

TEXTILE INDUSTRY AT THE VIENNA EXHIBITION.—No. X.

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THE PREPARATION OF SILK WASTE.

WITH the exception of the International Exhibition, now being held in London, that at Vienna is the only one at which the public have been shown the processes for the treatment of silk "waste." At the London Exhibition Messrs. Greenwood and Batley, of Leeds, show a set of machines—including a spreader, sett, or slivering machine, drawing machine, roving frame, spinning frame, and reeling machine—for performing the various operations which the "waste" undergoes, subsequent to the softening and boiling-off processes, while at Vienna Messrs. Theodor and Frederic Bell, of Kriens, near Lucerne, exhibit the series of four machines for the treatment of silk waste which we now propose to describe. In the first place, however, it may be desirable to explain what silk waste is, and to say a few words as to its preparatory treatment.

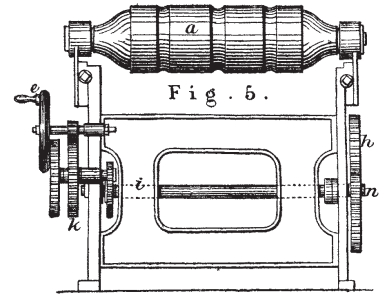
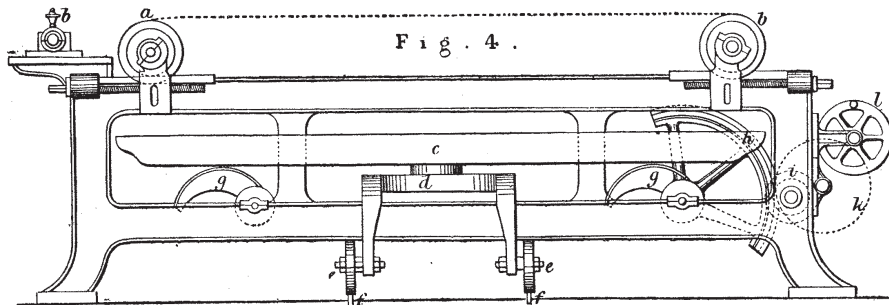
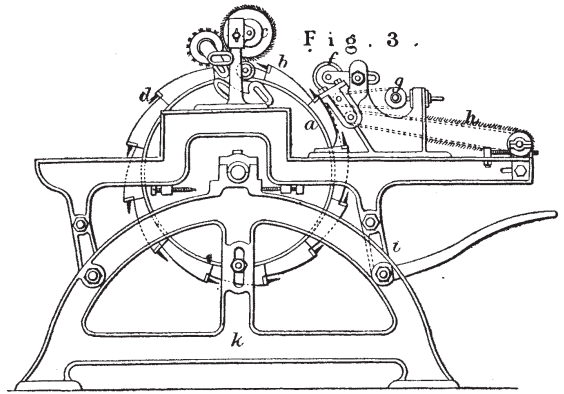
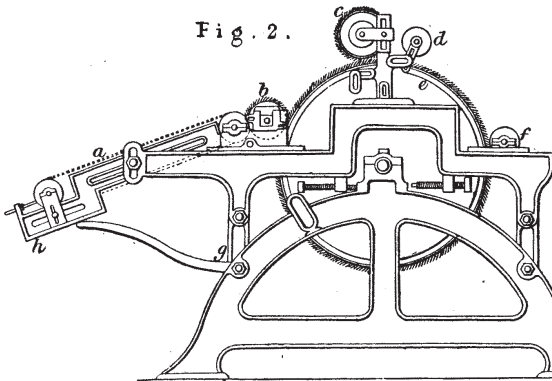
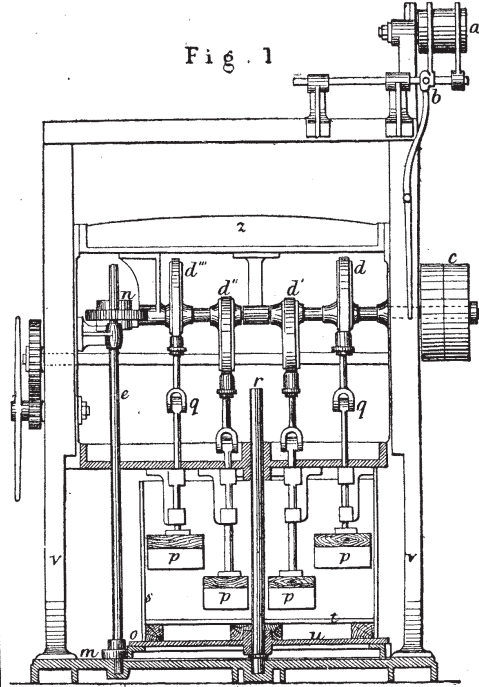
The so-called "waste," then, is derived partly from the waste which occurs during the regular process of winding, and from the operations of the throwsters, and partly from the defective cocoons, which are unfit for winding in the ordinary way. Amongst these are included the cocoons known as "strazza," and the cocoons which are eaten through. Another kind of raw material which goes to increase the silk "waste" is that known as "stami," this being found in a rotten condition, that is to say in a condition in which the organic matter has been brought into a state of fermentation. These masses of waste are placed in tubs or vats, and are moistened with water, and the tubs are then covered and left to remain in this state for three or four days. In consequence of this treatment another fermentation takes place, after which the rinsing and drying begins. If cocoons chiefly have to be worked up, the process of fermentation is followed by a process of stamping. After the fermentation has taken place, the second operation, that is to say, the injection of soap-water, glycerine, or oil and sal-ammoniac combined, is performed; and

