throstle, however, does not contain apparatus for reeling the silk, so, for this purpose, a subsidiary reel has to be used. This machine is automatic, in respect of stopping when a predetermined quantity of silk has been wound. One end of the axis of the reel is supported by a lever, whose fulcrum is at the centre of the machine ; the other end of the axis has a fixed bearing. Motion is given to the reels by a pinion fixed on the end of its axis, being driven by a spur wheel on the main shaft ; by raising the lever, which carries one end of the axis, the pinion would be withdrawn from the spur wheel, and the reel would ne­cessarily cease to revolve. The machine is rendered auto­matic from the raising of the lever being effected by pro­per machinery at the very instant that the reel shall have wound up the length of silk predetermined, and by a de tent locking it out of gear until the attendant shall have time to shift the apparatus which guides the silk to a new space on the reel.

We are sorry that we cannot present our readers with a more minute description of this machine, from the number of drawings which would be required to illustrate it.

Whether the hanks of silk have been reeled in the throw­ing-machine or on the automatic reel, they are afterwards treated in precisely the same manner. When the reels are filled with hanks, they are placed in a steam box, and sub­jected for a time to the action of the steam, to give the twisting of the thread a *set,* as it is termed ; each skein or hank is then tied up separately in two places while yet on the reel, which is then carried to the proper apartment, and the hanks removed from it and bundled up.

The silk may be used without being deprived of its gum, and is termed *hard,* or it may be acted on by soap and water to deprive it of its gum, and reduce it to the soft state. In either of these states it may be put into the hands of the dyer, whose operations succeed those we have described. When the hanks come from the dyer they are again trans­ferred to bobbins ; the hard silk by a winding machine, similar to the one already described, the soft silk by the machine represented in fig. 20.@@, In this machine, in place of the swifts arc sub­stituted the small reels A A, the upper one fixed in position but turning freely on its axis, the lower one also turning free­ly on its axis, which is attached to a le­ver *b*, whose short end carries an ad­justable weight, by means of which the hank of silk can be kept between the reels with the de­gree of tension suit­ed to the strength of the thread. The operation of this machine will be understood from the winding machine al­ready described, the only difference being, that the traverse guide has an equal and not an eccentric motion, so as tp lay the silk regularly from end to end of the bobbin, and not heaped up in the centre as before. The transferring the silk to the bobbins finishes the operation of the silk throw­ster, from whose hands the silk passes into those of the warper, to prepare it for weaving.

The drawings of the machinery, by which we have illus­trated our description of the throwing process, were, for the most part, made from machines constructed by Mr. Joseph Lomas of Glasgow, an engineer who has devoted much of his attention to the machinery used in this particular branch of manufacture.

Having thus traced the silk of the cocoons from its de- velopement to the perfection of the filature, and its adapta­tion for the loom, we will briefly describe the means used for preparing the waste silk for the weaver, in so far as they are peculiar to the silk manufacture.

*Silk Spinning.*

Under this term are included those operations by which floss silk, and the refuse of the throwing process, are, under the name of waste, worked into yarns for coarser uses, such as the manufacture of shawls, Bandana handkerchiefs, and similar textures.

When received by the silk spinner, the waste is in the form of small balls of entangled filaments. These, as a pre­paratory step, he assorts in parcels according to their qua­lity, and these different qualities are of course kept separate throughout the processes ; after being assorted, the waste is hackled on a hand hackle, to disentangle the filaments, the instrument and manner of operating being the same as in flax-dressing. When, by the hackling process, the fila­ments of a quantity of the waste have, to a certain extent, been disentangled, they are ready for the *filling engine,* which is a kind of hackling machine, whose effect is, in a greater degree, to disentangle the filaments, and in some measure to lay them parallel.

The essential parts of this machine are sketched in fig. 21 : *a a* is a feeding board, over the surface of which a tra­velling belt moves in the direction of the arrows, and carries forward to the feeding rollers *bb,* the hackled waste, which is laid on it. These rollers are fluted and move very slowly ; between them the filaments from the feeding board enter, and are held fast, and at the same time drawn forward into the machine As the ends of the filaments come to the other side of the rollers, they are acted upon by a series of iron teeth *c c,* fixed to an endless belt which revolves with a very quick motion in the direction of the arrows, and the teeth are consequently made to pass many times through the same portion of the filaments, clearing and disentang­ling them as they are slowly yielded by the feeding rollers; and as the ends of the successive portions of filaments cease to be held by the rollers, they are caught up by the teeth and carried round with them. Beneath the combs, as the travelling teeth are termed, a board *d* is fixed, having at in­tervals, along its surface, sets of teeth similar to the combs. When the filaments carried round by the travelling combs happen to fall off, they are caught on the fixed combs of the boards, and the regularity of their arrangement is not disturb­ed. When the combs, by repeated gleanings from the rollers, have become filled, the workman, with a pair of boards called *clutches,* removes from them, and from the teeth of the hori­zontal boards, their accumulation of filaments; these he car­ries to the next machine, called the *dressing frame,* which, like the filling engine, operates on the principle of combing. In this, however, the filaments are not gradually brought for­

@@@\* In England, throwsters rarely if ever wind the soft silk, this duty devolving upon the manufacturer ; but in Scotland, manufacturers being seldom provided with the requisite machinery, soft-silk winding is usually a part of the business of the throwster.