

These rolls, slivers, or cardings are taken up, one by one, from the apron of the carding-machine, by a boy or girl, and removed to another machine close by, called the slubbing-machine, or the slubbing-billy, where they are joined end to end in a continuous cord, called a slubbing. As the slubbing-billy was at one time the cause of much undeserved reproach against the factory system, we will illustrate its mode of action by a cut. (See p. 388.)

AA is a wooden frame, by which the other parts of the machine are supported. A moveable carriage DD runs from end to end of the frame, on small wheels, 1, 2. F is a hollow cylinder of tin-plate, about six inches in diameter; and it receives a rapid rotatory motion from a band and pulley in connection with the wheel E; the spinner stands at Q, and turns the wheel with his right hand, by means of a winch attached to the axle. When the cylinder F is rotating by these means, it communicates a still more rapid rotation to a number of steel spindles, 3, 3, set upright in a frame, by means of separate cords passed round the pulley or whorl of each spindle. B is an endless apron, on which a boy or girl places the cardings or long rolls of wool, side by side. The spinner, or 'slubber,' stands behind the moveable carriage, pushes it onward to the other end of the machine with his right hand, and then fastens the end of each carding to a spindle, there being as many cardings as spindles. The ends of the cardings pass under a roller C, and through the opening of a wooden clasp G. The spinner draws the carriage back about eight inches, carrying with it eight inches in length of every carding. By the action of a wheel, 5, connected with the carriage, on a lever and pin, 6, 7, connected with the frame, the clasp G is made to grasp firmly the several cardings, so that no more than the eight inches can be drawn out. The spinner then recedes to the end of the machine, drawing the spindle-carriage with him, and stretching out the eight inches of every carding nearly to the full length of the machine. As he recedes, he turns the wheel E with his right hand, and the rapid rotation which he thus gives to the spindles imparts a twist to the elongated cardings, thus giving them the first approach to the thread form. When this elongation and twisting are completed, the carding (now called slubbing) is made to wind conically on the spindles, by means of a moveable wire, 8, connected with a bar, 4. When this is done, the slubber moves the carriage to the other end of the machine, draws out eight inches more in length of each carding, and, by drawing the carriage back again, elongates those portions to the extent of several feet, and so on continuously. The reader will appreciate the action of this machine by remembering, first, that little rolls of wool, about half an inch in diameter, that eight inches in length of each roll are drawn out to the extent of several feet, and slightly twisted; thirdly, that this continuous thread, or slubbing, is wound on spindles, which, when filled, are replaced by empty ones.

We have now to state that, although the cardings are only twenty-eight inches in length, the slubbing produced from them is continuous. This is effected by the boy or girl who attends the machine, and who, while laying the cardings on the endless apron, slightly unites the ends of one set to those of the set which follows; and as there are from fifty to a hundred spindles in each machine, the attendant must keep up a supply of cardings for all of them, just as fast as the slubber can spin them. Generally speaking, four attendants, called 'pieceners,' are required to supply the cardings as fast as the slubber can work them. Unjust and cruel treatment towards these children was the cause, some years ago, of a great outcry against the factory system. The slubber was engaged at 'piece' work, and could work or not, as he pleased; if he chose to be idle for half an hour or an hour, a great accumulation of cardings from the carding-engine resulted, which the children were obliged to lay in heaps on the floor. When the man returned to his work, he

HISTORY OF A COAT.—No. III.

[Continued from No. 544.]

IN our last paper on this subject we traced the processes through which short-stapled wool passes from the time it leaves the back of the sheep till it assumes the form of long cylindrical rolls about the thickness of the finger.

endeavoured to make up for lost time by redoubled exertions, the consequence of which was that the children could not lay the cardings on the endless apron so fast as he could use them; hence followed blows and cruel treatment, in which the 'billy-roller' (marked C in the cut) was often used as an instrument of punishment. It was proved before the Factory Commissioners that the master manufacturers totally discountenanced, as far as they could, this harsh and unjust mode of treatment; and so far from being a proof of the cruelty of the factory system, it proves just the reverse, since, if the movement of these machines depended on the steam-power which moves the carding-machine, instead of on the caprice of the workman, the irregular and unequal labours of the children would become regular and systematic, and each one would know precisely how much he or she had to do in a given time. This circumstance has been so strongly felt, that attempts have been, and, we believe, are being made, to connect the slubbing-machine with the carding-engine in such a manner that steam-power shall effect both operations.

