CLOTH, WOOLLEN.

CLOTH, *n. s.*
CLOTHES, *plural.*
CLOTHE, *v. a.* & *n.*
CLO'THIER, *n. s.*
CLO'THING, *n. s.*
CLOTH-SHEARER, *n. s.*
CLOTH-PRESSING, *n. s.*
CLOTH-WORKER, *n. s.*

Ang.-Sax. clad, clæth. That which is woven, and now applied to any woven texture of whatever substance. The singular is applied to denominate the article as it comes out of the hands of the manufacturer. The plural is usually applied to the same article made into garments; and to garments in general: hence to whatever is used for covering and protection from outward injuries and unsightly nakedness. The different agents whose cognomen we have given are employed in the primary process of manufacturing and preparing the material; but not in the after process of forming it into apparel. To clothe is to invest, to adorn with dress, to furnish, provide with clothes, to cover.

Better it is to cast away thin here, than to cast away the swetenesse of our Lord Jesu Crist, and therefore sayth Saint Poule, *clothe* you—as they that ben chosen of God in herte, of misericorde debonairtee, and swiche maner of *clothing* of which Jesu Crist is more plesed than with the heres or habergeons. *Chaucer. The Persones Tale.*

The third had of their wardrobe custody,
In which were not rich tyres, nor garments gay,
The plumes of pride and winges of vanity,
But *clothes* meet to keep keene cold away,
And naked nature seemely to aray;
With which bare wretched wights he daily clad,
The images of God in earthly clay;
And, if that no spare *clothes* to give he had,
His owne cote he would cut, and it distribute glad.
Spenser.

He with him brought Preyne, rich arrayed
In Claribellae's *clothes*. *Id.*

Take up these *clothes* here quickly; carry them to the laundress in Datchet mead. *Shakspeare.*

I answer you right painted *cloth*, from whence you have studied your questions. *Id.*

Who fears a sentence, or an old man's saw,
Shall by a painted *cloth* be kept in awe. *Id.*
Care no more to *clothe* and eat. *Id. Cymbeline.*

The *clothiers* all, not able to maintain
The many to them 'longing, have put off
The spinsters, carders, fullers, weavers.
Id. Henry VIII.

My father is a poor man, and by his occupation a *cloth-shearer*. *Hakewill on Providence.*

The king stood up under his *cloth* of state, took the sword from the protector, and dubbed the Lord Mayor of London knight. *Sir John Hayward.*

I'll make the very green *cloth* to look blue.
Ben Jonson.

If thou beest he; but O how fallen! how changed
From him, who in the happy realms of light,
Clothed with transcendant brightness, did'st outshine
Myriads though bright! *Milton.*

At length by wonderful impulse of fate
The people call him home to help the state,
And, what is more, they send him money too,
And *cloath* him from head to foot anew. *Marvell.*

A costly *cloth* of gold. *Drayton.*

The Spaniards buy their linen *cloths* in that kingdom. *Swift.*

Your bread and *clothing*, and every necessary of life, entirely depend upon it. *Id.*

They leave the shady realms of night,
And *clothed* in bodies, breathe your upper light.
Dryden.

Gazing on her midnight foes,
She turned each way her frighted head,
Then sunk it deep beneath the *clothes*. *Prior.*

Let both use the clearest language in which they can *clothe* their thoughts. *Watts on the Mind.*

Nor let, like Nævious, every error pass;
The musty wine, foul *cloth*, or greasy glass. *Pope.*

Embroidered purple *clothes* the golden beds.
Pope's Statius.

True Witney broad-*cloth* with its shag unshorn,
Unpierced, is in the lasting tempest worn. *Gay.*

With superior boon may your rich soil
Exuberant nature's better blessings pour
O'er every land, the naked nations *clothe*,
And be the exhaustless granary of a world.
Thomson.

Who toils for nations may be poor indeed,
But free, who sweats for monarchs is no more
Than the gilt chamberlain, who *clothed* and fee'd,
Stands sleek and slavish, bowing at his door. *Byron.*

CLOTH is a cotton, linen, or woollen manufacture. That, indeed, which, among the inhabitants of Otaheite, and other barbarous people, is made of the barks of trees, has been sometimes treated under this term; but it has already engaged our attention sufficiently under the word BARK, which see. On the other hand, hair, silk, and the ductile and precious metals of silver and gold have been, in highly civilised countries, wrought into cloth.

But the three divisions of this extensive species of manufacture, which we have named, will embrace its principal and more common application. For HAIR-CLOTH, see that article; for cloth made of silk, see SILK MANUFACTURE; and for cloth of gold and silver, see TISSUE.

Cotton, linen, and woollen cloths, alike undergo three common processes from the raw material, to the complete and finished piece of goods. 1. They are prepared in various ways until they form yarn. 2. They are woven into cloth; and 3. They are bleached, dyed, printed, glazed, &c. to various stages of beauty and perfection. Under the names of the respective materials, COTTON, FLAX, and SILK, will the very distinct methods of preparing those materials be treated. Our attention in this article will be directed to the different operations by which our staple manufacture of woollen cloth is conducted after the sorting of the wool, for which see WOOL; and, with the exception of WEAVING, (an operation sufficiently important to require a distinct article) this finally receiving the name of *cloth*, in distinction from linen, cotton, and silk goods.

Cloths are of various qualities, fine and coarse. The following general criteria of the goodness of cloth, have been often given, viz. 1. That the

wool be of a good quality, and well dressed. 2. It must be equally spun, carefully observing that the thread of the warp be finer and better twisted than that of the woof. 3. The cloth must be well wrought, and beaten on the loom, so as to be everywhere equally compact. 4. The wool must not be finer at one end of the piece than the rest. 5. The lists must be sufficiently strong, of the same length with the stuff, and must consist of good wool, hair or ostrich feathers; or, what is still better, of Danish dog's hair. 6. The cloth must be free from knots and other imperfections. 7. It must be well scoured with fullers' earth, well fulled with the best white soap, and afterwards washed in clear water. 8. The hair or nap must be well drawn out with the feazel, without being too much opened. 9. It must be shorn close without making it thread-bare. 10. It must be well dried. 11. It must be tenter-stretched to force it to its just dimensions. 12. It must be pressed cold, not hot-pressed, the latter being very injurious to fine woollen cloth.

This manufacture we shall now more particularly consider in its processes. 1. Of preparing the wool, after it has been sorted for the weaver. 2. Of finishing the cloth after it is taken from the loom.

1. *Of preparing the wool after it has been sorted.*—The best wools for the manufacturing of white cloth, intended for dyeing, are those of England and Spain. Spanish wool, as it arrives in this country, has generally some part of the marking pitch still adhering to it in the bale, which must be carefully cut or picked off; and it is frequently so hardly pressed together in the bag, that it requires to be opened out by beating. Until recently it was the practice to beat the wool with rods, in order to shake out the dust and open the staples; but this is now principally done by an opening machine with long coarse teeth, called a devil, or wool-mill, described farther onward. English wool is generally cleaned from pitch marks or other extraneous substances by the wool-sorter, and left by him in a proper condition to commence the process of cloth-making.

In Hampshire, and the west of England, it is now most commonly scoured, by putting it into a furnace containing a liquor composed of three parts of water and one of urine; and after it has been well stirred therein, and the grease it contains dissolved, it is taken out, drained, and washed in running water. In Yorkshire this excellent practice is said to be omitted in regard to wools intended for white cloths; and manufacturers who dye their own wool frequently put it into the dyeing-vat unscoured; a process which, while it enables him to make a greater weight of cloth from his wool, injures the brightness of the colors. It also makes it needful that the oil afterwards used should be increased one-third at least; and gives a general want of cleanliness and comfort to the whole manufacture.

Berthollet states that in this operation, properly conducted, one-fourth of the previous weight of the wool is taken off; and he attributes to the ammonia of the putrefied urine its detergent quality. Vauquelin having analysed the grease, or yolk, as it sometimes is called, thus discharged, found it to consist of

1. A soap, with a basis of potash, which formed its chief parts.
2. Carbonate of potash, in small quantity.
3. A notable quantity of acetate of potash.
4. Lime.
5. A little muriate of potash.
6. An animal matter, which yields its odor.

He thinks the ammonia contained in the putrefied urine not to be conducive to its action, and advises the use of ordinary soap as better fitted to procure the desired whiteness to wools.

When wool is dyed in the fleece, or without being spun, it is now ready to be committed to the dye-furnace; and this is principally the case when it is to be employed for forming cloths of mixed colors; otherwise it is dyed after being spun. But it is most commonly dyed in the form of cloth.

