contained as it was, the working of it necessitates transactions outside the village and the crops have to be selected by the ryots not merely with a view to their own internal requirements and to meet the demands of Government

and the District Board, but also to meet the charges connected with the working of the engine. Outside markets have to be studied to a greater extent than formerly and the cultivator is brought into more intimate contact with the outside world. Of course the movement is a very small one at present, but the tendency is one in the right direction and should ultimately conduce to the development and education of the agricultural community.

In the South Arcot District where more pumps have been fitted up than in any other part of the country and where nearly all the wells have an unfailing supply of water, the owners of pumping plants are beginning to raise water and sell it to their neighbours when they do not want it themselves. At the Panampet Pumping Station which was leased to Messrs. Parry & Co., two systems of selling water were tried. Ground-nut crops were irrigated for Rs. 5 per acre per month and for other crops the whole supply of the pump was sold to any ryot who wanted water for a fixed rate per hour. This practice is very largely in vogue in the Western States of America where water for irrigation is a vital necessity, and if it is once recognised in this country that water is a commodity which can be bought and sold, it will probably greatly simplify some of the problems connected with the development of this kind of irrigation. Where the water-supply is very abundant and where the ryots have no capital and the land is sub-divided into small plots, it might be practicable to establish local water-supply companies who would raise water and sell it to the ryots either for a share in the produce of the land, or for a fixed rate per unit of volume or a fixed charge per acre irrigated. If anything of this kind is to be brought about, it will probably be necessary for Government to

pioneer the way and to provide sufficient legal protection to induce capital to flow in this direction.

It must be recognised that only in a few places will it be possible to pump large quantities of water from a single source of supply. The wells must be numerous and it will probably be found most economical to have a single power-generating station and to distribute the power electrically, driving centrifugal pumps with electromotors. Large power-stations are much more economical than small ones, and it is quite possible to put in motors and pumps that require no more supervision than that a man should go round and oil them once a day. Such water-supply corporations exist in America and have worked successfully for years past, and it is quite certain that there are no engineering difficulties worth speaking of. On the other hand in India it will require an immense amount of tact and patience to get the advantages of such a system acknowledged. To make it profitable intensive cultivation must be adopted, and even if the capital is forthcoming to enable this to be carried on, it is doubtful if the ryots possess the requisite experience to make it a success. After studying the question of the better utilisation of subterranean water for but a very short time I am convinced that there are no serious difficulties from the engineer's point of view, either as to a sufficiency of supply or as to the cost of raising it above the ground so as to make it available. On the other hand the practical administrator, who would like to make use of this water and apply it to the land so that the people may be placed in a position which will enable them to carry on their agricultural work with a fair amount of certainty, will find the achievement of his wishes a task of extreme difficulty.

The purchase of land is a favourite form of investment in this country and the line of least resistance seems to lie in the direction of encouraging people who have amassed wealth to purchase land which is capable of improvement and to reserve a considerable amount of their capital for the improvement of the land they have purchased. Money invested in land yields a very poor return, but, judiciously invested in the improvement of land, the results are likely to be much more profitable and the value of the land permanently increased. The work which is being done in this direction by men like Mr. Gopinatha Tawker, at Surapet, Mr. Tota Ramanujam Chetty, at Katalai, Mr. Panduranga Mudaliar, at Cuddalore, Mr. Tilla Govinda Gramani, at Nellikuppam, Mr. Abraham Pandither, at Tanjore, and by many others, is pioneer work of the utmost public value and deserves recognition at the hands of their fellow countrymen.

Irrigation by pumping is still in its infancy, but the success which has already attended the earlier installations renders it certain that it will grow rapidly and there is a vast field for it in Southern India. What has been accomplished so far is the direct result of the modern developments of the internal combustion engine in its various forms, and there is reasonable ground for hoping that further improvements may be effected in the future rendering motive power still cheaper and pumping appliances more effective.

APPENDIX.

Actual Cost of Installations under the Sub-heads.

Serial number.	Name of station.	Engine.			Pump.			Storeage of oil.	Foundations.	Engine shed.	Belting.	Miscellaneous including circulating cistern and fitting charges.	Total.
		B.H.P.	Cost of engine.	Cost of fittings.	Size of pump.	Cost of pump.	Cost of fittings.						
1	Kuhoor	3½	965	150	3″	285	93	30	40	30	50	82	1,725
2	Unjalur	5	1,286	77	3″	270	145	20	50	35	31	86	2,000
3	Thimmanacharikuppam	5	1,272	42	3″	270	103	20	70	30	31	82	1,920
4	Tanjore	5	1,286	180	3″	300	76	30	110	35	20	103	2,140
5	Pagalpatti	7½	1,472	108	3″	285	90	30	60	35	30	105	2,215
6	Dorigallu	7½	1,420	82	3″	300	145	30	50	150	43	110	2,330
7	Thirukkarugavoor ...	7½	1,597	77	4″	365	135	30	50	150	40	121	2,565
8	Bangalaputhur ...	7½	1,546	101	4″	345	165	30	50	35	40	118	2,430
9	Ramayyapatam ...	7½	1,546	91	4″	315	127	30	150	35	57	119	2,470
10	Nellikuppam	9	1,794	93	4″	365	128	30	80	50	40	130	2,710
11	Pallavàram	14	2,474	180	5″	450	...	30	80	200	81	175	3.670
12	Laccavaram	14	2,240	318	6″	385	243	60	100	200	81	183	3,810
13	Katalai...	25	4,423	730	12″	1,265	445	150	200	750	123	404	8,490
14	Hagari	28	4,800	755	10″	1,100	411	150	250	1,000	100	429	8,995

THE PROGRESS OF CO-OPERATIVE CREDIT SOCIETIES IN THE BOMBAY PRESIDENCY.

BY

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We have before us here a large subject ; and I have before me a short time only in which to write it up. At the best, I can but be superficial. However, I satisfy myself that an outline only is required, and that the progress of the movement *as a whole* is the object of inquiry. But, first of all, having discovered what we mean by " progress ", let us see what the words " Co-operative " and " Societies " may impose on us ; to say nothing of the familiar words " Bombay Presidency ". We ask vaguely, perhaps,—how is " Co-operation ", or the " Co-operative movement ", getting on in your parts ? Much as though we might ask, how is " inoculation " doing in your part ? We know what we mean by " inoculation ", but who knows what " Co-operation " may involve, or lead to ? It may take all sorts of forms, rather like a Government : it may be centralized or decentralized, monarchical or socialistic, or even nihilistic : as a matter of fact, with the prevailing democratic turn of modern ways, it has taken a turn for democracy. Let us be content, for the moment, with one form ; or two at most :—the democratic and the philanthropic, say, (illogical as this may sound).

Then " Societies " ? What is a Society ? There may be trading societies, religious societies, literary societies, and so on.

Ours are " Credit Societies ". And " Credit Societies " may deal with different classes of people ; or different objects of credit. We may take our stand on " cash "—" hard cash ". The difficulty of obtaining it, sometimes, for one's Societies, might well give it its name ! Now in a small area, say a Taluka, we might find a shoal of Societies all more or less identical in form and working ; very much as the Kunbis of the Taluka would resemble one another. But, we have the Bombay Presidency to deal with ; that is, we may well say, roughly five different countries, or parts thereof—Sind, Gujarat, the Konkan, the Deccan, and the Karnatic. Sind we will omit : I visited it, and had two Societies there originally ; one failed to start at all after registration, and was cancelled ; the other is, I believe, flourishing to date : but, the truth is, I have recently handed over that corner of the Presidency to a local Registrar. We are left, thus, with the Presidency proper ; and for convenience sake, we may simply divide it into three parts, corresponding roughly to its three different languages of Gujarati, Marathi, and Kanarese. The division is very practical from an administrative point of view ; for the fellow-feeling that makes us wondrous kind is considerably helped out by a mutual understanding of language. " Co-operation " assumes a wider sense when it bridges over intervals of language and custom. Perhaps we shall get there before we come to the end of this paper, which has been long enough beginning.

We are to study then certain democratic institutions, co-operating credit to secure cash ; the atoms, as it were, of " Co-operation "; and this in, roughly, Gujarat, and the Marathi and Kanarese countries.

Our standard, by the bye, is Act X of 1904 (India), and the Rules (Bombay) thereunder. Let us proceed by coun-

tries first ; from base to head ; and then to middle, last but not least, and perhaps the most vital part of all.

The Kanarese country was fortunate in its founder of " Co-operation ", my predecessor, Mr. J. McNeill, who was attached to Dharwar. So Dharwar led the way with 7 out of the first 9 registrations ; and Gadag Taluka claimed the first 3 of these. Here was our nucleus, and here is our nucleus still, in the South. The North has one now of its own, but not so full of life ; and the centre too at last, but not nearly so full of definite character yet.

Gadag Taluka has in all 10 Societies, one only Urban, the rest Rural. The terms " Urban " and " Rural, " I may add, for any who may not know, are imposed by the Act, the former being applied to Non-agricultural, the latter to Agricultural Societies. For instance, if in Surat the agricultural population formed themselves into a Society, it would be Rural ; while a Society of petty village boot-makers, or the like, would be Urban. The constitution of the two may be identical.

Betgeri Society is our Urban Society of the Gadag Taluka; it is open to all classes ; the liability of a member is limited to any amount unpaid on his share or shares. The value of a share is Re. 1 ; and one share at least must, but one only need, be taken up by each member. There is a Committee of not less than 5 members to transact business. They are elected yearly at the annual General Meeting. Membership of the Society is subject to election by this Committee, and is limited to residents of Betgeri and Gadag (the two places together forming one Municipality). The Committee will be responsible, too, for borrowing and lending, and for seeing the accounts are properly written up. They must appoint a

Secretary, of course, who may be merely a paid servant, like a Municipal Secretary. Loans to members (and loans are never made to non-members) will carry 9 % or so interest, not lower. In the word " non-members " I do not include other registered co-operative societies round about in the Gadag Taluka. The Society may lend to them. But they, if not members, are yet as it were sisters or daughters. We want more of these god-mothers (not step-mothers). Then, besides borrowing from without and lending within, the Society deals in deposits. Deposits short of the year draw $4\frac{1}{2}$ % interest ; beyond that they draw anything up to 6 %. The Society's capital now is roughly Rs. 10,500.

Let us step into a Committee-Meeting (as I once did unexpectedly). There is an air of business about, a heap of cash, hard cash, on the table, a Secretary writing away or rising to show or ask questions, learned looks on all brows. There is the Chairman, with his colleagues this side and that. A man is standing up waiting to be certified that his deposit of Rs. 100 (I happened to pitch on a day when a man brought Rs. 1,000 !) has been accepted and duly entered in his name. No sooner is he gone than another comes with one rupee and a request to be admitted as member : the rupee is the price of his share. A discussion follows—where does he live, what does he do, is he hard-working, is he likely to remain in the place, does anyone know him specially well, will he be honest enough to lend too ? Facts are considered, probabilities are weighed, and a majority elect him. Next week he will come again, not with money but for money. His rupee satisfied the Society, the Society is now to satisfy him with Rs. 50. He is a carpenter, and needs a supply of wood and a few new tools. After him, in comes a well-to-do member

who wants Rs. 500 to increase his shop-premises. The matter is discussed, his security demanded, his prospects considered, and it is finally agreed by the majority that Rs. 300 will suffice and be safe. Here we may leave, while they toil on to see that everything is written up and signed, proceedings, accounts, documents, &c. They are responsible to the Society for good business and honest dealings. But who has set this all in motion? I have mentioned Mr. McNeill; I must mention another gentleman round whom the Society delights, apparently, to revolve as round a pivot, namely, Canon Rivington, who wisely however says to them—"there is my opinion, but it is for you to decide." At Barsi I have a somewhat similar Society; and I like to consider my friend Mr. Sane as the counterpart to the Canon; though I believe he has more to contend against. We are very cosmopolitan in our co-operative work, and the question is not so much—who is he?—but, what work does he do? We want men who will work, not only preach and promise. The Committee must work, the Secretary must work, the borrowers must work, and the Society must work and work at a profit too. The local depositors, even, will work; to see their money is not squandered, and the neighbours do not default. Outside depositors or lenders lend or deposit on a name already made, on an audited balance-sheet, and on strictly-observed bye-laws.

I look on Betgeri and Barsi more or less as ideal types for Urban Societies, mediums for the dispensation of local or outside capital to the less-favoured members of the same community, lending Societies and Savings-banks combined, instructors in business and morals, delightful channels of communication to unite the rich with the poor. Let the rich be kindly and humble, and the poor know their place; and "Co-opera-

tion" will be there at its zenith. But what about "Rurals", the predominant partner in the business? In what do they differ? In liability of the member mostly. Nor do they go in for shares or dividends. They want something simple, something intelligible to the man behind the plough. He knows what a field is, and he knows what a field needs, and he knows what he wants but has not got; that generally resolves itself into "money". The savkar he has; but he does not know what he borrowed from him, what he pays or has paid to him, what he still owes him, nor whether he will ever get any more out of him. All he knows is that the savkar is still alive, and asking; and threatening, perhaps, a suit, in which his land may go. The "Co-operative" movement turns towards the agriculturist first, much as a doctor turns first to his most ailing patient.

Let us visit Hulkoti, then, just by Gadag, and see what its Society can tell us. We are met by an honourable Patil, Mr. Shiddangawda, and told he is the Chairman. With him are several others, more or less leaders too; and with them is the schoolmaster, who, we are told, is the Society's Secretary. We find that their capital stands now at Rs. 10,500, of which Rs. 4,000 (from the Bombay Urban Society) is entirely devoted to redemption of old debts, on land-bonds. We find they are charging 9 3/8 o/o on loans to members, and giving 6¼ o/o on fixed deposits. We think at once of investing in these paying "deposits", but are told that such a privilege is reserved as a rule for "members only"! What will they give then for a loan? They look at their books and find only five demands outstanding, just at present, for loans from members, they have Rs. 175 odd at hand, in the Post Office, instalments to the amount of Rs. 872 are due next

month (will very likely be paid before date, with correspondingly reduced interest), so that altogether they have no immediate need of our money; though they may shortly. Again, we are disappointed? But then, remember, we are dealing with one of the best, if not the best, Rural Society we have in the Presidency. We may expect them to be cool-headed and sure-footed. We ask about their membership, and find there are 123 members. The liability is unlimited; each is equally liable to gain or loss; and they are together more like a little family, a village within a village, ruled by a Panch, than a "Company established by law". The greater the danger the nearer are they likely to cling; unlimited liability is just the thing, the thing they understand, the thing outsiders value; not one man's credit, but the combined credit of all. We need not ask what they spend their money on: we all know the ordinary needs of agriculture and the agriculturist, and we have above alluded to the special need of redemption from previous burdens. Even in Hulkoti there is probably plenty more room for money, money to be safely invested, and well used when there. And the golden rule of "line upon line" may not be quite in keeping with the desideratum of "loan upon loan."

I have spent so much time upon two Societies (out of a total of 91 in the whole Presidency, excluding Sind) that people may be feeling they don't know to what lengths I may be going next!

The truth is a very few homely details about a living person may be worth much more than an elaborate character-sketch in a novel. I have been trying, with results of which I am the opposite of proud, the heavy burden of work (with my special plague duty added must be my apology), to convey

the inquirer into the middle of a village and town where co-operative life has begun, and is going on vigorously. I wonder whether I have allured him to attempt something of the kind near his own home (charity begins there) or stirred up his conscience to the possibilities of good that lie before him. Societies do not beg for money, they work for it. And honest work is probably a better security for repayment than numbers of sureties, or a house full of gold. It was meet, too, to dwell at length on two "Dharwar" Societies, a district so deeply connected with the beginnings of co-operation in this Presidency. And if it is—like mother like daughter, like priest like people,—we may expect to find other Urban and Rural Societies very similar to the ones we have now visited.

We may close our Southern Division with mere figures; there are in all 9 Urban and 28 Rural Societies; of the Urban two are purely for weavers; of the Rural two have included grain-dealing in their bye-laws. All the others are, more or less, what we may call normal.

We have only just enough time left to give a few figures, with a few remarks added, for our Northern and Central Divisions. Rather a large area to be disposed of so briefly!

Gujarat differs from the Karnatic possibly as much as one Presidency may differ from another. Yet there are more likenesses, perhaps, than differences; and our Societies being of so comprehensive a turn of mind may bring out both sides. The constitution will be much the same in both, but the needs and the cost of money will vary. In Gujarat, on the whole, money seems more plentiful, and therefore cheaper: a Society will, if one is not careful, go off with a flourish of rupees, and go on paying the interest thereon without investing any, or very much, of the amount he borrows: it will, as it were, tie

up its capital in a rumal, put it at 3 (if it has enough energy for that) in the Post Office, and go on its way cheerfully or thoughtlessly, paying out 6 per cent. for that for which it is getting 3 per cent. *Cui bono*, and for how long? In other cases, one may find a mixture, half the members mere depositors, the other half mere borrowers. Sometimes, the moneyed constituents will not trust the poor. What is the solution that approves itself to us most—let the two combine where they can, but where they cannot let each party be content with its own Society: and let the Society of rich depositors (or sharers) lend out to poor Societies near and far, such sums as they need and can pay for with their co-operative credit.

I would go beyond a Society's immediate neighbourhood, and suggest that well-to-do Gujarat Societies should lend money to poverty-stricken sisters of the Deccan. Security may be found in plentitude by those who can see on the spot; and they can convey their knowledge to the distant creditor. This has been done already by that philanthropic Society, the Bombay Urban; the Hon. Mr. Vithaldas Thackersey's Society, I call it. That Society errs, perhaps, on the side of philanthropy. I do not say that others must do so, too, though following their lead. Let the Societies be strictly business-like and let their lending rate even be not too low. But let them lend, not merely talk about it. "Bombay Urban" has lent some Rs. 14,000 to Rurals at a truly opportune time; what we should have done without it I really do not know. I ask that in places where people have money they may co-operate in lending it—they may if they like, of course, do a little local business in big or small loans, fixed or current deposits, and may act in fact as a general Savings Bank, and lend out their resulting capital discriminately, on the advice

of the Registrar or of anybody else they choose. I am not jealous ! When the Gujarati says, then, "I have money enough, I need no loan, or if I need, I have a cheap market ready at hand," we may reply by showing how he can employ his money both kindly and profitably, and safely, too, by joining it with that of others suffering from the same complaint to lend in lumps to like Societies of unlike means.

I close Gujarat with a few figures. Like the Gadag Taluka (Dharwar) of the South with its nucleus, so we have the Prantij Taluka (Ahmedabad) of the North with its 8 Societies; due, I believe, altogether, or in great part, to Mr. Bulakhidas, the then Mamlatdar, and to the aged Patil of Poglu. These two nucleuses form nearly the extremes of the Presidency proper, North and South. Mr. Lalubhai Samaldas, another name famous in the Bombay "co-operative" world, has stepped in conveniently in the North with loans, somewhat as Mr. Vithaldas Thackersey has with his Bombay Society in the South. In all, Gujarat has 4 Urban and 22 Rural Societies.

Lastly, the Deccan, we include in this, we may say, the very heart of the Presidency; and a good deal of its backbone, I aver, I am not an anatomist ! "Barsi Urban" I have alluded to, and Poona and Bombay have some 7 Societies between them. Manmad is the centre of a quasi-Railway Society, catering mostly for the welfare of Railway servants. Its moral nature, too, may be seen in its title "All-India Brotherhood" Co-operative Society. They have essayed co-operative stores. Poona, and East and West Khandesh together, have gained in importance (if possible) as the birth-places of Societies established for the benefit of Government servants. The Saraswat Brahman Society (Urban of course), with head-

quarters in Bombay, may serve as a good model for definite caste Societies. We may allot in all some 10 Urban Societies to our Central Division. But, the important question is the Rural. Even the Deccan itself is not uniform. We may consider the Khandeshes, perhaps, a country by themselves. " Bodwad Rural " shines brilliantly in the East, due much to my friend, Wajir Patil. But, I have no time to dwell on the events of the Society here. It has some Rs. 3,800 in deposits from members. We must postpone our visit to hospitable Bodwad.

Let us turn to the stern Deccan proper, the ' Nasik Nagar ', Poona, and Satara Districts. The three former are disposed of with one Society, and that, still undeveloped. For the Satara District, I can say much more than that ; but I will merely point out that my sojourn during the rains, after a somewhat exhausting tour and before the Annual Report, in Satara itself enabled the neighbourhood to pick up scraps of information, and come and ask for more. The result has been a nucleus round Satara itself, and spreading. The Societies are all young and tender, and they need and will need careful nourishing with bread and milk, that is money and advice, for some time to come. The field is large, and abounding in debt, the people poor and ready, they will co-operate in small companies, they have a will to work, they have little or nothing to deposit, they are honester perhaps than other parts we have dealt with ; what do they need ? Business capital to clear them from old debts, and then start them on new labour and improvement of their lands. To reverse these objects is to put the cart before the horse. We do not want them to pay off one debt and incur another to be treated with equal carelessness. Nor do we want them to learn to spend more on

what is not profitable. To both these points small Co-operative Credit Societies pay special attention ; so we want such Societies, well founded, well supervised, and well treated by kindly capitalists, small or great, local or distant, treated, I say, with the means of subsistence and the means to progress. Their own deposits may follow later on. The Satara District has now some 13 Societies : of these some are technically Urban, being of small artisans or the like. But the movement is Rural rather than Urban, and I am hoping our big men of Satara City may be shamed into action by the efforts of the little villages dotted in and round the sluggish mass of urbanity. Two of my little Societies are, as a matter of fact, actually in Satara City ; but they are not "Satara City". It is suggested that every city might have its lending Society and Savings Bank. Post Office interest is small.

I close the Deccan with the statement that there are about 17 Urban Societies in all, and about 11 Rural.

To sum up, I may say that there are 30 Urban Societies, and 61 Rural altogether in the Presidency proper. For further figures, if required, I would refer inquirers to my Annual Report, just out, for the 15 months ending June 30th, 1907. I have arranged that the Secretary of the Conference have one copy with him for ready reference.

What do we need ? We need honorary organisers. I have three noble ones. Rao Bahadur Motilal Chunilal (Gujarat) and Messrs. K. N. Bhangaonkar (Khandesh) and A. B. Desai (Belgaum). I want one more at least for the Deccan proper. The more, if suitable, the better. The work is growing, and growing complex. In all, 91 Societies exist now in the Presidency proper as against 31 reported at the end of the year closing March 31, 1906. You ask—how to begin ?—sit in the Chavdi

and tell them of Hulkoti, Bodwad and Betgeri with their thousands.

We need capital. We ask either for individual lenders, such as Mr. Lalubhai Samaldas, Sir Cowasjee Jehangir, M. D. J. Tata, and Sir Sassoon David have been, to our immeasurable gain; or else for lending Societies like the "Bombay Urban" of the Hon. Mr. Vithaldas Thackersey, or like up-country Urbans, provided they have the money to lend. We do not ask these latter to be as philanthropic as Bombay; nor do we ask all capitalists to be as philanthropic as Mr. Lalubhai; we ask for business loans on business terms, but with interest low enough to fit in with the needs of the locality. Up to now rates have ranged from 4 per cent. to 7 per cent. The first is obviously too low, the last for some a little high. $6\frac{1}{4}$ per cent. is a convenient rate all round, and a rate that enables redemption of old debts with creditable expedition. Once old debts are paid off, the savkar may learn to invest his money in the local Society, and draw his income or pension therefrom without trouble; while the ryot may learn to live within his means, that is, within the good books of his Society, and subjugate Mother-earth to yield her fullest fruit, and feed her happy children.

COMMERCIAL EDUCATION.

BY

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Twenty-five years ago, there used to be sharp differences of opinion as to what Technical Education meant and included. There was a vagueness—an indefiniteness in our ideas about the scope of Technical Education. For some time, every kind of education other than literary and professional education was considered to be Technical Education. Later on, the view began to prevail that Technical Education is neither more nor less than Industrial Education. Our ideas on the subject, thanks partly to the annual Industrial Exhibitions and Conferences, have now become much clearer, and it is now pretty generally recognized that Technical Education embraces three main heads, viz., Agricultural, Industrial and Commercial Education.

Agricultural Education is concerned with the production of the raw materials of commerce. Industrial Education is concerned with the conversion of raw materials into manufactured products, while Commercial Education is concerned with seeking out markets for commodities and finding purchasers for the products of Agriculture and Industry. Though it has not been easy to ascertain the best means of imparting Industrial

Education, we have always readily acknowledged the importance and utility of Industrial Education. It has not, however, been always so easy to get the public to recognize the importance of Commercial Education. Markets for commodities are as great a necessity for the producer as fields of production are a necessity for the continued existence of a market. The manufacturer's occupation will be gone the moment he ceases to be a merchant or to co-operate with a merchant.

The interdependence of commerce and industry is so real and obvious that it is difficult to realise why, in the past and to some extent even now, commercial education has not been recognized to be an important portion of technical education. It is readily admitted that preliminary training is necessary for a young man who desires to become a mechanical or electrical engineer, a manufacturer of glass or pottery, a spinner or a weaver, while it is often thought that buying and selling are sufficiently simple operations in which any young man born of a wealthy father may readily engage himself without previous training of any kind.

In the words of Sir William Preece, "the Americans and the Germans are ousting the British out of their markets not so much by any superiority in the quality of their goods, but by their superior knowledge of the demands of the markets, by better direct communication with foreign countries, by superior methods and business ways, by establishing regular intelligence departments, and, above all, by possessing and exercising superior commercial knowledge." If Europe and America with their accumulated prestige and experience consider it necessary to make commerce a subject of serious study, if such leading commercial countries as England and America, Japan and Germany, consider higher commercial education necessary for the advance-

ment of their commerce, how much more essential must it be to organize commercial colleges in this vast continent of India, so bountifully endowed by Nature and so little exploited by us. We are so thankful to the Almighty for having made our country so rich in natural resources that we do not care to teach our young men what India is capable of achieving in the world of Industry and Commerce.

