

*Proceedings of a Conference on Silk held in the Office of the Revenue and
Agricultural Department of the Government of India at Calcutta, on
the 8th January 1886.*

A meeting was held at the office of the Revenue and Agricultural Department on the above date for the purpose of discussing questions connected with silk production, and with the special measures to be taken for the equipment of a special Silk Court at the forthcoming Indian and Colonial Exhibition. Mr. E. C. Buck, Secretary to the Government of India, Revenue and Agricultural Department, presided, and Mr. Wardle, who had just returned to Calcutta after visiting the Eastern Bengal silk districts, took the leading part in the proceedings.

MR. BUCK introduced Mr. Wardle to the Conference as a gentleman who had come out from England to help the Royal Commission to prepare for the Indo-Colonial Exhibition such a collection of silks and information as might tend to awaken the attention of manufacturers. When the Exhibition was first announced the Government of India was reviewing the various products of the country with the idea of determining which might be the most likely to reward any effort that might be made to promote its development, and decided that silk was of all the products of India that of which there was most hope. Holding that opinion, it had allotted a larger portion of the Exhibition space at its disposal to a complete collection of silks than to any other class. During the year, however, information was received from the Royal Commissioners that they were extremely anxious that the Exhibition should be utilised for the purpose of bringing prominently forward the question of silk production to the notice of the public, and it was, by the mutual wish of the Royal Commission and of the Government of India, that Mr. Wardle, at the sacrifice of much time and personal comfort, consented to come out to India to do what he could in the same cause. It was at the same time suggested that there should be a special Silk Court, of which Mr. Wardle would have charge, and the proposal was put before the Bengal Silk Committee; for, before the question of Mr. Wardle's coming out here had been raised, the Bengal Government had been asked whether they would undertake the preparation of the Silk section, seeing that, of all the provinces of India, Bengal was the most interested in the silk question. The Bengal Government agreed to a Committee being formed in Calcutta, and the matter had proceeded so far when Mr. Wardle's arrival was announced. The Bengal Government readily assented to the proposal for a Silk Court and offered their collections and assistance to Mr. Wardle.

MR. WARDLE then addressed the meeting. He began by saying that it might naturally be asked why he, as a silk-dyer and silk and calico printer, should appear there to speak upon silk cultivation and the earlier operations in the manipulations of silk.

He would anticipate objections of that kind by showing that, apart from lengthened scientific investigation, he might be considered to have at least some claim to be heard on the subject from having been accustomed as a silk-dyer and printer during his business life, to examine every variety of silk fibre and its diversified kinds of manufacture, and had therefore had lengthened opportunities of studying the nature and many forms of the silk which came to him to be dyed or printed.

He hoped he could at least from this long acquaintance speak thoughtfully on the subject, and he must add that he spoke also from a disinterested point of view.

Having as early as 1872 succeeded in making some important developments in dyeing Tussur silk, at that time a very difficult fibre to dye, he had been consulted shortly afterwards by the Marquis of Salisbury, then Secretary of State for India, to report on the practicability of dyeing this silk in India and in examining the native dyes of India. The investigation took eight years to complete, during which time he was requested by the Government of India to take charge of Indian silks at the Paris Exhibition of 1878, and now he came out to India at the request of the Royal Commission of the Colonial and Indian Exhibition of this year to undertake the same duty, but on a more extended scale, and to properly emphasise the capabilities of India as a silk-producing country. Naturally with so long an acquaintanceship with both the domesticated and the wild silks of India he had their progress and utilities very much at heart.

Further, he was led to accept the invitation at Mr. Buck's expressed wish that he should come out in the interests of Indian sericulture.

He was here for several specific reasons; *first*, to stimulate and give encouragement to an extended production of Tussur silk, now a settled European manufacture and industry, requiring a much larger supply of the raw material than India was at present able to supply; *secondly*, to collect examples of the wild and domesticated silks of India in all their stages, from the eggs of the various silkworms to the finished fabrics for the Exhibition; *thirdly*, to see for himself

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how it was that Bengal silks had gradually fallen into disrepute in England and in all the other European silk centres during the last twenty-five years until they now hardly held a place worthy of respect.

Also to make an examination on the spot of the present system of reeling silk and to point out how it might be improved, and if possible, made equal to that of the best silk-producing countries.

Previous to that time in the town of Leek in which he lived, the staple of which was and is the manufacture of sewing-silks, the consumption of Bengal silk was the rule, that of other silks being the exception. Bengal silk, if properly reeled, has several properties which peculiarly fit it for sewing-silk, in addition to its suitability, when properly reeled, for weaving purposes, and a large quantity could be used for that important requirement.

Gradually the silks of China and Japan came in, and for many years past had almost entirely swept away the use of Bengal silk, and his motive was to try and restore this silk to its former position, one which he should be able to show from his recent visits to the silk filatures of Bengal, might easily be more than realized. He remembered that two great defects existed in Bengal silk, which, gradually increasing, has gradually led to its extinction for many of the important purposes for which it had been used. One was the very defective way it was reeled from the cocoon, and the other the difficulty there was in winding it when reeled. He was disposed to think, after seeing the rough-and-ready way the natives reeled their cocoons in their village-huts, that native-reeled silk had too frequently been shipped to Europe instead of that of the better reeled Indo-European filatures. But no doubt even the high quality of the latter, in hopeless competition with native reeling and also from other reasons, fell from its former excellence.

These were the principal causes which led to the ruin of the Indian trade not only in England but also in the other European silk manufacturing centres. From lengthened microscopical and other examinations of Bengal silk he had convinced himself that the fault was not in the fibre itself, for in comparison even with Italian silk its structure left nothing to be desired.

The principal cause of the irregularities in reeled silk is a defect termed by the French and Italians *duvée*, the precise nature of which he was told in all the filatures he had visited both in Italy and India he had been the first to point out and define. It was strange that this defect had not before been thoroughly understood, but as the use of the microscope in sericulture had hardly yet commenced, no one need be surprised at erroneous conclusions being drawn in matters almost invisible to the unassisted eye. He could not too strongly advocate the constant use of the microscope in every filature. It was not necessary to have an expensive instrument; he had brought out with him one of Beck's new small £4-4-0 microscopes with objectives of 1 inch and $\frac{1}{4}$ of an inch power, quite sufficient for all practical purposes. To this should be added a micrometer eye-piece for making measurements of the thickness or diameter of the fibre.