tub *s* provided, besides the perforated bottom *z*, with another bottom *u*. This second bottom is fastened by a strong boss to the shaft *r*, and is provided with the rim *o*, against which runs the friction pulley *m* fixed to the upright shaft *e*; this latter is driven by the pulley *n*, whence the friction pulley *m* puts the tub *s* into rotation. The stampers *p* each consist of a horizontal plate, to which are fastened three or four vertical boards about 6 in.

If a continuous jet of water is added this apparatus can be successfully employed for the squeezing of the waste and broken cocoons, and if the water is mixed with a little alkali, the fat, dust, and colouring matter of the chrysalis are easily carried off. This machine is also often used for the stamping of the waste of silk without maceration (as it is used afterwards for the working of the flock silk). Such a machine requires about  $\frac{3}{4}$  or 1 horse power to drive it, and weighs about 2 $\frac{1}{4}$  tons, for a set of eight or ten combing machines, and for the working of the best class of waste, one stamping machine is sufficient, whilst two are required if the waste silk is of an inferior class.

With the stamping machine is generally connected a washing machine, or the former is used for washing also, for which it is well suited on account of the perforated bottom. As already stated above, the worked-up masses receive an injection of water, in order to make them fit for the next manipulation, which consists of dividing or disentangling the materials, by means of an opening machine. This machine, of which we annex an illustration (Fig 2), works in the following manner: The raw material is placed on the feeding table *a*, which carries it to the roller *b*, from whence it is taken up by the cylinder *e*; the latter rotates considerably more quickly than the roller *b*. The stripper *c*, cleaned by the brushes *d*, works together with *e*. After the cylinder *e* has been covered in this manner with silk fibres, its motion is stopped, and the fibrous matter is cut along the axis of the cylinder and is wound on the roller *f*, after the feeding gear has been lifted off from the cylinder by the lever *g*. All parts of this machine are provided with adjustable bearings, so that the feeding can be regulated.

After the raw material has been passed through the opening machine, the raw and often still unclean fleeces are taken to the comb or drawing frame; this machine has been often altered, in shape as well as in position of the teeth on the cylinder, and at one



MACHINERY FOR PREPARING SILK WASTE, BY MESSRS. THEODOR AND FREDERIC BELL, ENGINEERS, KRIENS.

after these preliminary manipulations have sufficiently prepared the mass of fibres, the real mechanical working begins. We shall now describe, as the best explanation of the process of the spinning silk waste, the four machines to which we have referred as being exhibited by Messrs. Bell Brothers.

The first manipulation, that of stamping, is performed by a machine of which we annex an illustration (see Fig. 1), and which consists of a wooden

high; these stampers are carried by vertical rods connected at *g* with the eccentric rods of the eccentrics *d d' d'' d'''*, which are keyed to the shaft *c* driven by the gear *a*. Other arrangements are sometimes added in order to make the tub oscillating, or to alter the motion of the stampers. With this machine not only is much labour saved, as compared with doing the stamping by hand, but the raw material is more uniformly treated, whence naturally the product is better.

time one cylinder, and at another time two cylinders, have been adopted in order to produce a continued working. The illustration annexed (Fig. 3) represents the construction of the machine, now generally adopted.