On the recommendation of Lord Ripon's Education Commission, a resolution was passed by the Government of India in October 1884, "that every variety of study should be encouraged which may serve to direct the attention of native youths to industrial and commercial pursuits." The Royal Commission on the Depression of Trade in England recommended "a sounder commercial training as the chief remedy." This recommendation of the Government of India was first acted upon by the Trustees of Pachaiyappa's College, Madras, who, at the instance of Mr. John Adam, M.A., Principal of that College, started a Commercial School in Madras and placed it in my charge. We were able to secure the sympathy and support of the leading merchants of Madras and of the Madras Government. It was, however, thought by our sympathisers and supporters that the only useful work which could be done by a commercial school was to teach its students to write a neat hand, to fill in blanks in printed forms of mercantile letters, and to make the simpler arithmetical calculations with rapidity and accuracy—in a word to perform the duties of a Junior Mercantile Clerk. In the course of five or six years the commercial schools of Madras were able to convince the public that they could teach their students much more than this and that they could turn out young men qualified for performing the duties of Senior Clerks in the Correspondence and Account

Departments of Mercantile Houses. The commercial schools of Madras and Bombay have already proved their ability to turn out book-keepers and accountants, shorthand-writers and reporters, banking, shipping and insurance clerks, qualified to enter upon their duties without previous apprenticeship. The utility of the schools engaged in imparting elementary and secondary commercial education is now so largely acknowledged on all hands that the permanency of such institutions may now be considered to be well assured.

But commercial education will not deserve the attention which is claimed for it, if commercial institutions are merely intended to divert young men from one kind of quill-driving to another kind of quill-driving. The advocates of commercial education have always had a much higher object in view than inducing a few young men to accept clerkships in mercantile offices. The real and chief object of Commercial Education is to enable our youths to become traders, merchants, and bankers. The training imparted ought to attract the brightest of our youths and enable them to take a comprehensive view of the markets of the world, to seek out the cheapest sources of supply and the best markets for such commodities, and to ascertain and utilise the best means of transport for the commodities in which they deal. They should be enabled to read and understand statistics, to appreciate and fully grasp the significance of all changes in the money market, to take full advantage of the facilities granted by bankers to merchants, to promote the formation of joint stock companies, and to conduct the administration of such companies.

The most pressing problem in connection with Commercial Education that now demands our serious attention is the right method of imparting higher commercial education for the

purpose of turning out merchants, bankers, and financiers. What is the nature of the training to be imparted? By whom should our Commercial Colleges be financed and managed? By whom should our commercial examinations be conducted? How can we effectively attract students of the right class to these Commercial Colleges?

However well organized and well conducted a college may be, the usefulness of that college will be greatly reduced unless the college is able to attract students who by their previous education are qualified to benefit by the business training imparted in that college. We have for the past half a century been so much accustomed to associate higher education with a University degree that it is so difficult to prevail upon our young men or even their guardians to believe that a college which does not prepare its students for a University Degree deserves to attract the brightest of our young men. The impression unfortunately prevails that commercial schools and colleges are intended only for the benefit of such students as have not the intellectual capacity for a University course. Though it is quite easy to prove that such an opinion is based upon a misapprehension of facts, it will be unwise to ignore this prejudice against colleges unconnected with a University. The practical administrator ought to take note of this prejudice and frame his programme for the development of higher commercial education so as to attract the brightest of our young men as well as the sons of well-to-do parents. This one reason is enough to induce us to press the Indian Universities to institute Degrees in Commerce and affiliate commercial colleges that agree to prepare candidates for University Degrees in Commerce.

Another reason why our Universities should provide for higher commercial education what they have done for legal,

medical, and engineering education is, that the training imparted in a commercial college unconnected with a University will, in endeavouring to make its instruction practical, pay insufficient attention to the training of the intellect and to mental culture. Such a college will pay more attention to business routine and to the practical requirements of a business office than to the consideration of the larger problems of production, distribution, transport, and finance. Such colleges will succeed in producing capable head clerks and even managers, but will not enable our young men to grasp the marvellous and complicated phenomena of modern commerce and to generalise from complicated facts in the concrete life of commercial communities. A substantial portion of the course now prescribed by our Universities for the Degree of Bachelor of Arts is absolutely essential for the young aspirant to a Degree in Commerce. This is especially true in the case of Languages, History, and Political Economy. Without such intellectual training and without such culture, the graduate of a commercial college would be unable to apply his knowledge to the ever-changing problems of commerce that would await solution at every turn.

It is sometimes argued by University authorities that our Universities ought to have nothing to do with bread-winning pursuits like Commerce. University Senators often pat commercial education on the back, express the profoundest sympathy for it, and declare that it ought to be encouraged by every possible means. But when it comes to a question of instituting University Examinations in Commerce, they shrug their shoulders and fight shy of University Degrees in Commerce. It is not the business of a University, they say, to enable a man to earn his bread. Mental culture is,

I admit, one of the fundamental objects of education. But to plead that University training ought not to be calculated to enable graduates to earn their livelihood, is to ignore the past history of Universities, Indian and foreign. Are not the Legal, Medical, and Engineering professions bread-winning pursuits, and do our young men take degrees in Law, Medicine and Engineering merely to pay their homage to the Goddess of Learning? And do they, when they begin to practise their profession, charge no fees for their services? Or, when they do charge fees, do they charge just enough to keep their body and soul together? The fact is, to quote an eminent writer, "the philosophy that affects to teach us a contempt of money does not run very deep. So manifold are the bearings of money upon the lives and character of mankind that an insight which should search out the life of a man in his pecuniary relations would penetrate into almost every cranny of his nature. A right measure and manner of getting, saving, spending, giving, taking, lending, borrowing, and bequeathing would almost argue a perfect man."

Another objection which has sometimes been raised to the institution of a University Degree in Commerce is that the study of Commerce will have a narrowing influence on the minds of University students and will not tend to produce that mental culture which ought to characterise every course of University studies. But an honest and careful scrutiny of the course of studies recommended for a Degree in Commerce ought to dispel this illusion and ought to convince even the most advanced advocate of University culture that the studies required for a Degree in Commerce will discipline the intellect as much as the course for the Degree in Arts. It is because we consider general culture to be essential for the successful man of

business that we plead for University recognition of the study of Commerce. In the words of Sir Philip Magnus, "the function of a University is to liberalise all kinds of professional studies, Medicine, Law, Engineering and Commerce, and to suggest courses of study leading to a University degree in the branches of knowledge cognate to different professional careers, and to encourage learning and original investigation in any of the subjects of study included in such courses. The love of knowledge for its own sake, which it is the highest aim of every teacher to stimulate, is not excited but rather deadened by divorcing science from its application; and it is in the quest of knowledge to serve some special end that the highest truths of science have often been revealed and the pleasure of research and discovery has received its supreme satisfaction."

The great historian of the American Commonwealth and of the Holy Roman Empire, the Right Honourable James Bryce remarks: "I have felt for many years, and I have taken many occasions of urging that modern commerce, whether it be regarded as an exchange of commodities be studied from the side of production or the side of finance, has now become a subject which ought to receive full University recognition. It is a subject which is quite worthy of being treated in a philosophical and scientific way and of having a place in the curricula of our Universities."

His Excellency Lord Northcote, in his capacity of Chancellor of the University of Bombay, urged that "commerce should be as thoroughly taught and honoured a study as any other of those other branches of learning which an Indian University delights to honour and that the high literary reputation of the University of Bombay would in no way be

diminished by increased recognition on its part of proficiency in scientific, agricultural and commercial studies."

Whether the study of commerce deserves to be recognised by our Universities is a question which has during the past six years been satisfactorily answered by the institution of Degrees in Commerce by various British Universities. Faculties of Commerce with courses of studies leading to a Bachelor's degree and a Master's degree in Commerce have recently been instituted in the Universities of London, Birmingham, and Manchester. Even the University of Cambridge has instituted a Degree in Economics nearly on the same lines as the Degrees in Commerce of the other Universities. Our Indian Senators can no longer plead that the study of Commerce does not promote mental culture and does not, therefore, deserve University recognition. It may of course be urged by unsympathetic friends that whatever is good for England cannot also be good for India. The fact is, that, long before the institution of a Degree in Commerce by a British University, we in India were pleading for the institution of Degrees in Commerce by the Indian Universities. Our proposals were then laughed to scorn on the ground that we were endeavouring to copy the American Universities in the matter and that even England had not instituted University Degrees in Commerce. Now that English Universities have done so, we are sometimes told that we must wait sufficiently long to watch the result of the experiments being made by British Universities in the matter. An argument of this kind, if allowed to prevail, would prevent, or greatly delay, the introduction of almost every kind of reform.

One other objection that may be raised against the institution of University Degrees in Commerce is, that the training imparted in a Commercial College under University control would

be too theoretical and might be so much divorced from practice that the graduates of such colleges would not become successful men of business. An objection of this kind deserves careful consideration, but is one which may be met by a careful organization and by a carefully drafted curriculum. The best plan seems to be that our Commercial Colleges ought to be under the management of our leading merchants and bankers, subject to University control. University control will ensure attention to mental culture and to general principles. The supervision of the merchants will ensure attention to the application of the general principles to the practical problems of commerce. The examinations will be so conducted as to test the ability of the candidates to apply their principles in practice. The questions set by the examiners ought to consist of practical problems in Commerce which can be solved with the principles that have been taught during the University course. The co-operation of the University authorities with the leading merchants will secure both the objects and will create a supply of University graduates in Commerce, with a sufficiently sound theoretical and practical knowledge.

All other kinds of objections having been met, a new kind of objection was recently raised by His Excellency Lord Lamington in his first Convocation Speech as Chancellor of the University of Bombay. His Excellency remarked that "there seems to be a tendency to think that the establishment of a degree is all that is necessary for the complete equipment of any particular branch of higher education. I have heard suggestions for a commercial degree. Now, no one disputes the importance of the aptitude for success in commercial life, but that a Central University should be specialised to meet the requirements of the different professions that make up the

activity of the commercial world, I believe, would be unwise until it has adequate resources to take up the work thoroughly. The need for such specialisation may be met, when those who are chiefly concerned make the demand, as the Medical and the Legal professions have done in the past." It was unfortunate that His Excellency was not correctly informed as to the nature and character of our demand for the institution of a Degree in Commerce. We were not and could not have been so short-sighted as to think that the mere institution of a Degree Examination would be sufficient without the establishment of a well-conducted commercial college to prepare students for that degree. The fact is, that I was prepared to announce large donations for conducting such a course as soon as the University authorities were prepared to receive favourably my proposals for the institution of Degrees in Commerce. Again, it is against the past history of our Universities to declare, as Lord Lamington did, that our Universities should not recognise new branches of learning until they have adequate resources of their own to train students in that branch. Our colleges are now financed and managed either by private bodies or by Government, and our Universities do not contribute towards the expenditure of any of our colleges. What the University has to do is to institute and conduct the examinations and to see that adequate provision is made in a private or Government College for the preparation of candidates for that Degree. It is, however, gratifying to note His Excellency's admission that the need for such specialisation may be met when the demand is made by those concerned as in the case of the medical and the legal professions. I may be wrong, but I am not aware that our lawyers and doctors presented a petition to the University and to Government before our Universities instituted University Degrees in Law and

Medicine. Nor am I aware that our Colleges of Law and Medicine have been or are financed by our lawyers and doctors. Why is it then necessary that our merchants should petition for Degrees in Commerce and should offer to finance commercial colleges before the University thinks of instituting Degrees in Commerce or Government thinks of starting and maintaining Commercial Colleges? However, commercial colleges would certainly gain in prestige and usefulness if our merchants took up the question in right earnest and co-operated with the University. Let us now make an authoritative demand for University recognition of the study of Commerce and let us make an earnest endeavour to endow well-equipped commercial colleges in each province and I am pretty confident that it will be difficult even for unsympathetic friends to raise any more objections.

The chances of success are much brighter than before if fresh attempts are now made in this direction. The re-constituted Senate of the Calcutta University actually passed a resolution instituting a Faculty of Commerce, though this resolution was finally dropped by the Committee appointed by the Government of India to frame regulations for that University. An amendment to this effect proposed by some of us in the Bombay Senate had secured the support of a large number of our colleagues in the Senate but had to be dropped, for the time being, for certain other reasons. There was also an agitation in the Madras Senate for the institution of Degrees in Commerce, which, however, proved abortive.

Let me now briefly indicate the scope and extent of University courses in Commerce. A sound knowledge of English and of at least one Asiatic and one modern European language will form an essential feature of the University course in Commerce. Among other subjects will be Commercial Mathematics

and Accountancy, Mercantile Law and Practice, the history, science and practice of Banking, Currency, Foreign Exchanges, Economics, Economic Geography, the history of Commerce, Industry, and Manufactures, the theory and practice of Statistics, Railway problems, Transport, Public Finance, Industrial development, and the organisation of industries. The scope and extent of education that a young man would have received at college by the time he takes the Bachelor's Degree in Commerce would be neither more nor less than the training received by the Bachelor of Arts, the Bachelor of Science, the Bachelor of Laws, the Bachelor of Medicine, the Bachelor of Engineering or the Bachelor of Agriculture. The scientific study of Commerce is so vast and extended that there is ample scope for the institution of a Master's Degree in Commerce as there is in Arts, Law, Engineering, Medicine, and Science. As in the case of the other Faculties, a Matriculate will take four years to qualify for the Bachelor's Degree in Commerce and another two years for the Master's Degree.

The next problem in connection with commercial education that demands our attention is an improvement in the organisation of the commercial schools and colleges now in existence in different parts of India. Commercial schools have during the past three or four years been started in different parts of India without any attempt being made to profit by the experience of other Provinces in working similar institutions. Different systems are in vogue in the different Provinces of India and in certain cases the plan that has been tried and given up in one Province has been adopted in another Province. In 1890, the Madras Government tried the experiment of attaching commercial classes to the Government Training College, but very soon gave up the attempt in favour of starting an independent Government

School of Commerce. Though the requirements and opinions of local merchants ought to carry weight in settling the curriculum for these Commercial schools, the authorities should freely avail themselves of the experience gained in other Provinces in grouping and grading the subjects and courses of instruction. This has unfortunately not been done in every case; and the consequence is, that the mistakes committed in the earlier stages in one Province, though they have subsequently been remedied, are now being repeated in other Provinces. In Madras, Calcutta, and Lahore, the commercial examinations are conducted by Government with the co-operation of the merchants; these local examinations are more or less adapted to local requirements. In Bombay, the mania is for London examinations and London certificates. Some of these London examinations, especially those of the London Chamber of Commerce, are of a high standard. These London examination schemes are certainly not adapted to local requirements, though they are very good models for our framing an Indian scheme of examinations for Senior Clerkships in firms. An Indian scheme of Commercial examinations for Senior Clerkships framed on English models, but adapted to Indian requirements, is now a great desideratum. No specific general education qualifications are now demanded from candidates for the commercial examinations held in India. The consequence is that the training imparted in these commercial schools very often degenerates into cramming and coaching. It is necessary to insist that every candidate for these commercial examinations must have completed his High School course. It is also necessary to provide for some kind of inspection by responsible authorities to ensure the adoption of right methods of teaching. In Bombay, the demand for trained mercantile clerks is so large that a number

of private commercial schools and classes have during the past five years come into existence and are in a flourishing condition without any kind of endowment and without any kind of help from Government. Bombay is the only province in India where it has not been necessary for the Government to spend money on commercial education. This is a feature of which Bombay may be proud. But freedom from pecuniary responsibility for the spread of commercial education makes it all the more incumbent upon the Bombay Government to frame a local scheme of examinations and exercise some supervision over the commercial schools and enforce right methods of teaching by withholding recognition from schools that do not come up to the mark.

Another problem that awaits solution is the formation of vernacular commercial schools for the benefit of those that discontinue their studies on passing through the vernacular or primary department. Nine years ago, when I was Head Master of the Government School of Commerce, Calicut, I organised a vernacular commercial class for the benefit of the sons and wards of petty traders in continuation of their vernacular course. This class is still being conducted by my old students and assistants in Malabar and has proved a complete success. At the request of the Municipal Council of Sholapur, I have recently drafted a course of studies for a vernacular commercial school; and my draft scheme is now under the consideration of the Sholapur Municipal Committee with a view to its being introduced into the Municipal Commercial School of Sholapur. The chief difficulty in this case as in the other cases is about securing a sufficient supply of qualified teachers.

Arrangements ought to be made for the establishment of a Central Commercial Institution at the head-quarters of each Province. This institution ought to have distinct de-

partments for imparting higher, secondary, and vernacular commercial education; provision must also be made in this Central Institution for training secondary and vernacular commercial teachers and supplying such teachers to the smaller schools in the mofussil. A well-equipped Technological Institute will cost at least 20 times as much as a well-equipped Commercial College. Want of funds cannot, therefore, be so justifiably pleaded as an excuse for not organising a system of commercial schools and colleges. It is the will and not the absence of funds, that has been wanting. In spite of all these obstacles we may well congratulate ourselves that in the space of 22 years, commercial education in India has made the progress which it has, and has made the Government of India go so far as to offer scholarships to young men desirous of qualifying for one of the British University Degrees in Commerce. Another gratifying feature in the growth of commercial education in India is that throughout its history the initiative has always been from private individuals and managers of private schools and colleges. In Madras, after the managers of a private college had started a commercial school and proved it to be a success, Government took it up and started a school of their own in Malabar. In Bombay, again, it was reserved to the Trustees of another private college to start and conduct at their expense a College of Commerce.

It is gratifying to note that the example set by these private institutions of Madras and Bombay has since been followed by the Governments of Bengal and the Punjab, who have, during the past three years, started commercial schools of their own. An organised effort is now necessary to profit by each other's experience, to frame a comprehensive scheme, and improve the organisation of the existing schools.

HIGHER COMMERCIAL EDUGATION.

BY

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At this Conference annually, experts on industrial problems are invited to present papers on subjects of supreme and pressing importance for the benefit of those who are interested in the industrial regeneration of the country. The problem of *production* is closely associated with that of *distribution* in the machinery of commerce and the relation between the factory and the merchant's office is so intimate, that it is difficult to consider them except in connection with each other. Methods of production have undergone vast changes in the past fifty years, manufacturing has been revolutionised by new inventions, improved machinery and enlarged demands. The steam engine of Watt, the steamship of Symington and the locomotive of Stephenson have given fresh opportunities for the training of a new class of workmen more intelligent than the old. It is, consequently, required of the Technical Schools to supply for these purposes young Foremen and Superintendents. Along with the wonderful revolution in the methods of production there have been wonderful developments in the methods of distribution. Business methods have undergone immense change and the days have long gone by when men in business and industry were expected to learn their business by undergoing office routine. The idea that education in business can be achieved by mere rule-of-

thumb no longer exists and we find to-day more schools and colleges of commerce all over the world than under the old *regime*. It has been realised that industrial and commercial success in the future will depend more on educational superiority. Our late Viceroy, Lord Curzon, showed it emphatically while he distributed the prizes a few years ago at the annual meeting of the London Chamber of Commerce, that the prosperity of a country by manufactures and commerce would depend on the attention paid to technical and commercial education.

In this paper, I have the pleasure to give my views based on my experiences as an educational expert and a man of affairs. I have been for the past thirteen years engaged in the training of commercial students and also been intimately connected with the operations of a counting-house which had vast and varied ramifications of trade.

From that point of view, let me ask what is the modern conception of education in this work-a-day world, in which men cry "live and let live," and which

> "Is a very good world to live in,
> "To lend, or to spend, or to give in;
> "But to beg, or to borrow, or get a man's own,
> "'Tis the very worst world that ever was known."

But, whatever that may be, we must make the best of it; and education is the means whereby we seek to enable our young men, individually and as members of society, to make the best of the opportunities that present themselves by the development of their intellectual and adequate knowledge. Education, therefore, in the popular acceptation of the term, is meant to be the professional or commercial equivalent to the German expression *Gymnasial* or *Real*. I am concerned mainly with the latter of the two. In speaking on the subject, I make no claim to originality, almost all that can be said upon the subject has

already been dealt with by others; and my present purpose, therefore, is to summarise and to make this a basis from which to urge further action in the interests of those who seek to organise a system of higher commercial education.

By Higher Commercial Education I do not mean that which enables a youth to look to a higher rate of profit or of interest on the capital embarked in the business, but that which trains him to appreciate fully the advantages of a commercial calling. It is that kind of instruction that prepares the future business man for his professional success. Such a training should enable him to compete successfully with the developments of the outer world. It must be worked on a solid basis in order that it may serve its function for the preparation of the duties of life. It has been agreed by most educationists that the primary system of any education should not be the loading of the memory, but must be such as to conduce to the development of the mental faculties with a view to the formation of character and to that power and habit of good thinking which is so essential to a nation. In the primary period, the question of special training is out of the question, but considerations of utility should never be forgotten. Good grounding in primary education is the necessary basis of all secondary and higher education, whether professional, technical or commercial. The question, therefore, of a systematic and steady development of Commercial Education and a properly organised Commercial school resolves itself into a question of culture—but culture, in the real sense of the term, cannot be imparted in schools. It must find its source in self-improvement and self-exertion, but the schools that train the minds of the youths should model their work in such a way as to give them a strong desire for self-culture and self-improvement. This is the true aim and object of all educational systems.

There is a general notion that Commercial Education is nothing more than the bare teaching of commercial subjects and that methods of commerce may even be gathered by undergoing an apprenticeship in a routine of office work. The idea that a youth can enter a counting-house and conduct his work satisfactorily after a period of apprenticeship is no longer possible as a highly specialised knowledge of his profession together with the wider culture which enables him to adapt his knowledge and his training to the varying demands of modern commerce is highly essential. Commercial Education, as Sir Albert K. Rollit, M. P., says, is the larger and better adaptation of education in general to commercial requirements. It is the special training for trade, an education which aims directly at fitting the individual for the needs of commerce and the application of general education to industrial purposes. Colleges and Schools of Commerce that conform to this ideal see that the cultural element predominates in the teaching of commercial subjects. The curriculum of a business college should be so framed as to enable the recipients of that training not only to serve intelligent apprenticeships in business pursuits, but also to enable them to achieve success in the discharge of the highest functions of the State.

It has been said that the commercial success of any nation depends on its educational superiority. There was a time when the sole object of education was to train men for ecclesiastical purposes; at another period its aim was to qualify men for civic duty. We have already entered upon a period when men are recognised as parts of an industrial order, and education must, therefore, train the people for an economic citizenship. It is with social science and the demands of this citizenship that business education must deal.

The best preparation, therefore, is to afford a good general education ; in fact, the aim of all systems should be to offer general or liberal courses of all standards and of the very best character, and get as many young men to pursue them as possible. It should then go further, and allow those youths who have gone as far as possible in the liberal courses an opportunity to pursue their education still further along lines relating to their future calling. For instance, an education which is based on science and is properly organised cannot but be liberalising, no matter if it be technical in the proper sense of the term. In the same manner the curriculum of a Commercial High School or College may be sufficiently liberalising in all its aspects, at the same time that it trains a youth so as to make him more useful in a business house. The work of a good industrial or trade high school may be made thoroughly educational. It is work of this kind, which is liberal and practical, that educates a man while it trains him for a livelihood, and which should be introduced into any system of Commercial Education.

A commercial school which imparts instruction in the higher commercial subjects, viz., the History of Commerce and Commercial Institutions, Commercial Geography with the necessary preliminary work in Physical Geography, the study of Products, the theory and practice of Accountancy, should be of general interest to every educated man, whether he is going to business or not, while the study of commercial law, economic theory and history, political science, banking and currency, supply liberal courses of education especially adapted to the needs of persons who are or who intend to be engaged in any kind of administration. Such a study constitutes what is called the "SCIENCE OF COMMERCE." By Science of Commerce I mean a systematic study of principles and usages of all branches of trade, buying and

selling of different commodities, mercantile agencies, shipping, railways, insurance warehouses, banking and speculation. Such a training would constitute a proper faculty in the Science of Commerce. Commercial education should then satisfy commercial needs which can be ascertained only from a knowledge of the function of the mercantile classes.

In order to make the education imparted in a commercial school thorough and efficient, students before leaving school must be made to undergo a course of training in what is termed the "PRACTICE OF COMMERCE". The object of this course is to train the students how to apply to practical business what they have already learnt under various other subjects. It is not my intention to offer any remarks as to how this course should be pursued, but what I would convey to you is that the education imparted in a commercial school or college should be considered incomplete if the students trained there possess no knowledge of the definite functions they have to perform when they are thrown in the great battle-plain of commercial life. The various forms of ordinary trading such as local sales, imports and exports on one's own account and on commission, consignments, indents, agencies, etc., must be introduced by fictitious transactions, the leading data of which must be based, if possible, upon the transactions of a large public concern. Special attention must be paid to standing in account calculations, forward exchange contracts, commercial and banking correspondence, cable codes, &c.