Many opinions of the supposed nature of the *duvée* were given him by the several gentlemen engaged in the filatures both in Italy and India. Amongst them were these principal ones, *first*, that the *duvée* consists of broken ends of the *bave* arising from the piecing of the thread by the reeler or by replacing carelessly the end of a fresh cocoon; *secondly*, that the silkworm does not deposit its silk in a continuous thread but leaves off and recommences at intervals throughout the cocoon, causing ends in its double parallel thread or *bave*; *thirdly*, that the fibre is hairy, somewhat as in fig. 1, plate 1; but this is not so. The silkworm deposits its silk with extraordinary regularity and method. The outer and inner threads of the cocoon are, indeed, finer than the central portions, the thickness increasing very gradually to about the middle of the cocoon, but the thread is, in every case he had examined, always continuous and of excellent structural regularity. He had never been able to detect the *bave* or fibre of any silk to be hairy or externally fibrous. It is in the *reeling* only that defects begin to appear.

The silkworm, by moving its head from one side to the other, deposits its double thread in loops as at *a* in fig. 2, plate 1.

At the points of contact the gum adheres more firmly than it does laterally, consequently in the reeling, the *bave* frequently comes off in loops as at *b* *b* fig. 2, plate 1.

In fig. 3, plate 1, is given the appearance of *duvée* upon a thread of raw silk composed of four cocoons reeled together.

Fig. 4, plate 1, is the microscopical appearance of an aggravated form of *duvée*, in which a series or layerlet of loops have come off together, and which having passed both *filière* and *croiseur* without being reduced, have resolved themselves into a tangle which constitutes what is known as "knibbiess" in the raw silk.

PLATE I.

Fig. 1



Fig. 2

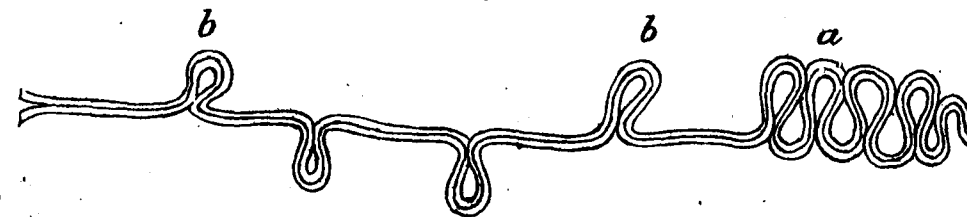


Fig. 3

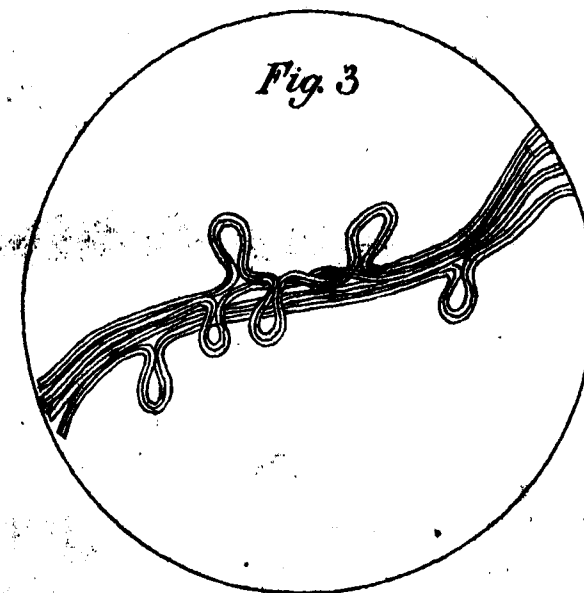
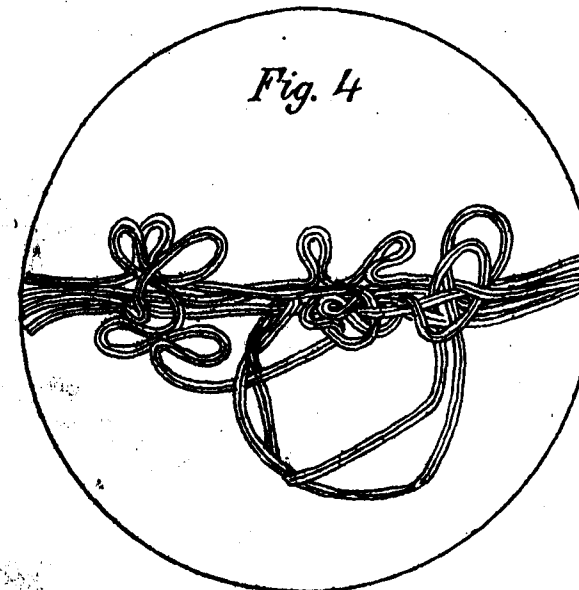


Fig. 4



In native reeling it is much worse and much more frequent. In the Bengal cocoon this defect is much aggravated from two causes—

1st, by the greater amount of gum or *grés* which the worm exudes to cover its silken thread than in those of the Italian, French, Chinese, and Japanese worms.

2ndly, from the Bengal cocoon being smaller than those of the countries just mentioned. This smallness increases the difficulty of reeling, especially towards the inner end of the cocoon.

In the Italian cocoons the chrysalis is larger than the Bengal ones, and helps by its greater weight to prevent the cocoon from being drawn out of the water in which it floats whilst being reeled. In the Bengal cocoon when the *bave* is nearly all reeled, it is often jerked from the water to the *filière*, many loops being loosed and drawn up on the reel at once. Often for want of care whole layers come off at once and form what are called “knibs,” “foul,” “slubs,” &c. The cocoon, it should be stated, is as stratified a piece of construction in its way as the liassic formation and the layers are very apt to come off *en masse*. This is particularly noticeable in village native reeling, where irregularity of thread, however great, seems to be no drawback. He had seen the silk drawn off in positive lumps, and the wonder was that with the extraordinary rapidity of their reeling they obtain any but a thread of *chassum*, so clumsily and rapidly do they piece up the breakages, unavoidable in their rough-and-ready reeling.

In the best European filatures the irregularities are merely the occurrence of loops, *duvée* when only a few occur, “knibs,” “slubs,” or “foul” when in quantity or in mass, but seldom found in the best reeled silk of Italy.