In the making of superfine cloths, in Hampshire, the wool, after dyeing, is again washed, well dried and beaten with rods on wooden hurdles, to free it from the dye-stuff, which still hangs about it; or this effect is produced by putting it into a wool-mill, formed of a four-flapped vane or fan thinly set with iron spikes, and swiftly revolving within a hollow cylinder of small wooden rods or staves; sufficiently wide apart to suffer the dust to fall through, as the wool becomes separated by the motion of the fans. It is now once more carefully picked, in order to take out the locks which are unevenly dyed, and also the lint, and other filth with which wool in this state abounds. In the manufacture of mixed cloths, wool of the different colors, being weighed out in their requisite proportions, are first shaken well together; they are then further mixed, by being well turned in the wool-mill, and, by being afterwards twice passed through the scribbling engine instead of once, they are generally found to be sufficiently intermixed.

The nature of wool, as a species of hair, has been well illustrated by M. Monge in his Observations sur le Mécanisme du Feûtrage, Ann. de Chimie, tom. vi. 'The surface of all these objects,' he observes, 'is formed of rigid plates, superposed or tiled from the root to the point, permitting progressive movement towards the root, and resisting a similar movement towards the point. This conformation is the main cause of the tendency to felting, which the hairs of all animals in general possess.'

But this conformation, it is clear, must be an obstacle to the spinning of wool, and the fabrication of cloth. Their fibres, therefore, are now coated with oil, which, by filling up the cavities, renders their asperity less perceptible in these operations, just as a film of oil is put upon a smooth file when we wish to render it still smoother. For fine cloths, Gallipoli, or olive oil, is principally used: and rape oil for coarse cloths. In still coarser goods, and where color is not an object, fish-oil is sometimes employed; but if the latter remain in the wool or cloth, it is subject to a fermentation injurious to the cloth, and turns it brown. Combustion has even sometimes been known to take place from

it. Some of the Yorkshire manufacturers make use of a mixture of soap and water with oil, which answers, in moist weather, and, if the wool be immediately carded and spun, very well; but the mixture evaporates, if it remain some time unwashed, or the weather become hot.

In oiling, the wool must be sprinkled as evenly as possible. They spread it, for this purpose, on a floor, in Hampshire, beating it in with heavy rods, and use, for superfine cloth, about three pounds of olive oil to twenty pounds of wool. In Yorkshire they reckon six gallons, or a peck, as the proper quantity for fine cloths, and use the wool-mill to assist in its more equal distribution.

This machine consists of a species of cylindrical drum, from three feet, to three feet and a half long, and two and a half to three feet diameter, enclosed with its rollers in a close box or case, in which is a door let down by a hinge. . Its circumference being furnished with teeth or spikes, immediately above are five small rollers, furnished with similar teeth: and the machine is made, it is said, to revolve 300 times in a minute. The teeth of the rollers and those of the drum intersect each other, as they all turn round; and the teeth of the five small rollers also intersect each other. The door being opened, or turned down into a horizontal position, about a pound weight of wool is laid upon it at once, and is brought, by its being closed, within reach of the teeth of the cylinder, which take and carry it upwards, so as to work it between the teeth of the cylinder, and those of the five rollers. This opens and separates the matted fibres. Close below, and fitted to the cylinder, is a grating of wooden rods, through which the dust and dirt are carried off. When the door is re-opened, the cylinder throws out the wool in an instant; but sometimes two doors are placed on opposite sides of the machine; one to receive the raw wool, and the other to discharge it when the operation is finished. Coarse goods are passed through this mill; to break the mats of the raw wool and render it light; a second time after it is dyed; a third time, to mix the different sorts together; and lastly, after they are oiled, to spread the effects as we have stated.

The *scribbler*, a kind of rough carding machine, is now resorted to, to break down the longer fibres, and to lay them straight and parallel. It is the same in principle with the carding machine, hereafter described; and, like the above, consists, 1. Of a large cylindrical drum; but covered on the surface with sheets of leather stuck full of projecting wire-teeth, or card-wires, which, as the cylinder is turned, feed themselves with the wool: 2. Of several other smaller cylinders, called workers and clearers, fixed around the great cylinder in pairs. The wool is taken by the teeth of the workers from the great cylinder, and given to the clearers, which return it again to the great cylinder. It is then transferred to another worker, and by its clearer given back again to the great cylinder, and so on. While the teeth of the different cylinders do not actually touch each other, they revolve so near, that the fibres of the wool which the teeth of one card contains are caught by the teeth of the other card, and drawn out a very few at a time, which renders the wool light and open. 3. When it has passed between three or four pairs of workers and clearers, it is taken up by the *doffer*, a small cylinder, which turns round very slowly. 4. From it the wool is stripped off by a steel comb, which is placed parallel to its axis, and moved rapidly up and down by a crank. The comb, in ascending, does not touch the doffer; but only as it falls down. The successive portions thus combed off, finally hang together in a thin fleece or web; received in a basket from the machine. Scribbling is repeated twice or three times before the wool is completely disentangled and fit for carding, which, as we have stated, is only an improved operation of the same kind.

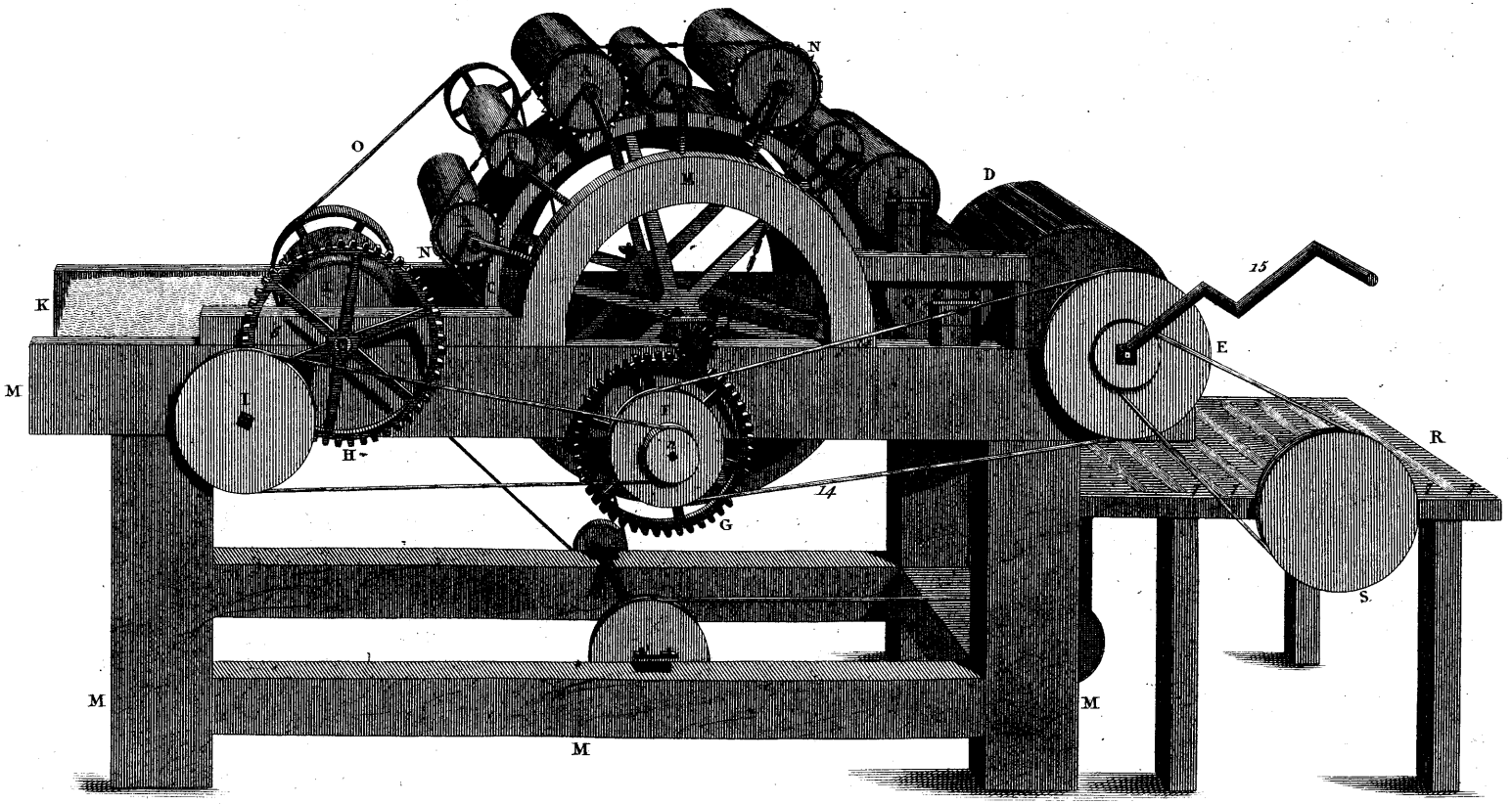
But great attention has been bestowed on the *carding* engine. We shall best illustrate it by the accompanying plate. M, M, M, M is the frame work of the machine which is of wood or cast iron, the arched part receiving the screws, which support the cylinders or workers and clearers fixed round it. The workers A are larger, and turn slower, than the clearers B; but all work against the cards of the great cylinder, and each is worked upon its clearer. C is the large cylinder turned by an endless strap applied upon a pulley at one end of its axis. It performs 100 revolutions per minute, and is from thirty to thirty-six inches in diameter. D is a roll-bowl, as it is called, or a cylinder of wood, fluted shallow, and moved by a pulley E, connected with another endless strap moving round a second pulley F, on the cogged wheel G. The lower hemisphere of this roller-bowl is circumscribed with a fluted shell, to catch the wool that falls from the doffer on the left of it. H is a cog-wheel receiving motion from the pinion of a pulley I, turned by an endless band moving on the central pully of G. This wheel is connected at top with a pinion fixed on the axis of the large cylinder.