I have dealt with the definition and scope of Commercial Education that should find a place in the present economic order. The education that is required at the present day is not merely technical, not merely literary, but it must be a combination of both. The possibility and value of Commercial Educa-

tion to the future business man is of the greatest importance, as Lord Rosebery observed that the twentieth country is destined to witness a struggle for commercial predominance among the trading nations of the world. This pre-eminence can be attained only by a correct notion of the present commercial and economic situation, and that country will be most prosperous by trade and commerce which pays her attention to commercial and technical education. The future business man should have a clear conception of the production, distribution, and exchange of the various commodities that are produced in different regions of the world. He should be equipped with an education which will enable him to gauge correctly the state of the daily money market, glance over current prices, discuss the probable crops of corn, cotton, sugar, wool, silk, weigh the chances of foreign competition and from all these data, decide his own mercantile operations. Such a man must be a student of social science, a man imbued with sufficient knowledge to conduct his daily operations of the counting-house. Such is the merchant of the future and he may be likened to a great general sitting in his war-office planning operations for a distant field of action. Commercial knowledge is impossible to attain without a thorough knowledge of a man's environments and the victories of this twentieth century, as I have already pointed out, are economic—such as will rest with those who can best utilise the modern agencies of industrial and commercial life.

I am not, however, prepared to state that educational superiority alone is the only criterion of the commercial success of a nation. Educational superiority there must be undoubtedly; but coupled with this, the future business man must have an aptitude for his profession, he should believe in his

work and love it, and then he will do better work and be happy in the doing of it.

> "If I were a cobbler, it would be my pride,
> "The best of all cobblers to be,
> "If I were a tinker, no tinker beside,
> "Should mend an old kettle like me."

Such must be the ideal of a business man. He should have faithfulness and intelligent devotion in the performance of his duties. Business men must have business talents inborn in them—successful business men are thought to be born not made. This is not all that is required in a business man as a *sine qua non* of his success—he should possess good moral qualities. In this connection it is well worth quoting the words of Mr. J. W. Gilbert, the pioneer of the system of joint stock banks in England. "Is it knowledge that gives respectability in commerce? What profession requires so much and such varied knowledge as that of a merchant? Is it utility to the State? What order of men tend more to increase the wealth and happiness of the State than that of merchants? Is it moral character? To whom is moral character so essential as to a merchant? Without this he is despised." A business man should have thorough experience of his special branch of business, without which he will drift without a rudder, and is always in imminent danger of a catastrophe. Business cannot be reduced to an exact system of knowledge like medicine, law or theology. A business man's success lies in his wide general knowledge acquired with regard to his particular walk of life. It is impossible for him to become a specialist in all branches of trade and one who tries to do all is likely to lose everything; the success you know is for the tortoise and not for the hare. In these days of keen competition and with the vast varieties of the different

departments of trade that beset a business man, it would be well for him if he were to devote his attention to the specialization of trade, as otherwise, success is difficult to achieve, whatever may be his merits.

I have explained to you the scope, value and possibility of Commercial Education and the young man who has acquired a thorough mastery of the modern methods of Commercial Education can never become a failure in his profession.

I shall now deal with the salient features of the educative value of commercial subjects in order to show that Commercial Education constitutes an intellectual training fit to rank with that of any classical, legal or scientific studies. I shall also dwell briefly upon the system of academic education in England, on the Continent, and in America.

I have already pointed out that in order to make Commercial Education a success, the curriculum of the school should be made as liberalising in character as possible. A commercial school which imparts instruction in the higher commercial subjects, viz., the history of Commerce and Commercial Institutions, Commercial Geography with the necessary preliminary work in physical geography, the study of products, the theory and practice of accountancy, should be of general interest to every educated man ; while the study of Commercial law, Economic theory and history, Political Science, Banking, Currency, supply liberal courses of education specially adapted to the needs of persons who are or who intend to be engaged in any kind of administration.

The science of Accountancy or Book-keeping which is considered to be a dry subject has, in my opinion, some excellent claims to be ranked amongst the educative subjects. We have often heard an eloquent vindication of the claims of several

subjects by veteran educationists at the Educational Guild lectures and in educational magazines; but we have not seen many champions of book-keeping who have made themselves heard in defence of this important art. If a subject has to be ancient in order to be educative, book-keeping has the greatest merit. From certain allusions in the works of Pliny it is evident that some sort of Book-keeping was in vogue in his days and from certain transactions entered into by Cicero there is ground to believe that Book-keeping takes its origin in the 14th century. Is Book-keeping really educative and does it really afford a useful mental discipline such as is calculated to render the mind better fitted to deal with general problems than before? I have no hesitation in answering both these questions in the affirmative. It is impossible to master the mysteries of Book-keeping by double entry without having gone through a process of scientific training. This and other subjects that come under the category of Commerce are, in a true and lasting sense, educative.

The question may now be well asked whether the curriculum of a properly organised Commercial School or College be such as to create a Faculty of Commerce. That it is capable of establishing a Faculty of Commerce may be seen from the steps taken by the Universities of England, the Continent, America, and Japan. The Right Honourable J. Chamberlain, the most distinguished citizen of Birmingham and Chancellor of the great modern University—the University of the business-man and not the mere academician—thought fit to establish in connection with the Birmingham University the first Faculty of Commerce in the United Kingdom, where the future leaders and organisers of industry should receive a thorough training of a higher and more efficient character than had previously been

possible. Similar Faculties were also created in London, Cambridge, Manchester and Leeds. These Universities grant Bachelor's and Master's degrees in Commerce and Economics.

There are important Universities of Commerce in France, Antwerp, Brussels, Russia, and Switzerland. Space will not permit me to deal exhaustively with the system of education in vogue in these Universities, but suffice it to say that the graduates turned out from these institutions find themselves so fully equipped for practical business affairs that soon after their leaving the Universities, they enter the foreign market either as buyers or sellers with an enormous advantage over the man whose education has been acquired under less systematic methods.

The Universities of New York, California, Chicago, and Pennsylvania have instituted Faculties of Commerce and Industry. The first of the institutions to give Commercial Education of College or University grade in the United States was the University of Pennsylvania, in its Wharton School of Finance and Economy. There are also Universities of Commerce in Wisconsin, Vermont, and Dartmouth.

Commercial Education was considered by the first Cabinet of the present Emperor to be very essential for promoting the foreign trade of Japan. The Japanese Government in order to establish Universities of Commerce deputed their Government officials and students of Commercial schools to go abroad to study the system of education in vogue in Western countries and on their return they were appointed as Professors and in any kind of administrative work including the service of Government, Railways, Banks, and Insurance Companies. The higher Commercial School at Tokio stands now as one of the first Commercial Colleges in the world, the status and

education of the graduates of which are at least equal, if not superior, to those of any of the Continental Commercial Colleges.

From the above brief survey of the University system of Commercial Education, it will be observed that the cry in every quarter is "EDUCATION FOR BUSINESS AND PUBLIC LIFE" and how best this education can be attained in business Colleges. The object, therefore, of a properly organised Commercial College should be to afford a systematic training in higher commercial subjects, in the study of government and administration and in the work of economic and social investigation.

Turning now to the system of Commercial Education in vogue in India, I may be permitted to say that it is not of a very high order; nay, it has not even touched the fringe of Higher Commercial Education. The system in vogue is not such as to be compared with those existing in the European countries, nor is it of such a standard as to create a Faculty of Commerce. I would ask whether the time has not arrived in India to modify the present system of Commercial Education in a manner after the model of English and Continental methods and to create a Faculty of Commerce in the Universities of India. I have already pointed out that the curriculum of a properly organised Commercial school should be such as to create a Faculty of Commerce. Success in the path of Commercial Education can be achieved only when our intelligent young men can be brought under the influence of this Faculty. The desire to secure a University degree is so great on the part of our young men that when a Faculty of Commerce is created a portion of the young men who are now preparing for the various degrees will take up this important branch of tudy and thus, in course of time, a number of Bachelors of Com-

mercial Science would be turned out who, unable to secure the much-coveted Government appointment, would have to resort to commercial undertakings. The outlook clearly points to individual effort as the only means of success in life for the majority, and that effort must be directed towards Commercial and Industrial undertakings. India will find a vast field in this rather than in the more highly favoured directions pursued at present by the young men of India, namely, Government Service and Law.

I may add that until Commercial degrees are instituted in connection with Indian Universities and until students of Commerce are made to realise that a knowledge of the higher branches of Commerce is essential to the purpose, Commercial Education in Commercial schools in India should aim higher than the modicum of clerical knowledge that will be required for a clerical post. Commercial instruction of a secondary standard has prevailed in India for the last twenty-two years and it is certainly time to modify the methods of instruction. A great leader of educational thought in the United States has recommended that once in ten years an attempt must be made to formulate anew the educational doctrine, keeping in mind the changing social needs, the new literature of education and the practical experiments that have been conducted. A change in the system of our Commercial Education is indispensable. Unless that change takes definite shape in the form of higher Commercial Education fit to be placed on the same intellectual plane as legal education, true Commercial Education would not lead its votary throngh the mysteries of *haute finance* by which Commercial students might hope to take an important part in the near future in the commercial struggle of the nations.

TECHNICAL EDUCATION FOR THE WORKMAN.

BY

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How shall we estimate the progress of Technical Education as imparted in our schools during the past 20 years, and where shall we seek the proof of it? One naturally looks among the familiar craftsmen, the carpenters, joiners, masons, smiths, painters, glaziers, plumbers, tinsmiths, and decorators, expecting to find improved methods of work, greater accuracy and expedition and better choice of materials. But such is not the case. Native workmen, working under Native control are, generally speaking, as bad as ever. It is only necessary to visit some of the largest houses in course of construction in the best parts of Bombay, to find workmanship of the lowest class. In one large house, facing the Elphinstone College, all the joinery is finished with the jack plane, many of the joints in shutter frames would admit a half anna coin, the jhilmils rattle loose, and the locally-made hinges are all deficient in wearing surface. Many of the hinges are not in line. The work of the plumbers and electric fitters is exceedingly rough, although their material appears good; the painters seem quite incapable of mixing the same shade continually, and the national lack of standard of excellence is just as obtrusive now as before. An Indian cannot paint a window frame without painting the glass, and if obliged to clean the glass, he will use sand paper or emery cloth which ruins the surface. He will varnish a dogcart with his fingers dipped in

varnish, or paint doors with a piece of rag, instead of using a brush, leaving clots of paint in the corners. If he paints or colour-washes a wall, he leaves the floor all foul with droppings, and he rarely does any repair work without damaging, in some way, the building in which he works. The Indian mason continues to build walls with stones of a pyramidal shape, the base forming the exterior surface—a most vicious practice, and the cabinet-maker has so little confidence in his own jointing that he ties the legs of tables together to keep them from coming loose. Slovenliness and imperfect knowledge of his craft are the characteristic of his work, and his outfit of tools is that of a man who will buy or make nothing that he can possibly do without, and who has no regard for time as an element of cost. If tools are provided for him he will wear them out in half the time a European would take, and the wear is generally that of abuse or neglect. I found in Dhulia, Khandesh, a very clever wood-worker engaged in joinery and cabinet-making. He had made several labour-saving machines including circular and fret saws. Among his products were kindergarten school sets of models, which he shortly afterwards abandoned, as they did not offer him a sufficient profit, although labour and wood were both cheap. The explanation of his failure lay in the faulty construction of his tools. There was no real accuracy in them. A well adjusted circular saw, properly sharpened, will cut hundreds of cubes so accurately that they do not need planing at all; a slight application of fine sand paper is all they need, and even that may be dispensed with if the saw is sharpened in a certain manner. The Dhulia joiner might, to-day, have a steady business in kindergarten models if he had the benefit of instruction from a qualified teacher of handicrat, and it is a reproach to the wood-workers of India

that any articles of wood, used for drawing or for kindergarten instruction, should continue to be imported from Europe. The potter, for many centuries has continued to make unglazed cooking pots while the potters in Southern Europe, with appliances almost as simple as those of this country, are producing glazed goods that are preferred to any other material for cooking pots.

The Indian artificer has no standards of good workmanship; he will give the smallest possible return for his pay and, when taxed with scamping or fraud, he will display considerable ingenuity in refuting the charge, and endeavouring to prove that his work is as good as, and possibly better than, was ordered. It is not etiquette to admit a blunder—and the occasion offers an opportunity for talking. Setting aside his fertility in excuses, the Indian workman is almost devoid of originality, but it is to be hoped that this waste energy may, some day, be converted into useful force; it offers an interesting problem to the educationist.

All well-wishers of India desire to see a better use made of the raw products that are exported at present in such quantities. Materials to produce paints, varnishes, leather, canvas, cordage, textiles, drugs, oils, and metals, many of which return in a manufactured state, might all be dealt with here if workmen were more reliable. It is they who determine the final quality and finish of any manufacture, and if they are stupid, careless, irregular, migratory and improvident, no talent of master or manager can avert the deterioration of the product. We must, therefore, give such attention to the education of the workman as shall improve his working capacity.

Meanwhile, large sums are annually spent on Technical Instruction. I do not imply that good workmen are not increas

ing in India, for that would not be true. Good workmen are being trained in railway, dockyard, and other engineering workshops under European control throughout India, but what I do contend is that the influence of schools where handicraft is taught, pure or mixed with science and literature, has not yet reached the rank and file of workmen, even in the towns where the instruction is given.

It cannot be said that the Indian is averse to things that are foreign. His consumption of kerosine, wire nails, corrugated sheet iron, cheap padlocks and cutlery is enormous, and he has taken kindly, indeed far too kindly, to literary education until the market is glutted and the pay for clerical work does not provide a decent living. Meanwhile, the earnings of a good craftsman may easily be double those of the clerk. Why, then, should the ordinary workman be so indifferent about technical education? He will not go to a night school, and he has but scant appreciation for the instruction his son may get at an industrial or an art school; indeed, the knowledge of drawing that the boy acquires is the only part of the training that is appreciated by a future employer and by the workman himself.

The schools, sometimes called technical and sometimes industrial, according to the fancy of the promoters, and where the prospective workman gets his training, are in charge of men who have not been taught to teach. Some are selected workmen who have exercised their trade for some years; others are young men fresh from some technical institution, who have a very superficial knowledge of handicraft, and have no experience of trade methods and workshops. They generally attach more importance to scientific than to technical knowledge, and this accounts chiefly for their failure as teachers, while the pure workman teacher simply continues the habits of his craft without any

thought of improvement. He jealously conceals what he considers to be his trade secrets for fear any boy should become clever enough to supersede him. These secrets generally turn out to be things that are common knowledge in other countries.

One of the rarest things in India is to hear a definition of technical work. It is generally assumed to consist of a mixture, in no fixed proportion, of science and art; the science being mathematical, mechanical and chemical, and the technique the art of some kind of work in wood and metals. My earliest recollection of King's College, London, is the memory of a definition of physical science given by one of the masters. He said it was a form of knowledge that could be conveyed in writing, and that could be tested experimentally, giving the same results from similar premises. Technique is a word that has been appropriated principally by the exponents of the fine arts, and is used with reference to the work of sculptors, poets, painters, writers, and actors, and in every case it means the distinctive finish of the work, the result of their method, and talent, and although it forms the chief object of criticism, it cannot be acquired by any amount of reading, and is thus completely distinct from science. Technique is the strict equivalent of art and craft, it is the same thing expressed in words of Greek, Latin, and Saxon origin, and although nearly related to science the idea is quite distinct. For example, one may read all that can be written about hammering a nail, handling a saw, wheeling a barrow, riding a horse, or swimming, without acquiring any one of these arts, but the most illiterate man may become expert in them all by a sufficient amount of practice. A technical school is literally one where science is not taught; a school where science and craft are mixed is a trade school, and to organise a trade school properly the most important directing influence should be that of men

having an intimate local knowledge of the trades intended to be taught.

The confusion of the terms technical and scientific are exemplified in two institutions in the Bombay Presidency. In the College of Science, Poona, various physical sciences are taught, and illustrated by means of work in wood and metals for the training of engineers of roads, bridges and canals. In the Victoria Jubilee Technical Institute, Bombay, various physical sciences are taught, and illustrated by means of work in wood and metals, for the training of students in mechanical or electrical engineering and textile work. It is not easy to guess on what basis the titles of the two institutions were chosen, but they illustrate the popular acceptation of the terms Science and Technique. In Manchester at the present time a project is being discussed for the establishment of a technical library. A library of Applied Science is probabiy what is meant.

The cause of the present state of technical education in India is traceable to the constitution of the Educational Department which is controlled by University men, whose ideas of education are so built upon reading and writing as a foundation, that they have overlooked the true relation of technique to science in a country whose industrial training is still in a very backward condition. In every other country, which has reached any industrial eminence, the knowledge of handicraft preceded, by many generations, that of reading and writing. Even in Japan, which is so often referred to as an example for India, reading and writing only became common property about 50 years ago, and even at that time the Japanese craftsmen were a century ahead of the Indian workmen to-day.

Of the leading countries in Europe the same story may be told. Craft reached a high development before literacy

was needed and yet, in spite of all past experience, the Indian Government through its Educational Department has attempted to improve the technique of the people through literary channels. It was expected that the young men coming out of the scientific and technical schools would become teachers among the men they would ultimately control, but this did not happen. The scientific training the students received generally increased the mental distance between supervisor and workman. The students had not been taught to teach. In the meantime, and quite unofficially, real technical education has been introduced and was being successfully imparted to the Native workmen in the railway and other workshops under European supervision, and the training, being limited to the work the men were paid for, was a success from the beginning. The foremen were not trained teachers but they knew the work and were responsible for its execution, so the men increased in wage value and learned orderly habits. Success was inevitable, for the teacher knew exactly what was wanted and taught nothing else. This was a good beginning but it must be improved upon, a subject to which I shall presently come.

When lay assistance was required for the management of trade schools the Educational Department was not fortunate, for the persons chosen to control these schools are chiefly remarkable for their lack of technical knowledge. Lawyers, doctors, civil servants, merchants, are appointed; they carry out the business of the school, and look after the finances, but the important matters of technical instruction are left with the masters who are frequently very ill-prepared for their duties. If they have been brought from Europe they naturally want to carry on the work as they have done in their own country, regardless of the enormous differences that exist between the

foreign and the Indian student and between the actual industrial requirements of the two countries. In such matters the committee or board should be able to furnish the necessary guidance and control, directing the teacher's efforts to the most immediate need of the crafts represented in the school. The ordinary committee man, who can only regard technical education from a scientific or literary point of view, cannot understand that a sound training in handicraft may be given to a man who cannot read and write. No man can safely meddle with technical education in India who does not know practically the details of at least one trade as exercised both in India and in Europe, in order that the defects in Indian methods may be corrected. This intimate knowledge is necessary, because an inexperienced committee man is liable, either to overlook defects in technique, or to propose reforms that are premature or unsuitable. Is it any wonder if the men who know refuse to sit in committee with the men who do not know? There is also observable among inexperienced men a deplorable disposition to multiply subjects of instruction without any assurance that a competent teacher is available. This has been disastrous in several instances. Lack of knowledge of technical matters is especially noticeable in the speeches of prominent men, delivered on public occasions, such as the opening of a new school or the distribution of prizes. They will talk of the advantages of scientific knowledge, the increase of wealth due to technical training, the utilisation in the country of raw products and, sometimes, even of the dignity of labour. But of real technical matters not a word. And the audience departs not only no wiser, but with a false idea of the subject. The very worst friend of technical education is he who collects the programmes of the most advanced scientific educational institution in Europe and America, and presents them, in his best literary

style, as models to be followed in India. He would repeat, if he were allowed, the errors of the so-called higher education, some of whose results are in such unpleasant evidence to-day.

Technical education has no necessary connection with elaborate buildings containing marble slabs on which the name and virtues of the founder are conspicuously inscribed. Any shed that is of sufficient size and is properly lighted, ventilated, floored and drained is good enough for the purpose. So many schools and so many teachers are required that anything but the simplest of buildings would savour of extravagance.

An educational programme for India should have a very definite object, especially if the subject be technical. The object is to improve the efficiency of the Native craftsman so that he may turn out more and better work and get a better return for his labour. To carry out the programme it will be necesary to know very clearly what are the defects of the workman, what is the knowledge that he most needs, and how much of this most necessary knowledge can be imparted to him, and assimilated, during the time available for his instruction. We seem already to have drifted a long way from the imposing studies of the scientific universities of other countries, but we are getting nearer the mark. In instructing the Indian workman it is also well to remember that he can only take in a limited amount of new knowledge per generation ; there is, therefore, all the more need to discriminate in the choice of subjects.

The success of technical instruction in railway workshops suggests an extension of the system by which the foreman might receive a special course of instruction that would improve him as a foreman, or qualify him to be a teacher in a primary technical school. The carpenter may be taken as a familiar example. He might be selected

between the ages of twenty and twenty-five after having given proofs of his intelligence and ability as a workman and, as the chief defects of the Native workman are carelessness as to measurements and neglect of his tools, the pupil would be instructed in cutting edges with tests as to their working value, the sharpening and use of various saws, the construction of labour-saving devices of wood, simple calculations of quantities and hand sketches with dimensions as working drawings. An important part of his training would be the art of demonstrating with the aid of the blackboard various familiar processes in carpentry. For example, he might represent a jack plane, a saw, a centre bit or even a paring chisel and describe its construction and the reasons for the shape of each part in such simple language as would be familiar to men of his class. There are reasons for every movement in handicraft, but Indian foremen are rarely able to tell them. A simple course of plain geometry, conveyed as much as possible by means of the plumb level and tape measure and applied to the school building would complete the course which could be mastered in from 6 to 8 months. These men should be able to read and write, but they should be able to teach without the aid of books because most of their pupils will be illiterate.

As the quality of any manufactured article depends on the ability and discipline of the workmen, who are generally illiterate, and who have rarely served any serious apprenticeship, the training of foremen is a matter of great importance. These men would have to be maintained during their period of training and I have reason to believe that among the Native Chiefs and the wealthy Indian employers sufficient funds could be raised for the fees of the normal training school and the support of the pupils they would send. The course of training just indicated may

seem meagre to a man of European experience but, compared with the mental equipment of the average Native maistry, it represents a considerable step on the road to efficiency and it is probably quite long enough to start with. It has, moreover, this recommendation, that while it improves his efficiency in his own line it does not tempt him out of his proper groove towards clerical employment. There is, however, one serious difficulty in the way of this project. There is, so far as I know, no normal training school in India for instruction in handicraft. Attention has been principally directed to the training of masters. This may probably account for my experience in the many technical and industrial schools I have visited. I did not find one saw in good condition, the grindstones with one exception were all in very bad order, and I did not find any of the wooden screw vices of the pattern that are still common in England and are especially suited for Indian workmen on account of their cheapness. What kind of training can the teachers have had to allow the tools to get into such a state, and what is the value of the inspector who tolerates such slovenly teaching?

The subject of technical instruction cannot be left without reference to the primary training of children of the labouring classes. What should they learn?

If we may rely on the evidence of Mr. Nesfield, Director of Public Instruction in the North-West Provinces, the three R's were not of much use. He found that primary education made the children of cultivators less contented with their lot in life, less willing to work and more litigious. He persuaded 1,037 old pupils who had left school for some time to present themselves for examination and of these, 16 per cent. passed in one or more simple subjects (reading, writing and arithmetic) and in one

or other of the three more difficult grades, while the remaining 84 per cent. failed to pass in any one subject. The instruction given them appears to have been of no use in their daily work, and they forgot their schooling as people forget the things they do not practise. Education did not make them better agriculturists because their instruction did not include anything directly bearing on agriculture. It was also made clear that the short receptive period of the lives of these youths had been sacrificed to a system borrowed from another and totally different country. This incident took place 24 years ago and, although object-lessons have since been introduced, rendering the tuition more interesting, reading and writing continue to be taught to, and forgotten by, the bulk of the pupils. The teaching of five boys to read, in order that one might remember the art, indicates very peculiar ideas on the subject of education.

The primary trade school can only be opened after teachers of handicraft have been trained in a special class and, taking wood-working by way of example, they should be able to teach the following subjects :—Freehand drawing and arithmetic as applied to the carpenter's craft.

The use of the foot rule in correct measurement.

The reading of the clock.

The use of the mallet and chisel as an introduction to the study of cutting edges.

The use of the saw for exact work, *i.e.*, cutting out a pencil line on both sides of a piece of wood. This is soon acquired when the saw is in good adjustment. The exercises should include working with the saw in the usual state, comparing the time occupied in doing the same amount of work with each saw. As the saw is the most neglected tool in the kit of an Indian workman, special care should be given to this subject. The

pupil would finally learn to sharpen and set the teeth of saws.

The systematic grinding and whetting of cutting tools would follow with a comparison of the time used at the grindstone and at the flat stone (lisano) generally used. Edges sharp and dull would be examined by a watchmaker's lens, and comparative working tests would be made of sharp and dull tools.

Tests of the strength of wood. These are made with various samples of wood of similar size, resting on supports and loaded in the middle with a bag filled with stones, until they break. Instruction should, at the same time, be given on the qualities of the samples tested.

The holding power of nails and screws. This lesson is taught with the aid of a nail-puller and a bag of stones, the wood being held in a vice. Experiments are made with bright and rusty nails, and with screws. Screws, as driven in India, have often less holding power than nails. In this lesson the shape of the point of a screw-driver is explained.

The correct use of planes and their adjustments. This work is taught partly by demonstration at the blackboard and partly by graduated exercises.

The fitting of handles to hammers and chisels. If one may judge by ordinary examples, this subject calls for definite instruction of a simple kind.

Every school should possess examples of wood-working machines, made principally of wood, to shew how much a carpenter may do for himself in making machines of precision. I have, for many years, used a lathe, made principally of wood, in which sawing, screw-cutting and dovetailing is done, besides all the usual work.