He had suggested that attention should be directed to a better and more perfect state of tension between the bassine and *filière*, and before the thread reaches the Tavellette, for no amount of *croiseur* can effectually reduce the *duvée* of a single *bave*; i.e., before the cocoon fibres join together, as it is hopeless to attempt to reduce the loop on a single *bave* when it has passed through the hole of the *filière* which unites into one thread the *baves* of as many cocoons as may be reeled together—

Of Italian silk 4 cocoons reeled together are required to make a thread of 10 to 12 deniers;

and 10 to 12 to make a thread of 25 to 30 deniers.

Of Indian tussur silk 4 cocoons are required to make a thread of 40 deniers; and three for 30 deniers.

He was cordially thanked in Italy for having pointed out the nature of the *duvée* and in having shown that by the slightest pull of the single *bave* this *duvée* was resolved into a perfect line, and steps are being taken to overcome the defect.

The *duvée* is not easily seen on the Italian silk except when on the reel and in a good north light, but its removal will mark a new era in all *Bombyx Mori* silks, particularly that of Bengal, in which they have hitherto been more numerous.

Referring to his visit of the past ten days to the Bengal silk districts, he said that at the invitation of Mr. Keswick and Mr. Lyall, he had gone through the filatures in the Rajshahye and Murshidabad districts. He had been very much impressed with his visit. He found beautiful silks, although capable of improvement, being produced all over the district, and he had been received with the greatest courtesy and kindness; and while there, he had drawn up a few suggestions, which would, he hoped, be of special interest to Mr. Buck, as Secretary to the Government of India in the Revenue and Agricultural Department. He called on Mr. Morey, of the Sardah Filature, on Mr. Stocks, of the Bengal Silk Company at Murshidabad, and subsequently on Messrs. Louis Payen & Co., meeting Monsieur Gallois. With regard to the properties, the structure, and the fibre of the Bengal silk, he had shown them side by side with Italian silk, and proved to these gentlemen the accuracy of his former examinations, that there was really no practical difference in the fibre, and that of the two, the Bengal silk might be preferred in several respects if it were properly reeled. It was surprising how near they were together both in size and in homogeneity of thread. He was, however, bound to remark that the present mode of reeling in the Bengal filatures was a little old-fashioned, and it was worthwhile to invest money in altering it, and to adopt the Italian mode of reeling. He was not sure whether he knew enough about the matter, but on his way to India he had visited Italy, and had seen there what he considered to be the very best method of reeling. He saw every detail in connection with the preparation of the cocoons and the subsequent reeling of the silk. He also saw the working of the reeling machine known as the *Tavellette Consono*, a simplified and beautiful contrivance exactly suited to the reeling of the finest silks. Although the Italian and Indian worms were practically of the same species, there was some difference between them. The Italian worm at full size was much larger than the Indian one. Mr. Wardle would not now enter into scientific considerations on the point, but he was quite certain, and had convinced the gentlemen he had visited, that

the silk of the Indian worm was as good structurally as the Italian one. The Bengal cocoon was not as large as the Italian, and did not contain so much silk. From measurements, he found that the white and yellow cocoons of the old Italian breed measured 650 metres in length each, the Bengal cocoon only averaging 150 metres. This was an immense difference. There was some cause for this, and he thought it might result from the Indian worms being multivoltine, and also from their being imperfectly bred and badly nourished. He had been at some trouble to obtain the matured opinions of the gentlemen engaged in the industry in Eastern Bengal, and he would place a summary of them before the meeting. On the authority of each of the filatures he visited, the rent exacted by the zamindars from the ryots who cultivate the mulberry plant is excessive. Before the American War it was R1-8 to R2 per bigha. During the war and the prosperous few years which succeeded, the rent became R14 and even as high as R16 per bigha. In the neighbourhood of Berhampur it is now R12 to R14; in Malda R16. There are three bighas in an English acre, and the rent would be R48 per acre—a rent very much higher than the average of English rents. Rather than lower their rents, the zamindars will sometimes allow their land to lie fallow. In the good years he had just spoken of, the ryots paid any price the zamindars asked, and it seems to be nothing short of a misfortune that rents have not come down with the depression of recent years, and the declining demand for Bengal silks.*

It is the native zamindar who exacts such very high rents and not the European,† and who, if he would wish to see the industry again in a flourishing state, would do well to be wise in time, and assist the present effort of its revival by moderating his rent and so encouraging it. He was told that R3 would be a very fair rent. There are at present some low-lying lands, which are rented at R6 to R7, and even as low as R3, but not in the Berhampur and Sardah districts. In a letter he had received from Monsieur Gallois, of the filature of Messrs. Louis Payen & Co., since he visited the filature, the following opinion is expressed:—

"I told you in the course of our conversation that I consider the decrease of late years in the rearing of silk-worms (*Bombyx Mori*) in Bengal to be entirely due to the excessively high rents the zamindars put upon the mulberry lands in years of prosperity in the silk-trade, and which they maintained when the value of silk in the world fell down 20 to 50 per cent.

"I could point out estates in the Maldah, Rajshahye, and Murshidabad districts where rents for mulberry lands are as high as R12, R14, and R16 per bigha.

"I am perfectly aware that the Government is powerless to interfere with the zamindars to bring them down to lower rents for lands which they have collected for many years past, but I believe that a great deal might be done in the estates under the Court of Wards‡ if the Collectors in charge would fix a fair rent for all

* Since the meeting he had received the following letter from a native gentleman occupied with native interests but who did not wish his name to appear:—

"DEAR SIR,—Government holds certain lands as immediate proprietor or zamindar. These lands or estates are called *Khas mahals*. Government as a model zamindar can introduce in the *Khas mahals* all improvements and reforms which are likely to increase the material wealth of the country. The ryots hold land immediately under the Government and, while letting out land, the Government can make its own terms with them. For instance, if there be any mulberry lands in any one of the Government *Khas mahals*, and if the Government be convinced that low rate of rent is likely to improve the quality of cocoons grown and to foster the trade in silk, the Government can very easily set an example by reducing the rent in the *Khas mahals*. In fact, as a model zamindar, Government can introduce any reform in the *Khas mahals* that are likely to develop agriculture, trade, or industry.