The wool having been scribbled is spread upon the feeding-cloth K, an endless sheet stretched over two rollers, on the axis of one of which moves the wheel H. It is taken off the sheet, between a pair of feeding-rollers about two inches and a half diameter within the frame, and clothed with cards laid on in spiral fillets. They are moved by toothed pinions, on the axis of the cloth-roller, rather quicker than the feeding-cloth, and, in the most complete view of the machine we can give, are concealed by other parts of it. These rollers deliver the wool to the cylinder L, about nine inches in diameter, which works against and communicates it to the great cylinder. It is now conveyed to the five workers, and clearers, embraced by the chain N passing under a wheel fixed in G, shown under the frame work, but this chain only moves the three workers A, which revolve once in about four revolutions of the great cylinder.

The clearers both card the wool on the workers, as well as that on the cylinder, and are moved by the band O passing over a wheel eight inches and a half in diameter fixed on the extremity of each of their axes, and communicating with a wheel twenty-two inches in diameter, fixed on that of the great cylinder. The cylinder turns about

CLOTH WOOLLEN.

CARDING ENGINE.



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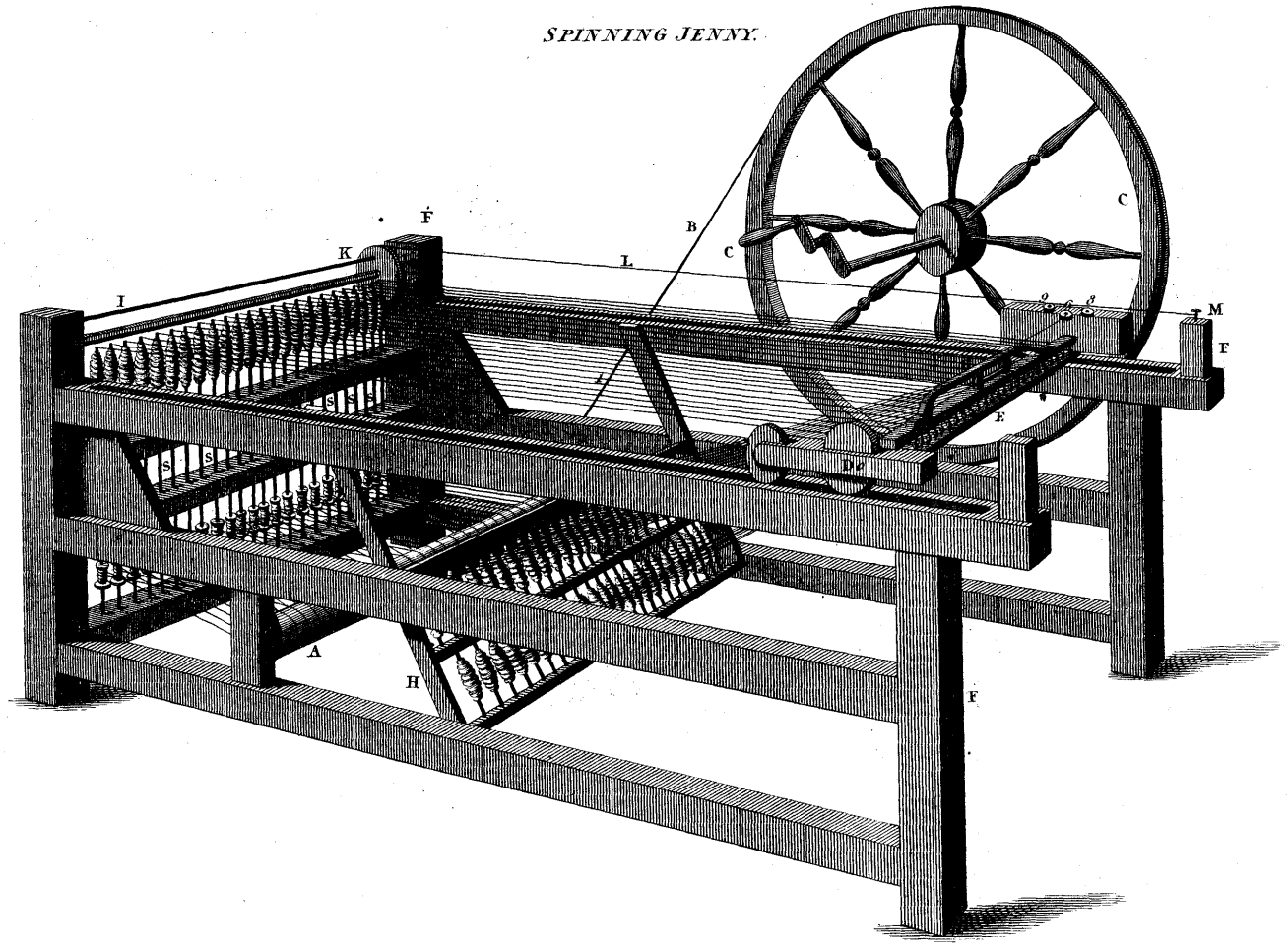
CLOTH WOOLLEN.

SPINNING JENNY.



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three times and a half as fast as they: this same strap moves the currier L. It also turns the fly P, moving the same way as the surface of the great cylinder, but about half as fast again. This fly is designed to raise and lighten the wool on the surface of the cylinder (not to take it off), so that the doffer, which we have already mentioned, Q, may act upon it the more effectually. This is a cylinder of about fourteen inches diameter, covered with cards about four inches wide, and moving round at the slow rate of about one-thirtieth of the pace of the great cylinder: it is turned by a band connected with the axis of the roller-bowl: a comb which works against these cards cannot be seen. It is supported by rods screwed to it at each end, guided by two horizontal levers. The lower ends are jointed on small cranks formed on an horizontal axis at the lower part of the frame, and put into very quick motion by a strap, from a pulley at the bottom. Each revolution of the cranks causes the comb to rise and fall about two inches; when it descends, its edge-teeth act on the surface of the doffer cards, so as to take out the wool and drop it slowly into the shell of the roller-bowl. The revolutions of this bowl within its shell rolls the wool between them into a straight cylindrical shape, called a carding; these cardings are yielded from between the roller-bowl and its shell, upon a flat table R, in portions there exhibited. An endless cloth covers this table. It is stretched over horizontal rollers, and carries the cardings away to the slubbing machine or biley, by means of the motion it receives from the pulley S, which is fixed on the axis of one of the rollers.

The *slubbing machine* is a species of spinning engine performing the preparatory operations of reducing and clensating the cardings, and giving them a slight twist. They are then called rovings or slubbings. This was once accomplished by hand on the common hand spinning-wheel, then machines were invented, by means of which a number of slubbings could be drawn out together; but the aid of hands being required for joining the rolls or cardings of wool, they were found of little service, and have universally given way to the modern machine, which we shall now endeavour to describe.

