

HISTORY OF A COAT.—No. II.

[Continued from No. 539.]

ALTHOUGH there are many species of animals whose wool is susceptible, in some degree, of the process of felting, yet sheep's wool is the species almost universally employed in the production of what are termed woollen fabrics; so that the details relating to the woollen trade and manufacture in England are to be deemed as applying to the wool of the sheep.

It will be desirable to explain what is meant by *felting*, before we proceed to the detail of the cloth manufacture. If we inspect a piece of good broad-cloth, we perceive that it presents a texture strikingly different from that of linen or cotton: a slight downy appearance, called the *nap* or *pile*, so completely conceals the threads, that it is by no means apparent that the cloth is woven at the loom. Yet the manufacture, up to a certain point, very much resembles that of linen or cotton, and the change takes place when, after the weaving, the minute fibres of the woven threads are worked up by a species of friction, and then matted or twisted together into that particular state constituting the nap. Now this could not be done unless the fibres had the property of curling and interlacing among each other; but among the various fibrous substances which the animal and vegetable kingdoms yield, sheep's wool is one of the few which possess this property. This peculiarity has been known for ages; but its cause has only been recently discovered. The Tartars are accustomed to place a layer of moistened wool on the ground, and then to beat and press it until the fibres interlock among each other so as to form a continuous substance, which serves them as a carpet, or as a covering for their tents. A somewhat similar plan was practised in the Isle of Skye when Pennant visited it about sixty years ago: a number of women seated themselves on a bench, and felted a quantity of wool by rubbing and beating, first with the hands, and then with the naked feet. That a tolerably firm fabric may be produced by these means is proved from the fact that the felt of which the foundations of beaver hats are made is produced nearly in the same way, that is, by working moistened wool with the hand. After wool has been spun into thread, and then woven into cloth, it still retains the felting property; so that if the fine fibres can be worked up from the thread in a series of points, and then rubbed or pressed backwards and forwards, they will unite and form a kind of felted envelope to the woven threads; the working-up of the fibres is effected by the process of *teazling*, and the rubbing or felting by that of *fulling*, both of which we shall hereafter describe.

Many theories have been formed respecting the felting property of wool: some persons think it is due to the attraction of cohesion; others attribute it to the bending of the fibres by the beating with the fulling-hammer; but M. Monge, a French chemist, supposed that there were projecting filaments or serrations on the surface of each fibre, and that the serrations of adjoining fibres locked or fastened into each other. Experiments were therefore made with the microscope, in order to detect the existence of any irregularities in the surface of the fibres; but all these experiments were unsuccessful, until the year 1835, when Mr. Youatt succeeded in demonstrating the existence of the tooth-like projections. With a magnifying power of three hundred (linear), he found that a fibre of Merino wool appeared of a pearly grey colour, darker towards the centre, and having faint lines across it; that the edges were evidently hooked, or rather serrated, like the teeth of a saw; that the fibre was one seven-hundred-and-fiftieth of an inch in diameter; and that there were about two thousand four hundred serrations, or teeth, in a longitudinal inch. It was found that different qualities of wool had different numbers of serrations in a given length; and there is the strongest reason for believing that the felting property of different qualities depends principally on this

difference of number. It will not be difficult for the reader to conceive how the serrated texture of the fibres enables them to lock or cling together by rubbing or beating. We will therefore here quit this part of the subject, referring to 'Penny Magazine,' vol. viii., p. 202, for further details.

There are, in former volumes of this work,* several articles which, taken collectively, will convey a sufficient idea of the species of sheep most fitted for producing fine wool, of the management of the large flocks of Merino sheep in Spain, and of the process of shearing, as performed both in Spain and in England. We will therefore take up the subject from this last-mentioned point, and suppose the wool to have been transferred from the sheep-proprietor to the wool-stapler or dealer.