A short course of applied geometry will be required in which it will not be necessary to talk of Euclid or the Law of Gravity. The making and testing of a wooden square, a straight edge and a plumb-level, the fixing of hinges three in line (as on a door) and exercise with the square, plumb-level and tape measure upon the walls, doors aud windows of the workshop, properly explained, should form an introduction to the carpenter's art and a safeguard against many vague or erroneous notions which beset the ordinary worker in wood. This instruction should also render him more observant of any further useful knowledge that might come in his way; it would not be likely to run to waste, for it would all be required by the future workman.

The most successful exponent of technical instruction that I know in India is Mr. Alfred Chatterton, Director of Industrial and Technical Inquiries in Madras. When he introduced the manufacture of aluminium into India, he made no conditions of literary accomplishment in his technical school. He took in such workmen as wished to learn, devised tools of the cheapest and roughest appearance, but which were effective, and afforded the workers every encouragement and assistance when they left, to work on their own account. The success of this aluminium industry needs no further detail. His weaving school is on an equally non-literate basis, and his latest enterprise in boring for water by means of which he has discovered enormous supplies, exceeding in many places the needs of the farmers, will be a standing memorial to his intelligent appreciation of the practical needs of the people. It is impossible at the present time to estimate the benefit he has conferred on the district—not by finding out how to bore for water but by prevailing on a very conservative people to adopt the system and to purchase oil engines and pumps to lift the water.

India has yet to recover from an educational impulse in the wrong direction. Reading and writing, which have been of incalculable value to certain classes, are not of use to all, and they become positively pernicious when they entice young men away, from a sure living by handicraft, to the overcrowded ranks of clerical labour.

A time will come when literary knowledge will be necessary to the whole population of India, but that is the affair of posterity.

I have endeavoured in the foregoing remarks to prove that no suitable education has been provided for the large class of workmen on whose competence the quality of India's products principally depends, and that many of the attempts that have been made to improve the craftsman have defeated their own ends by teaching the wrong subject and attempting too much. Employers of labour in India, who know the work they command, can all tell how very little special knowledge would be required to increase to a considerable degree the wage value of their men, and how a logical habit of thought, which can be acquired at a very early age, would enable them to continue their education, by habits of observing, throughout a lifetime. Education for the masses has been tried for many years, with singular insuccess if we may judge by results, and it is certainly not because the pupil cannot learn. A new class of teachers is required, with special training, to meet the real needs of the working community, and no man should be allowed to undertake class work who cannot furnish proofs of his ability to teach. An incompetent teacher of craft, however clever he may be as a workman, will simply help to perpetuate the faulty methods, the bane of India's industries, which it is the chief object of technical education to remove.

The desirability of commencing Agricultural Exhibitions in the Bombay Presidency, especially at Surat and Poona.

BY

STANLEY REED, ESQ.,

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Mr. President and Gentlemen,—Two years ago it was my good fortune to pass through the principal of the Punjab irrigation colonies, and to be able to see something of the revolution wrought by the hydraulic engineers, which has enabled the once desolate *bar* to support the most prosperous peasantry in the world. Riding from Lyallpur to one of the typical villages on the Chenab, my attention was arrested, on the outskirts of the town, by a series of mud structures, bearing a faint likeness to a grand stand and a judge's box, dotting the wide maidan. In response to my inquiries I was informed that this was the site of the annual agricultural show, which was one of the great annual festivals of the neighbourhood, and which brought the peasantry in their thousands with exhibits in large numbers and of all classes, in friendly rivalry once a year. This unexpected spectacle caused some little heartburning to one who believes that the Bombay Presidency is the salt of India, and should lead it in every important development. The Punjab peasantry are grand men, but as cultivators they are surpassed by our Kaira ryots and the very astute farmers of Mahim. In the Punjab they are laying the foundations of a scientific agricultural staff on generous and well-considered lines. But in this

respect they are a score of years behind the Bombay Presidency, where the exhaustive study of Indian agricultural conditions was commenced by Mr. Ozanne two decades ago. In these circumstances, is it not a reproach to us that in parts of the Punjab they should be able to organise, on a considerable scale, that invaluable means of linking science to practice—the agricultural show, whilst we are still discussing how to commence the formation of agricultural societies?

No one acquainted with the conditions of rural England, and especially with the West of England, can fail to be struck with the enormous influence exercised by agricultural societies, and especially by their principal outward expressions, agricultural shows, upon the improvement of English agriculture. Of recent years a revolution has been wrought in the conditions of life in the English countryside. By the adoption of intensive cultivation, scientific stock-breeding, and the substitution of dairying for unprofitable corn-raising, prosperity has been made to smile over wide areas formerly smitten with disastrous depression. In this revolution the agricultural society, and especially the agricultural show, has been the determining factor, for there is no other agency so fruitful of educative influences. In this Presidency we have an agricultural department, ably though inadequately staffed, burning with the desire to accomplish practical work. The results of its investigation are just coming into sight. The introduction of long-stapled cotton into Sind promises to buttress still more firmly our spinning and weaving industry. The hybrid between the Broach and Deccan cottons, if established, will give an immense stimulus to the Indian cotton production. In various other directions the scientific experts are pressing forward towards knowledge which will remove many of the most grievous

burdens under which Indian agriculture labours. On the other hand, we have a peasant population full of inherited lore, and anxious, according to general testimony, to learn about agricultural developments. But between the expert on the one hand and the cultivator on the other, there is practically no link. It would be scarcely an exaggeration to say that the experimental farm and the scientific expert mean no more to the great mass of the land-owning and cultivating classes of this Presidency than the laboratory and the alchemist did to the Middle Ages.

This, it seems to me, is the weakest spot in the agency set up to improve the standard of our oldest and most important industry. If the country is to derive an adequate return for the considerable sums which Government is wisely spending on the scientific study of agriculture, it is a gulf which must be speedily bridged. Government may do much. It may provide demonstration farms and itinerant demonstrators and lecturers: it may furnish a constant stream of agricultural knowledge through the publication of leaflets and the dissemination of news, in popular form, through the English and vernacular press: it may encourage certain forms of agricultural education. But the main impetus must come from outside the machinery of Government: it must, as it has been in almost every other part of the world, be unofficial in character.

It is not my purpose to discuss in any detail the precise form which the necessary agricultural associations should take. At the recent Conference at Ahmedabad a decided preference was expressed for village, or at the most taluka, associations. I would only say that this is one of those questions which it is desirable to hasten slowly, and if it be agreed that a start should be made with village societies, those villages should be selected where the co-operative credit movement has taken the firmest

root. But whether village, taluka, or district associations be accepted as the most promising, it will be necessary, in favourable localities, to focus our efforts if the societies are to materialise into agricultural shows, without which they must be shorn of most of their value. It seems to me that there are certain centres clearly marked out for our earliest efforts in this direction. They are here, at Surat, where the Government Experimental Farm forms an admirable centre round which an agricultural exhibition could be arranged: Poona, where the farms at Kirkee and Manjri offer facilities no less favourable: Dharwar, where the experimental farm is newer, but is making great progress. No less desirable is it to join, at any rate at first, these exhibitions with occasions which bring men of all classes together. Those of us who have followed the instructive debates at the recent Agricultural Conference at Ahmedabad will lament the fact that they did not take place in a showyard displaying the best which agricultural Gujerat can produce, and the most promising results which the Government experts have to show. How much more educative this Conference would be if we could walk from this pandal to a collection of the products of Surat and Broach, and follow practical demonstrations illustrating the course of agricultural progress. Let us proceed with our village and taluka associations by all means where the ground is favourable; but let us simultaneously organise, at Surat and Poona to commence with, associations whose principal business it shall be to focus diffused effort into annual exhibitions, made as attractive as possible, where the progress of agriculture can be brought home to the landowner and the ryot with a force and directness which all other means cannot equal.

Gentlemen, it will not be necessary to bespeak for any such movement the support of Government. At Ahmedabad,

Dr. Harold Mann expressed his opinion that not nearly enough use was made of the agricultural show. We may confidently rely upon the Agricultural Department for financial help, and for expert advice and assistance. We may turn to the railway companies for cheap fares. Not the least of the advantages offered by Surat and Poona for this purpose is that both are within easy reach of Bombay and are convenient railway centres. We may ask Government, in the early stages of the movement, to assist still further by bearing the cost of bringing picked ryots from a distance to the site of the show. But if the movement is to have life and durability, the burden and heat of the day must be borne by non-officials. I can imagine few works which should appeal more strongly to the patriotic Bombayite of all classes. A blessing was of old called down upon him who made two blades of grass grow where one grew before. We can, everyone of us, earn a share of that blessing by helping to bring home to the hereditary and patient farmers of Western India the scientific knowledge which will enable them to double the scanty produce of their fields.

CULTIVATION OF COTTON IN INDIA.

BY

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History of Cotton.—The fibre which furnishes the staple article of clothing in India is scarcely mentioned in the early literature of the East, but this may be explained by the contemptuous indifference evinced by learned men to the products and necessaries of every-day life.

The Sanskrit word translated "cotton" is first mentioned in the Institutes of Manu where it is enjoined that the sacred thread of a Brahmin must be made from cotton.

Herodotus gives a clear description of the cotton plant, when he says that the wild trees of India bear wool like sheep and the Indians use cloth made from these trees. Theophrastus describes a plant with a leaf like that of a black mulberry, the whole plant resembling the wild rose, and being grown in rows in the fields.

The first mention of cotton as an article of foreign trade is by Arrian, who flourished in the first century. He says that the Arabs exported cotton to the Red Sea.

From India the cultivation of cotton seems to have been spread westward as far as Southern Europe.

Cotton seems to have remained unknown in China until the 13th century. As the cottons of this country approach closely in appearance to those of Bengal and Burma, it is probable that they, with tea, were introduced from India.

In the New World, where varieties of cotton distinct from those of India are produced, the product must have been used from the earliest times. The knowledge of spinning and weaving gradually extended westwards and reached England in the 17th century.

In the early years of the last century the production of cotton in the Southern States of America was enormously increased and this rise in importance of America as a formidable competitor induced the Directors of the Honourable East India Company to initiate the experiments for the purpose of improving the quality and quantity of Indian cotton for export to England.

EXPERIMENTS TO IMPROVE INDIAN COTTONS.

The causes of the decline in the appreciation of Indian cottons in the European markets have been often explained.

As regards the intrinsic value of the staple, the superior kinds of Indian cottons compared favourably, on the whole, with the American short-stapled cottons. The average staple of Upland Georgian is between 1·00 and 1·02 inch ; that of the best Broach from ·90 to barely one inch. The circumstances which tend to increase the inferiority of Indian cottons are carelessness in picking, which causes a loss of 2·5 to about 7 $^{o}/_{o}$ against under 2 $^{o}/_{o}$ of the American Upland Georgian. It must be remembered that the friability of the leaves of Indian cotton plant is due to the drought of the picking season so that, even with extreme care, it will never be quite possible to pick Indian cotton in a perfectly clear state.

Owing to the stronger attachment of fibre to the seed, Indian cotton is more liable to be injured in ginning than that of America and Egypt. The tenacious adherence of the fibre to the seed of course spoils the cotton in two ways, by the liability of the fibre to be cut and torn and by the breaking or crushing

of the seed from which oil exudes to stain the fibre. The high pressure to which cotton is often subjected in baling is said also to be detrimental to the quality of the fibre.

According to Watson, the native varieties of cotton may be divided into two principal groups; the North-Western, yielding about one-third of its weight of clean cotton and including the Broach, Dholiera, Bhaonagar, Old Khandesh (*Varadi*) and the *Fari* variety of Umravati cotton; and the South-Eastern group, yielding about $\frac{1}{4}$ of its weight of clean cotton and including the Hinganghat, the Bani variety of Umravati cotton, the Kumpta, Madras (Upum variety) and the new Khandesh cotton (from Hinganghat seed). The short-stapled Sind cotton, yielding rather more than a third of its weight of clean cotton, may be considered as forming a group apart. The varieties under the names of Western and Tinnevelly cotton, must have been yielded by the Bourbon variety, which has been acclimatized in the Madras Presidency since the beginning of the last century.

The four varieties which in point of quality proved superior to all the others were the Hinganghat, Broach, Kumpta, and the Dharwar American cotton. The varieties next in order are the Khandesh, Western, Dholiera, Umravati and Madras cotton, whilst the Sind cotton must be placed last of all.

The principal descriptions of Indian cottons according to Beaufort are, Hinganghat (Central Provinces), Broach (Southern Guzerat), Dholiera, Bhaonagar (Northern Guzerat, Kathiawar, Cutch), Umravati (Berar, Khandesh, Deccan), Kumpta and Dharwar (Southern Mahratta country), Sind (Sind), Bengals, (Central India, Punjab, United Provinces), Bengal Westerns (Sholapur and northern part of Madras), Salems (Salem and Coimbatore), Cocanadas (Kistna, Nellore,

Godavari), Tinnies or Tinnevellys (Tinnevelly, Madras, Trichinopoly).

Two factors of inferiority in Indian cottons are staple and yield, and many experiments have been attempted with the express object of increasing the value of these.

The most obvious and speediest solution of the difficulty, namely, the introduction of higher class American or Egyptian, was suggested at first, but long experience has shown that, except in some particularly favoured districts, no advantage whatever is gained from efforts in this direction.

Recent experiments point out that successful results will ultimately be arrived at by the exceedingly slow but certain methods of selection. Theoretically no practical difficulties are anticipated in the establishment of farms to produce seeds of improved varieties in moderately large quantities, but the maintenance of these varieties when they perhaps cover large areas in cotton districts, is a subject which has not yet been sufficiently discussed in all its bearings. Loyal co-operation on the part of cultivators and merchants will be necessary for many years to come. It is impossible for the members of a small department to control arrangements beyond a certain point.

It must not be supposed that the cultivator himself is not fully alive to the importance of seed selection. Many farmers hand gin the seed required for the following year's crop; some in suitable parts of the Dharwar District already find it to their advantage to introduce seed of a superior variety from Broach, others particularly reserve the green seeded form of Dharwar American and in Khandesh the coarsest varieties are deliberately selected on account of their hardiness, productivity and higher percentage of cotton.

Taking into consideration the want of capital and the average small holding of the Indian farmer, any method of cultivation which would entail expenditure on artificial or farmyard manures is at present out of the question. The general consensus of opinion of the expert cotton-growers who conducted experiments in the Cotton Department appeared to be that no improvement was to be expected from any alteration in the native methods of cultivating cotton as the implements already used were extremely well adapted to the purpose. The defects complained of, as has already been shown, were due to faulty processes during and after harvesting the produce.

The experiments, however, in these early years were directed with the purpose of introducing the finer exotic varieties into the country. This object was only attained by the establishment of the Upland Georgian into the Dharwar District and of Bourbon into parts of Madras. The sum of experience gained amounted to the fact that experiments with foreign cottons were often successful when conducted as costly garden trials, while on transfer to the fields it was found the plants would grow so moderately as not to afford a reasonable profit to the cultivator. Further, the foreign cottons with naked seeds fell an easier prey to harmful insects than the native varieties which, with one exception, have their seeds guarded by a dense covering of short hairs.

The universal result of the experiments may be summed up in the words of the report issued on those at Broach. "Some kinds of exotic cotton, such as the New Orleans and Bourbon, yielded occasionally a small crop when cultivated as garden plants with great care and expense, but they never escaped partial damage from the effect of the seasons. When the same kinds were cultivated on a larger scale, even with

the greater skill, labour and care of the experimental establishments, the crop invariably failed. The possibility of raising garden samples of any kind of cotton, anywhere, by unlimited care and expenditure, is scarcely doubted, but the feasibility of doing so upon terms within the reach of the ryot and within the actual market value of the article, has not been demonstrated at Broach. It was proved that, by double the care and attention and more than double the expense of the native cultivation, a larger yield and better and cleaner quality might be obtained from the indigenous cotton than the ryots can produce, but not sufficiently so to repay the additional outlay.

This may be considered the final word on the subject until the various Agricultural Departments in India again took it under consideration. They have profited by the lesson that little can be gained by the introduction of foreign cottons which have to be subjected to a long course of acclimatization. The failure of tree cottons on a large scale after their success has been completely established in garden trials has been repeated and the inevitable result should now be accepted as a fact so that further loss can be avoided in the future.

The pursuance of a rigid system of selection on a scientific basis and the more intelligent appreciation of the laws which govern the production of crosses and hybrids will probably lead to definite results, at first on the seed farms and afterwards on the fields. New varieties will be introduced into districts suitable in every way to their individual requirements of climate and general environment. The Agricultural Department can furnish the necessary scientific guidance, but nothing can be done on a field scale without the assistance of the farmer and trader.

COTTON SOILS AND CULTURE.

Black soils in India are pre-eminently the best for cotton. Red soils are scarcely ever used for this crop. The superiority of the black soil is probably due to its depth and adhesiveness, which render it very retentive of moisture.

Mr. Mercer made the following remarks regarding the state of native cotton culture :—

In Guzerat, Khandesh, Southern Maratha Country and Berar, I find an approach to the American mode of culture, by sowing in drills and at regular intervals, while in Madras, the North-West Provinces and almost every other part of India where cotton is grown, the broadcast system alone is used. The first, by allowing the crops to be kept from grass and weeds, by means of the plough or cultivator and the ground about the plants being thoroughly and constantly stirred, gives an advantage both in regard to cheapness and the improvement of plants themselves that the other never can possess and is, indeed, the chief excellency of the American mode of culture and the only one of its features which has been found not to need much modification.

It appears that the natives of large tracts, as Guzerat, Berar, already employ a mode of cultivating the cotton plant, in principle nearly the same as the American, but better suited in some respects to locality, &c. No people better understand the advantages of rotation of crops than do the natives of India generally. With regard to implements of cultivation, those now in use amongst the natives of the districts where the drill system of cotton culture is practised are quite sufficient, being fully adapted to the most thorough tilling of the ground. Though the field for improvement is great, still the manner of growing the cotton is not nearly so defective as it has heretofore been the practice to represent.

Previous experiments carefully conducted proved that irrigation, especially in the later stages, is harmful to the crop and weakens the fibre.

In conclusion, at the present juncture we are only in a position to say tentatively, exotic cottons can only be cultivated in favoured parts of India ; tree cotton cultivation is not worth the risk ; varieties can only be improved in their own localities, by the adoption of methods of selection and crossing and that varieties can only be maintained in a pure state in the fields if the cultivators and traders are willing to observe the needful precaution.

COTTON CULTIVATION IN THE CENTRAL PROVINCES AND BERAR.

BY

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The area under cotton cultivation in these Provinces has increased from 1,837,767 acres in 1866 to 5,821,041 acres in 1907. It now occupies a larger area than any other crop, rice being second in importance, with an area of about 4½ million acres. The great increase in material prosperity that is everywhere evident in the cotton-growing districts of these Provinces is largely due to their extension of cotton cultivation. This extension is directly due to the rise in prices, coupled with seasons of light rainfall favourable to cotton, which has resulted in making cotton more profitable than wheat, linseed, gram, sesamum, and other minor crops which it has replaced. In Berar, where about 44 per cent. of the cropped area is already under cotton, and where the demand for fodder crops is very great owing to the very limited area available for grazing, the area under cotton has possibly almost reached its maximum. In the Central Provinces, on the other hand, there is still considerable room for expansion both in the present cotton-growing districts, as well as in some others where cotton only figures as a minor crop at present.

The short-stapled cotton, which is now almost universally grown, is admirably suited to the soil and climatic conditions which obtain in the cotton-growing tracts. The fertility of black

cotton soil is proverbial. It varies in depth from 2 to 12 feet, and in texture and colour from the deep fine-grained and almost jet-black soil of low-lying fields to the shallow grey soils of the higher land containing more sand and lime-stone. The latter gradually merges into the former, the grading process being largely due to the effect of water. The cultivation of cotton is mostly restricted to the better classes of soil but owing to the great boom in the cotton trade and the consequent rise in prices of late years, cotton is now often grown on the light inferior soils. In these latter soils it can only be grown profitably while high prices prevail ; any considerable fall in prices would result in the substitution of sesamum or some of the smaller millets which make less demand on the plant-food of the soil.

The climate of the cotton tract is drier than that of the rest of the Provinces, and recent years of short rainfall have been peculiarly favourable to cotton. The average rainfall for the last 40 years varies from about 32 inches in Nimar to 46 in Nagpur. As the rainy season extends over a period of $3\frac{1}{2}$ months only, viz., from the middle of June till the end of September, the surface soil gets very dry and begins to crack freely by the beginning of November. The fissures increase in number and size during the dry weather and injuriously affect the cotton crop later by letting in the drought and breaking many of the rootlets. The only remedy for this is to do as much interculture as possible up to the time that the plants flower. This secures a fine surface mulch which checks evaporation and the consequent cracking of the soil. To succeed under these peculiar climatic conditions, the cotton grown should mature in about five months, so that at least one good picking is obtained before the drought begins to be much felt. The two indigenous varieties commonly grown, namely, *Jari* (*Kativilayati*) and *Bani*

(*Hinganghat* or *Ghàt Kapàs*) mature in about 5 and 5½ months, respectively, while the only exotic that has given promise of success is Upland Georgian which matures even earlier than *Jari*.

The Jari, which is now almost universally grown, is one of the coarsest and shortest-stapled cottons produced in India. Its origin is not well known. It is said that the Jari grown thirty years ago was comparatively a superior cotton, that it spun up to 16's, or even 20's, and was in demand in the Bombay market for export to England. The present Jari falls far short of this description. Its staple is coarse and short, at its best it spins up to 10's only, and it no longer finds a market in England, not being suitable for use in the Lancashire mills. The introduction of the coarser strain is said to date from about the year 1873. In that year a white-flowered cotton, which was said to give 50 per cent. of clean cotton, which ripened early and which was a most prolific yielder, was introduced into Berar from Khandesh. The first cultivators of this new introduction, having observed that the seed possessed a sharp beak resembling a thorn, and having concluded that it was a foreign variety, named it *Kativilayati*, or 'thorned English.' This Kativilayati proved to be a most vigorous grower and a big yielder and readily adapted itself to the soil and climatic conditions of these Provinces. Its botanical designation is *Neglectum roseum* and *Neglectum roseum Cutchica*, there being two types with white flowers but the one giving a slightly better lint than the other. The Jari which it has largely supplanted was most likely of the two finer-stapled types, viz., *Neglectum malvensis* and *Neglectum verum*, mixed with a fairly high percentage of Bani, (*Gossypium indicum*) which was the predominant cotton in those days. The percentage of the

coarser type in this mixture has gradually increased until the Jari of the present day contains from 70 to 80 of the coarser, *i.e.*, the *Roseum* type. The reasons would seem to be that Kativilayati is a hardy cotton and a big yielder and that despite its coarseness it finds a ready market at a good price both for export and for the use of Indian mills. It is exported mainly to Germany and Japan, where it is found very suitabe for mixing with wool in the manufacture of coarse woollen fabrics; in this country the existence of a large quantity of machinery especially constructed for dealing with short-stapled cotton also gives it an artificial value. The ryot, recognising that Kativilayati is a hardy cotton, suffers less than other varieties from the exigencies of the climate, and gives large fluffy bolls with a very high percentage of lint to seed, prefers it to the finer types which have less bulky bolls. The good cultivator in Berar, who selects and gins his own seed, chooses only the big fluffy bolls, *i.e.*, bolls of the *Roseum* type. The percentage of the coarser types in this mixed cotton known as Jari is thus gradually increasing at the expense of the finer.

While the coarser types of Jari are thus ousting the finer, the Jari mixture is at the same time ousting Bani. *Bani, Hinganghat* or *Ghat Kapas* is a cotton of long staple and silky fibre. The percentage of lint to seed is about 26 compared with 32 per cent. for the finer types of Jari and 40 per cent. for the coarser. Its staple is about 1 in. in length as compared with $\frac{1}{2}$ in. for the coarser type of Jari. In 1878 there were 1,558,426 acres of Bani grown in Berar and only 629,653 acres of Jari; in 1906, there were 2,558,320 acres of Jari and only 639,580 of Bani. In the Central Provinces Bani has suffered even more. Of the 1,536,900 acres under cotton last

year, there were only 58,011 of Bani. This variety, formerly known as *Hinganghat* or *Ghát Kápas*, had earned for itself a name, and was exported in large quantities to England long before spinning and weaving had made much headway in India. When grown pure, it was suitable for spinning 40's. At present the home of Bani is the plateau districts, extending in a horse-shoe shape from Nimar in the West to Chanda in the East. That plateau includes most of Buldana and Yeotmal and part of Akola in Berar, and part of Nimar, Wardha and Chanda in the Central Provinces. In Chanda, where it is grown as a cold-season crop, it is known as Chanda Cold-Season Jari; it is known as Nimari in Nimar, as Hinganghats in Wardha from the tahsil of that name in which it used to be largely grown, and as *Ghát Kapás* in the Berars and the Nizam's dominions. This plateau is mostly situated from about 30 to over 100 miles from the railway. Where the communications have been improved by the opening up of new lines of railway as in Wardha, Chanda and Nimar, Jari is fast encroaching on the Bani tract, and the cotton now grown there is much mixed with Jari. In the more isolated parts of this tract, however, Bani is still grown almost pure. The very best cotton sent to the Akola market at the present time is *Ghát Kapás* (Bani) from the Nizam's dominions beyond the Painganga and from Basim, a taluk of Akola. Would Jari pay better than Bani if grown in the Bani tract, is a question that is often asked. Judging from the facts that in that tract buyers give only Rs. 2 or Rs. 3 more per khandi of Bani Kapás than for Jari, and that the outturn of Jari is recognised to be somewhat higher than that of Bani in ordinary years and still higher in years of drought or of excessive rain, we believe that Jari would be the more profitable variety at present prices. Bani-growers, however, like other cultivators,

are a conservative class, they know no other variety and will be slow to introduce even a more profitable variety.