It is a wooden frame, within which passes to and fro a moveable carriage, containing a number of perpendicular spindles, put into rapid motion by a long cylinder, and a band from a pulley affixed to each spindle. These spindles are placed perpendicularly, in a frame at about four inches from each other; their lower extremities are pointed, and turning in sockets; and the upper half projecting above the frame. On the lower part a small pulley or whirl is fixed, to receive the band from the horizontal cylinder (about six inches in diameter), and a little longer than the row of spindles: it is placed before them with its centre at a lower position than the row of whirls. The cylinder receives motion by a pulley at one end, with an endless band from a wheel, made like the large wheel used in spinning wool by the hand. This wheel is situated at the outside of the frame of the machine, and its axis supported by upright standards erected from the carriage; the wheel is turned by the left-hand of the spinner, applied to a winch, and gives motion to the cylinder, which turns all the spindles at once. The operations of the spinning jenny are so very similar, that our plate of that machine will fully enable the reader to comprehend this. The discretion of the spinner regulates the degree of twists given to the slubbings, which depends both on the rapidity with which the wheel is turned, and the corresponding quickness with which the carriage is drawn out, as well as on the fineness of the wool and the length of its fibre.

For fine shawl yarns, a machine called the mule, similar to the cotton mule, is often employed, see COTTON MANUFACTURE, the slubbing passing through rollers which assist in drawing out the thread smaller and more regularly.

In the *spinning jenny* the slubbings are again spun and prepared for the loom. Its parts are similar to those of the preceding machine, only differently placed. Our plate II. CLOTH, WOOLLEN, contains a view of this important modern invention. F, F, F, is the frame work, at the end of which the spindles *s*, *s*, *s*, are placed, about four inches apart. As in the slubbing machine their lower ends turn in caps or sockets of the cross-rail, and near the middle they are held up by brass collars fixed on another rail. Towards the lower end they receive an endless strap round their respective pulleys, communicating with the great roller A, which is generally made of tin plate, and receives its motion from the band B, which passes the great wheel C C. The moveable cross-rail D is morticed into blocks of wood, and runs on the general frame by means of small wheels or castors. It can be moved to and fro from six to seven feet. The underside is furnished with narrow notches for the slubbings to pass through, opposed to the projecting pieces, of a parallel cross-rail E, so as to form a clasp which confines the slubbings in the notches when the lower rail is raised up. They can however pass freely through the notches when the lower rail is down. This rail is limited in its movements up and down a small space by staples, which project downwards from the upper rail. Its rising and falling is effected by small cords fastened to it at about every three feet, and conducted over small pulleys in the substance of the upper rail, which are all attached to a handle, situated over the middle of the upper rail, beneath an arched bar G. This the spinner holds in her left hand, while the right is employed in turning the wheel; and by the fingers of her left hand she raises up the lower rail, and draws it close to the upper. In this position it is returned at pleasure by a small spring-catch, and clasps the slubbings in the notches, through which they pass; when the spring-catch is pushed back the lower rail falls, and releases the slubbings. An inclined frame H, receives the cops of the slubbings to be spun. They are rolled on iron wires, placed in two rows, each containing half as many cops as there are spindles. Each slubbing is conducted through a notch in the clasp, and thence it now proceeds nearly in a horizontal position to the spindles *s*, *s*, *s*. The yarns having been drawn out and twisted are wound on the spindles in balls.

I is a wire used for bearing down the thread from the points of the spindles, and attached to a horizontal rail, which is supported on pivots at its ends, close to the row of spindles. A pulley K receives one end of this rail, and a short lever at the other is hid by part of the framing. Between the pulley K and the lever the wire is extended, and by turning round the rail the wire receives a perpendicular motion This the spinner can communicate when at her business by the cord L, the end being made fast to a pin at M, and the pressure of her finger on a small trigger in the handle G. A counterweight to bring it back to its first position is suspended from the pulley K.

The spinning jenny is worked by a female (generally) standing within the frame and turning the wheel with her right hand, while the cross-rail D is managed by her left. We have described the manner in which the slubbings are drawn between the upper and lower rails of this part of the machine; they are drawn off the balls at H, when the clasp retires from the spindles, until a certain length of each is extended nearly in an horizontal position between the spindles and the clasp. The motion of the wheel then twists those parts of the slubbings which are extended, and first in a contrary direction to the twist of the slubbing. They are now wound up upon the spindles, previously to drawing out a fresh portion of each slubbing, in order to spin it in the same manner. For this purpose they are pushed down upon their respective spindles, by pressing the trigger which moves the wire L; and the motion of the wheel is applied while the carriage and clasp are pushed home towards the spindles. Arrived there, the thread is finished and wound up.

The art of using the jenny consists in drawing out the carriage with a movement correspondent to the rapidity with which the spindles give the twist, or rather untwist, to the slubbing; for the principal extension of the thread is effected whilst this is going forward: as also in giving an equal degree of twist to the whole thread. The yarn that is intended for the warp, we should add, requires that the spindles be turned for a time after the thread is extended to its full length; but for the yarn which is to be used as weft, it is different: the whole of the twist is given during the extension of the thread, and none afterwards; this renders the weft softer than the warp, because in the cloth the weft appears more on the surfaces than the warp, and it is principally the felting and interlacing of the fibres of the weft that will form the surface of the cloth.

Warping, which is our next process, is performed by mounting the yarn on wires in a frame, and drawing it off the coppings, so as to combine a number of them together. The warping-mill, which is now generally used, is a large reel, with an horizontal axis; the ends of the threads in fact are made fast to the reel, which is turned round, and it draws off the threads upon its own circumference. To prevent them overlaying one another, they are guided through an eye or ring affixed to a slider, moved along a wooden rail, in a direction parallel to the axis of the reel, by a cord that winds round one end of the axis.

After this process the warp is *scoured* with urine to cleanse it from the unctuous matters adhering, and sized in a cauldron, about a dozen yards at a time: it is then dried and stretched in the open air: and when dry it is transferred from the field to the loom. The weft-yarn is wound off the jenny-cops on the quills or bobbins which are afterwards used by the weaver.

For the loom employed, and its most recent improvements, we refer the reader to the article WEAVING. It will be sufficient here to observe that the width of the cloth returned from that process is expected to correspond with the number of the yarns, so that 3000 common threads will make a piece of coarse cloth 103½ inches wide; and 100 yards of fine cloth is expected to be produced from about 2960 threads: the weft averages about one pound per yard: and sixty-two yards of cloth is considered a fair return for sixty-five yards of yarn.

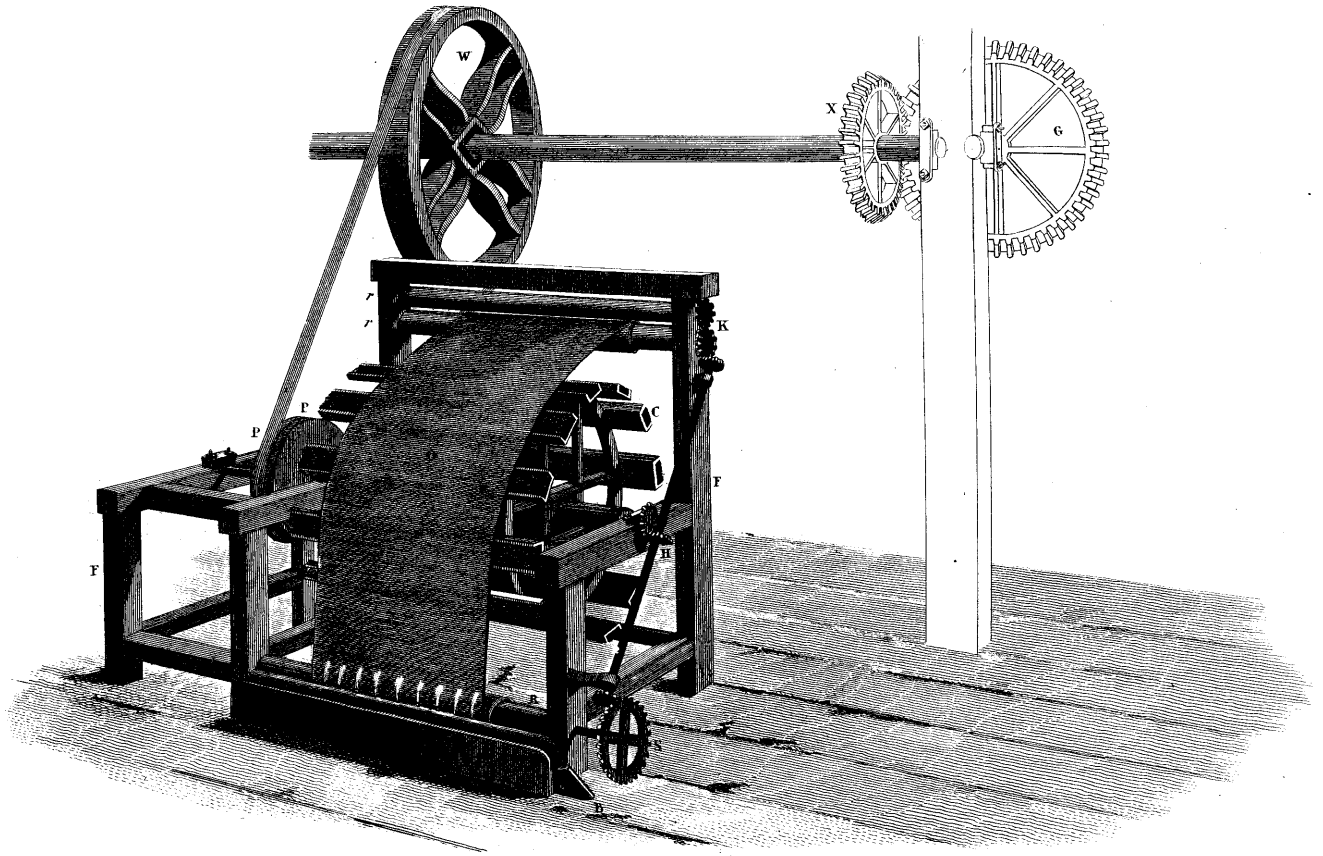
The cloth must now be scoured in the piece, preparatory to felting: and for this purpose it is taken to the fulling-mill, which ordinarily consists of a pair of stocks in wooden hammers, suspended in an inclined position, and the heads lifted up and down by cogs or tappets, fixed on the axis of a water-wheel. When the cogs are removed by its revolutions from under the hammers, they fall by their own weight, and strike the piece of cloth, which is contained in a wooden cistern or trough. This both causes a continual circulation or turning round of the piece of cloth in the trough, and effects the scouring or washing it by continually bending or folding it in a fresh direction. It is now extended on the well known tenter-hooks, fixed in horizontal rails, attached to vertical posts, one line of the rails being fixed and the other moveable, by means of pins and holes.