Wool is distinguished as long or short. Long wool, called also *combing-wool*, varies from three to ten inches in length in the fibre; it is combed out into horizontal fibres, and then worked up into hosiery, waistcoating, carpets, bombazeens, crapes, poplins, &c. Short-stapled or cloth wool varies in length from three to four inches, and is used for broad-cloth, such as is employed for the making of a coat; the latter kind is therefore that to which our attention is here directed. The sheep, in its natural state, secretes a kind of grease or yolk, formed of potash and an oil, which remains in the fleece; this grease serves, with the aid of water, to form a kind of sud or lather, by which the wool is cleansed before it is sold. In some breeds of sheep the washing takes place before the shearing, cold water being employed; but where the fleece is thick, the wool is first sheared, and then washed in warm water. So much grease and other impurities are contained in the fleece, that it loses more than one-third of its weight by washing. The wool is sometimes washed a second time, in order to free it as much as possible from grease and dirt. We may here observe that the price of wool varies, according to its quality, from 1s. 6d. to 8s. per pound, and that the weight of a fleece varies from two to eight or nine pounds, the short-stapled fleeces being the smallest in weight.

When the wool is brought to the factory, it is further cleansed in a machine, called by the various names of the wool-mill, the willy, the willow, or the devil. The object of this process is to disentangle the fibres one from another, and to cleanse them from sand and other loose impurities; and the mode of affecting it has varied according as new modes of applying machinery have been adopted. One description of the willow is as follows:—A hollow cylinder or drum, about three feet long and two and a half feet in diameter, has five small rollers working on its circumference and parallel to its axis; and the surfaces of the rollers, as well as of the cylinder, are covered with teeth or spikes. The whole of these revolve on their axes, a case or box encloses them, and a quantity of raw wool is put in at an opening in this box. By the rapid rotation of the cylinder and the rollers, the wool is dragged from tooth to tooth, by which it is opened, the longer fibres broken, and the sandy impurities separated. After a certain number of revolutions, a door is opened at the lower part of the machine, and the cleansed wool is thrown out by the centrifugal force of the cylinder. Another supply is then put in, and the same process is repeated. More recently a willowing-machine has been introduced, by which the process is performed more conveniently; the wool is placed on a continuous travelling apron near the upper end of the machine; it is from thence drawn into the smaller end of a conical barrel, and by the revolution of this barrel is gradually forced towards the larger end, in obedience to the well-known effect of centrifugal force. The exterior of the cone and the interior of the case in which it is held are studded with pins, and the wool, being caught between these pins, is disentangled and cleansed in the way before alluded to. When it is cleansed, the wool

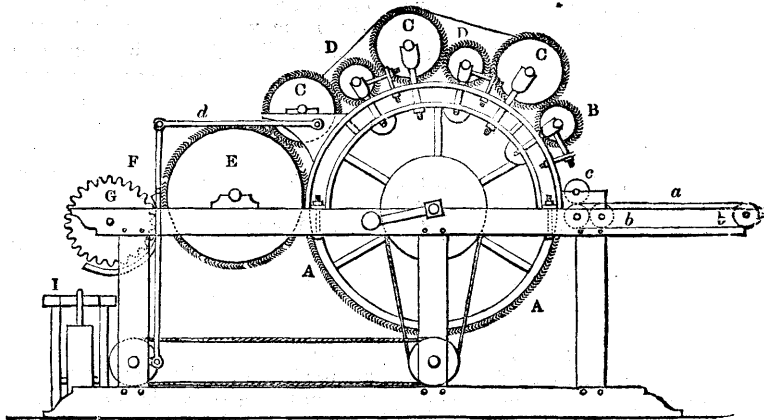
* Vol. i., p. 123; vol.

is thrown out on another endless apron; and at the same time a fan or blowing-apparatus is so arranged as to extract almost every particle of dust from the wool. Where the machine is of a less perfect construction, coarse wool is sometimes passed through the willow twice or thrice; it will, however, be sufficient for the reader to understand that in whatever way the process of willowing be performed, its object is to disentangle, in some degree, the fibres of the wool, and to separate from them any loose impurities.