The only othor cotton grown by ryots in these Provinces is Upland Georgian, an acclimatized exotic introduced about 30 years ago. It is equal to Bani in length of fibre and will spin up to 40's, but it has deteriorated very much in strength. The total area under pure Upland Georgian in all these Provinces will not exceed 100 acres. The other cottons that have been tried on the Nagpur Farm on an experimental scale are tree cottons, the various annual species from other Provinces and new and acclimatized exotics. The tree cottons that have been tested have without exception proved failures; others are still being tried. Of the various species of indigenous cottons from other Provinces, not one has been found equal in profit-yielding to the local varieties. The finer-stapled varieties such as the Bombay *herbaceums* take from 7 to 8 months to mature, and are not, therefore, suitable for our climate with its short rainfall for reasons already explained. Some of the early-maturing *neglectums*, all short-stapled species, thrive well, but they give a smaller outturn than the local Jari and their fibre is equally coarse. The unacclimatized exotics tried or at present under trial, including American, Afghan and Egyptian varieties, have given little hope of success. By sowing Egyptian in April or May with irrigation a small but unprofitable outturn of lint of weak fibre was obtained. From the many trials made with these cottons, it is evident that a variety which takes 7 or 8 months to mature has no chance of succeeding unless sown before the rains; but as irrigation is available in the paddy districts only, where owing to the higher rainfall the climate is unsuitable for cotton of any kind, it follows that there is little chance of being able to introduce such a variety, be it ever so desirable.

Of the acclimatized exotics Buri is far the most promising yet tried. It is an acclimatized type of American Upland, the seed of which was obtained from Bengal 2½ years ago through the Inspector-General of Agriculture. This cotton has long been grown in the Sonthal Parganas of Bengal under the name of Buri and is said to be the best foreign cotton tried there. It has been successfully grown on the Nagpur Farm for the last two years, and gives remarkably big bolls and the staple is very good. Several private cultivators, to whom small quantities of seed were given last year, are already sending in orders for as much Buri seed as they can get as they wish to try it on a larger scale next season. Botanically it resembles Upland Georgian, but matures 3 weeks later. It is suitable, therefore, for our short rainfall. Khan Bahadur Bezonji, Manager of the Empress Mills, who inspected the growing crop of Buri and to whom samples of the different varieties of cotton grown on the farm, including selected and unselected Upland Georgian and Buri were afterwards sent for valuation, described Buri in the following terms:—"The best outturn we have found is Buri which should be paid the greatest attention to. The staple is as good as fully-good middling American. I believe the yield per acre will be very great and if it can be successfully grown, the Jari would soon be ousted." He calculated that it would spin up to 40's and that its value per bojha of 345 lbs. was Rs. 150 with Jari selling at Rs. 90 and Bani at Rs. 130. One particular strain of selected Upland Georgian was valued at Rs. 5 more than the unselected.

With the exception of Upland Georgian and Buri cotton, the former of which has been a partial success only, and Buri the success of which is not yet assured, all attempts to introduce long-stapled cottons in these Provinces have failed for reasons

already explained. The Agricultural Department, therefore, in considering new measures for improvement, has wisely directed its efforts mainly to the improvement of the quality and outturn of the local varieties chiefly. The general scheme of improvement includes, (1) plant-to-plant selection of seed of all indigenous and exotic varieties likely to do well in these Provinces; (2) hybridizing; (3) the trial of exotic varieties; (4) manurial experiments; and (5) the distribution of pure seed of improved varieties to the ryot through the agency of cotton seed farms.

Plant-to-plant selection is carried out on the experimental stations under the direct supervision of an agricultural expert. Cotton is grown on special areas for selection; the land is well manured and carefully cultivated; the plants are thinned out so as to give them plenty of room for their full development. A few of the very best plants out of thousands are then selected as mother plants of which the seed is to be kept for propagation. In selecting the plant, its shape, vigour of growth, its freedom from disease and insect pests, and the quality of its lint are all considered. The cotton of each plant that satisfies all these conditions is stored in a separate bag and weighed; the cotton of all plants that fail to give a certain weight of lint are afterwards discarded. The seed of each plant that passes all these tests is sown in a separate line, and from each line mother plants are again selected next year. In nature like begets like; the offspring of any one mother plant should be good as a whole, *i. e.*, they should be true to type; but some will always be found to be more prolific than the mother plant, others will be found to give a finer lint. By carefully inspecting the individual plant and by selecting the very best year after year, the strain is gradually improved. This work is now re-

ceiving very careful attention at the experimental stations and it is certain that much good will come out of it.

Some progress has also been made in plant-breeding, but so far no definite results have been obtained.

Trials also continue to be made with exotics, Buri and Upland Georgian receiving special attention. There is good prospect of the former being successful.

The only manure used for cotton at present is cattle-dung, but the supply is very small, as in the cotton tract there is much less grazing and fewer cattle kept per acre than in other parts. A part of the already inadequate supply is used for fuel, especially in the cotton-growing districts of the Central Provinces; consequently experiments are now being carried out at the agricultural stations in order to test the effectiveness of other manures as crop-producers. Cattle-urine, conserved by the dry-earth system, is found to be equal in value to cattle-dung, and measures are being taken to induce cultivators to save this valuable part of their manure which they have totally neglected so far. Artificial fertilizers are also being tried and from results already obtained there is good reason to hope that nitrogenous fertilizers (such as nitrate of soda and sulphate of ammonia) can be supplied very economically to cotton grown in these Provinces. The results obtained last year from a series of experiments in which nitrate of soda, superphosphate and sulphate of potash were applied to cotton, gave the results shown below :—

Plot.	Manure applied.	Outturn in lbs. Seed-Cotton per acre.	Increase and decrease in this due to manure.	Value of increase and decrease per acre.		Cost of manure per acre.			Gain and loss.		
				Rs.	A. P.	Rs.	A.	P.			
1	Nitrate of soda Superphosphate and Potash.	870	+ 360	+ 35	9 ...	30	7	...	+ 5	2	...
2	Nit. and Super.	800	+ 290	+ 28	9 ...	25	5	...	+ 3	4	...
3	Nit. and Pot.	800	+ 290	+ 28	9 ...	20	3	...	+ 8	6	...
4	Nit.	u60	+ 750	+ 24	10 ...	15	1	...	+ 9	9	...
5	Pot. and Super.	480	— 30	— 3	... ...	15	5	...	—18	6	...
6	Super.	390	— 120	—12	... ...	10	4	...	—22	4	...
7	Pot.	520	+ 10	+ 1	... ...	5	2	...	— 4	2	...
8	No manure	510	...	...	... ...	...	...	...	...	...	...

The conclusions to be drawn from these experiments are:—(1) that nitrogen alone is deficient in this particular soil and that, from an economic point of view, nitrate of soda is a highly profitable manure; (2) that the cotton crop is not materially benefited by applications of potash or superphosphate without

nitrogen; (3) that when potash and phosphate are applied along with nitrogen, the value of the increase is not sufficient to cover their cost; (4) that potash and phosphate, applied together or singly without nitrogen, result in a dead loss. Another fertilizer that should do equally as well as nitrate of soda as a manure for cotton is sulphate of ammonia. The cotton manured with it at the Akola Experimental Station has this season done better even than that manured with nitrate, though the final outturns have not yet been ascertained. If it is found possible to produce this useful manure at cheap prices as a bye-product of the iron works to be constructed by Messrs. Tata & Co., we believe that it will give a fresh impetus to cotton cultivation in these Provinces.

Another line of work, which is receiving due attention from the Agricultural Department, is that of establishing cotton seed farms, from which pure and selected seed can be distributed to the ryot. These seed farms have already been in existence for the last three years, and have met with a considerable measure of success. The land belongs to private cultivators who supply the manure and labour; the Department of Agriculture sends an Agricultural Assistant to supervise the cultivation and to advise the owner as to its management. The owner guarantees to follow the improved methods of cultivation prescribed by the Department for seed production. The Department on its part guarantees to compensate him for any loss he may suffer thereby. The cotton is ginned on a Platts' gin driven at a slow speed by a bullock-gear. The seed is purchased, and distributed by the Department. As the policy of the Department is to encourage private enterprise, the Assistant in charge is withdrawn as soon as it becomes evident that the owner is capable of managing the farm successfully without him; but the Department will continue to supply the owner with a fresh

strain of selected seed for the experimental stations each year. It will also continue to assist the owner to find a good market for his seed, either by purchasing it for distribution as at present, or by advertising it widely for him. This line of farming should prove to be a most profitable one for the owner who can establish a reputation for supplying superior seed. It will, at the same time, be a great boon to cultivators who at present often experience great difficulty in getting good seed for sowing. Seed farms also serve as demonstration farms where the best methods of cultivation are practised, where new manures that have been tested at the experimental stations are tried on a field scale, and where all the most desirable cottons, including new crosses and varieties, can be grown before distribution to cultivators.

These, in brief, are the measures that are being taken for the improvement of cotton in the Central Provinces and Berar. As yet the work has but begun, but steady progress on these lines should have far-reaching effects. It will enable the cultivator to procure supplies of pure and improved seed of the indigenous varieties and of such acclimatized long-stapled varieties as are likely to succeed in his tract. It will enable the local manufacturer to procure better lint of the present short-stapled Jari and of a purer form of Bani; it will, we hope, also enable him to obtain locally a larger supply than he does at present of the long-stapled varieties instead of having to import them from America, as he is compelled to do under existing conditions. The work of improving this, our most important crop, is thus being conducted on sound Swadeshi lines.

CULTIVATION OF COTTON IN BERAR.

BY

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INTRODUCTION.

When you view the industrial situation, Gentlemen, the first thing that forces itself on your attention is the primitive condition of the premier industry of the country. I mean the Agricultural Industry, the industry which supports more than 65 per cent., according to Lord Curzon 80 per cent. of our population and on which we must depend for our subsistence as well as for the raw material of our chief manufacturing industries.

I rejoice to see the greatest landlord of all in India, namely, the Government, is recognizing his duty and has taken, and is taking, measures to spread a scientific knowledge of Agriculture, by means of colleges, experimental farms and such other measures, to free cultivation from insect pests and to introduce new and valuable forms of the Agricultural industry.

Few people talk of the Swadeshi movement in connection with Agriculture. But really that is the industry which most requires the application of the true Swadeshi spirit, for on it are based all our possibilities of manufacturing industries. (*The Hon. Mr. Vithaldas Damodher Thackersey, in his Presidential Address at the Second Indian Industrial Conference,*)

The small Province of Berar, known in days of yore by the name of Vaidarbha, has been famous for its cultivation of cotton. It grew some of the best varieties of the plant yielding a fine and strong fibre. It was the home of the once celebrated Jadi and Bani varieties which flourished to a large extent and afforded a superior sort of material not only to the mill industry in India, but also to that in England. When England was unable to get cotton from America in the sixties of the last century, the cotton of Berar supplied the deficiency

to a considerable extent in quantity and quality as well. In view of these facts, the statement made by Mr. Vithaldas Damodher Thackersey that " if the mill industry flourishes in Western India, it is because the Gujarathi is acknowledged on all hands to be the most efficient cultivator of cotton in India", requires to be modified to some extent.

AREA UNDER THE CROP AND ITS EXTENT.

2. Berar is pre-eminently a province of agriculture and amongst its agricultural products cotton stands first. Nearly two-thirds of the culturable area is now grown with cotton. Its cultivation has immensely and very rapidly grown during the last ten years as will be seen from the following table :—

	Area in acres.	Remarks.
1896-97	234,709	
1897-98	2,150,709	Year of scarcity.
1898-99	2,471,123	
1899-1900	1,084,418	Famine year.
1900-01	2,521,651	
1901-02	2,689,201	
1902-03	2,765,635	
1903-04	2,851,000	
1904-05	3,069,000	
1905-06	3,197,900	

3. The increase is observable in all the districts but it is most in the districts of Amraoti, Basim and Yeotmal. In the latter two districts large tracts were lying fallow and have

recently been brought under the plough. The taluks of Wun, Kelapur, Yeotmal, Darwha, Mangrul and Pusad have contributed a great deal towards the increase. For sometime there was a belief that these tracts were not suitable for the production of cotton, but recent experiments have removed the misapprehension. Most of the land in these tracts is what may be called virgin soil and hence the cultivation of cotton is found specially paying. Even in tracts where cotton has been sown since days of yore, more land is being brought under its cultivation to the exclusion of other crops—more especially Jaori—the staple food of the province. I have remarked above that the increase in the area under cultivation is observable all through the province, and the following table bears this out. It shows the increase in the area brought under cultivation in the several districts of the province.

	1866-67.	1904-05.
	Acres.	Acres.
Akola	406,862	743,268
Amraoti	182,183	715,127
Basim	62,241	360,059
Buldana	195,113	421,768
Ellichpur	309,172	348,591
Yeotmal	131,161	478,211

DECLINE OF THE INDIGENOUS VARIETIES.

4. It is satisfactory to note that the cultivation of such a useful article for trade should increase to such an extent, but it is to be regretted that along with the efforts towards the

increase of area there have been absolutely no endeavours to improve its quality. This has resulted in the deterioration of the commodity produced and the fair name of the province has suffered.

5. The evil seems to have been recognized as early as 1867. Dr. Hume then remarked :

The subject of cotton in Berar is one that requires immediate supervision. It has been left in the hands of ignorant Kunbees who have no thought for the morrow, but grow whatever pays best at the time. The Khandesh variety is being grown largely to the ousting of other varieties to the most certain ruin of the Berar cotton trade. At present they get from Vilayati Khandesh an early crop, also a large one, getting three or four pickings instead of two or three as they get from the indigenous cotton. They get Rs. 3 or 4 a bale less in price than for the indigenous cotton, but the greater bulk compensates much more for this small loss. But this apparent prosperity will be short-lived, for it is only by mixing this Vilayati Khandesh cotton with the indigenous cotton that merchants can get it accepted.

EARLIEST VARIETIES.

6. The earliest varieties grown in the province were Jadi (Chanda Jadi) and Bani. The former was a cold-weather variety, fine and silky, staple 1½ inches. The latter was sown at the beginning of the rains, fine and silky, staple about 1 inch. Later on came into existence Jadi sown at the beginning of the rains, hard and prolific, coarse, staples about ¾ inch. These have been described as under :—

Jadi :—Tall sparsely branched plants. Lower branches long, slightly ascending, median upper sparse, more or less drooping, becoming successively shorter apex of simple stem much produced. Leaves dark green, strongly heliotropic. Bractiolis triangular, entire or slightly toothed upwards. Petals reflexed, yellow or white.

Bani :—Tall sparsely branched plants. Lower branches long, slightly ascending, median and upper sparse, short, more or less drooping, becoming successively shorter, apex of simple stem much produced. Leaves yellowish green, entire to three lobed usually, lobes broadly ovate. Bracteoles triangular, entire or slightly toothed upwards. Petals reflexed, yellow or white. Cotton scanty and fine in the most typical examples. *(Mr. G. A. Gammie.)*

THEIR QUALITY AND OUTTURN.

7. Both Bani and Jadi yielded long staple. The lint of the former was uniformly fine, more glossy and silky than that

of the latter, though its outturn was comparatively less. Both the varieties ripened late. Bani was more delicate and was less adapted to stand the fitful changes of the seasons. Both the varieties continued to grow in the province and commanded good price in the Bombay market until within the last forty-five years when they were ousted by the plant now known as Kantabilayati, Bilayati, Houri, or New Jadi.

8. This variety in recent years has become very popular because of its sturdy character and ability to stand both excessive rain and partial drought. Says Mr. Gaskin :—

> Jadi is popular because of its hardiness and certainty, its heavy yield (1,000 lbs. seed cotton giving 330 lbs. lint per acre), the ease with which it is picked up and the fact that it ripens early and so can be placed on the market in October.

9. In 1896-97 there was an early cessation of rains as has been the case in the year we have been passing through. The rains stopped in September and yet the cotton yielded a harvest of from 8 to 12 annas. Even in the current year the outturn varies from 6 to 16 annas according to the soil and other circumstances. Another peculiarity of this variety is that it yields a bumper crop with a rainfall of 20 inches evenly distributed throughout the season. Bulk for bulk its yield is much larger than that of the old Jadi and Bani though the staple is much shorter and less glossy. The old varieties come into market in January and February, whereas the new plant ripens much earlier and enables the cultivator to line his coat with silver in the months of November and December. These circumstances mostly have effectively thrust out the old indigenous varieties of cotton. The change, it is said, came about in this way.

10. With a view to improve the cotton cultivation in the province Government introduced the seed known by the name of Bilayati or Houri. It is also called Jadi in some provinces, but

I consider it has tobe distinguished from the old Berar Jadi variety known as Chanda Jadi. The seed was distributed *gratis* to try its growth and the experiment proved that the variety introduced was suited to the soil and the conditions of the country in such a remarkable manner that before long it became popular among the agriculturists to such an extent that the old varieties were completely forgotten and driven out. In connection with the introduction of this variety Mr. Gaskin observes " that by the irony of fate the very cotton which the Government endeavoured to eradicate became known as one which they had introduced. Could confusion of ideas go further ?"

11. According to Mr. B. P. Standen, C. I. E.: " These are hardy plants which can be cultivated with success in any part of the province where the soil overlies trap and drains early and the temperature of the cold season is not so low as to kill the plant in December." According to him Jadi (the local Houri) has thrust out the old indigenous varieties Bani and Jadi " because the former even in the most favourable years pays better than the latter." The same officer is of opinion that the cultivation of Bani on the Ghats south of Berar is due to a spirit of conservatism on the part of the cultivators rather than to any prudential considerations.

12. " Not only does Bani yield a smaller proportion of lint than Jadi (Houri), it gives also, under the most favourable circumstances, a smaller average crop, being more liable to damage from the vicissitudes of the season." Such, in short, are the circumstances under which the old famous Berar varieties of cotton have dwindled and disappeared. Jadi as sown in these provinces, is a mixture of the following four varieties :—

(1) *Gossypium neglectum malvensis* ; (2) *Gossypium neglectum vera* ; (3) *Gossypium neglectum rosea* ; (4) *Gossypium*

neglectum rosea cutchica.--The "Agricultural Journal of India," page 188.)

CLASSIFICATION OF SOILS.

13. The soils of Berar have been classified under seven heads known in the local language by the name of (1) Kali—deep black soil ; (2) Marwand—black ordinary ; (3) Paudhari—white, adjoining the village habitations and popularly called Akhars ; (4) Chopan or Chikani—land over which a white substance gathers in the rainy season and is mostly devoid of productive capacity ; (5) Malai—alluvial land formed by floods ; (6) Pivali—yellowish ; (7) Kharad Barad—rugged and stony land of inferior quality. Of these the first, the third and the fifth, viz., the black soil, the white soil adjoining the village habitations and the alluvial formed by the floods of river are specially adapted for the cultivation of cotton although it is capable of growing in all the seven varieties detailed above. The difference is purely one of degree.

PREPARATION OF THE SOIL.

14. *Ploughing* :—Unlike the white soil adjoining the village habitations, and the alluvial, the deep black soil does not require to be ploughed every year for the cultivation of cotton. For its better cultivation it is necessary to plough the other varieties of the soil. It is carried out with an implement, Naugar plough, to which are yoked two to three pairs of bulls. The implement consists of a block of bent wood two cubits long with a curve in the middle, close to which is attached an iron bar पास pointed at the front, and is parallel to it. The iron bar is fixed to the block along the tooth (Dat) parallel to it and is longer than it by a span and is enclosed by an iron ring. To the straight block is attached a pole to which the bulls are yoked.

15. Although the black soil may not be ploughed every year, it needs ploughing at least once every three years. The ploughing is undertaken to make the soil soft so that the seed may have no difficulty in sending down its roots deep. Another object with which this operation is made is to turn up the land inside out in order to bring up down strata so that the seeds may thrive better. The operation is as costly as it is difficult and tedious, requiring hard and strenuous work. Its cost is usually Rs. 16 per tiffan of four acres or Rs. 4 per acre. Four men with three pairs of bulls are required to plough, three men to drive the three pairs of bulls yoked, and the fourth to hold the handle in order that the iron bar may go on working straight and deep. It is the force of this man that drives the bar deep.

16. *Harrowing:*—Another measure adopted towards the same end and which has to be repeated annually in all soils is tilling वखारणें . It is carried out with an implement, harrow वखर, consisting of a block of wood with two teeth at either end to which is attached a piece of iron bar कुशा and a pole to yoke the bulls. The first operation, *viz.*, ploughing, is usually carried out soon after the harvest. When done at this time it is more economical and less tedious. Two pairs of bulls are enough to carry it out. The latter, harrowing, is undertaken on the New Year's day—*Chaitra Shudha Padva*—and is continued and repeated till the commencement of the rains. The plough is worked usually once but the harrowing has to be done at least twice. The first working, technically known as Vahi (वाही), is called Ekarni (एकारनी), and the second Vahi, which is done crosswise, is called Dubharni (दुभारणी). The more the land is harrowed the better it becomes fit for cultivation. The last working of the harrow is called the Jambluel Vahi and is usual-

ly undertaken when the monsoon bursts and is a preliminary to the sowing operation.

The cost of harrowing Ekarni and Dubharni is usually Rs. 5 per tiffan of 4 acres. A pair of bulls with a man harrows a tiffan of 4 acres in three days. The Dubharni is undertaken a month afterwards in order to allow the earth to be soaked with the sun's rays before the second turning.

17. *Manuring :*—The most common manure is the droppings of cattle and the refuse of the stables including cattle urine. They are collected and deposited in waste land adjoining villages. Many stack them in pits specially made. Most of the agriculturists make use of it within four or six months of their stacking, but a few allow it to rot for a year and then it is removed to the field and spread across it before the harrowing begins.

18. Another mode of manuring is to allow the flocks of sheep and goats to stand over the field for days so that their droppings and urine may fertilize the land. Cows, bulls and other cattle are similarly moved from place to place in the fields for the same purpose in the hot season.

19. Human excreta is also used for manuring. Its use, however, is confined to fields adjoining the village lands and known, as remarked above, by the name of Akhars. Powerful and valuable as this manure is, the villagers get it absolutely free. The fields adjoining the gaothan—habitations—are the public latrines of the villagers. To them they resort for purposes of nature throughout the year and hence the Akhar fields are looked upon as of great value. With plenty of rainfall at seasonable intervals an Akhar field yields double the outturn of distant fields. Hence Akhar fields always fetch a higher price than the others.

20. Other manures are unknown. The modern science of agriculture is yet a sealed book to the Berar agriculturists, and happy will be the day when it is opened to them.

21. The manure collected in pits and stacks is removed to the fields and is spread over in a number of places in small heaps. This is usually done soon after the removal of the crop and about the month of Falguna-Shimga. These heaps are spread over with a shovel all over the field before the harrowing begins. The harrowing mixes the manures with the soil reducing it to minute atoms and assimilating it.

22. The improved method of manuring which has recently been adopted in a very few individual cases requires to be prominently mentioned. It consists of fertilizing the land at the time of sowing by the same implement with two additional sarates सरत attached in front. The manure made up of stable refuse and cattle droppings is pulverized and the powder is dropped through the front sarate सरते just as the seeds are dropped in the hind ones. The effect of this mode is that the seed drops and takes root exactly in the spot manured. This method is more effective and economical but it is said that it has a temporary effect, just only for one season. The manure spread in the old style has the power of fertilizing for a longer period, at least for three years.

23. At present the old method is more popular and is considered more beneficial in the long run. The point is one for the consideration of experts and for experiment by practical workers. I consider both the methods have their advantages. The latter, the newly adopted method, is yet in an experimental stage and pronounced opinion as to its superiority or otherwise over the former would be rather premature.

24. There is yet another mode of fertilization. It is independent of manures and consists of sowing crops by suitable rotations. In the language of the agriculturists, the method is known by the technical term Biwad. The fields sown in the preceding year with sesamum, gram, wheat, lac, linseed, are considered well adapted for the cultivation of cotton. If cotton is sown after sesamum it is said that the field has had sesamum Biwad. It is the best Biwad. Rabi crops Biwad is superior to that of Kharif crops, viz., jaori, turi, odid, muga, &c. But any rotation is preferable to sowing cotton after cotton in successive years.

ROTATION OF CROPS.

25. I have known of instances where agriculturists have prospered in the cultivation simply by the punctilious adoption of rotation of crops. Sowing by rotation does not require much extra cost or labour in cultivation, yet 90 per cent. of cultivators do not follow it because they find the cultivation of cotton after cotton according to their crude notions less troublesome and more remunerative.

This neglect of the rudimentary rules of the science of agriculture may be attributed to the easy-going habits of the cultivating classes who have been immensely wanting in the spirit of industry and perseverance.

SELECTION AND PREPARATION OF SEEDS.

26. The selection of seed for cultivation is known by the name of Alkabalka. At one time it was practised by the agriculturists extensively. The mode adopted was to select the best bolls at the second picking and stack the cotton in a heap by itself. The cotton was separately ginned and the seeds so obtained were reserved for sowing for the next season.

The practice of harrowing has, for all intents and purposes, died out though it is said that it is followed by a few individuals in some villages towards Akote and Ellichpur.

Any seed is now considered good for sowing and no effort is made towards selection. For sometime after the introduction of ginning factories, seeds of machine-ginned cotton were looked upon as unsuitable for cultivation. But the prejudice is fast dying out and now the sowing of hand-ginned seeds is more an exception than a rule. Experience has proved satisfactorily that machine-ginned seed is as good for sowing as that obtained by hand gins. The omission to keep a supply of seeds before sending the cotton to market, often lands a cultivator in difficulties, and these he tides over by purchasing from Marwaries such seeds as he may sell and pay the price he dictates.