When the wool has been brought to the state of slubbing, it is a loose kind of worsted thread, but with scarcely coherent strength enough to hold together. To reduce it still more in thickness, to twist it, and to make it tolerably hard and strong, are the objects of the next process—spinning. This process has already been described, in connection with the cotton manufacture;* and as it differs but very little, whatever be the material employed, a few words will suffice respecting the spinning of wool. There are two kinds of machines employed in spinning, viz. the jenny and the mule; but in each one the slubbing is held fast at one end, while the other, being attached to a moveable carriage or frame, is stretched or drawn out; while, from the rapid rotation of the spindles to which the wool is attached, the yarn becomes very much twisted, and thus considerable strength is imparted to it. Spinning is, in fact, a repetition of the process of slubbing; in the last-mentioned process, the cardings are elongated, and have just such a degree of twist given to them as will enable them to bear the strain without breaking; those slubbings which are destined to form the warp of the cloth being more twisted than those intended for the weft. In spinning, the slubbings are drawn out to about three times their former length, and a degree of twist is given to them proportionate to the purpose to which they are to be applied.

The materials for our coat are now in the form of yarn, or woollen thread (not worsted, as this is made of long wool, and has nothing to do with our present subject). The fibres of this woollen yarn are not so straight and regular as those of cotton yarn, since the former are purposely left somewhat entangled, in order to facilitate the process of felting or fulling. The yarn has now to be woven into cloth, and here again we may observe that the different material employed does not render the process very different from that of cotton-weaving. We will therefore refer to vol. ix., p. 45, for a few details respecting cotton-weaving, and here merely notice the points in which wool requires a modification of the process. Broad-cloths are sometimes woven to the width of twelve quarters, and must therefore require a very large number of warp-threads laid parallel to one another. This arranging of the threads is called warping, and is effected by means of a machine called the warping-mill. Continuous threads, about sixty yards in length, are wound regularly, and side by side, round a large reel. After a little subsequent cleansing and dressing, the yarn is wound on the warp-beam attached to the loom, and the process of weaving commences. Three thousand threads, laid side by side, for the warp, will make a piece of cloth about one hundred inches wide; and each thread, which is sixty-five yards in length at the commencement, contracts to about sixty-two during the process of weaving. The yarn which is to form the

weft, or cross-threads, is of a somewhat different quality from that forming the warp; it is wound from the spindles of the spinning-machine on to the pirn or bobbin of the shuttle, one pound of weft being required for about a yard of cloth one hundred inches in width. In weaving woollen cloths, a few threads of coarse and strong yarn are laid at the edges; these form what is called list, and are intended to afford a firm hold for some hooks by which the cloth is stretched during a subsequent process; this list is considered as waste material when the cloth comes to be cut up for use. We must here remark that the use of such enormous widths as twelve quarters (three yards) is owing to the shrinkage occasioned by the subsequent fulling process: cloth which is twelve quarters in width when it leaves the loom, is but little more than six quarters when ready for sale.

In the manufacture of cotton, silk, or linen, when the weaving is finished, the range of processes has approached nearly to an end; but in the woollen manufacture the case is far otherwise; that peculiar texture which we call the nap or pile requires many nice processes for its production. The appearance of the cloth when it leaves the loom may be easily conceived; all the threads are visible, but they have a more hairy or fibrous appearance than those of cotton, silk, or linen; and these fibres, still further loosened and worked up, subsequently form the nap or pile, after the various processes of scouring, fulling, tentering, burling, milling, teasing, shearing, &c.

As a considerable quantity of oil is used with the wool in the early part of the manufacture, this oil must be removed after the weaving by the processes of scouring and fulling. The cloth is steeped for three or four hours in an alkaline mixture, and then removed to the fulling-mill, where it is beaten for two hours. The cloth is put into a kind of trough, and two fulling-stocks (which are large wooden hammers) continually beat against the cloth, turning it over and over in various directions. The handles of the hammers are several feet in length, and are fixed in an inclined position, so that, by the action of steam or of a water-wheel, the mallets or stocks fall with great force against the cloth. A constant supply of water is flowing through the mill, carrying with it the grease and other impurities. Sometimes soap is employed to assist the removal of the grease; but, whatever be the detergent employed, the cloth is afterwards fulling a second time in clear water. This series of tossing, rubbing, and beating for three hours, has the effect of removing all the grease, and of partially felting the cloth, that is, its appearance is midway between that of a woven tissue and of a felted cloth.