"In the Court of Wards' Estates, Government has no such free scope as in the *Khas mahals*. In those estates, the Government holds the land temporarily in trust and can within a certain limit introduce reforms which the actual proprietor would have introduced had he been in possession. These estates are generally the estates of minors, and Government holds or manages them in trust for them.

"You will confer a great boon to the country if you could prevail on the Government to act as a model zamindar in these *Khas mahals* and show the poor ryots what can be done in the way of improving agriculture, trade, or industry."

Yours faithfully,

† My correspondent in conversation rather questions the accuracy of this statement, and thinks there is not so much difference as might be inferred from it; but he admits there is a difference in favour of the European zamindar.

‡ NOTE.—It may be of interest to readers out of India the nature and work of the Court of Wards and attached estates in Bengal. Mr. Wardle had been assisted in this by an interesting article on the subject in the *Englishman* of the 11th January 1886.

There are 107 wards, and 99 attached estates under the management of the Revenue authorities, who fix and collect the rents of these estates.

Indifferent harvests have made the collection of rents difficult. In the Bhagalpur Division the collections only amounted to 84.1 per cent., and they were also unsatisfactory in the Burdwan and Rajshahye Districts.

There would probably be increased revenue if the silk industry of Bengal could again flourish, so that more land might be put under mulberry cultivation.

The estates have to bear subscriptions, donations to schools and to dispensaries, and for keeping the property in good order for the benefit of the wards, who are minors, who are educated first in the zilla and other district schools, then in some cases by special tutors, whilst "others are educated at various colleges with private tutors to direct their studies. One good feature in the curriculum of education is that, as soon as any minor reaches the age of 18, he is, in addition to his ordinary education, taught the principles of zamindari business, and is practically inducted into the management of his own estate."

lands. This step would at once increase the mulberry cultivation in these Court of Wards' estates and be a very good example for the neighbouring zamindars to follow.

"I consider R3 per bigha a fair rent for the best mulberry lands. The best rice-producing lands are seldom rented higher than R1-8 to R2 per bigha."

The industry appears to be crushed because of this high rent. There are hundreds of square miles of land under mulberry cultivation, but the quantity is rapidly declining, and the land used for other crops. The mulberry is not grown as a tree for silk-rearing in the Bengal districts proper, but is planted over the land as a shrub, and does not grow higher than from 1 to 2 feet. It is the *Morus indica* and not the *Morus alba* of Italy. Land for mulberry-growing has come to be more highly rented than for any other crop. Even land used for growing rice adjoining the mulberry plots is only rented at 12 annas to one rupee per bigha. A striking difference this it must be owned. Other causes are also in operation increasing the difficulties of recent sericulture in India, and, as it was one of his missions here to stimulate the industry and to point out reasons for its improvement, he hoped it would not be considered out of place if he placed on record all the hindrances to sericulture recorded to him in his visits to the filatures. Mr. Morey, of the extensive filatures of Messrs. Robert Watson & Co., of Sardah and other parts of the province, told him that another great reason of the decline of this industry is mainly due to the low price of the silk market and the failure of the cocoon crops. The cultivation of the mulberry, too, had considerably decreased, owing to the reasons already given, and in consequence of the ryots finding better remuneration by sowing rice, sugarcane, and other crops, the cultivation of which had considerably increased. He considers the failure of the cocoon crop to be principally due to the bad seed selected by the native breeders. Formerly they themselves went to purchase seed from other districts, and saw the worms spinning before buying their seed cocoons. In doing this they also rejected any bad cocoons. Now the system is that brokers, "Sanchoo-Pikars," go instead and buy indiscriminately and sell to the rearers. The consequence of the absence of proper selection is that diseased and weakly worms are bred, the crop fails, and the rearers get disheartened. Mr. Morey suggests that Government should come to the rescue and rear cocoons for seed purposes only, and also in growing mulberry properly to feed these seed worms. This latter would take, perhaps, a year to do, but the benefit would be very great; the natives would also gladly purchase good seed. He suggests that at first the Government might distribute the seed to the native rearers gratuitously in order to get them to take it, but as soon as the natives were found to use this better seed eagerly, it could be sold, and funds would be created as well as the silk industry greatly improved.*

Further, Mr. Morey suggests that, as during the hot months worms are killed by the extraordinary hot winds, because of the matted walls used in the construction of the native village huts, it would be well for Government to help in erecting huts with mud walls in all large cocoon-rearing villages, in order to show the rearers that by this plan they would save their worms and secure much larger crops than at present. In those villages where the rearers have mud-walled huts, the cocoons seldom fail. This, he thinks, is a very important fact. Mr. Morey had told him that during the last three years at least 60 per cent. of the worms had died from the hot winds. He thinks Government should employ some responsible person to visit the rearing districts, and show the rearers what is required. He also thinks the zamindars should be asked to interest themselves more. He also thinks it worth suggestion that Government might commence the rearing of brood cocoons in jails under the supervision of a paid expert.

Now, as he, Mr. Wardle, knows from long experience that many gentlemen connected with Government administration in England "pooh-pooh" any request or suggestion for the substantial and practical aid of anything connected with trade or commerce, and are ever ready, too ready he thinks, with their pet expression, "It must be left to private enterprise," that it is quite possible that some or all these thoughts may receive similar treatment, yet he cannot help hoping that Mr. Buck, who has repeatedly proved to him the very strong interest he feels in this industry, and at whose call he has at great sacrifice come out to India, will consider the wants of Indian sericulture with a breadth which he thinks it needs, and a determination not to let the subject pass away until it meets with that great resuscitation which with proper care and assistance awaits it. He earnestly appeals to him to support this industry.

He ventures to say that collective action is what is most needed to restore our silk industry both at home and in India; it is, in his opinion, necessary that Government should take the initiative in a well-thought out application of any lever which will help to raise so beauti-

* Mr. Wardle had called upon Dr. King of the Royal Botanic Gardens, Calcutta, who had kindly offered to cultivate the various species of mulberry and to distribute plants gratuitously to any mulberry-growers who cared to apply for them.

ful and artistic an industry to its proper and ancient proportions. The wearing down of any artistic industry is a national loss which requires national aid and encouragement.

The silk industry of England has received no real encouragement from her Governments, not even in providing well and correctly-compiled statistics. In this respect we are behind every other Western silk country, and its present state is dreadful.