A strong frame *k* carries on two rollers the endless leather with cards *h*, above which is placed a second endless leather *g*, also running over two rollers. The raw material coming from the opening machine is placed upon the feeding apparatus *h*,

and by means of the second leather with cards *g*, is forced towards the cylinder *a*, which is provided with radial steps carrying steel rails with teeth between 2 in. and 5 in. long. These teeth catch the material pressed forward by the feeders, and as the cylinder *a* rotates very quickly, the teeth take the fibres with them, disentangling in this manner all knots, balls, and lumps of the raw material, so that the cylinder is gradually covered with drawn-out silk fibres. These fibres, when passing the roller *c*, which is provided with strong radial pins, are flattened down to the surface of the cylinder, whilst this roller *c* is cleaned by the brush *e*, that is to say, the former is kept free from fibres.

The upper feeding leather *g* is also provided with a brush-roller *f*, by means of which it is kept clean. The whole feeding apparatus is carried by a separate movable frame fastened to the frame *k*, and can be moved round *i* by means of a hand-lever, that is to say, it can be lifted off from the cylinder *a*. After the latter has made a certain number of revolutions its surface become covered with silk, when the fibres are cut through at a distance of each two steps, and silk skeins of a length of fibres of from 8 in. to 12 in., according to the distance between the steps of the cylinder, are obtained.

The skeins produced in this manner, are now ready for the process of carding, for which specially constructed carding machines are used. The manipulations belonging to this process are generally as follows: The skeins of silk obtained from the comber or drawing frame, are fastened to wooden cramps, consisting of two boards of hard wood about from 24 in. to 40 in. long, and about from 6 in. to 8 in. wide; the skeins are fastened in such a manner that about half of their length is covered by the boards, whilst the other half is projecting. The cramps with the skeins are piled up in such a manner in the carriage of the carding machine, that all the skeins project at the edges over which the cards of the machine have to pass. These "books" or wooden cramps are called in Switzerland simply "brettli," and in France "cigarettes en bois."

The carding machine (Figs. 4 and 5) is arranged in the following manner: a long frame carries the rollers *a* and *b*, over which passes an endless cloth with hackle bars. The rollers have, as shown in Fig. 5, three grooves in which the straps for the fastening of the endless band run. The latter is about 10 ft. 10 in. long, and has three cross bars with cards, besides two thinner rods and a pair of wooden rods without cards. The rollers *a* and *b* are provided with brushes in order to clean the hackle rods, but the roller *a* only is connected by wheel gearing with the driving shaft, whilst the roller *b* is moved round by the friction of the hackle chain. From the roller *b* the motion is transferred by wheel gear to the spur wheel *k* and the shaft *i*, which carries the pinion *n* (Fig. 5) gearing into the wheel segment *h*, on the shaft of which are fixed the cams *g*, whilst the second shaft with cams *g* receives its motion from the shaft of the segment by means of rods and pinions. The cams support the box *c* which contains the "brettli," or cramps with the skeins of silk, and lift it gradually up according to the progress of the carding process, so that the cards penetrate more and more into the skeins of silk. The box *i* is supported by a carriage *d*, which can be taken out of the machine sideways by means of the wheels *e* and the rails *f*; this carriage is further provided with an arrangement for the fixing and fastening of the wooden cramps.

The manner in which this machine is used is as follows: After the skeins of silk fastened to the wooden cramps have been properly fixed in the box *i*, and the latter has been placed in its position by the carriage *d*, the machine is started, when by the wheel gearing mentioned above, the wheel segment begins slowly to move and to turn the cams *g*, which gradually lift the box *i*. The skeins are thus brought in contact with the cards of the endless band running over *a* *b*, and the lifting up being continued, the cards penetrate deeper into the skeins. When the cams have reached the highest position, a contrivance stops the motion of the machine, and the cams are brought back into their original position by means of the hand wheel *e* (Fig. 5). One end of the skeins of silk having been carded in this manner, the same manipulation is repeated for the other end. By this carding process, short fibres are drawn out, also impurities and flocks, and the remaining skeins are considered as the first "draft," or the first "peignés." The shorter fibres, which have

been drawn, are carded again with finer cards on the endless cloth, whence a new length is obtained; these manipulations being repeated until generally six to seven different lengths are got. The last remaining matter is used as raw material for the manufacture of coarse silk, for which, again, carding machines are applied. The number of carding rods or cards used varies between 16 and 24. With respect to fineness, generally three different carding machines are used, in order to obtain the various lengths. Such a set contains, therefore, three carding cloths with about 60 carding rods; further, six cleaning cards and six brushes, three iron rods, and 192 "cigarettes," or cramps. One set of these appliances weighs about 6½ tons, and one attendant is able to look after four carding machines. For two sets of carding machines, one comber or drawing frame is required. The production of the carding machines depends, of course, upon the quality of the raw material; but if all sorts of broken and damaged cocoons, &c., are used, one set will work in the average about 10 kilog. of skeins of different lengths in 12 hours.