Milling is another operation performed by the action of the hammer of the fulling-mill. To a piece of cloth thirty-one yards long, three pounds of soap are allowed at this stage, and it is worked in the mill about two hours, then soaped anew twice, and returned to the mill for about the same time, so that it undergoes the operation three times.

'The operation of fulling woollen stuffs, has so close a relation with felting,' says M. Monge, a writer we have before quoted, 'that we cannot dispense with entering into some details on this subject. The roughness with which the fibres of wool are bristled at their surface, and the disposition which the fibres have to take a progressive movement in the direction of the root, is an obstacle to the spinning of wool and to the fabrication of stuffs. In order to spin the wool, and afterwards weave it, we are obliged to coat all the fibres with a film of oil. When the piece of stuff is manufactured it must be deprived of this oil which gives it a disagreeable color, and constitutes a kind of filthiness which would be an obstacle to dyeing. For this purpose it is carried to the fulling-mills, where it is beaten with mallets in a trough filled with water, through which clay (fuller's earth) has been diffused. The clay combines with the oil, which it renders soluble in water; both are carried off by the fresh water which the machine itself brings

CLOTH WOOLLEN.

Gig Machine



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upon it; and at the end of a certain time the stuff is scoured.

But scouring is not the only object of the fulling. The alternate compressions which the beetles exert on the piece of stuff, especially when the scouring is well advanced, produce an effect analogous to that of the hand-pressure of the hatter. The fibres of wool which compose one of the threads of the woof, or of the warp, take a progressive movement, get introduced into one of the neighbouring threads, then into those which follow, and soon all the threads both of the woof and warp are felted together. The stuff, after having suffered a narrowing in its two dimensions, partakes of the nature both of web and felt; it may be cut without being liable to open out its threads, and there is no necessity for hemming the different pieces which enter into the composition of a garment. If it be ordinary knit wool, the stitch is no longer apt to run when it happens to escape. Lastly, the threads of the woof and the warp being no longer so well defined, or so distinct from each other, the stuff, which in other respects is thickened, forms a warmer clothing.'

After milling the piece is again stretched on the tenter-hooks, and only now awaits the finishing operation that forms its surface. To effect this it is generally first dressed with teasels, a species of thistle; the part used is the ball, or ear, which contains the seed of the dipsacus fullonum. Scales project from this ball, with elastic points turned downward. They are fixed in a small frame which is provided with a handle eight or ten inches long, having a small stick, about eight inches long, passed through it at one end. This stick is split into two at each end nearly all its length. Near the middle there is another similar stick which is passed through the handle; the two split sticks being parallel to each other. The space between them is filled with teasels, jambed in very fast, as also in their split parts, where they are secured by strings extended between the ends, and twisted until they draw the sticks and bind the teasels forcibly together. The whole forms a tool resembling the curry-comb, and which is used in a similar manner, to draw out, by scratching, all loose ends of the fibres of the wool. Two men hold the teasel-frame and work the cloth as it hangs up in a vertical position, drawing it down in portions as they proceed. The first time the cloth is thus dressed it is wetted, and worked three times over in that state by strokes, in the direction of its length, then it is worked again three times in the other direction. But more scientific modes of accomplishing this part of the manufacture have of late been adopted in Yorkshire. Plate III. Cloth, Woollen, represents a gig-mill, very commonly used in the manufactories. On F, a wooden frame is erected, a cylindrical engine C, over which the cloth is conducted, and which revolves with the pullies P P, receiving an endless band from the upper wheel W. The pullies are, one fixed and one loose for the straps to turn upon freely, that the machine may be the more readily put in motion or stopped. W, communicates with a barbed wheel X, by means of a strong iron shaft, and is moved by the great wheel G, connected with any convenient first mover. Round the cylinder, C, are teasels secured in boxes or frames. One end of the piece of cloth is wound over the roller R, at the bottom of the frame, and the other end of the piece is wound on the rollers r, r. The roller below is moved by a bevelled wheel s, and fixed on the extremity of the axis of the cylinder, having a pinion at each end. The upper rollers r, r are both turned by a large spur-wheel which works in a smaller wheel, on the end of the cylinder; one roller is mounted over the other, like the two rollers of a flatting-mill, and pressed together by screws with sufficient force to draw the cloth between them. The piece of cloth, when brought to the machine, is laid down on a board on the ground before the machine, and one end is passed under the roller R, which is merely to guide it; then it is carried over the cylinder, as at O, and introduced between the pair of rollers at top, which draw it slowly forwards; from these it turns upwards, and is extended horizontally over two other rollers suspended from the ceiling. Quitting these it descends perpendicularly, and is gathered on the ground in folds on a board or bench. To make the piece pass a second time, or as many times as is required, through the machine, the two ends of it have only to be sewed together, and it will circulate continually over the machine. B is a perforated pipe which conveys water to the machine for wetting the cloth. The teasels are picked in the course of these operations and cleaned by children. Various substitutes of metallic teeth &c. have been suggested, but none seem to have answered on a considerable scale.

The wool of the cloth is raised by the preceding process, so as to stand up all over its surface in a loose fur: the last operation is shearing, or cropping this fur. The clothiers' shears, for performing this by hand, consist of two very large flat steel blades, united together by a stem, which is bent into a circular bow, and sufficiently flexible to allow one of the blades to be moved upon the other, but not in parallel planes like scissars, for when the one blade is laid flat upon the cloth the plane of the other will be inclined to it at about an angle of forty-five degrees. The spring of the bow, however, is so set as to press the two edges into contact. The edges of the two blades are not parallel to each other, but inclined, so that the edge of the upper blade crosses the edge of the lower blade, and bears upon the flat surface of that blade, at the end nearest to the bow, whilst the other end of the edge of the upper blade is removed over the edge of the lower blade, thus leaving an interval between the two edges when the shears are open. In this state, the shears being open, if the lower blade is laid flat upon the surface of the cloth, the nap or wool, which is to be removed by the cropping, will stand up above the edge of the lower blade, in the interval between the two edges; then, if the blades be forced together, the edge of the upper blade will pass or cross over that of the lower, and cut away all the wool which projects above the edge of the lower blade. The contact of the cutting-edges begins at the end nearest to the bow, and proceeds regularly to the other, because, as before mentioned, the edges are not parallel. The blades open or re-