As the silk industry gradually travelled westward, Rulers and Governments assiduously welcomed and nurtured its growth, never more so than in France in the past and especially at the present time. Extraordinary effort is there made outside private enterprise for the retention and extension of this her valued industry. We have an advantage which France and hardly any other nation possesses in having a great silk-growing country in India, capable of supplying not England merely, but all Europe. In England we have silk centres, such as Spital-fields, Coventry, Macclesfield, Congleton, Middleton, and other districts, not long ago great centres of silk industry, now paralysed, and the want of collective action and Government supervision has had not a little to do with it.

In what way it would be best for the Government of India to support this effort is hardly for him further to suggest, but he is sure there is an immensely important future in India, not only for the ordinary silk of commerce, but also for the newer industry of Tussur silk, with which he has had something to do during some years of persevering effort to bring into life. With regard to the silk of commerce, he has been able to convince the gentlemen who have charge of the Bengal filatures he has had the pleasure of visiting, that they are manipulating a fibre quite equal, if not superior, to that of Italy, in respect of structure and regularity. He is certain, from the microscopical and other examinations of many species of silks he has had the honour to make for and at the request of the important Chamber of Commerce at Lyons, a report of which has been circulated in India by the Government, and which should be read and studied at every filature, that Bengal silk is capable of as much refinement as any other silk of the same species, be it Eastern or Western. He repeated that it is all the produce of the *Bombyx Mori* practically, and the fibre is, for all practical purposes, the same. With care and perseverance India will realise the truth of these examinations and assertions. On the table will be found specimens of silk which he has seen reeled with the appliances of which he has spoken other than those at present in use. The silk produced is almost as good and pure as Italian, in fact much better than some of the Italian silks.

To those inclined to doubt what he says he commends a careful examination and comparison of the specimens which he saw reeled in the Rajshahye filatures and which now lie on the table.

India only wants the application of progressive observation, and the immediate adoption of whatever method the progress of science and mechanical art bring to add better results in Europe. That there is ample scope may be inferred from the fact that for the 10 years ending 1883, we in England have been purchasing manufactured silks from countries in Europe to the extent of about 11 millions lbs. sterling annually, and that whilst during that period Europe has been annually consuming 6 million lbs. grown in Italy, 1½ million lbs. grown in France, 7 million lbs. grown in China, 3 million lbs. grown in Japan, India can only show an export of 1 million lbs., and last year it had sunk down to an export of only 457,600 lbs. This does not include that grown for native consumption, which is no doubt very considerable, and has much increased since the very low prices of Bengal silk of late.

He found at Poona, as well as at other places, the silk manufacturers were all buying their raw silk from China on account of superior quality, and had given up the use of the silk of their own country. At Lahore he found Bokhara silk exclusively asked.

The value of the exports of silk from India in 1884-85 was R46,35,613, whilst that of the silk imported was R74,75,633, or nearly twice her exports.

Is it not high time that collective as well as individual effort should be made to alter so serious a state of things?*

From these statistics it may be inferred that every acre of mulberry land may be multiplied manyfold.

*NOTE.—He extracts from Mr. J. E. O'Connor's "Review of the Trade of India in 1884-85" the following interesting statement:—

"Silk was imported to a much smaller extent than in the last two previous years, only 1,831,702lbs., which was 17 per cent. less than in 1883-84, though still a very large quantity for a country which is held to be a great silk-producing country. Whatever may be the capacity of the country for producing silk in large quantities, it is clear enough that while India imports more silk than it exports (the bulk of the exports being, moreover, only waste or chassam), the country must more properly be called an importer and consumer rather than a present producer of raw silk. Most of the imported silk comes from China and from Siam via the Straits for Bombay mainly and Burma in smaller degree. Even Bengal, however, the great silk-producing province, imported 212,840lbs. of silk last year. It is understood that this silk, like the silk imported into Bombay, is for the use of a local mill which has been at work for a couple of years weaving silks for the Burma market."

From the short time placed at his disposal by the Royal Commission he had not had an opportunity which he should have much desired of visiting those districts in India where sericulture has been attempted or is being to a less extent carried on, namely, the North-West Provinces, the Punjab, and Kashmir.

The mulberry thrives luxuriantly in these provinces, and he has no doubt there is a good prospect in store for them under sufficiently trained European superintendence and patient development on a moderate scale.

There will be shown at the coming Exhibition in London cocoons of the *Bombyx mori* of excellent quality and form from these provinces.

He would strongly urge that Government should annually ascertain the quantities and values of native-reeled silk used chiefly in India and Burma, and also that produced by European reelers in India for export. In France and Italy the quantity of cocoons annually raised is recorded and published, and it should be so in India; also the quantities of Tussur, Eria, and Muga, not omitting the waste silk of all kinds carefully defined. The want of these statistics is very great, and it is a reflection upon our system of compiling our Board of Trade returns that comparatively no information of value can be as yet obtained. It is particularly necessary, now the Tussur utilizations promise a most important augmentation to the silk trade of India, for if it is properly cared for he predicts for India an enormous expansion of Tussur silk-growing and reeling, and, as he is fully convinced that a great future also lies before Bengal in the revival of her at present distressed and unremunerative silk industry, he thinks it will not be denied that his suggestions on this head of accurately compiled returns is of the first importance. He repeats that what is wanted is—

- (1) an annual return of the quantity of cocoons raised of the mulberry-fed worm of each kind, distinguishing the univoltine and multivoltine kinds;
- (2) an annual return of silk reeled in Bengal in the European filatures;
- (3) an annual return of native-reeled silk, which could be obtained without much difficulty. All the silk produced in the different districts comes through the bazars in the raw state, and the Magistrates could easily obtain statistics by finding out the quantity annually sold at the different marts;
- (4) an annual return of all waste, chassam, knubs, pierced cocoons produced in the reeling, breeding, and manufacture of silk proper;
- (5) tussur silk, quantity of cocoons raised in the various provinces;
- (6) quantity of waste, raw silk, and cloths of Tussur;
- (7) similar returns of Eria;
- (8) similar returns of Muga;
- (9) the nature and quantities of the exports of each kind to be severally and accurately defined.