27. In view of these circumstances, it is necessary to revive the old and useful practice of Alkabalka selection. But this point will be more appropriately treated under the head of improvements suggested.

28. Cotton seeds previous to sowing are passed through a sieve. A *charpai* is usually used for this purpose and cotton seeds are rubbed over it. These are then bathed in a lotion made of a mixture of black earth and cattle droppings. In some places they are bathed in a lotion of black earth only. Some people prefer white earth for this purpose. This process is undertaken to prevent the seeds from sticking to each other and to facilitate their dropping down with ease through the Sarate. It is said that in times gone by the cotton seeds used to be bathed in water mixed with asafœtida but the practice seems to have come into disuse long since. Such a procedure is considered quite unnecessary because the seeds are not liable to be infected by the insects before germination. The sowings

begin with the outburst of the monsoon in the Mrig Nakshatra falling usually on the 5th to the 7th June, and is continued throughout that Nakshatra and also through the next Nakshatra of Ardra. The time for the sowing is called घात and is limited to these two Nakshatras of 15 days each. Roughly speaking, it has to be sown from the middle of June to the middle off July. In a few cases they sow cotton in the dust even before the rains set in.

29. Seeds so sown germinate and flourish well with a seasonable and copious rain but oftentimes they are in fear of being eaten away by birds or being otherwise damaged. The popular belief is that cotton sown in the Mrig Nakshatra yields a bumper harvest, and hence it is that, as noted above, some cultivators sow it in dry earth even if there be no rains in that Nakshatra.

30. The sowing is carried out by means of the implement called Doosa. It consists of a block of wood like that of the harrow with the teeth and the Pas—the iron bar removed. In place of the teeth are put in pegs made of Babul wood. They serve to make the lines, over which the seeds drop. Behind the pegs parallel to them and at a distance of three cubits stand two pipes of bamboos. These are called Sarate सरते and through them the seed is dropped. Five men are required for sowing one to drive the ' Doosa,' two for dropping the seeds in the bamboo pipes, and two to drive the harrows following the lines sown to spread earth over the seeds dropped in the soil. Oftentimes the harrow behind the Doosa is replaced by a bundle of Babool branches drawn across the lines sown. It is called Fasati. Of late, the agriculturists have taken to put up these Sarates to the Doosa with a view to save time and money and Tasati also is more freely employed towards the same end.

The cost of sowing is on an average Rs. 5 per tiffan of 4 acres.

GERMINATION.

31. Germination begins in four days, and the first two leaves are put forth in a week. In a fortnight is undertaken the operation of putting fresh earth around the seedlings. It is called Davaran. The implement used in carrying it out is called Davara, and is like the Vakhar, except that it is of smaller dimensions to admit of its running between the two lines of the sowings. An iron bar, Pas, is attached to the teeth जानकुट and it shoves on earth over the roots of the young plants. Two Davaras are worked by one pair of bullocks driven by two men. The average cost is one rupee for a tiffan of 4 acres. The operation is called Ekatashi Davaran in the agricultural dialect, and is usually undertaken when the seedlings are four fingers' high. When carried on when the plants have grown a span high, the operation is called Dotashi Davaran. The difference in both the operations is this, that in the former the implement runs only once in each line and that in the other it runs twice. The latter operation affords more nourishment to the young plants. Its cost, however, is double that of the former. The Davaras are worked from two to four times in a season. The more they are worked the better the crop thrives, receiving more nourishment at each working.

32. Another implement used for the same purpose is called Doonda and is similar to the Davara, except that the former is larger in dimensions than the latter. The operation made by it is called Doondan and is usually undertaken after the Dotashi Davaran has been finished. Working of Davaran and Doondan is usually begun in Shravan and is continued up till Ashwin, when the plants flower and blossom.

33. Simultaneously with Davaran and Doondan is carried out Nindan, the weeding out of the wild growth, and is continued till the plant ripens and bears bolls.

34. Cotton is sown by itself. But sometimes and in some rare places and cases it is sown as a mixed crop with tur. It is so sown in the proportion of 20 lines of cotton to one of tur. Cotton is sown in lines at a distance of two spans. Cotton plants are sown close to each other. It is usual to keep a distance of about 2 inches between each plant ; but this distance is not enough and more distance is needed to let the plants grow and spread freely. When it is found that the sowing has been too close, some of the plants are weeded out to enable the crop to thrive. Plants sparsely placed thrive better and yield a comparatively larger outturn than those allowed to remain very near to each other.

35. The average outturn of cotton is 2 khandies, equal to 300 seers of 80 tolas per tiffan, of four acres and its average market value is Rs. 50 per khandi. It would thus appear that an acre of land under cotton cultivation yields a crop of Rs. 25 to the cultivator. The cost of cultivation is usually Rs. 6 and the Government rental is Rs. 2. Thus with a cost of Rs. 8 the farmer is able to earn Rs. 25. This is an ordinary yield and is capable of being increased to double the quantity and price and even more by the use of manures and regular and systematic agricultural operations.

36. The picking of cotton is usually begun after the Divali. The work is carried out by women and children. The payment of wages for this purpose is made in kind. About a twentieth part of the cotton picked up by the labourer was given to him as his wages. This practice is still in vogue in some places, but it has been replaced by cash payment in recent

years, because the payment in cash is found more economical to the cultivator. The usual rate of cash payment is annas 3 per maund of cotton picked. In fields with a larger outturn, a labourer is able to pick from two to three maunds of cotton a day, and thus earn a wage of six to nine annas. But the payment in kind enabled him to get 10 to 12 annas a day for the same quantity picked. The twentieth part of the picking was given for the first picking and for the subsequent pickings a higher proportion had to be given, with the result that the labourer carried away the greater portion of the picking. To prevent this the present system of cash payment has come into vogue.

DISEASES.

37. Unlike Jaori the cotton plant is not liable to many diseases. It thrives on vigorously until the Hasta Nakshatra. Rainfall during the first quarter of it renders the soil hard and is not very beneficial to the plant. But the rainfall in Chitra is mischievous. In consequence of rain in that period flowers and blossoms borne by cotton plants drop down considerably. Later on, in consequence of extreme cold, a disease called Chikta infests the cotton plants, but it disappears as the sun grows powerful in the day.

38. Sometimes owing to excessive rains in the cold weather, the cotton bolls are infected with insects. The agriculturists know no remedy for it, and they look to nature for its cure, and nature affords it. The general experience is that with the clearing of the weather accompanied by sunshine and heat the insects die of inanition. A number of insects attack cotton. These have been described as under by Mr. H. Maxwell Lefroy :—

First, when the cotton plant is still small and flowers are not yet come, you will see that the leaves are sticky and the plant is sickly and if you look carefully you will see many small creatures dark-coloured or

yellow, like many little grains, on the lower side of the leaf ; these cause this sickness. In good seasons this disease will go away and your plant will become well ; many other insects will come to eat these little creatures ; you will see these on the cotton plant, little yellow insects with black spots like half a pea, and others. If the disease is very bad you should take ashes finely powdered and in the early morning when the plant is wet with dew, you should sprinkle this on the plants where the insects are, specially turning over the leaves and putting it on the lower side. Do this only if the disease is very bad and will not go away, as in a good season the plant will get better of itself.

After this and when the flowers are coming on the plant, you see many plants get yellow and die ; they dry up and grow no more ; if you pull up one of these and break it across near the roots you will find a worm inside, a long white worm, very big and round, at one end. This it is which eats your plant and kills it. When you find a plant dead like that, no man can restore it but you are to gather all such plants, put them in a heap and burn them, lest the insect come out, breed and multiply and the young, which are very many, eat many more of your plants. If you kill all the insects that infest and kill the young plants, there will be no more to continue eating your plants later on ; so your field will be full of good cotton and there will be no empty places.

At this time another insect, green in colour like a little worm, comes in the top shoots and tying all the leaves together, kills them ; you see then the withered leaves at the top of each shoot and if you look you will find the worm. This too you must take away and burn, lest it increase and eat all your leaves and you get no cotton at all. You will find this and the white worm in the stem at the same time, and then the cotton bolls begin to grow and swell before they open. These are eaten by worms, one a pink worm long and slender ; the other a short thick worm, black and white with many spots. These eat holes in your green bolls to reach the tender seeds within and feed on them ; you are to go often to your fields when the bolls are green and look for these worms. When you see a boll that is sick, or discoloured, or that has holes in it, there you will find the worms. If you leave these worms, they will come out when they are big, and will breed and multiply till your field is full of worms ; these will eat your bolls, and when you come to gather cotton, much is yellow and dirty, very much has been eaten and many seeds are spoilt. You do not get much cotton and much of this is dirty and bad. This is because of the worm ; if you go to the fields when bolls are green you will see it. Therefore you are to pick off the first bolls that get worms and so strive to stop the many worms that will come later. If you can destroy them when they are few, they will not be able to multiply and eat many of your bolls. Every two worms will bring nearly two hundred more, so you can see that you must kill the first at the cost of a few first bolls which are already spoilt if you wish to get more cotton. Many cultivators do not know these things because they never look in their fields, when the bolls are yet small, and the cotton is not ready. Then, when they go to pick the white cotton, they find little, and much of what they find is dirty and does not sell well. This should not be and you are not to let the worms eat your cotton when you can kill them while

they are few. Kill all these, the first that come, and you will see good cotton in your fields.

MEASURES FOR IMPROVEMENT.

39. Having detailed the different processes of cultivation, manuring, picking and outturn, the next question that demands our attention is the improvement of cotton cultivation. The improvements have to be carried out with two ends in view—(*a*) increase in outturn, and (*b*) improvement in quality. Simultaneous and continued sustained efforts in both the directions are needed.

40. Experience has shown that the outturn from the variety Kata Vilayati which is also called Nagpur Jadi or Houri and which continues to be such a great favourite has been gradually declining. Many a large and knowing landholder with whom I have had occasion to talk on the subject has noticed the decline and has been deploring it. This decline must be due to a variety of causes, but the chief cause to which it may be attributed is the selection or rather want of selection of seed.

41. It has also suffered in quality. For, whereas in former years the Jadi cotton was suitable for counts of 16's to 20's, it can now barely spin 10's. Mr. Gaskin, I. C. S., Deputy Director of Agriculture, C. P., is of opinion that "under the system of selection practised by the ryot, the finer varieties, Malvensies and Vera, are deliberately thrown away and the coarser roseas retained."

42 The old Berar indigenous varieties of Bani and Jadi —Chanda Jadi, were capable of yielding a superior quality of cotton. They produced lint capable of spinning up to 40's. The Manager of the Empress Mills, Nagpur, classes Bani as equal to middling American. He says that "it will spin up

to 32's easily and 40's with difficulty." Mr. Gaskin is of opinion that " there has been little, if any, deterioration in Bani. When grown at its best and grown in the old strongholds of the plant, it is capable of spinning up to 40's and is probably as good as it was 40 years ago." If the old varieties were superior in quality, the new variety excels them in quantity as will be apparent from the following table :—

OUTTURN PER ACRE.

Uncleaned Cotton.	Lint.	Value.
Jadi or Houri ... 350 lbs.	155 lbs. (33 per cent.)	£. 2-0-8
Bani ... ... 250 lbs.	70 lbs. (28 per cent.)	4¼d. .. ...

43. Now that the cotton mill industry has tremendously increased throughout India and shows signs of further expansion, the necessity of improving both the old and new varieties is becoming greater day by day. Even in our small province a new spinning and weaving mill has come into existence last year at Akola, thanks to the indefatigable and energetic effort of Rao Saheb Deorao Vinayak and his band of workers. Signs are not wanting indicating a desire to extend them. With their extension both the long and short stapled cotton are bound to have a demand such as never existed before. In view of these facts a revival of the old Bani and Jadi varieties requires to be undertaken. That they are capable of growing in the Berar soil cannot be questioned. The remarks of Mr. Gaskin on this point are very pertinent and worth quoting. He says :—

I see now with my more intimate knowledge of the country, what I did not realize before, that, owing to the physical peculiarities of the Berars, good reasons exist for this seed (Bani) proving a success in some localities and yet not answering in other parts of the province. And this rather confirms the view I have already expressed of the importance of trying to improve, by seed gardens and other measures, the indigenous

produce of each tract, the suitability of which to the soil and the climate has been established by long years of local experience. In the almost unfathomable black cotton soil of the Poorna valley the seed did not answer, and there is reason to believe that the statement of the people that the Jadi (old Chanda Jadi) plant there grown is the class of cotton best adapted to the peculiarities of the soil, is correct and the importance of making further experiments will not be lost sight of. Attention will be given to improving the Jadi seed which hundreds of years of cultivation have proved to be well adapted to the rich land of the valley of the Poorna.

44. Attempts are being made in the experimental farms at Nagpur to improve the cotton varieties by acclimatization and hybridisation. The upland Georgian variety of cotton has been acclimatized on the farm during the last ten years, and it has been distributed in several districts of the Central Provinces and Berar, where it is reported to have done fairly well. (*Vide C. P. Farm Reports.*) These efforts are of use and value in their way. But I would suggest that it would be more beneficial, and is likely to lead to better practical results if more concentrated and continued efforts are made to regenerate the now defunct races of the old Jadi and Bani varieties. These require to be revived and developed with crosses and fertilizers. Efforts in this direction are being made in the farm at Nagpur. " Bani is one of the parents of five of the seven crosses experimented and it is hoped that the crosses while inheriting the good qualities of their parent Bani, will show greater vigour of growth and yield better." Similar efforts are needed to develop and improve the Houri or Bilayati now in vogue. For scientific men are of opinion, as Professor Gammie said, that " the progeny of plants which are artificially cross-fertilized are usually more fertile than their parents. This proves that cross-fertilization is really of great service to the plants".

45. Experience has so far shown that foreign exotic plants do not thrive in Berar soils. In view of this fact it would be

only prudent if efforts are made to develop and improve the indigenous and tried local varieties by crosses, fertilizers and more improved methods of cultivation carried carefully, systematically and steadily.

46. Along with the selection of cotton varieties suitable to the soil and climate of the country, it is necessary that the seeds used to grow the plants should be well selected. Unlike the Oudh agriculturists, in the Berar agriculturists there exists "a lack of appreciation of the benefits to be derived from choosing seed from the best of the produce." When the cotton has been picked up, it is sent into the market wholesale by farmers small and large. There is absolutely no attempt at keeping a portion of the produce for seed for the next season. In the ginning yards cotton from all places and of all sorts is ginned promiscuously and the seeds also so stacked. These seeds are purchased in the beginning of the monsoon to sow in the next season. It is no wonder if the outturn and quality of the variety should deteriorate day by day. To remedy this the old system of Alkabalka, noted above, requires to be revived. It consists of picking up the best bolls in the field at the time of the second picking and stacking the same separately. The cotton so picked is ginned separately and the seeds are preserved for sowing at the next season. The work could be done by the District and Taluk Board members. Most of them are large land-owners and their efforts in this direction are bound to be successful. If they follow the practice in their fields and preach it in their circles, a vast change for the better will be apparent before long.

47. The opening of seed depots and their working on lines indicated by Mr. W. H. Moreland, Director of Agriculture in the United Provinces, will be a step towards the same goal and its

adoption in Berar will be productive of much practical good. The assistance and co-operation of the local bodies, District and Taluk Boards and Municipalities, in this behalf could be enlisted with ease. Another body of persons who should be employed to carry out these measures are the *ex*-pargana officers—the Deshmukhs and Deshpandes. They represent the old landed aristocracy of the province. They wield a large influence within their sphere and it would be only proper that it should be freely utilized to improve their lands and incomes as well as those of their neighbours. At one time they were the revenue officers of the province, but now they are only political pensioners. They are looked upon as a link between the Government and the people; and no agency could forward the measures for the improvement of agriculture better than these *ex*-pargana officers. Government could enlist their aid and co-operation for the mere asking, as the status of those persons is likely to be elevated by Government taking them into their confidence.

MANURES.

48. Next after the selection of seeds comes the question of manures. The province of Berar is pre-eminently a black soil tract and Mr. Clouston is of opinion that "black cotton soil is especially deficient in nitrogen." The deficiency has to be made good by manures. These are of two kinds: (1) bulky manures such as cattle dung, and (2) artificial manures such as saltpetre. The former is known to the agriculturist and the latter requires to be made known. The first acts slowly and the second quickly.

49. Although the Berar cultivators have been using cattle dung manure to a certain extent, yet there are reasons to believe that they have not fully appreciated its value and importance. For the larger quantity of cattle dung is made use of as fuel. It is doubtful if the ashes of the cattle dung so freely

burnt are carefully preserved and used as manure. In view of this fact it is necessary to bring prominently to the notice of agriculturists that "the manurial value of the ashes of cattle dung is shown to be considerable in comparison with no manure. The ashes appear to be almost equal in value to $\frac{1}{3}$rd the dung from which they were derived. Two-thirds of the value of the cattle dung are therefore lost when it is used as fuel. This means a loss of Rs. 14 per 160 maunds. It is very questionable whether the fuel cakes made from this quantity of dung would be worth this sum."

50. Land in Berar has been under cultivation for ages and has naturally suffered in its productive powers. It will continue to do so unless it is sufficiently manured with cattle dung. "In cattle manure, intelligent farmers in any country should recognize a cheap product of the farm that is always available in arable cultivation, which will produce good crops, gradually enrich the soil and improve its physical texture." Experiments tried at the Nagpur Farm have proved that "land manured from year to year with cattle dung restores its fertility. Bulky organic manures of this type (cattle dung) have, therefore, a definite value quite irrespective of the results they produce in the year of application, for the land to which they are applied acquires a fertility which it would take years of cropping to exhaust. It would be difficult to state the money value of fertility acquired in this way, but it certainly has a very real value as every practical cultivator knows." The experiments have further established the fact that for black cotton soil ordinary cattle dung is the cheapest manure. "The results for four years show that cattle dung gives better results than any of the other manures in the year in which it is applied and that the cumulative effect of its residues is also greater."

51. In addition to the bulky manure of slow action it is necessary to apply artificial manures of quick action to secure a full cotton harvest. Experiments have proved that for the black cotton soil an artificial manure rich in nitrogen can be applied with profit. For cotton nitrate of soda aad sulphate of ammonia are considered the best fertilizers. It must not be forgotten that these quick-acting fertilizers have disadvantages of their own. They exhaust the soil in a short time. To prevent this the simultaneous application of cattle dung is needed. "The ryot should be at least able to apply it (cattle dung) to his cotton crop at the rate of one ton per acre. The ryot who will supplement this natural fertilizer by a top dressing of about one maund (82 lbs.) of nitrate of soda, immediately after the plants are thinned out, will find that his profits are enormously increased thereby."

52. For the improvement of cotton fibre the manure of potash is considered especially suitable. Mr. Clouston has noted in his paper on "Fertilizers for Cotton" that "the coarseness of fibre would seem to be due rather to the absence of potash than to the presence of nitrate of soda. The cotton grown on all four plots to which potash was applied is classed as fine. This may be taken as something more than a coincidence, corroborating as it does the results of American experiments which prove that potash manures improve the quality of the lint."

52. The methods of conservation of cattle-dung manure are defective and faulty and these require to be improved as stated below:—"(1) The urine as well as the more solid excreta should be preserved; (2) the manure should be stored in pits and always kept moist, but should never be allowed to get

over-soaked; (3) the manure should be well rotted before it is applied to the land."

IMPROVEMENT OF PLOUGHS.

53. "We do not advocate new ploughs," said Mr. John Kenny at the First Indian Industrial Conference. But even if this be not advocated, it is necessary to try them side by side with our local indigenous ploughs and ascertain the results of their working. English ploughs have been, in recent years, exhibited to the Berar agriculturists but they have not been worked in a manner so as to drive home their superiority in practical working. The English plough goes deeper and produces better results, but its adoption is beset with practical difficulties. First, its price is very high. Secondly, should it get out of repairs the local village smith is unable to mend it. Thirdly, it requires more power to work it than the country plough. It is, however, necessary that the implement and its working should be exhibited on a larger scale and the ryot enabled to test its effects. I would suggest that a plough should be supplied to each taluk and that it should be worked at first in the central villages for a week every year. The co-operation of local revenue officers to carry this out could be enlisted. Other improved implements and agricultural apparatus should also be supplied and worked out with the aid of the same agency, without telling the ryot that "his ancestors for thousands of years were all wrong in their ideas of ploughing and sowing and agricultural work in general." Much could be done to improve the present modes and implements by the exhibition and trials of the new ones.

SUPPLY OF CAPITAL.

54. Like the United Provinces, Berar is a province "of small holdings and high interest; the cultivator himself has

little or no capital and the rate of interest is prohibitive." These circumstances handicap many a cultivator wishing to improve his soil and cultivation. Want of capital has been a great difficulty to the cultivators all over India, and Berar is not free from it. The cultivator is always in debt. He makes over the harvest to the creditor and carries on his future operations on fresh advances received. Oftentimes he pledges his future crops to enable him to carry on the agricultural operations of the season. This method of raising the loan is known by the name of Laoni and under it the agriculturist practically sells his crop at a rate less by far than that obtaining in the market. No attempt has yet been made to save the cultivator from this plight. In other parts of the country efforts have been made in this direction both by Government and the people and these have proved successful to some extent. The establishment of Co-operative Credit Societies is a measure which has given relief to the agriculturists in those parts of India where they have been thriving. In Madras these societies have done a very useful work. People have heartily co-operated with the Government in making popular the work of the societies. It would appear that they had a nucleus of the new societies in their old Nidhis. Even the money-lending classes there have come forward to advance the cause of the Co-operative Credit Societies. Says Mr. P. Rajagopalachariar :—"I have seldom met with opposition from this class and in a great many cases they gave me active help in starting these sccieties to their pecuniary detriment." The remarks of the Hon. Mr. A. E. Castlestuart Stuart are still more encouraging. He says :

> The fact that the rural money-lender and local Nidhis have shown themselves friendly to the young societies is encouraging and there is not the least reason why they should be otherwise. In this presidency, the large majority of money-lenders are not professional Shylocks unconnect-

ed with the land and with no local interests; but are for the most part the lending agriculturists of villages who, by superior intelligence and enterprise, have risen to the position they hold as the financiers of their poor brethren. The rates of interest they charge for loans are by no means, as a rule, exorbitant, having regard to the security offered. The Madras Sowcar has played and is playing a useful and important part in village life and there is no reason why he should not, as a member of his village Co-operative Credit Society, play an even more important part in the future.

55. The Marwaries are the most prominent money-lenders in Berar. But they too have become large landholders owing to their long domicile in the province as also in consequence of the nature of the transactions they carried on. The firms of Shri Ram Shaligram, Raja Gokuldas and many others are no longer mere money-lending shops. They have become holders of extensive tracts of good land all over Berar. Even among the Kunbi and Mahomedan agriculturists has grown up a class of persons "who by superior intelligence and enterprise have risen to the position of the financiers of their poor brethren."

56. It would thus appear that the conditions of Berar are not quite unlike those of Madras where the credit societies have been flourishing so well. They would thrive in this province, too. A few have been established in the Akola District. But they could hardly meet the requirements of the province and it is necessary that there should be quite a number of them all over the province. This is a work in which the local leaders, the Industrial and Agricultural Associations, the Government, and the so-called 'Lokamanyas' and 'Deshabhaktas' are alike interested. Persistent and continued work to this end carried on from one end of the year to the other will result in far-reaching beneficial results.

57. As observed by Mr. W. H. Moreland: "The provision of cheap capital is very much the most important agricultural

improvement that can be suggested. The capital required by the individual cultivator is small, but the aggregate amount required is very great; while the supply must be made promptly and on terms that the cultivator can accept." Such a provision could be secured by the establishment of the Credit Societies and I appeal to the local members of this Conference to take early steps to start them on an extensive scale in our province.

58. Addressing the *eilte* and gentry of the Yeotmal District, the Hon Mr. R. H. Craddock, the Chief Commissioner, has said: "There are many things which the Government cannot do without your help and there are also many things which you cannot do without the help of the Government. If there be co-operation between the two, what great results might not be achieved in agricultural improvements, in industry and in education." Let us all then combine, and, as the poet has said, "Act, act in the living present, Heart within and God overhead," to achieve these ends.

THE HAND-LOOM IN AHMEDNAGAR.

BY

THE REV. MR. D. C. CHURCHILL, AHMEDNAGAR.

In this paper I shall try to give some of our attempts and results with work with the hand-loom in Ahmednagar.

In January of 1902, I received a commission from the Society which I represent to "find or produce" a hand-loom which will be suitable for the weavers of the Ahmednagar District. This was for the purpose of starting a school of weaving which should lead eventually to a livelihood for many of the famine orphans in the care of the American Mission. If you will include the work we have done in the field of warping and dressing, we can say that we have been at work to carry out that commission ever since.

Before purchasing any looms I visited the Madras School of Arts and the Basel Mission Weaving Establishments in three cities on the Malabar Coast and many other places where other than Indian hand-looms were in use and largely on account of the opinion of Mr. Chatterton and because the Managers of the Basel Mission Factories were looking for better looms than the English fly-shuttle (Swiss pattern) which they were then and are still using. I came to the opinion, I will not say conclusion, that the chief requisite to make hand-weaving in Ahmednagar profitable, was a good hand-loom.

We began by the use of an Indian pattern of the English fly-shuttle loom and subsequently bought two of the Basel Mission pattern. This loom was invented by John Kay in the latter part of the 18th century. It is now made in a great variety of forms and qualities by a great many people,

but, in its essential principles, those of the shuttle drive and beating up motions it is the John Kay loom, the forerunner of the power loom, in use for more than a century. It is, therefore, interesting to read Mr. Chatterton's "Supplementary Note on Hand-weaving" accompanying Government Resolution No. 4434, in which he says that he has found no loom better suited to the general run of Indian hand-made cloth than the English fly-shuttle loom.