turn to their former position by the elasticity of the bow, but in order to make the cut they are closed by means of a handle or lever, which is fitted or lodged on a round part of the stem of the bow, so as to play thereupon as upon a centre. A double cord is made fast to the lever or handle near to this centre, and the other end of the cord is fastened to a block of wood, which is screwed to the flat of the lower blade, and rises up to a proper height. By depressing this handle the shears are closed, and make their cut with the greatest facility, the elasticity of the bow returning the handle. The manner of cropping is:—Let the piece of cloth be laid down in folds upon a plank, or low bench, placed on the ground, and the end drawn across a table or bench, which is covered with cloth and stuffed. The cloth is stretched out flat upon the surface of the table, and is retained by hooks and weights. Two workmen are now employed who place the lower blades of their shears flat on the surface of the cloth, with the line of the edge in the direction of the length of the piece; one of the shears is laid on the edge or list of the cloth, and the other exactly in the middle of the breadth of the cloth The bows and stems of the shears project over the edge of the table where the workmen place themselves. Each man guides the shears with his left hand, and makes the cut with his right. To hold the shears a short staff is lashed to the bow of the shears, and secured by a stay to the lower blade; its direction is nearly parallel to the back edge of the upper blade. The workman puts his arm through the bow as far as the elbow-joint, then lays the fore-arm flat against the staff, which he grasps with the hand; and in this way he has a great command of the shears, leaving the right hand at liberty to work the handle which closes them. This is moved backwards and forwards with great rapidity to make cuts or clips on the cloth, and between every cut the lower blade is moved forward on the cloth. The art consists in moving the shears with proper regularity. To assist this weights are laid on the flat of the lower blade, which press it down into the cushion on which the operation is performed. Common cloth is cut wet the first time, then dressed with teasels, dried, and cut three times in a dry state. The most common shearing-frames used in the manufactories are only intended to give the difficult motion used for cropping by the hand.

We copy the specification of a patent granted to Mr. Harmar, of Sheffield, for a machine for raising a shag on all sorts of woollen cloths, and cropping or shearing them; which, together, come under the description of dressing woollen cloths, and also for cropping or shearing of fustians. This was until a late period very generally used in Yorkshire; it is said to have been since simplified. See plate IV. CLOTH, WOOLLEN.

Fig. 1. exhibits a side and end view of shearing cloth from list to list. A is the frame, with its pillars, legs, and rails. B is the cushion or shear-board over which the cloth is extended. C, the cropper's shears in their situation for working, with their bobs or levers. D, the harness or breeches fitted to each end of the riding blade of C; at the near end is hollowed the bow of C, and at both ends fastened with screws passing through the blade, or else is grooved to admit the blade, and is fastened with wedges. It is composed of two strong pieces of plank, with holes to admit screws through to nut-screws fastened to their upper surface, and square holes through which pass small pillars; other two pieces of plank are frames for wheels turning on pins (as in drawing), situated under the pieces fastened to the riding blade; here the lower ends of screws are rivetted to plates, but so as to turn, which plates are screwed to the wheel-frames; also, in these lower pieces, small pillars are fixed, which, passing through the upper pieces, steady the harness; those screws turned to right or left bring the edges of C to the angle of B, for the work of shearing. E, the inclined planes down which the wheels of D roll when the machine is working. F is the working axle, with its rods or rails; the gudgeons of this axle rest on the cross rails of A; the axle has the inclination of B and E, as in drawing. Its rods, fixed to the sides of it by projecting pieces, are about four inches from its centre, and the thimbles of G ride down them to keep pace with C in its progress. G is the line communicating at the lower end by a thimble with the rods of F, and at the upper end with the bob or lever of C, as in drawing. H is an axle-tree, with its handle, cog-wheel, and stop, fixed by stops, on which it turns, to the pillars of A. I, the lines communicating with the extremities of K at one end, and the other with H. K, levers, turning on their pins, and, by the action of K and I, work against E, to raise C from B, for all necessary purposes. L, pulleys in their frames, to give a proper direction to I, that the turning of H may have the effect before named. M is a crank attached to the lower gudgeon of F; the crank handle has an eye in it, through which a square leg passes, against which works the lower end of a screw, the nut of which is one side of the said eye. This screw, turned to right or left, loosens or fastens the leg in the eye at pleasure. The said leg at the other extremity has a handle where the near end of the catch N is fitted on. Now, as the leg is shifted by means of its eye and screw in that end where the handle is further from the centre of F, N works O with more speed. N is the catch that works O. O is the cog-wheel of N, with its screw pinion on its axle. P is an iron axle, with pulleys near both ends, with a cog-wheel. R is a small sword, fitted into the mortise of the projection on the lower extremity of F, and pinned, and the other end is fitted to the crank handle of S. S is the crank axle and pulley that carries the band which goes to the power that works the machine. The situation for R, as to that end that sits on the crank of S, is directly behind the lower end of F, and under the further extremity of B, where the crank end of S rides on a stop fixed to the further rail of A; the pulley end, where the stop is, rides on X. Now the crank S being put in motion, gives R the necessary vibration, and R works F, which alternately raising or falling its rods or rails by G, C works; and, to effect the progression of C, F being in a working state, M works N, and O works P, and C is carried forwards by T, and to

Fig. 1.

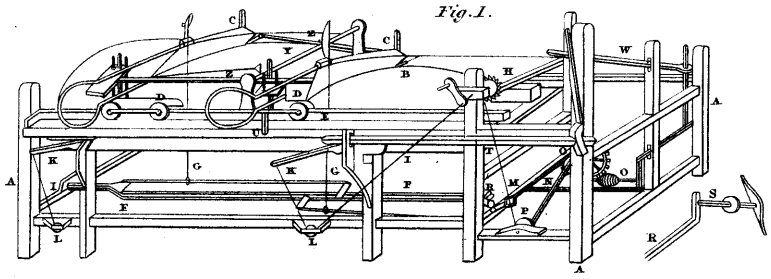


Fig. 2.

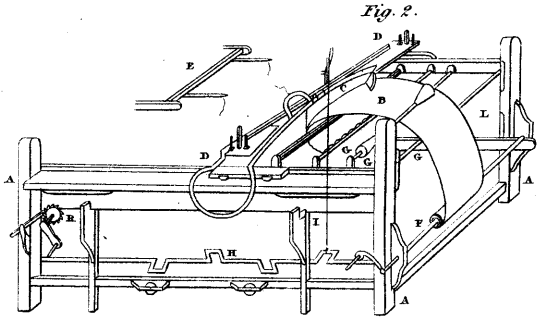


Fig. 3.

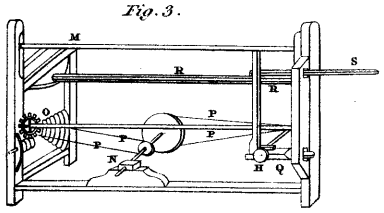


Fig. 4.

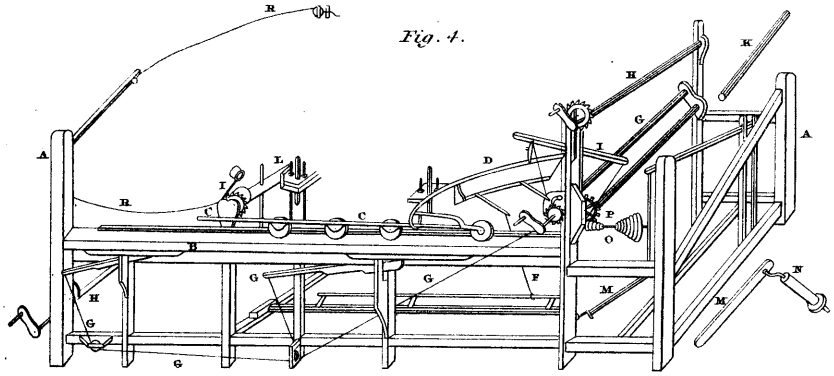
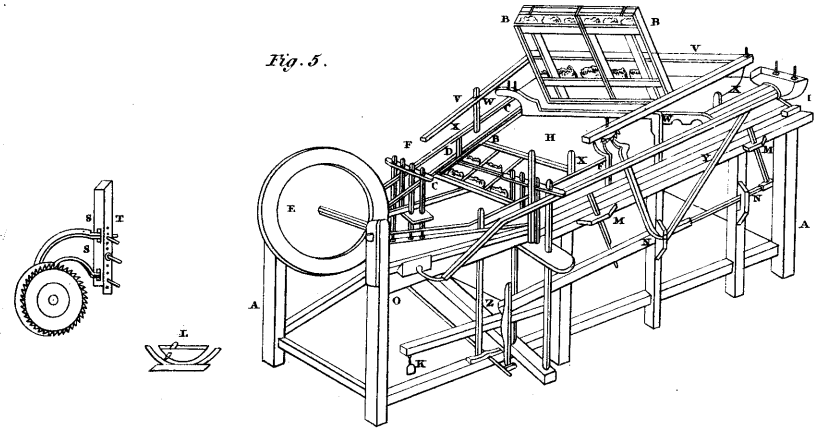


Fig. 5.