Another subject which had specially occupied his attention was the development of the trade in Tussur silk, and he had been engaged in attempts in this direction for some years past. He could not for some years induce the manufacturers in England to utilise Tussur; and had to visit Germany to have his ideas of Tussur plush first carried out. The Government of India sent home in 1874 a quantity of Tussur cocoons of various sorts, and he had succeeded in reeling them in Italy. Later on people began to see that there was something in Tussur silk. In 1878, at the Paris Exhibition, the French manufacturers were very much struck with his examples of improved reeled Indian Tussur, telling him that they could give orders for almost any amount if it could be reeled as well as that exhibited. He told them that such silk was not yet in the market. He then appealed to India for it, and the Indian producers did not at all respond to this appeal. There was then nothing left for the manufacturers but to go to China and there they have found what they wanted; but although China had got the start in the race in the competition with India, India had now begun at the right end. China began, by sending out the worst rubbish she could possibly find, and India had begun by sending her best reeling. The fibre of Indian Tussur silk is a better one than that of Chinese Tussur, which is quite another species, *Antheraea Pernyi*. It must be a great pleasure to all who were connected with sericulture in India to find several gentlemen vying with each other to produce the best quality of real Indian Tussur silk; and the task of comparing one production with another had now become a most invidious one. The new appliances and inventions for reeling were all good, but they might all be improved. In an adjoining room would be found various specimens produced by new methods. Mr. Cleghorn had been paying a good deal of attention to the softening and reeling of cocoons, and with a great deal of success. In the silk districts Mr. Wardle had heard high opinions expressed as to the value of Mr. Cleghorn's patent. Mr. Peppé of Arrah had also been working in the same direction, and had produced some beautifully lustrous Tussur.

M. Gallois had been working in the same way, and had produced Tussur which was in great demand on account of its softness and excellent reeling. He was supplying extensively the Lyons market, and could not produce it rapidly enough. While at Sardah he happened to be present at the reeling of silk by Mr. Cleghorn's method; Mr. Marshall, the manager of one of the filatures of the Bengal Silk Company, came over to Berhampur to meet him, and brought with him his own developments in the production of Tussur silk. This morning M. Gauthier of Hazaribagh had brought examples of his reeling. They were all beautiful, and the gentlemen present could judge which of them were the best. Specimens of each kind of improved reeling lay on the table. Mr. Wardle urged the adoption of the *Tavellette Consono* in the reeling of Tussur cocoons. He believed it to be indispensable and as yet the best and most simple appliance for reeling. Fig. 5, plate 2, is a full-sized drawing of this little instrument. Its position in the reeling machine is easily recognised in fig. 6, plate 3. The framework is of brass.

A. A. fig. 5, plate 2, enamel guiders through which the combined threads pass from the reeling basin and *filière* upwards to the reel.

B. B. light pulleys of wood with glass spokes revolving on steel pins.

C. the *croiseur* or crossing of the silk whereby a gentle friction upon itself by itself is given. This method of *croiseur* is superior to that which was used in France and Italy some years ago and known as the *Tavellette Chambon*, and which he had described and figured in his "Handbook of the collection illustrative of the Wild Silks of India in the Indian section of the South Kensington Museum" in 1881. It has since given way to the improvement effected by Consono in the form of the *Tavellette* known by his name and illustrated in fig. 5, plate 5. Of its superiority and efficiency too high praise cannot be accorded. For reeling Tussur cocoons it is absolutely necessary as he had proved in the several filatures where he had mounted and worked it.

D. point of attachment by a screw to the *Tavellette* stand or support.

The difficulty of softening the cocoons preparatory to reeling is evidently wholly overcome in each of the new methods. Submitting them to the action of steaming appears to him to be the chief point in overcoming the difficulty of softening* so hard and shell-like a cocoon. It was now left to the Government to come forward and facilitate the cultivation of Tussur silk and the collection of cocoons, as well as giving facilities for buyers of cocoons to transmit cash readily into the innermost jungles to pay the natives on the spot. It is at present most difficult to send money into the interior. Tussur was entirely wild and uncultivated and would possibly so remain, but it could be and was managed as an outdoor production. These results had clearly proved that Tussur silk could be well reeled and produced and made to pay as an article of commerce, and Mr. Wardle considered his work in connection with it was coming to an end. He had been assured that Tussur silk as an article of dress was rapidly gaining favour and becoming very fashionable in France, and that the demand for it might increase to such an extent as to make its price even as high as that of other silks.

There were two other silks which now engaged his attention, and which would be found mentioned in his Handbook published in 1881 and the various Government Reports before and after that time. Since then he had been working at them, and he could now speak of them with much greater confidence. The first was the Eria silk of Assam, the worm of which fed on the castor-oil plant, a plant which he found abundantly all over the district he had just visited and in the other parts of India he had travelled through. He suggested that they could as well cultivate the Eria with the mulberry-fed worm at the same time, and he thought this would be soon tried. The cocoons of this worm could not be reeled to pay, and he would suggest they be packed up in pressed bales and sent to the spinners of Europe to be carded and spun. The next was the Muga silk produced by the larvæ of *Antheraea assama* at present chiefly an Assam worm but found also in North-East Bengal feeding on the Soom tree, *Machilus Odoratissima*, a laurel which abounds in Assam.

Of this silk he could not report too highly; it had an immense future before it. It was already exported from Assam to Calcutta, and beautiful embroidery made with it. At present the only difficulty in connection with it lay in its limited production, in overcoming which lay bright hopes of promise, for the improvements effected in Tussur reeling applied exactly to Muga. He should have more hopes for it than for the other. It was a beautiful silk, which took dyes more readily than Tussur, and was worth the attention of every one who was interested in producing it.

The immense district of Chota Nagpore was being opened up to Tussur enterprise.

* Since the meeting he had visited Futwah in the Behar district and had seen the native reeling tussur and found that they softened their cocoons perfectly by boiling them for three hours with *sagi* and reeled them by hand and thigh, a decoction of myrabolans being used as a lubricant and to cement the thread.