The fibres are thrown together, by the process just described, in a confused and disorderly manner; the next process is intended, therefore, to arrange them in a broad thin fleece or lap. This process is called scribbling, and is effected by the scribbling-machine, which consists of a large central cylinder, having smaller ones on the exterior surface. These cylindrical surfaces are covered, not with pins, as in the willowing-machine, but with bent wires, similar to those employed in the carding-engine. The larger cylinder rotates with great velocity; its surface is covered with wool, which is laid pretty evenly upon it; and the wires on the smaller cylinder (called workers and clearers) catch the fibres, a few at a time, from off the wires of the larger one, and thus obtain a layer of fibres, much more light, open, and regular than that which covers the larger cylinder. After the wool has passed between three

or four pairs of workers and clearers, it is taken up on the surface of another cylinder, called the doffer, and from this it is removed by a sort of comb, which yields it in the form of a continuous fleece. The smaller cylinders are arranged in pairs round the larger one, in such a manner that the workers take the fibres off the larger cylinder, the clearers take them from the workers, and the doffer finally removes them from the clearers. This operation is performed once, twice, or three times, according to circumstances. The arrangement of the scribbling-machine will be better understood from an engraving of the wool-carding engine, which it somewhat represents, so far as regards the bent wires fixed on the surfaces of the various cylinders.

The scribbling-machine leaves the wool in the form of a broad thin fleece or lap; and in order to carry it one more stage towards spinning, the fleece must be separated into narrow and tolerably regular bands or slivers. This is done by the process of carding, in which important improvements have been made of late years; for the carding of wool, like that of cotton, used to be effected by hand-cards, that is, pieces of wood with bent wires fastened into their flat surfaces. From that primitive form many deviations were gradually made, and the wool-carding engine at length assumed the form represented in the annexed cut. This cut presents a section at right angles to the



axes of the cylinders. The wool is laid by hand, as evenly as possible, on an endless apron (a), stretched round two rollers (bb); by the rotation of the cloth apron the wool is introduced between the feed-rollers (c), and from thence passes to the surface of a large cylinder (A), whose surface is covered with cards or bent wires (to prevent confusion in the cut, only the lower half of these wires is represented). The wool is then transferred to and fro in a singular manner; first from the great cylinder to one of the workers (C), then from the worker to the adjoining clearer (D), and from thence again to the larger cylinder (A). Every worker and every clearer is supplied with wire teeth, so that the filaments of wool become separated and drawn out, by being repeatedly drawn from the teeth of one cylinder to those of another, during nine or ten transfers. The cylinder marked E is called the doffer, and strips off the carded wool from the large cylinder. F is a vertical steel comb, which has a motion of such a kind imparted to it that it strips the thin fleecy web of wool from off the doffer. In the scribbling-machine the fleece is wound continuously on a revolving roller; but in the carding-machine the wires are so arranged on the surfaces of the cylinders as to separate the fleece into strips a few inches in width; and after these strips have been removed from the doffer by the steel comb, they are caught in the grooves of a fluted cylinder (G), which is partly enclosed in a concave case. The effect of this is, that the narrow bands of fleece assume the form of cylindrical rolls, which

fall on an endless cloth connected with the apparatus (I) beneath the fluted roller.

In allusion to the effect of this process, Dr. Ure observes, "Carding opens up and separates the woolly filaments; renders the fleece lighter and more equable and homogeneous; it occasionally breaks the fibres in disentangling their connections, multiplies their fibres, and, by giving them a bristling and downy texture, renders them more disposed to agglomerate in the fulling process. By carding, wool expands greatly in its dimensions; the short broken filaments get crossed in every possible direction, and are ready to lay hold of one another, constituting the most favourable condition for being fullled. As the fibres of wool are more tortuous, elastic, and stiff than those of cotton, they require in their carding-apparatus not merely a main cylinder with card-teeth, but a series of smaller ones riding upon and embracing it, for alternately taking off and returning the wool, so as to open it sufficiently without breaking it to pieces, and to lay the fibres at every imaginable angle to each other."

The state in which we here leave the wool on which we are engaged, is that of a light and delicate roll, about twenty-eight inches in length and half an inch in thickness.

[To be continued.]