The next process is that of tentering, or stretching the pieces of cloth in the open air. The tenter-frames consist of a number of vertical posts fixed in the ground, with a continuous horizontal rail fixed on their tops. Other horizontal rails are fitted between the upright posts, in such a manner as to slide freely up and down, and can be fixed at any distance beneath the upper rail by means of holes and pins. Tenter-hooks are driven into the upper and lower horizontal rails, and on these the list of the cloth is fastened; by lowering the bottom rail, the cloth is stretched to its full extent, and is then secured by pins. Here the cloth is left, exposed to a free circulation of air, until dry.

The process of burling succeeds that of tentering, and consists in a minute inspection of every part, in order that all knots and uneven threads, or extraneous matters, may be removed; any rents or defects which may be found, are repaired by introducing fresh threads. No such process as this occurs in the cotton manufacture, for two reasons: first, there is no beating process, such as the fulling of woollen cloth, which is very likely to produce holes and defects; and, secondly, there would be no means of hiding the mended places. In the cloth manufacture, the milling operation, which follows the burling, entangles

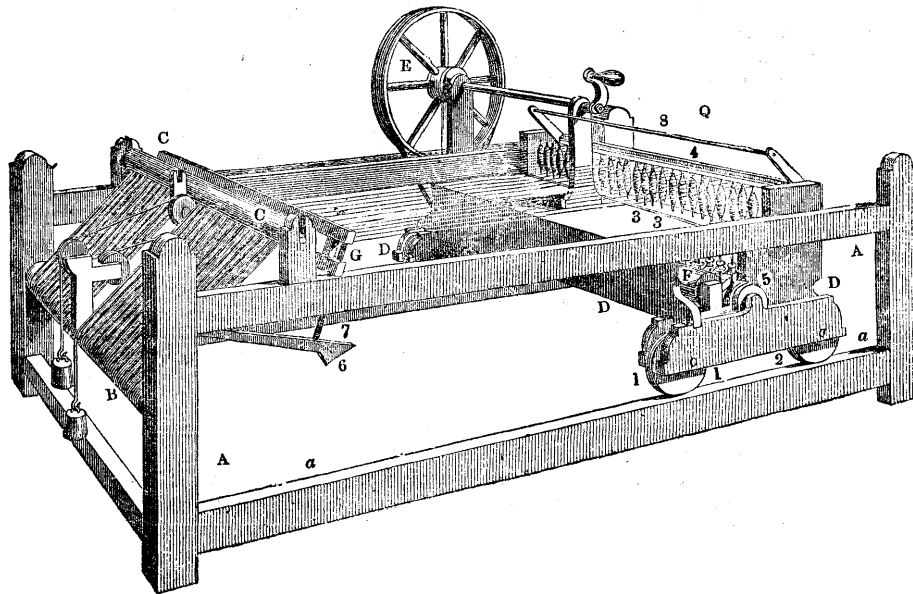
* 'Penny Magazine,' vol. v., p. 268

the fibres of the repaired spots in such a manner as to conceal the defects and give the whole a uniform appearance. In the operation of burling, the cloth is spread out flat, and the burlers, generally young women, inspect it and make the necessary repairs. A machine, called *épincéteuse*, has been partially employed for this purpose in France.

The various operatives who have been employed on the wool up to the present stage are the following:—wool-sorters, who separate the wool into different degrees of fineness, to be applied to different purposes; pickers, who remove the rough impurities by hand; winnowers, who tend the winnowing-machine, where the locks of wool are separated and loosened, and the dust removed from them;

scribblers, who arrange the wool in a light, thin, fleecy sheet; carders, who separate this sheet into rolls about half an inch thick and two feet and a half in length; pieceners, who join these rolls or cards end to end; slubbers, who elongate the cards into thin continuous slubbings; spinners, who still further elongate the wool and convert it into yarn; warpers, who arrange the yarn in parallel layers, to form the warp; sizers, who coat the warp-thread with a layer of size or paste; weavers, who weave the warp and weft into cloth; scourers, who remove the oil, &c. from the woven cloth; tenterers, who hang the cloth on the tenter-frame; and burlers, who examine the dried cloth and repair defects.

[To be continued.]



[The Slubbing-Billy.]