Fig. 5

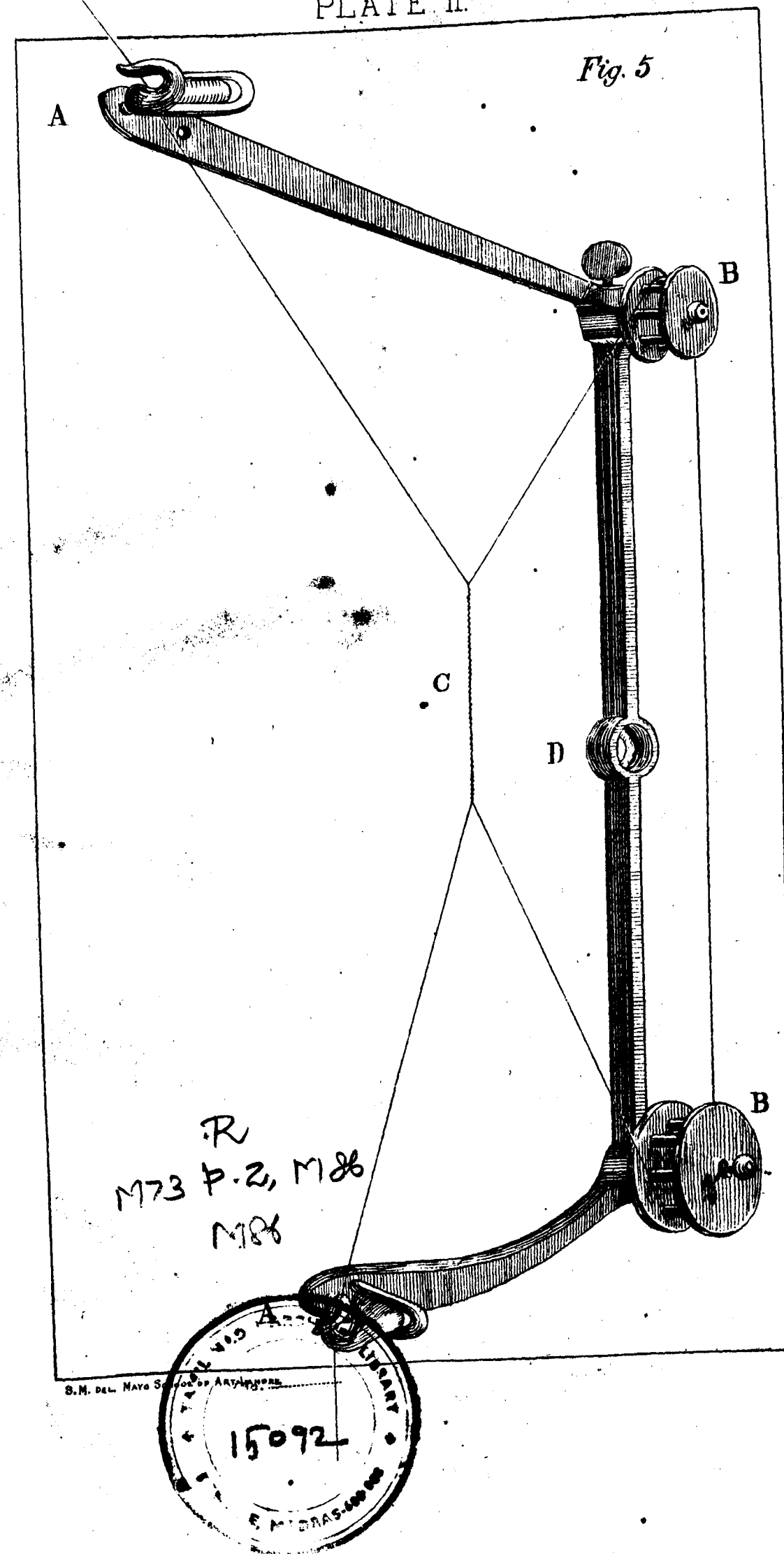
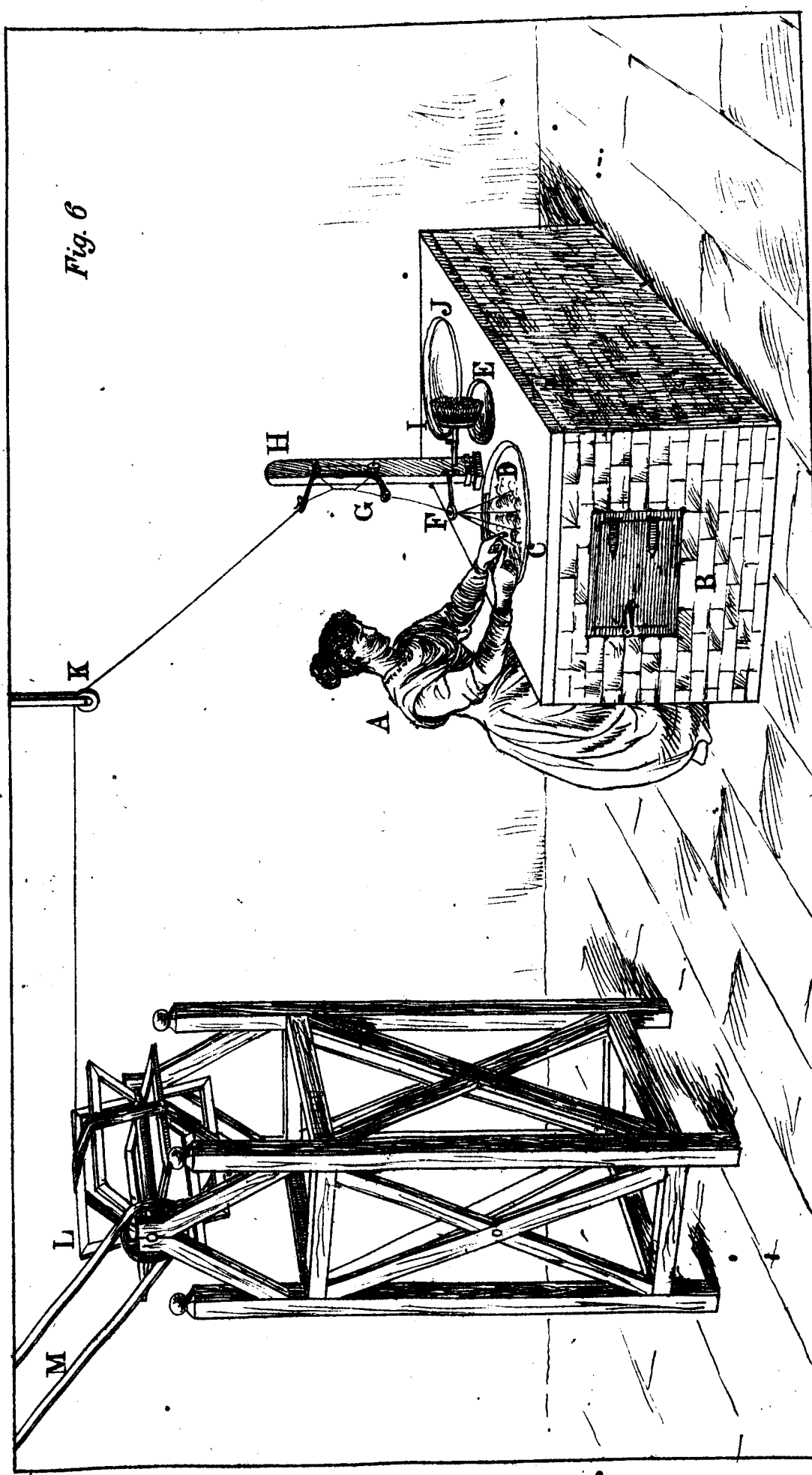


PLATE III.