That is the experience of many men who have laboured long and earnestly in trying to find and introduce a good hand-loom into India. That is also our experience in Ahmednagar. Let us make a profound salaam to the memory of John Kay and wonder why the wonderful, mechanical 19th century did not improve upon the work of his hands and mind in the field of hand-weaving.

"Fools rush in where angels fear to tread." We in Ahmednagar were only beginners in weaving experience, but we soon made up our minds that that loom was not good enough or fast enough to weave the lugade and sari at a paying rate under ordinary conditions and as we could find none better in the market we began constructing one in which the picking was automatic, yet simple, the shuttle being driven in each direction without the use of cams, springs, pawls, clutches or anything of the kind, the reverse taking place solely through a system of levers with their ends firmly jointed to each other. To reduce breakage we introduced a spring tension for the warp which has been widely copied on other hand-looms and which greatly reduced breakage. We were able at that time to weave about twelve yards a day of coarse dungri, while with the John Kay type we were able to weave about 8 or 9 yards. Our loom ran at a speed

of about 110 picks per minute and we were using native hand-made warp which was good in quality but which was not well beamed. It then became evident that the product of only twelve yards a day was not due to the lack of speed in the loom but to other things too numerous to mention here, but chief among which was the badly beamed and arranged warp. We therefore left the loom largely in the hands of the weavers and applied ourselves to the warp and to making a few changes in the loom as they were suggested by use in the school. In a year the speed had risen to an average of 130 picks and the product per day by one weaver had risen to 23 yards, our best record for any one day being 33 yards. We then made a test covering six months in which five boys averaged 23 yards per day each during that time. Meanwhile, we learned for a fact that no loom alone could put hand-weaving on its feet but that the use of any good loom must be combined with good warping, dressing and pirn-winding apparatus. Many other experimenters in India have come to these conclusions during the past few years and they may now be accepted as a basis on which to build.

But I shall confine myself to the subject of the loom in the present paper.

In the weaving of coarse cloth of one yard in width we were so successful that when our attempts to weave saries of 45 and 50 inches in width proved little more encouraging than by the use of the English fly-shuttle, we were very much disappointed. Mr. Chatterton about this time purchased some of our looms for the new factory he was about to start in Salem, but they were ordered of a width beyond any which we had yet constructed and I pointed out to him at that time that the shuttle drive, while working at a better rate than anything heretofore produced, was based on principles which could never attain the highest speed

mechanically possible in a hand-loom. As Mr. Maxwell has adopted this principle in his Salvation Army loom and as many other experimenters have copied it and will doubtless spend much time and money on it before giving it up as we have, I might here state its defect.

In such looms (where the motion of the shuttle is derived directly from the motion of the sley) the picking mechanism begins to act when the sley has nearly reached its back position and the shuttle does not leave the picker until the sley *has reached* its back position. This is just as the shuttle has partially entered the shed.

The shuttle must now make its entire movement across the full width of the cloth during the time that the sley is moving from its back position to its mid-position and if the sley is moving to and fro with a smooth motion (approximating "harmonic motion" as must be the case if high speed is attained) this time will be about one-fourth of the total time of one "pick," or a complete to and fro movement of the sley. It will, therefore, be seen that if the shuttle can be made to *start* when the sley is at its *mid-position*, on its backward movement, instead of at its *back position*, it (the shuttle) will have one-half the entire time of one pick for traversing the cloth, instead of one-fourth. A *perfectly timed pick* may, therefore, weave cloth of approximately twice the width, at the same number of picks per minute, as a loom working on this defective principle.

A power-loom approximates a perfectly picked loom, as to the timing of the shuttle drive, and the English fly-shuttle loom may be perfectly timed in the same way by a very skilled weaver, but because of human imperfections and by becoming tired with the monotony and stress of weaving, he

loses much of that perfection of timing his movements necessary for fast weaving, and drops to a much lower speed to avoid mistakes.

In Ahmednagar, therefore, we have left these principles and believe that we will make progress in hand-weaving by the use of more perfectly adapted mechanical principles.

The direction of our efforts is determined largely because we have become convinced of the following points.

1*st*. That the power and skill required to perform the act of weaving light cloth at a rate which can compete with the power-loom, as at present constructed, is entirely within the capacity of a weaver when the advantages of hand-weaving are taken into consideration.

2*nd*. That the English fly-shuttle loom does not begin to realize the possibilities of hand-weaving as to speed, wear and tear on the warp and so forth and that this loom presents too small an advantage over the Indian hand-loom to make the possibility of its supersediug the latter at all convincing.

3*rd*. That for fine cloths there is no better than the English fly-shuttle loom on the market and if the hand-weaving industry is to prosper there must be a better one and that if a much better one can be found and the Indian warping methods much improved, as most of those engaged in hand-weaving believe is entirely possible and probable, we may expect the continuance and prosperity of the hand-weaving industry for many generations to come.

4*th*. We believe there has yet been no serious attempt to improve the existing hand-weaving apparatus in India and that the time has come to do it. By "serious attempt" I mean that the energy, ability and equipment necessary to make sound mechanical improvement in a well-founded industry have never

been brought to bear on the Indian or any other hand-loom in the way that such energy, ability and equipment have been used to develop the power-loom and its allied apparatus. We believe that such serious attempt is absolutely necessary, side by side with the study of the Indian weaver and his materials and products: of what he will and will not do and can and cannot do.

Such attempts as those of the Hattersley Company of Blackburn, England, to produce hand-machinery have been exceedingly helpful to us here in India. In mechanical perfection it will be many years before we can hope to approach the work of this Company, but their set of apparatus with us fails as it has failed elsewhere in India because there is no connection between the makers of the apparatus and the weavers who are to use it, and the former have no appreciation of the requirements, likes and dislikes of the latter, and last but not least, because the designers are evidently builders of power-machinery and not of hand-machinery. Their loom is a *power-loom* with pedals, and when considered as a piece of weaving-machinery for a hand-worker, is about as near to the mark as one might expect to get if he should order a bicycle of a carriage-builder. A phæton with pedals would be a comfortable thing to sit in and would present a good appearance and workmanship, but the sitter would get nowhere though the vehicle was intended for transportation only. A bicycle is a light unsafe machine. It will not stand alone. A much too small three-cornered piece of leather serves as an uncomfortable seat and a delicate rubber air bag, expensive and unreliable, serves as a tyre.

All these defects the public puts up with and pays its money for because the machine gives cheap and convenient transportation and that is what it is made for. The first

bicycles were made by carriage builders with carriage wheels and like construction. I owned one myself.

A modern bicycle is as far removed from a horse-drawn carriage in design and construction as one can imagine a vehicle to be. The carriage has changed little in thirty years because it is suitable for its purpose and method of propulsion. The bicycle has been revolutionized in the same time, each successive change, the wire spokes, the ball bearing, the rubber tyre, the tubular low frame, and the pneumatic tyre, having been adopted because the demand was for *transportation* and little else, *by the limited power of the rider*. There was no way to increase that power. All that could be done was to utilize it without waste, to the full. This has been done and we have the bicycle as it stands to-day. It is the most perfectly adopted man-driven machine in existence, and we can, therefore, learn much that is useful from it when we try to develop another man-driving machine, the hand-loom, the usefulness of which is limited largely because of the limited power available to drive it. Energy, ability and equipment, used persistently over years have put the bicycle and the power-loom and every other useful machine into useable form and we may not expect the hand-loom to be anywhere near perfection until the same thing may be said of it.

With these points in mind I will enumerate some of the principles on which, and the directions in which, in my opinion, the further development of the hand-loom may profitably take place.

1st. Ease of running.

Any improved hand-loom must be capable of being run all day, day after day, *with ease*, by an ordinary man, else it will fail. In the design of such a loom the ease of running must be kept

constantly to the fore as the most important point: assuming of course that good cloth of the kind desired must be produced in any and all cases.

To put it beyond the probability of being soon set aside in competition with the power-loom, it should have a speed approximating that of the latter. Mechanically speaking this is entirely possible, as the power required to put a thread through a shed is insignificant. It is the cumbersome methods and machinery now in use to accomplish this that demands the power, not the act of weaving *per se*.

2nd. The speed desirable.

3rd. Adaptability. It must be adaptable to all ordinary widths and fineness of Indian hand-made cloth.

This does not mean that the same loom must weave all these but that it ought to be capable of being designed to suit the various kinds of cloth.

If we assert that the English fly-shuttle loom with certain attachments is the best hand-loom now on the market but that it is too slow, we feel under obligation to point out why, in our opinion, it is too slow and how this can be overcome in any loom which may be an improvement upon it.

We believe it is of necessity too slow first because the timing of the primary movements relative to each other depends on the precision of the weaver at each event, and experience has shown that this fact very much limits the speed attainable by any weaver, hour after hour, independently of his strength.

1st. Separation of primary movements.

Eighty or ninety picks per minute seems to be the rate at which the consensus of opinion places the running speed of a fly-shuttle loom on a 45 " reed. Our experiments carried on

for more than a year with a new type of loom show that 120 to 130 picks per minute are quite within the capacity of boys and girls for continuous work on a 45" reed when the three primary movements are mechanically so connected that their relation cannot change.

2nd. Occupation of the hands in driving loom.

Second. The results of the tests in Calcutta last year and Mr. Chatterton's report this year as well as our own experience, go to show that in a day's run practically all of the improved hand-looms of this type are capable of an "effective" number of picks of from one-fourth to one-third the "ideal" number, *i. e.*, the number obtained by multiplying the number of picks per minute by the total number of minutes in the working day. This small percentage of effective picks is due to many causes but is fairly uniform in amount in those looms which drive the beater to and fro by hand.

The process of hand-weaving requires the use of the hands for many things beside driving the beater and shuttle. Even in the power-mill a man in charge of two looms is fairly busy filling shuttles, mending warp, cleaning cloth of loose ends, &c., though he has no temples to move. In the use of the fly-shuttle loom whenever any of these things have to be done and we see that they occupy from two-thirds to three-quarters of the weaver's time, the loom stops, not because the weaver is tired or because things are in such shape that the process of weaving might not continue, but because the weaver's hands are otherwise engaged. We have, therefore, during the past few months constructed a loom which is run by the feet, on lines determined by more than three years' experiment and trial in this direction. This loom has not been constructed this way for the purpose of running it faster than our old loom in picks per

minute, but for the purpose of freeing the hands of the weaver to perform the duties of refilling the shuttle, adjusting the temples, throwing aside a broken end, &c., *while the loom is running.* We have also constructed this new loom and abandoned the old in order to adopt principles which are applicable to the finest yarns and widest cloths.

We are able in consequence to get effective picks for the entire day of from 50 per cent. to 90 per cent. of the "ideal," depending on the quality of the yarn used.

I mention this here as a counter argument to those who assert that 80 to 90 "effective" picks per minute are all that are desirable or that are humanly possible in a hand-loom.

In general on speed.

As I have said above, I agree with those who think that the John Kay type of loom is the best all-round loom at present on the Indian market, but when such go so far as to say that 85 or 90 picks per minute is the proper speed for a hand-loom and that further attempts are in the wrong direction or unnecessary, I do not agree. Some investigators seem to be against fast picking on principle. The word fast is relative and it has not yet been determined what is fast picking on a hand-loom. A well-known writer on the hand-loom was the author, some time ago, of an article in a prominent Indian paper in which the loom with which my name has been associated was berated, apparently because he said that it ran at a rate of 160 picks per minute although, according to his own figures, it had an output greater than any other loom that he had an acquaintance with. I cannot yet see what objection he can have against speed if it produces the cloth. Of course, there is a limit to the speed of any loom. If one systematically increases the speed of the power-loom, he comes to a

place before long where the wear and tear of the pickers, boxes, bands, &c., is a greater loss than the increased value of the output. I know of a power-plant which formerly ran its looms at 200 picks per minute and which subsequently reduced the speed to 180 picks and made money thereby chiefly on account of reduced wear and tear. Will any one say that to have come down to 160 picks would have resulted in a still further saving? Did you ever hear of the Yankee who had stoves to sell and who urged his customer to purchase one, guaranteeing that thereby he would save half his fuel? The customer—he could not have been a Yankee—finally decided to buy two stoves and thus save it all. In the present state of the art who shall say how fast a hand-loom shall be picked? We have seen that the speed may easily approach that of the power-loom even with the present kind of cumbersome, power-absorbing shuttle-box, and if some one will devise a simple mechanical contrivance by which at least a part of the energy of the moving shuttle is stored and used for driving the return pick, he will make possible a speed in a man-driven loom beyond the present or ordinary requirements but are mechanically entirely possible, and it is a mistake to assume that 80 or 90 picks per minute in a hand-loom is the limit.

The human side.

To those who insist on the monotony of hand-weaving and object to making a man into part and parcel of a machine, I extend a hand of sympathy. This is an important subject but has no place here. Certain it is that the lot of the weaver is not going to be made more monotonous by putting within his hands the means of doing his work in half the time. Weaving is at best a monotonous process. It is the same thing over and over again and there seems to be no emancipation from such

a lot if one remains a weaver, except to acquire an education and cultivation and turn one's attention more and more to the production of finer and more artistic kinds of goods. A loom which is good for India will have within its capacity these finer designs also, but this does not mean that a good speed of pick will not be helpful.

Introduction of improved looms among the people.

This subject, of which the mechanical improvement of the loom is only the introduction, is too important to be relegated to a paragraph at the end of an already too long paper and must be considered at another time and place.

THE SALEM WEAVING FACTORY.

BY

ALFRED CHATTERTON, Esq., B. Sc.

(Contributed to the Industrial Conference held at Surat in December 1907.)

In the present paper I propose to give a brief account of the origin and objects of the Hand-loom Weaving Factory which was established early last year in Salem under the orders of the Government of Madras. This Factory has attracted a great deal of attention not only in the Madras Presidency but in all parts of India; unfortunately, however, its aims and objects have been misunderstood, with the result that the work done there has not exercised that influence over the movement in favour of reform in the methods of the hand-weaver which, we think, it is entitled to, and which, in the interests of the Indian weavers themselves, it should.

As far back as the year 1900, my attention was drawn to fly-shuttle looms as an improvement over native hand-looms by the then Deputy Superintendent of the Chingleput Reformatory, and in the following year I set up about half-a-dozen fly-shuttle looms in a shed in the School of Arts, Madras, with the object of getting experience as to their working capacity and data regarding their possibilities. I was aware of the existence of the large weaving establishments on the West Coast belonging to the Basel Mission where fly-shuttle looms are exclusively used, and as Inspector of Technical Schools in Madras I knew a number of mission institutions where weaving with fly-shuttle looms was

taught. But in every case the work done on the looms was with comparatively coarse counts and the goods turned out were invariably copies of the Basel Mission work. So far as I was aware no attempt had ever been made to turn out purely indigenous cloths on fly-shuttle looms and it was to achieve this object that I began the investigations. From enquiries in Madras I found that some attempts had been made by people interested in the piece-goods trade, but that nothing had come of them, and a Muhammadan firm—Messrs. Hajee Mahomed Badsha Sahib & Co.—showed me the results of a very extensive series of experiments they were undertaking in the manufacture of Madras handkerchiefs with the domestic hand-loom manufactured by Messrs. Hattersley & Sons. As their experiments had ended in failure they lent me some of the looms with which to make further experiments and these looms may still be seen in the School of Arts, Madras, among the discarded relics of our various weaving experiments.

At the outset Madras handkerchiefs were taken up and for two or three years we made great efforts to improve the various details of their manufacture in the hope of being able to turn them out at a profit. At first the handkerchiefs fetched poor prices, but latterly we were able to command the highest rates paid for them. Attempts were also made to introduce the manufacture of these handkerchiefs into some of the industrial schools, but in every case the experiment ended in failure and at the end of 1905, after carrying on the work for nearly five years, it was found impracticable to make the fly-shuttle loom a success on the lines along which we were working. We had, however, definitely ascertained that it was practicable to turn out a much larger percentage of cloth on a fly-shuttle loom than on the native loom, that a cloth of even better

texture could be produced and that if the sizing processes could be improved, there seemed to be some hope of the fly-shuttle loom coming into general use throughout the country. Our want of success was largely due to trying to do many things at one time and to the difficulty of getting good weavers to work regularly in the weaving shed.

In August and September 1905, I made a tour through Bombay, the United Provinces, and Bengal, and in passing orders on my report the Government of Madras expressed their willingness to establish a hand-loom weaving factory for experimental work either in Salem or Madura. For a variety of reasons the former town was selected, and in February of last year the looms and apparatus with which we were working in Madras were transferred to Salem and a new start was made. Salem was selected, because, according to the Census Reports, there were over 8,000 hand-weavers in the town who were supposed to be in a more or less chronic state of poverty, because the climate was considered suitable, and, finally, because it was conveniently situated in regard to access from Madras—a matter of some importance in connection with the supervision of the factory. All the experience gained in running the looms in Madras was made use of in considering the lines upon which the Salem Weaving Factory was to work.

The weaving problem was obviously a much more complicated one than was dreamt of by Mr. Havell who, since 1901, has persistently advocated the substitution of the fly-shuttle loom for the native hand-loom, claiming that if that was done all would be well with the weavers, that their output would be doubled, and that they would gradually regain the enormous volume of trade which has been surrendered to the power-loom

weaving factories. Optimism is essential if one is to endeavour to raise the status of the hand industries of India, but it must be based on a practical knowledge of the possibilities of each industry and not the result of ignorance. The dilettantism of the artist is a poor equipment with which to endeavour to solve the economic problems which the Indian manufacturer has to face, and the Weaving Factory at Salem was started with a perfectly open mind as a centre for experimental work in the weaving industry and without the slightest idea of using it to furnish data to support previously formed conclusions.

In a report on the results of the first year's working of the factory which was submitted to the Government of Madras, I have explained that it is an experiment to ascertain whether it is possible to improve the condition of the hand-weavers in Southern India—

(1) by substituting for the native hand-loom improved hand-looms which will enable the weaver to produce a greater length of cloth in a given time without in any way sacrificing the essential characteristics of native hand-woven goods;

(2) by introducing the factory system among the weavers so that they may work under the management of men with commercial and manufacturing experience and so that capital and organisation may be introduced into the industry to render the hand labour more productive;

(3) by introducing, if possible, improved preparatory processes to diminish the cost of the preliminary warping and sizing which the yarn undergoes before it is placed in the loom.

From this it will be seen that the Weaving Factory is not a school for imparting technical instruction in the trade, but is simply for solving certain problems which have been definitely formulated and the future action of Government in regard to the weaving industry will largely depend upon the kind of solution which is arrived at. With the first set of problems and the third set no one, I think, will disagree, but a great deal of opposition has been raised to what is characterised as an attempt to introduce the factory system with all its squalor and ugliness into what has hitherto been an artistic handicraft. If the hand-weaving industry is to be materially improved, a great deal has to be done not merely in connection with the technical details of the weaving processes, but also in connection with the training and education of the weaver himself. In the design of woven fabrics there is immense scope for artistic skill, but the production of these fabrics in the loom is a purely mechanical operation and the hand-weaver is an artisan and not an artistic handicraftsman. The production of solid bordered cloths is still beyond the capabilities of the power-loom and for the very finest work the native hand-loom is still supreme; but for the bulk of the textile fabrics required by the people of India, the power-loom represents one method of manufacture and the question which has yet to be answered is whether ultimately it will not represent the only method of manufacture.

Those who study the weaver in his house amid his ordinary everyday surroundings, often short of work and nearly always in the hands of the cloth merchants in the bazaar, see little of the independent artisan who is to be the industrial backbone of this country, but much of the misery and poverty of his lot. With the assistance of his women and children he ekes out a

miserable existence and his seeming independence is merely indolence and aversion to regular work. The imagination of the artist casts a glamour over the wretched isolation of the weaver and would have us leave him to fight a losing battle against the products of one of the largest and best organised industries in the world, telling him to work with tools which have been discarded in other countries as inefficient. The purchasing power of money in India is steadily decreasing and in most of the other trades and industries the earning of the workers are increasing. In the weaving trade at best they are stationary and in many places are on the decline. Will the hand-weaver survive the stress of competition or will he be driven, as in other countries, to seek a livelihood at other work? The answer is doubtful. The fact that he has survived so long is in his favour and there is no doubt the transitional period can be prolonged, but it is still an open question as to whether he can be put in a position which will enable him to command the same wages for the same number of hours of work as the power-loom weaver, or the blacksmith and carpenter, whose industrial existence is not threatened by the prospect that ingenious machinery will be devised to supplant them. On all these questions, I have in respect to the weaving factory endeavoured to preserve an open mind and it has only been called a factory and organised it on factory lines because it seemed to be the simplest way of testing the efficiency of new methods of working and of training a certain number of weavers to carry on industrial experiments to a definite commercial conclusion. As a Government institution one can hardly hope that it will be a great commercial success. Experimental factories cannot be run on purely commercial lines and there is no chance of establishing any sort of a monopoly

which might enable us for a time to obtain unusually profitable work.

So far at Salem we have not had time to tackle any technical problems connected with the hand-weaving industry. All our time has been engaged in getting together a sufficient number of capable hand-weavers to really test the capacity of the various looms which have been brought to our notice. We have found that the hand-weavers of Salem, like the hand-weavers of Madras, object to working in the hand-weaving factory, and although their wages are good their attendance is unsatisfactory. This is mainly because the weavers prefer to work in their own homes assisted by their women and children and dislike being subjected to the discipline and regular hours of working which must necessarily prevail in the factory. Although the men can earn considerably more than they do in their own houses and are ensured regular and continuous employment, they much prefer the old system and seem to find steady employment extremely irksome, but few of them are free agents and nearly all are in the hands of the cloth merchants who, from time to time, make them advances and receive the cloths they manufacture. Naturally, these gentlemen view the experiments at the Weaving Factory with suspicion and their influence has all along been against us. So far, therefore, we have had to work mainly with waifs and strays of the weaving community, and the Assistant in charge of the Factory has had a long and tedious task in getting into it even some semblance of order. Private individuals, however, have watched our efforts, imitated our methods and met with a much greater degree of success, and without any special advocacy on our part a considerable number of hand-weaving factories have been started in various parts of the Presidency, but with what degree

of success I am not able to state. The interest in hand-weaving is mainly due to the Swadeshi movement and most of these factories owe their existence to the enthusiasm engendered at the birth of a new political movement. Whether, in the long run, they will hold their own or not, and whether, in consequence, they will grow in size and multiply in number, remains to be seen. Comparatively recently there has been a great development in the use of cotton checks for native clothing and it is largely to supply this demand that most of the factories were started. The pioneer work in this direction was done by the Basel Mission Weaving Establishments and it is not improbable that if the demand continues to grow to any great extent the power-loom weavers will try to cut into the business and possibly with success. In Madras, at any rate, there are two large hand-weaving factories in Tondiarpet, both of which are manufacturing mainly Madras handkerchiefs and in this direction the proprietors assure me that they are doing better than with native hand-looms, but as no accounts are available it is difficult at psesent to tell whether they have succeeded in placing these factories on a firm commercial basis, or whether they have achieved little or nothing more than has been done in the Government Weaving Factory. One result of our work at Salem during the last 18 months is to furnish fairly reliable data for the opinion that the weaver himself is not likely, within any reasonable time, to change his methods of working and take to the fly-shuttle loom, and it seems almost certain that in this part of India the factory system will have to be introduced if anything is to be done. In the North of India, especially in the United Provinces, from enquiries which I have recently made, it would seem that the weavers there are more likely to take to improved looms on their own initiative and it

does not seem to be altogether hopeless that there the difficulties connected with the establishment of the hand-weaver in a sound economic position may be solved through the agency of Weavers' Guilds or other forms of co-operative enterprise. It is not my intention now to discuss these questions and I have merely mentioned them to indicate that in different parts of India is is quite possible that the weaving problem will be solved in different ways. A scheme which may be successful up north will prove a complete failure down here and *vice versâ*.

I freely invite criticism of our methods of working and of the way we are tackling the weaving problem, but I deprecate all criticism which is based on ignorance of our local conditions. In Conjeeveram, a large weaving centre, at no great distance from Madras, the National Fund and Industrial Association have endeavoured to popularize the fly-shuttle loom and I have assisted their efforts in so far that I have, with the consent of the Board of Revenue, lent them six fly-shuttle hand-looms, but the experiment has not been productive of any satisfactory result and the National Fund and Industrial Association have failed to popularize the fly-shuttle loom, notwithstanding the fact that they fully recognise its merits. Similarly, in the town of Madura, where the weavers are more enterprising than in most parts of the country, numerous experiments have been made with fly-shuttle looms and I have seen the most improved types of European hand-loom such as the domestic loom of Messrs. Hattersley & Sons at work in the bazaar, but none of these looms have caught on and plain weaving to-day is done in Madura much in the same way as it was more than a hundred years ago. It is not the expense which a good fly-shuttle loom entails which stands in the way, for in places where looms have been lent there has been no eagerness on the part of the weavers

to avail themselves of the loan. Finally, our experience in Salem itself is dead against any idea that the fly-shuttle loom can be popularised among the weavers themselves. They are ignorant and conservative and in their eyes the doubtful merits of the fly-shuttle loom are insufficient to make them change their ways of working. As the results therefore of our work at Salem and of the observations which I have been able to make whilst tournig through other parts of the Madras Presidency, I am of opinion that the only hope of progress in this part of the country is that outsiders will put their money into the trade and that through their intelligence and energy it will be placed upon a new footing.