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carry C forwards faster or slower, as necessary. For the due performance of shearing cloth, the handle of the leg of M, where N is fitted on, must be brought nearer to the centre of F for slacking, and more distant from the said centre to increase the speed, as then N will take more or less teeth in O.

Or the progression in this frame may be effected by the method described in the progression of fig. 3, under the letters M, N, O, P. T, the lines for carrying forwards C by P. U is a projection fastened to D, and works against U when C is about to stop. V is a rail and small sword passing through a mortise fixed to one of the legs of A, at nearly one end, and by a working joint, goes up to near the extremity of W. W is a lever, passing through its fulcrum, and pinned to the upper end of X; and near the other end rests on a small notch, sunk in the inside of the upper end of one of the pillars of A, and weighted in the extremity with lead or iron. X is the step of the pully end of S, and, by a small sword, goes up to W, on the near side of one of the pillars of A, through which X goes, and moves on a pin, and is the step of one end of O; and the further side of the said pillar, where the letter X stands, is the step of the pulley end of S. Now when U or D works against U or V, W is thrown from its notch, and W sinking raises X, and slackens the band on the pulley of S; then the machine stops, and X, raising the step of S on the further side of the pillar of A, on the near side of it sinks the step of O, and the screw-pinion is thrown out of the large cog-wheel of P. Y is a small axle on steps, fastened to D, with its handle and bands going too near the extremity of Z. Z, two small rails, with catches at their extremities, which fall into notches in D to fasten both the shears of C together. Now when the machine stops, by the means already described, the pressure of the handle of Y raises the catches of Z, from their notches in D, and the shears of C are at liberty, and may be driven by the hand to the necessary situation for shifting the cloth, first turning H to the right, to clear them from B. The cloth being shifted, bring the said shears of C to their proper situation, and the catches of Z will fasten them; then turn H to the left, throwing back its catch, and the shears of C are brought to their work; when lift up to its notch the extremity of W, and the band on S is tightened, and the machine works.

Fig. 2 is a side and the two end views of shearing the length-way of the cloth. A, the frame, with its pillars, legs, and rails. B, a circular cushion, or shear-board, formed to the angle of the cropper's shears, and at each end resting on steps fixed to the top rail of A, to be moved round, as occasion shall require. C, the cropper's shears in its harness, or working position. D, the harness, attached to both ends of the ledger blade of the shears C, as particularly described in fig. 1, under the letter D; but this mode of shearing requires that the strong pieces, attached by screws to the ends of C, should be framed together near the back of the said ledger blade, to take the weight of the ends of the shears. When the whole width of a narrow cloth is shorn, the second shear of C is placed behind that in drawing, and has another, B, for it to work upon, and I, to be worked by. And that part of D attached to the heel of C and letter E, are lengthened as described, fig. 3, under the letter C; so in like manner the shears are situated behind each other in taking the width of a broad cloth. Here it must be noted, as in this mode of shearing the cloth having the progression, the wheels of D are omitted, and pieces of wood, half rounded, supply their place. E is a small frame in its steps, with its arms and lines. The situation of E is seen under letter D, fig. 3; it is attached to the heel part of the harness, as there seen by the drawing. One of the lines of E goes down to the working-rail of E, in the aforesaid, fig. 3; and the other line communicates with the lever or bob of D. F, the roller, with its handle, on which the cloth to be shorn is wound. G, the small rollers, to guide the cloth to B; the middle one which swells riding on it, lighteneth the lists of the cloth as it rides forwards: the swells are moveable, for the purpose of suiting cloths more or less longlisted. H, the rod, cranked on every side, with the pulley for the progression, and that also which carries a band to the working power situated at the upper end of K, near Q. I is the thimble fitted on the crank, with the line going up to near the extremity of the bob working C. K, and axle, with its cog-wheel and stop, as particularly described, fig. 1, under the letters H, I, K, L, and produce a like effect, and must be fixed to this figure the same as in that. L, the cheek to F, fastened by a pin at the near end, and passing under F, being hollowed to it, the further extremity (being carried under C and B) having a weight suspended on it. M, the roller, with a cog-wheel, to which the end of the cloth is attached; and, being tightened by the handle of F, the weight on L keeps it in that tight state as it is carried through the work. N, an iron axletree, carrying a large pulley with one groove, and a five-groove pulley with its steps, that out of sight lies under A on a cross rail. O, an iron axletree, carrying a five-groove pulley and screw pinion on steps, as in drawing. P, bands going from the small pulley of H to the large pulley of N; and from the five-groove pulley of N to the five-groove pulley of O.

Now these five-grooved pulleys gradually descend in their dimensions from fourteen inches to three inches in one, and the other may be the same dimensions, or very considerably smaller; or it may be reduced to a pulley of three inches diameter with one groove. These five-grooved pulleys stand, in respect to each other, in contrary directions. Now when the crank by a band on the pulley on its upper extremity is set to work, the band B, from the other pulley, puts O and P in motion, and carries forward M. That M may have different speed, the band of the five-groove pulleys must be shifted for that purpose to the different grooves, which give them more or less speed. *The Stop-Frame*—Q, the step where rides the upper end of H, which step at one end is tenoned into the pillar of A, and pinned. R is a small sword, at the lower end tenoned into the extremity of Q, and pinned; and at the upper end is mortised, so as to admit the further end of S. S is the lever, tenoned

into the mortise of R, and pinned, and passing through a mortise in the pillar of A. Now to stop the machine, the near extremity of the lever S must be pressed down, and that slackens the band communicating from the acting power to the pully of H. When set a-going, the said extremity of S must be lifted up, and pinned there. To work this machine, put the cloth to work as directed under letter M; then throw back the stop of G, and the shears are brought to their work; then raise the extremity of S, and the machine works. Fig. 3 shows a second mode of shearing cloth the length way, a side and end view. A is the frame, with its pillars, legs, and side and end rails. B, the inclined planes, as fig. 1, under E, C, the shear boards, over which the cloth is stretched from H to H; every shear has its board, and is placed by the side of each other, so as to take the width of the cloth; and the shears, situated for the like purpose on them, the harness H, and small working frame E, fig. 2, are lengthened accordingly. D, the cropper's shears in its harness, and bob or working lever, with E, fig. 2, in its proper situations, attached by the steps to the harness of D. E, the axle, with the line communicating with the bob at one end, and at the other with one of the axle rods, by a thimble, described under F and G, fig. 1. F, the line and thimble before named.

G, is a small axle, with its lines, levers, pulleys, &c. particularly described under letters, H, I, K, L, fig. 1. H, rollers for the cloth, and their cog-wheels and stops. I, a lever, with its catch and stop to the wheel of H, which is on the other side of the pillar of A, near the middle of it, and falls into the cog-wheel of H, which line communicates with the lower end of the catches on H and L, and passes through small pulleys, fixed under the catches, on the inside of the frame A, that, by the pressure of the upper extremity of the said lever, the catches are raised out of the cogs of their wheels, to give liberty for winding the cloth when shorn on the roller of H, situated near to I. K, a roller to guide the cloth, when wound forwards, that it may keep its situation on the surface of C: it is placed near the axle G, on steps, in the same direction fixed to the pillars of A. L, an axle, with its handles, cog-wheel, and stop, resting on B, with its near stop. This axle has an aperture through the middle of it lengthwise, to admit the cloth through. Now when the cloth is stretched from one of the rollers of H to the other, by turning L to the right, more regular tightness is given to the cloth, and better fits it for the action of shearing. For effecting the progression in shearing and working the shears, M is a small sword, fitted on the handle of the projection of E at one end, and at the other on the crank handle of N. N, a crank, with its pulley with one groove, and a small five-groove pulley. Or this may be reduced to a small one-groove pulley, of about three inches diameter. The larger one-groove pulley carries a band to the power that drives the machine. The situation of this crank is nearly the same as S, fig. 1, and produces the like effect. O is an axle, with a large five-groove pulley and screw pinion. These pulleys of N and O have their bands, and descend in their dimensions, as particularly described under letter P, fig. 2. P, a roller, with its cog-wheel, on which the bands wind that carry forward D, D, with all the other shears, more or less, fastened together by a rail, at their proper distances from each other (as in drawing), that each may take its proper share of cloth, being situated as described under letter C. Bands from P to D carry forward the shears of D. For stopping this frame, the stop part of fig. 1, under letters U, V, W, X, must be put to it, fixed to the rails and pillars of A. Q is a projection attached to D, and will stop this frame when the parts above directed are fixed to it in the manner directed, fig. 1. R is a line attached to the shears of D, and, passing through a small pulley fixed in the back rail of A, runs through another pulley fixed in a convenient situation over the frame of this said fig. 3, and by pulling its extremity draws back the shears of D when they have cut their board of cloth. For working this machine, the cloth is wound on the upper roller of H, and round a small roller at the upper end of A, and extended down C, and under K, and to the other roller of H, where it is attached; the stop of the upper roller falling into its wheel, the cloth is tightened by the lower roller and the handles of the roller. L, their respective catches falling into the cogs of their wheels, which keep the cloth in a tight state, then throwing back the catch of G, the shears of D are let down to their work, when, by means of R, they are brought to their proper situation on B. Then lift up the lever of the stop-frame into its notch, as directed under letter S, fig. 2, and the machine works. When the machine stops, as before directed, and particularly described, fig. 1, under X, to shift the cloth for cutting another length, press down the near extremity of I of this third figure, and wind the cloth that is cut on H. When, lifting up the said extremity of I, the cloth may be tightened as above described, and the shears of D shifted to continue their work.