Cocoons are found abundantly, and agents at Ranchi are now buying them largely from the natives, who bring them in from the jungles on the plateau 2,200 feet high, where he believes both the mulberry and Soom trees would flourish, and the *Bombyx Mori* and Muga silk, if not Eria, could be cultivated advantageously, because labour is there so cheap and plentiful. Besides this district Mr. H. G. Turner, Collector of Vizagapatam, has just arrived in Calcutta and told him of an enormous area there where Tussur occurs. The other day a firm in Madras purchased Rs 42,000 worth of Tussur cocoons from the Chota Nagpore district.

Mr. Wardle then explained the method of working the reeling machine which is universally in use in Bengal, and then contrasted it with the improved reeling machines used in the largest filatures in Italy. Fig. 6, plate 3, shows the whole machine at work and the following is a description of its parts:—

- A. Woman reeling.
- B. Construction of brick supporting the bassine with fire or steam arrangement as desired.
- C. Bassine from which the cocoons are reeled.
- D. Four cocoons being reeled together.
- E. Small bassine, in which the cocoons are first washed, softened, and arranged for the reeler.
- F. *Filière* uniting the four cocoon baves into one thread of raw silk.
- G. The Tavelette Consono.
- H. The tavelette support.
- I. Brush by which the reelable threads of the cocoons are found. It is turned downwards when used, and is worked backward and forward.
- J. Bassine for another reeler.
- K. Pulley guiding the silk to the reel.
- L. Reel on which the silk is wound.
- M. Pulley and strap for turning the reel. The turning can also be done by hand when desired for cottage reeling. The silk when taken off the reel constitutes the raw silk of commerce.

Mr. Wardle stated that the value of Italian silk in England was about 19 shillings per pound; whereas the value of Indian silk in England, reeled by the crude apparatus in use, was but from 8s. 6d. to 11s. 6d. This difference was entirely due to the different method of reeling and to the great attention paid to the sizing of the silk in Italy. He also explained the difference between the kinds of labour employed in the two countries and the greater speed at which the reels were driven in India compared with that of Italy. He concluded by stating that he thought he had sufficiently explained what he had to say, and had exhausted his subject. He was much obliged to all present for the earnest attention which they had paid to his remarks. He was obliged to all those gentlemen who had aided him in his visit to the silk districts, and particularly to the kindness of Mr. Keswick and Mr. and Mrs. Morey of Sardah.

Mr. Keswick then proposed a vote of thanks to Mr. Wardle for the very interesting report on what he had seen and heard, and he felt certain that the suggestions he had been able to give to the managers of silk filatures in Bengal would produce most satisfactory results.

Mr. Buck said he had one word to add to what had fallen from Mr. Wardle as to the assistance which was expected from the Government. The policy of Government was to confine any assistance which it offered to private enterprise to the pioneering stage, and that in most directions silk enterprise had passed that stage. He admitted that Government might perhaps do something towards investigating the various kinds of silkworms and moths of the country, and in ascertaining whether the area of useful worms could in any case be extended to other parts of India. The recent investigations in connexion with the Exhibition have added much to our knowledge of the distribution of silkworms, &c., and that there seems no reason why some of the best wild silks should not be more widely cultivated. The Bengal Silk Committee have been invited to place before the Government any suggestions they might be able to make as to the direction in which Government aid would be otherwise useful.

Mr. Keswick remarked that it might be worth the while of the Government to take an interest in improving the *Bombyx Mori* cocoons of Bengal, but he was not prepared to say how they could best assist private enterprise in this direction. He did not believe in importing seed but in the more skilful treatment and selection of what we had in the country.

Mr. Liotard remarked that the real objection to the cultivation of the silkworm lay in the high rental of land. There was one class of cultivators of mulberry, who sold the leaves

of the plant, and the rearer of the worm, who purchased the leaves, often, to raise his income as much as he could, did not feed the worms sufficiently, which resulted in their producing a small quantity of silk. There was no hope for improvement, unless the zamindars reduced their rents.

MR. KESWICK thought that land, like anything else, must be governed by the laws of supply and demand.

Mr. Buck thought that it might be safely left in the hands of the Bengal Committee to consider any steps which it might consider useful to take in the matter.

MR. WARDLE, in acknowledging the vote of thanks, wished to call attention to the interesting entomological and industrial additions which had that morning been made to the collection he had brought to India illustrative of the utilisations of Tussur silk in England, and of the examples of the successful application of the tinctorial matters of India, paying a strong tribute to the value of Dr. Watt's most interesting collection of raw products in Indian cocoons, silks and dyeing plants, and of his energetic collection of them throughout India, and also to the great benefit which would accrue to Indian sericulture by Mr. Buck's wisely calling in the aid of the resources of the Calcutta Indian Museum with its beautiful entomological collection now in the next room, and to the scientific investigations of Mr. Wood-Mason, Officiating Superintendent of the Museum, who, at the request of Mr. Buck, had undertaken to prosecute a thoroughly scientific and continuous examination of the numerous silk-producing larvæ and their moths of India, a more complete knowledge of which is anxiously called for in both England and France, and which will greatly aid the silk rearsers of India in lessening disease and in promoting good bunds.

A vote of thanks to the Chairman brought the meeting to a close.

Plates 1—4 have been drawn and lithographed at the Mayo School of Art, Lahore, under the superintendence of J. L. Kipling, Esq., Principal, by Shah Muhammad, Chief student. Fig. 5 was drawn at Calcutta.

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