cording to the colours, from 10d. to ls. 6d. per lb. ; that is, 10d. to ls. for woaded medleys, 1s. to 1s. 2d. for wool- dyed blacks, and ls. 2d. to ls. 6d. for blues. Piece-dyed cloths are sent to the dyeing-house after fulling and scour­ing (see Dyeing).

Delivered at the mill :—the wool (dyed or undyed, as the case may be) is now submitted to the first of a series of machines, ali of them admirably adapted to perform their respective parts in the production of the woven fabric. This first machine is called the willy or the shakewilly in Yorkshire, and the twilly in Gloucestershire. Both seem to be a corrupt mode of pronouncing the willow of the cotton manufacture (as the Scotish call window windy) ; and even willow is probably a corruption of winnow, *win­nowing* the wool being really the office it performs.

There are various kinds of willying machines in use, but the best appears to be the conical willy, made by Mr Lilly of Manchester. It was first applied to the cleansing of cot­ton ; but it has been tried in Leeds with success, and, we believe, is now used to a considerable extent.

The willy consists of a revolving cone, armed with four rows of iron spikes, strongly fixed to four longitudinal bars, which being fastened to three concentric wheels of different diameters, the common axis of which forms the shaft of the machine, the conical form thereof is at once accounted for. This cone revolves at the rate of from 300 to 500 revolutions per minute, within a casing cylinder, armed with similar spikes, but placed so as to alternate with the spikes on the cone. At the small end of the cone is a concentric covering of thin sheet-iron, and at the large end is a gridiron plate.

The machine is fed by means of an endless apron, the wool entering at the smaller end, so that when most en­tangled it is subjected to the least motion. This apron is a great improvement on former machines, which were filled by hand ; an operation attended with danger, and some­times resulting in accidents. By the revolutions of the cylinder, the wool is torn, disentangled, and cleansed ; and by the gradually increasing centrifugal force, it is impelled forwards towards the large end of the cone, encountering in its way increased motion; which, however, it is the bet­ter able to bear, by becoming less and less entangled at every' revolution.

When the wool thus reaches the base of the cone, it is tossed into a chamber, where it is received upon another endless apron, moving in a direction from the machine in­stead of towards it. Over this apron is a cylindrical wire cage, which revolves on an axis disposed parallel to the apron, and immediately over it *a* revolving fan. Both these are covered and protected by sheet-iron casings, but communicate with the chamber which receives the wool from the cone. When the whole is at work, the fan, drawing the dust out of the chamber, blows it through a chimney or pipe, connected with the machine for thc purpose. The cage prevents the escape of the wool with the dust, and by its passage over the apron it lays down the wool in a continuous fleece.

The coarser wools, destined for common cloths, are wil- lied more than once ; for instance, before as well as after dyeing, and after oiling and before being scribbled. The finer wools do not however require this, as the operation of scribbling is a sufficient preparation for carding.

In the west of England the wool is beaten with wooden rollers by women, after which it is placed on a wire screen or hurdle, and pulled with the hands, so as to get rid of any burs, or pitch, or other dirt which may not have been separated by the willy. In Yorkshire the wool is picked by a boy, called a wool-moater. If this be not done, the scribbling machine is injured by any lumps of pitch so fre­quently found in wool.

The wool is next oiled for the scribbling machine, three

or four pounds of Gallipoli oil being intimately mingled with twenty pounds of wool. A man can oil about twenty score, that is, 400 lbs., in a day.

The process of scribbling differs but little from that of carding; the only difference being that the machine is coarser, and that the wool is delivered in a continuous fleece instead of narrow bands or slivers. The object of both is further to separate and open out the fibre of the wool, and even to tear it asunder. Both processes should, if successfully performed, equalize the quantity of wool in a given length of cardings. In order that the disentangling and separating of the wool may be as complete as possible before it is moved from the scribbling to the carding en­gine, it is sometimes made to undergo the scribbling pro­cess two or even three times.

In Plate CLXXVII. (Cotton Manufacture) figs. 1, 2, 3, and 4, the carding engine used in the cotton manu­facture is shown ; but the wool-carding engine is some­what different, as it consists of one large cylinder or card­-drum, surmounted by three pairs of smaller cylinders, called urchins, all of them covered with card-cloths armed with carding wires. The smaller cylinders are of unequal size. The larger of the two is called the *worker,* and the smaller the *cleaner,* which revolves at great speed. At one end of the engine is an endless feeding apron, upon which equal portions, by weight, of the oiled wool is evenly spread by hand. This apron, by its motion *towards* the engine, de­livers the wool through a pair of *feed-rollers,* which distri­bute it upon the card-drum. From this the wool is gra­dually stripped, as it were fibre by fibre, by the first worker, whence it is received by the first cleaner, and by it again deposited in the card-drum. This is twice repeated, so that the disentanglement and separation of the fibre be­comes more and more complete. When it has passed over the last cylinder on to the drum, it is taken from it by a cylinder somewhat larger than the workers, and called a doffer ; from which again the wool is scraped off by a *dof­fing knife,* which moves rapidly up and down by means of a crank, so that it scrapes the doffer downwards only. In the scribbling process, the wool is wound round a revolving roller, in an endless fleece, having the appearance of a fine blanket. But the carding engines differ from the scrib­bling machines in the mode in which the doffer is armed, and in the contrivance for receiving the wool from the doffer. The doffer, instead of being uniformly covered with wires, is merely armed with a succession of card-lea­thers, arranged in longitudinal bands parallel with the axis of the doffer. The effect of this is, that the doffing-knife detaches the wool from the doffer, in the shape of bands or slivers. These, instead of being wound round a roller, fall into the flutes of a fluted cylinder ; and as half of this cy­linder is covered with a case, called a shell, near enough to the cylinder to touch the slivers as they lie in the flutes or grooves, they are rolled into what are called *cardings,* and are received upon an apron moving in a direction *from* the engine.

The several cylinders move at different velocities, not merely in relation to their surface, but in the relative num­ber of revolutions which they perform in a given time. The card-drum is usually three feet in diameter, and makes one hundred revolutions in a minute. The workers are about eight inches in diameter, and make only ten revolu­tions in a minute ; hence the surface of the drum moves forty-five times as fast as the workers. Their surfaces move in the same direction.

The cleaners revolve in the contrary direction, and they card the wool on the drum as well as on the workers. They move very rapidly, namely, 300 revolutions in a minute ; but as they are only one ninth of the diameter of the drum, their surface has only one third of the velocity of the sur­face of the drum.