In connection with weaving in fly-shuttle looms the opinion has hitherto generally prevailed that fine cloths cannot be woven on looms fitted with the fly-shuttle attachment, because owing to the greater strain only comparatively coarse yarn which will not readily snap can be used for the warp. This opinion has absolutely no foundation in fact, as where the fly-shuttle looms are designed for working in fine counts no difficulty has been experienced. The great bulk of the work done in the Salem Weaving Factory is in counts between 60's and 100's and I should not have the least hesitation in undertaking work in higher counts if the orders were sufficiently large to make it worth while. The fly-shuttle loom, no matter what type, must be constructed to suit the work for which it is intended and a loom which may do very well for dungries or checks may be unsuited for fine counts and it is mainly owing to the neglect of this point that fly-shuttle weaving has made so little real progress among the Indian weavers.

From the time when these experiments in weaving were first started a great deal of attention has been paid to the various

forms of loom which have been placed on the market and any pattern which offered the least promise of success has been thoroughly and carefully tried and I propose briefly to state the results of the observation. Work was started on hand-looms of the pattern generally found in mission schools in the south of India and it was found in such looms that although fly-shuttle enabled the rate of picking to be greatly increased yet the increased time spent in mending broken threads in the warp almost entirely nullified its advantages. One by one the defects of this loom were remedied, the proportions were changed, the warp beam mounted on springs, an automatic take-up motion was introduced and the picking string carried over a guide pulley, with the result that at the present time it can hold its own in fairly fine weaving against any loom which has so far been brought to my notice. In this loom there is nothing absolutely novel. It has simply been proportioned in its various parts to suit the work to be done and care has been taken to prevent it becoming complicated. For instance whilst we were engaged in making Madras handkerchiefs in which several colours are used in the weft it was thought that possibly the English drop box might prove a convenient addition to the slay but in practice it was found to be no great advantage and the use of the drop box was discontinued. In the English hand-loom, as in the native hand-loom, the picking motion is independent of the treadles which control the shedding motion and the weaver must learn to jerk the picking string with his hand when he has opened the sheds sufficiently through the levers controlled by his feet. The loom is in no sense automatic, but it is passible when the picking strings are carefully adjusted to make from 80 to 100 picks per minute through a warp 54" wide. At the present time at the

Salem Factory where we use nothing but country warps sized by hand and provided with a lease and lease rods, to avoid frequent stoppages ; to shift the lease rods a fairly long spread of warp between the warping beam and the healds is necessary, and this is the most serious objection to this form of loom inasmuch as it makes it very bulky.

It became obvious at a very early stage in the experiments that the fly-shuttle slay could be used in the native hand-loom, and that we could improve the rate of picking. I am not now certain to whom the credit of first making this suggestion is due, but it is a very important one, as it places in the hands of the native weaver a very great improvement in his loom, and one which can be obtained at a very small expense. This modification has been largely tried and with considerable success, but it does not secure all the advantages of the frame-loom pattern and is to be regarded rather as an intermediate stage between the Native and the English loom. Experience has taught us that the greatest defect of this loom is the number of broken ends which occur in the process of weaving, and these have been much reduced by putting the warp on an elastic frame and by using brass reeds and healds with metallic eyes. The healds and reeds we employ are obtained from Messrs. Jones Brothers, of Blackburn, England, through their agents Messrs. Hutheesing and Co. of Bombay. They are considerably more expensive than native healds and reeds, but those who have given them a fair trial consider that they are worth the money. It is not an uncommon custom for native weavers to vary the closeness of the texture of their cloths by using reeds set much closer together near the edge of the cloth than in the middle. The practice, if not actually fraudulent, is not to be recommended, as it is calculated to deceive the unwary, but it is widely in

vogue and is likely to render English reeds unpopular unless they are made to conform to this practice. The automatic take-up motion is not an essential feature of the loom, nor is it a very popular one with native weavers, but it enables the weaver to produce cloth of a perfectly uniform texture and I am quite certain is fully appreciated by the weavers of such cloths who find them more durable. The cost of this loom complete varies with the amount of timber put into it, the quality of the timber and the general style and finish. Complete with English healds and reeds it will not cost more than Rs. 100 and in large numbers can be produced for a somewhat smaller figure. In our experimental workshops we have made a good number of these looms and we sell them, exclusive of healds and reeds, for Rs. 85 each. These looms are purchased more as patterns to be copied than as actual working looms and our price is perhaps somewhat high.

I do not propose to furnish a dissertation on weaving mechanisms, but before discussing the results obtained with other types of loom, it may be well to explain that in all the improved hand-looms mechanism is provided whereby the picking and shedding motions are combined, and the weaver is reduced to a pure automaton who either works the loom through a pair of pedals or sets the mechanism in motion by causing the sley to swing in pendulum fashion by one or both hands. The weaver is a mere automaton so long as everything works well, but if anything goes wrong, or if the driving force he supplies is insufficient, a break-down always occurs and his skill as a weaver will be called into play in repairing the damage done.

During the last few years the discussions about the hand-loom weaving in India have led many people, competent or otherwise, to attempt the improvement of the hand-loom, and many

worthless patents have been taken up. During the last six years I have had under observation every loom that I have heard of which seemed to offer the least prospect of turning out successful, and the following is, I think, a complete list of the looms which have been tried :—

(1) The Domestic hand-loom of Messrs. Hattersley & Sons.

(2) The Domestic loom of Messrs. Raphael Brothers.

(3) The Japanese hand-loom.

(4) Mr. Churchill's loom (Ahmednagar).

(5) Captain Maxwell's loom (Salvation Army).

I had the Hattersley's looms at work for a long time on a great variety of fabrics made from yarn of counts up to 40's, but the output was never satisfactory, as the work of driving the loom was far too heavy for the native weaver. For a time I tried them putting two weavers for each loom so that when one worked the other rested and this naturally increased the output but not to the extent that was to be expected. When the loom is driven at a perfectly uniform rate, it works very satisfactorily, but when the source of supply of power is an Indian weaver, the supply is very irregular and the result unsatisfactory.

The Raphael loom was never actually at work in either the Madras or the Salem Weaving Shed and my knowledge and experience of its working is gained by observations made on the loom purchased by Mr. Theagaraya Chetty of Tondiarpet. This loom suffers from the same defects as the Hattersley's loom and is much too hard work for the undeveloped legs of the Indian weaver. To all intents and purposes both these looms are power-looms and unquestionably better work will be got from them if the treadles or pedals are done away with and an arrangement made to drive them off a line of shafting. The

looms are made of cast iron and it is astonishing how easily the castings are broken and how helpless the Indian weaver is in face of even a simple fracture. These looms are totally unsuited for individual weavers working on their own account, and I fail to see what advantage there is if they are gathered in large numbers in a factory and human labour is employed to drive them. Thirty or forty such looms can be driven by a small oil engine costing not more than Rs. 4 or 5 a day to run and there is not the least doubt that the output of these looms will be three or four times as much as when worked by hand labour. I am inclined to think that small power-loom factories of this type might be worked with great success in this country and would afford an admirable training ground for the development of indigenous manufacturing genius. I am now dealing with hand-weaving and it will be out of place to discuss this suggestion any further, but I think that small power-loom factories of this kind would prove very successful if properly designed and worked on the right lines.

With the Japanese hand-loom my experience was very unsatisfactory. It was obtained from Mr. Shafi through the Ludhiana Loom Manufacturing Company and was found to be a crude and ill-designed loom and no warp ever put into the loom was woven into a satisfactory cloth. Why the loom was brought from Japan to India I do not know and the sooner it sinks into the obscurity from which it was dragged the better. I have been told by Japanese connected with the weaving trade that the loom is not used in Japan and I am not surprised, as at the best it is only suitable for very coarse work.

Mr. Churchill's loom.—When I visited the American Mission Industrial School at Ahmednagar in 1905, Mr, Churchill showed

me a number of his looms at work on a kind of dungri, and I was much struck with the results obtained when weaving this kind of cloth. Subsequently Mr. Churchill built 6 looms for the Salem Weaving Factory to weave fine cloths from 45" to 55 ' wide. On such work the loom has not been a success and the Salem weavers object to being put to work on it. The mechanism for timing the throw of the shuttle is defective and the shuttle is very liable to be caught in the warp when it is more than a yard wide. To make the shuttle travel properly the sley has to be moved forward with increasing rapidity and then suddenly brought to rest, and on the finer warps the percentage of broken threads renders the output of the loom much smaller than would be anticipated from the rate at which picking can be done when the warp is not too wide.

The last loom with which we are still experimenting at Salem is that invented by Captain Maxwell of the Salvation Army and known as the "Triumph" loom. I have only one of them at work at Salem with which fairly satisfactory results have been obtained and a second loom has been ordered with some slight modifications which it is hoped will improve its outturn. If this anticipation is realised, it is proposed to put down six more looms and to thoroughly test them on the same class of work against six looms of the English pattern already described.

In the looms of both Churchill and Maxwell the driving force is applied to the sley and I am inclined to think that, whilst this willl work satisfactorily on coarse warps, the necessarily somewhat jerking motion of the sley is not conducive to a good output when the warp is fine. Personally I hold the opinion based on nearly seven years' experience with different types of hand-loom that, when the power-loom is converted into a hand-loom, it becomes an unsatisfactory machine

owing to the irregularities in the driving force and that the hand-loom must be a simple piece of mechanism in which the irregularities of the weaver are compensated for by the gentleness of the action of the loom.

A power-loom will make from 200 to 250 picks a minute, and from careful observations which I have made of the outturn of hand-looms I find that the daily average has only in one instance exceeded 30 picks per minute and when weaving fine cloths an average of from 20 to 25 picks a minute may be considered very good work.* Mr. Churchill at Ahmednagar was able to weave 30 yards of dungri in $8\frac{1}{2}$ hours, the warp and weft being of 10's counts and the number of picks per inch 28. This is equivalent to an average rate of picking of 60 per minute and is an extraordinarily good result. I have often observed my weavers at Salem and I find that they can easily do from 80 to 100 picks per minute whilst actually weaving, but their daily outturn under favourable circumstances shows that at this rate of picking less than 25 per cent. of their time is spent in plying the shuttle and that the rest is frittered away. Weaving is a very monotonous occupation and the weaver is certainly unable to go on picking for any length of time without a change of some kind. The changing of pirns, the repair of broken threads, the shifting of the lease rods and other little incidents break the monotony of the work, but they greatly impair the efficiency of the loom.

* These facts are substantiated by the recently issued report of the weaving competition which took place at Calcutta at the exhibition associated with the Indian Industrial Conference of 1906. The Salvation Army loom, which was awarded the gold medal, was worked at the rate of 37·3 picks per minute for $7\frac{1}{2}$ hours, but at the end of that time the weaver showed signs of distress as did all the other competitors and it was obvious that the result depended as much upon the endurance of the weaver as upon his skill or the merits of the loom.

I am convinced that, if the fly-shuttle hand-loom is to be largely used in making the finer classes of native goods, the direction in which improvement should be sought for is not so much in increasing the rate of picking which is already quite fast enough, but in improving the details of the shedding and the working of the sley so that the operation of weaving subjects the comparatively delicate threads to the minimum amount of strain. The idiosyncrasies of the weaver, however, remain and I doubt if, under any circumstance, the average rate of picking throughout a day will ever rise to as much as 40 or 50 per cent. of what may be termed the normal rate at which picking can be done. Even in a weaving factory it is very difficult to collect reliable data regarding the working of looms and their output. The conditions vary so much from time to time and the human element plays so important a part, that some exceptional motive must be brought into play to obtain anything like uniform conditions. For this reason I attach considerable importance to the results obtained in weaving competitions when a powerful stimulus is supplied to each weaver to do the best he can under the circumstances. Under the auspices of local associations in the Madras Presidency one or two such competitions have already been held, and in February next a competition is to be held which is being organized on much more elaborate lines than any of those already mentioned. The main object of the competition is to ascertain the working capacity of the various hand-looms on the market under favourable conditions, but under, as far as possible, conditions which could be reproduced in a weaving factory. Each competition will last for six days and each weaver will have to work for 7 hours a day and the results will be judged by the week's outturn. In this way it is hoped we shall obtain reliable data regarding the output of the various types of loom when working on different kinds of cloth. A considerable number of competitions have been arranged for and the Government of Madras have contributed very largely to the prize fund which it is hoped will induce the makers of every practical type of loom to enter them in the competitions.

Details of the cost of Production.

—	Cost in Rs.	Percentage of total cost.	Cost in Rs.	Percentage of total cost.	Cost in Rs.	Percentage of total cost.	Cost in Rs.	Percentage of total cost.	Cost in Rs.	Percentage of total cost.
Warp ...	2 0 0	22·3	1 6 0	19·5	14 0 0	33·2	11 4 0	34·7	2 0 0	56·2
Weft ...	1 4 0	14·3	1 0 0	14·2	9 13 0	23·2	7 8 0	23·1		
Warping and sizing ...	1 8 0	17·2	1 2 0	15·9	4 7 0	10·5	2 9 0	7·9		
Beaming warps ...	0 8 0	5·7	0 4 0	3·6	0 14 0	2·1	0 14 0	2·7	0 10 0	17·6
Pirn winding ...	0 4 0	2·8	0 4 0	3·6	0 8 0	1·2	0 13 0	2·5		
Weaving ...	3 4 0	37·2	3 0 0	43·2	12 8 0	29·8	9 8 0	29·1	0 15 0	26·2
Total cost ...	8 12 0	100	7 0 0	100	42 2 0	100	32 8 0	100·0	3 9 0	100·0
Cloth ...	Turbans.		Angavastrams.		Dhoties.		Women's cloth.*		Country towels.	
Counts in warp and weft.	100 × 100		100 × 100		60 × 60		60 × 60		20 × 20.	
Length ...	24 yards.		12 yards.		100 yards.		54 yards.		20 yards.	
Breadth ...	28 inches.		45 inches.		54 inches.		45 inches.		36 inches.	
Ends per inch width ...	90		88		80		80		40	
Picks per inch ...	68		72		70		60		40	
Rate of picking at Salem per minute.	18		16		23		12		... ...	

* Turkey red yarn dyed with indigo.

From data collected at the Weaving Factory at Salem a tabular statement has been prepared giving details of the cost of production of several kinds of goods most largely manufactured there and I would draw attention to the columns in which the cost of each item is given as a percentage of the total cost. These figures are very interesting and it would be well if similar figures could be produced from other weaving establishments and the various items discussed. It will be seen that in the very fine cloths like angavastrams and turbans the cost of the raw material is but little more than a third of the cost of the finished articles, whilst in the goods made in the lower counts the percentage varies between 56 and 60. At Salem the warping and sizing is done outside the factory by men who do nothing else but this sort of work and they use fairly efficient warping mills and from the figures for warping and sizing it is obvious that there is not a great amount of room for improvement. The cost of the actual weaving work is probably the main item in which improvement can be effected and this is emphasized by the figures given regarding the rate of picking which varies from 12 to 23 picks per minute excluding country towels, the figures for which are not given as they are usually made on native looms with a simple fly-shuttle attachment. The item 'warping and sizing' varies considerably with different kinds of cloths and the figures given are probably lower than would be obtained in many other places owing to the fact that in Salem the preparation of warps is to a large extent a special business and is carried out in a much more efficient manner than I have seen elsewhere.

Whilst the experimental plant was in Madras a great many experiments were carried out in different methods of sizing and various forms of hand-warping mill were tried. The

problem of preparing warps suitable for use on native hand-looms was laid before the makers of warping machinery at home and after a great deal of discussion a plant was ordered from Messrs. Butterworth and Dickinson. It was set up and tried in Mr. Theagaraya Chetty's factory at Tondiarpet, but the results were anything but satisfactory and on account of other and more important work the experiments are at present in abeyance. The main idea was to employ hanksizing and a sectional warping machine capable of turning out cheeses of warp of 500 ends. To make up a warp containing 3,000 or 4,000 ends the requisite number of cheeses were put on a spindle and the required warp run off on to the weaver's beam. The principal defect is in the sizing which proved inferior to that which is done by the native method where the warp is stretched out on a frame and carefully brushed. It is my intention, as soon as posssible, to set up this warping mill again and prepare warps of unsized yarn and then to expose the warp in sheet form and size it according to the ordinary native method. I cannot say that I am very sanguine that this will be a success, but it seems worth trying and should effect a considerable economy in the cost of warping. Recently Messrs. Hattersley and Sons have brought out a hand slasher sizing machine, which will probably give good results with low counts where the hand-looms may be expected to turn out from 20 to 30 yards of cloth a day, but with much finer class of goods which we are weaving at Salem, where the outturn is seldom more than 5 yards a day, the use of very long warps is not recommended as they remain in the loom much too long a time and the sizing deteriorates so much that the warps have to be resized on the loom and, when this is done, it greatly diminishes the outturn.

Before concluding this paper it may be of interest to give some details regarding the factory itself. For the present the factory is located in a rather large straggling bungalow in the middle of the town of Salem for which we pay a rent of Rs. 60 a month. It was intended originally to install about 100 looms, but owing to the difficulty of getting weavers nothing like that number has yet been reached and we find it difficult to keep more than about 35 looms in full work. The cost of running the factory last year was about Rs. 300 a month in addition to the sale-proceeds which amounted to about Rs. 350 a month. A steady improvement is, however, going on and with between 40 and 50 looms installed and an average of 35 at work, the sale-proceeds amount now to over Rs. 1,000 a month and the cost of running the factory to about Rs. 200 a month. Ultimately it is hoped that the factory will pay its own expenses and it can probably be made to do so now were commercial considerations of paramount importance.

To the capitalist who puts his money into a hand-weaving factory it is essential that a profit should be earned and as that is not done at Salem, it may be well to indicate briefly why such a desirable result has not been attained. In the first place, the factory is a Government institution, and it is generally recognised that commercial work cannot be carried on under Government with the same degree of economy as is possible when the control is vested in the hands of private individuals who are keenly interested in making it pay. In the factory we have arrived at some conclusions regarding looms which have already been stated, and if money-making was the object in view, we ought to at once discard all other types of loom and confine ourselves to those classes of work which pay best. New experiments are always being tried, looms are always being altered, the

weavers have to accustom themselves to the new conditions, frequently a good deal of cloth is spoiled and generally the efficiency of the institution as a factory is greatly impaired. It is for these reasons mainly then that the factory does not pay and those who examine the accounts must take these facts into consideration. If some of the gentlemen who have interested themselves in hand-weaving and have started hand-weaving factories could be induced to furnish accurate manufacturing accounts, they would be of great value, but it is hardly fair to expect businessmen to give away the results of their experience, and those who would like to find out whether the investment of money in hand-weaving factories is likely to be a success, must examine the published accounts of the Salem Weaving Factory in the light of my remarks.

INDUSTRIAL BANKS.

(Paper read before the Industrial Conference of 1907 at Surat.)

BY

MR. MAHADEW RAJARAM BODAS, M.A., LL.B.,

Vakil, High Court, BOMBAY.

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The important part which is played by these banks in modern times in promoting the trade and manufactures of a nation is now recognised in all civilised countries. Banks are the arteries which supply the life-blood that nourishes the different branches of commerce and industry; and skill in financing an enterprise is always the *sine qua non* of ultimate success. National trade usually develops by the increase and spread of mutual credit, while arts and industries flourish only when the trade of the country is in a prosperous condition. Banks by drawing together the scattered cash in society in a safe and public receptacle, serve like reservoirs that first collect rain and subsoil water, and then fertilize the surrounding land with it. They employ the superfluous wealth of some individuals for the use and profit of others, and the ultimate benefit of the whole nation. If money is power, these banks, if properly managed, concentrate this national power and direct it to a definite and approved aim. In a country like India, where capital is usually stationary and trade is comparatively sluggish, a financing agency like a public bank is an absolute necessity to accommodate enterprising traders and supply the needs of current business. Every industrial or trad-

ing centre in India has hitherto contained a class of sowkars or Bankers, each of whom finances and controls his particular set of clients carrying on some one industry. Thus there are Sowkars in every village to help agriculturists to pay assessment and buy seed. In weaving centres like Sholapur, Yeola and Malegaon, there are Sowkars who supply money on yarn to the weavers, and buy the products of their looms in exchange. In cities like Bombay, there are capitalists who advance money on cotton or opium and earn a handsome profit thereon. But times are coming when such individual financing will not suffice. Every branch of trade and manufacture is rapidly growing in magnitude as well as intricacy ; and an incorporated Bank, with a large capital and managed on modern methods, can alone meet the multifarious demands of present times. The necessity has long since been recognised in larger centres of commerce, and cities like Bombay, Calcutta, Dehli and Lahore already boast of several organised and well-conducted Indian Banks. But the smaller towns and rural districts equally want them. The needs of the agricultural classes who form the bulk of the population in villages may be partially satisfied by the new Co-operative Credit Societies initiated by Government; but no such concerns can really be proper substitutes for a well-organised Bank with a large reserve capital. The question of the establishment of such Banks in different centres of business is vitally connected with the problem of developing Indian trade and industry.

It is a necessary corollary to these general principles that these Banks, Syndicates or Credit Societies, by whatever name they may be called, must be suited, in their scope and constitution, to the circumstances and the object to be served in each particular case. Exchange Banks, Deposit Banks, Credit Societies or Urban Associations, each of these serves a special

purpose and ought to be adopted for it. Rural and Urban Societies, such as are now being formed in all districts under the auspices of Government, may largely help agriculturists and other handicraftsmen by advancing small loans on personal security, and they are often effective in keeping those classes alive and in normal condition ; but they are too petty to promote new manufactures or revolutionize an industry. Special Industrial Banks are necessary to give financial help to ensure proper organization of new industries. Such Industrial Banks are rapidly multiplying in all civilised countries, and in New York, Chicago and other large cities of America we often find a separate Bank established in each street. The chief function of these Banks is to receive deposits and to invest the money in advances to enterprising manufacturers or artisans on good security at moderate rate of interest. With good management as well as honest and close supervision, there ought to be very little risk in such investments ; and the chances of a loss by failure or dishonesty in any particular business can be minimized by framing strict rules for giving loans and taking security. A committee of good and honest businessmen can easily find out in each case whether the applicant for a loan is fit, and the security offered by him is sufficient to cover at least the principal of the loan. These loans are repayable with interest either in lump or by instalments within a number of years ; and in the meanwhile they are made a charge on the profits of the business. The proprietor of a successful business is always glad to pay not only good interest on the loan, but also the capital in order to be freed from the overhanging burden as early as possible ; while the Bank gets not only handsome interest but also the credit of having introduced a new business or factory in the country. Some of the existing Banks in India may be doing

this kind of business in exceptional cases ; but there is at present a great want of separate institutions started with this object alone. Ordinary Banks on account of being closely involved in current transactions of trade or exchange, cannot afford to lock up much of their capital for a long time in long-standing advances on machinery, building or the equipment of a factory. A special industrial Bank with an expert Manager and a suitable Committee of advisers is, therefore, an absolute necessity to achieve the object.

The question of starting such Industrial Banks ought, therefore, to be immediately taken in hand by leaders in different Provinces ; and I earnestly request the delegates to this Conference not to go home unless they formulate a workable scheme. The time has not perhaps come to start separate Banks for each district, but it is quite possible at present to establish one for each province. This province or territory of each Bank should I think at present be formed on the basis of language, as the operations of the Bank will require very close and constant intercommunication between the Manager and their clients. Thus a Bank may be established for Guzerat, another for the Deccan, one for Sindh, another for Bengal, and a third for Punjab, and one each for Telugu and Tamil-speaking Madras. The capital of each of these Joint-Stock Banks may be from 5 to 10 lakhs according to requirements ; and the shares may range from Rs. 25 to Rs. 100. The shareholders may be paid a dividend of not more than 5 per cent. ; and the depositors from $3\frac{1}{2}$ to $4\frac{1}{2}$ per cent. ; while all surplus profits ought to go towards a sinking fund to recoup accidental losses, and to pay bounties and other aids to growing industries. The interest on loans should not exceed 6 per cent., except in exceptional cases ; and the advances should be made either on very good personal security or on the security of

immoveable property, machinery or stores, proper care being of course taken to see that the security is good and sufficient. An Advisory Board of disinterested experts should be appointed for each Bank to sanction loans and examine securities, and an agency to gather full and reliable information about each applicant may also be needed. Good and honest management is of course absolutely necessary to ensure success, but if the institution is started under good auspices, we may rest assured on this point.

The utility of such Banks in helping enterprising manufacturers and thereby promoting new industries, can never be overrated. We often come across men who are clever artisans, or who know a valuable trade secret or who are anxious and capable to start a new industry, but who cannot do anything for want of capital. There are many manufacturing concerns that yield none or very little profit, simply because there is not good and up-to-date machinery. There are many people who know valuable processes, which cannot be turned to account for want of means. An industrial bank will help these men by timely help and thereby become the mother of so many different industries. I may give another illustration. In a recent trial in Germany, it came out that almost half the factories in Germany are worked by machinery that is given on loan by the makers who agree to receive the price in instalments. Now, if some such facility is provided to Indian artisans or capitalists who cannot command a large sum at once to sink in machinery or dead-stock, many of them will readily start new factories and produce articles which we are just now importing from foreign countries. So long as there are no manufacturers of machinery in India to give such facilities, an Industrial Bank is the best agency to achieve the purpose. The point in fact is so clear that I do not think I should dilate upon it here at any great length. My object in noting these few observations has been not to lay down a definite or hard-and-fast scheme, but to draw your attention to a subject which, in my opinion, demands your most urgent consideration. Let us hope that something will be done in this direction before the next Session of the Industrial Conference.

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