Fig. 4, for raising a shag on cloth preparatory to shearing. A, the side and end rails, legs and pillars, with its teasle frames, and cotters. B, the frames, one open and the other shut, which turn on hinges, and, when shut ready for work, are fastened by buttons screwed loosely to C. C is a frame mortised, to fit four sides of B, when shut; and by projections, or sides fixed to its four corners, rides in the groove of a third frame, fixed to the rails of F. D, a third frame in the inner grooves, or two sides of it; C rides this frame, is attached to F, its projection slides through the gutters or flutes of L, when working. E, the double crank, with its large pulley, which by a band goes to the working power. These cranks stand in contrary directions, on the same axle, that the frame may work alternately. F, working rails, fitted on the crank handles, and fastened on by screws. These rails have a working joint near the side of G, and on the further side of G are attached, by screws, to each end of D; and as E works the frames of D, which carry C and B, works round L, and so raise the shag. G, the pulleys, fixed in their frames, over which F rides. H, the board for raising, in its inclined posture, with the cloth passing over it from one

roller of I to the other. I, the rollers, situated before and behind H, and attached to the legs of A, by screws, the gudgeons rising on steps; and at the upper end of H is a small roller, to guide the cloth round the end of H, which swells for both lists of the cloth, after the manner of fig. 2, under the letter G. K, the check to the fore roller I, which at one end is attached to one of the legs of A, and near that end lies over the same roller, and hollowed to fit it, and at the other end carries a weight, as in drawing. L, two pieces of plank, situated on both sides H, at the upper termination of M. The inside of the said planks are fluted or guttered to the angles of L, which stands at the foot of A. The small projection at the top of L is a pattern of the slides fixed to the sides of D, which pass through the aforesaid angle when the frames are working, which raise them to and from the cloth. To effect the revolution of the slides that carry C, the top piece of L is fastened to the side of its plank, at or near the upper end, by a screw, on which it moves, and at or near the bottom end it is fastened to its plank, but with the liberty to play.

When D, by its slides, has passed through the gutter, the lower end of the top piece of L falls, and forms a bridge, to carry the slides of L to the top of the gutter, for the making of another revolution. M are small swords, terminating in L, and fastened with pins, and passing through sockets fixed to the rail of A, and mortised at the lower extremity into N, where they move on pins. N, a strong rail, extending along the side of A, having a joint in it, and turning on pins in a mortise fixed to the pillars of A. O, an axle, with small projections at its ends, in steps, lying on the lower rail of A, extending from one side of the machine to the other. P, small swords, one tenoned into the projection of O, and the other admitting the near extremity of N, through a mortise where it moves upon a pin. Q, an upright leg, fastened at the lower end to the axle of O, near the lower rail of A. Now by turning this leg to right or left, it moves O, and O by its projection raises and lowers the near extremity of N, and N raises and sinks L, which has a like effect on B, C, D; so that, by these mediums, B is brought into contact with H in all necessary degrees. R is a cog-wheel; its situation is on the further extremity of the back roller of I. S, two catches, for carrying forwards R, attached to I at one end in mortises, and moving on pins, and the other working the cogs of C. T, the working leg, fixed to the further pillar of A by a screw, as in drawing, The upper extremity of the said leg goes through a socket, fixed to the further rail of F, near the upper part of it. Now, by the vibration of this extremity of T, in its socket, by E working F, S carries round R, and by varying the pins of S nearer to, or more distant from, the centre of its motion, the said R is carried forwards either faster or slower. For shifting B and C to right and left of H, for the purpose of raising more regularly U, a cog-wheel and stop of the under side, with a handle near the periphery of the said cog-wheel, to act as a crank on the top-side. F, three rails. The rail that crosses the top of H is tenoned into the extremities of those that form or lie to the right and left of it. W, the steps on which V right with pins to keep the rails of V in their place. X, bands fastened at one end to C, and the other extremity passing through nuts fixed to V, where they are fastened by the end, screws working through the side of their nuts against them. Y, two legs, fastened together at the lower end by a working joint at the upper ends. The further is attached to the near rail of F, and that nearer works upon a pin, a little short of its extremity, with a catch falling into the teeth of W; and, as it works U round, there is another catch on the same side, which prevents the said U from working back. Now F works Y, and Y works U, and U works by its crank V, and X shifts C from right to left by turns in the degree necessary, by tightening and slacking the band X. Z is the near step of E, screwed to a short rail at one end, tenoned into the near pillar at A, near which the step of A is situated. The other extremity of the said rail is fixed under a pin, on a short upright leg, which at the lower is screwed to the inside of the near rail of A, near which the step of A is situated. Now to set this machine to work, or to stop it when working; for the latter, move the said rail from under its pin, and by raising it, the band on E slackens, and the machine stops; and having extended the cloth from the near roller I, on which it is wound, to that behind H, and fixed the handles in B, with its cutters, and buttoned them down, you must then bring the extremity of Z under its said pin, and the machine works.

A perpetual shearing machine is used in the west of England, and is well adapted for narrow cloths. The shears lay crossways on the piece, which is drawn beneath them regularly in the direction of its length without interruption, and hence its name.

A complete rotatory shearing machine, for cropping cloth of any breadth, was invented by Mr. Price, of Gloucestershire, in 1815, and is described with plates in the Repertory of Arts, vol. xxxix. This machine crops the cloth across the breadth, beginning at one end of the piece and continuing regularly to the other. The cloth for this purpose, is conducted through it by the motion of rollers, and is drawn over a bed or support which lies beneath the stationary or fixed blade of the shears or croppers (which answers to what is called the ledger-blade in the common shears), so that the cloth passes between the bed and the stationary blade. The moving blades of the shears are fixed on the circumference of a cylinder situated above the fixed blade, with its axis exactly parallel to it, and capable of revolving by the power of machinery, so that the edges of the moving blades will be carried against and passed over the edge of the fixed blade, in order to cut away all the wool of the cloth which rises above the edge of the fixed blade. Several such moving blades are fixed upon the same cylinder, to act in succession against the fixed blade; and these moving blades are placed obliquely to the axis of the cylinder, or in such a manner as to form portions of spirals; but, as all parts of the cutting edges are equidistant from the axis of the cylinder, it is

manifest that, in the revolution of the cylinder, every part of each spiral edge is brought in succession into contact with the fixed blade, so that in its revolution it crops off all the wool, which by the progressive motion of the cloth over its bed, is raised up against the fixed edge. The edges of the moving blades are placed at such a degree of obliquity to the axis of the cylinder, that at the same instant the end of one ceases to cut against the edge of the fixed blade, the following revolving blade will begin its action at the other end of the cylinder; therefore, by the time that any one of the revolving edges has passed over and made its cut against the whole length of the fixed blade, and is ready to quit it, the succeeding revolving edge is brought into action, and, when this has passed, the next in succession begins, so as to keep up a continued action. The cloth is stretched in width by a contrivance which he calls stretching-bands, to prevent it getting into folds or wrinkles, which would be injured by the shears, or make irregularities in the shearing.

These stretching-bands are endless straps or bands, each of which is extended over two wheels. The bands have sharp pins projecting from them to prick into the lists at the edges of the cloth; and the bands being so situated that one of them lies exactly beneath each list, they will be caused to circulate round their respective wheels by the motion of the cloth. The stretching of the cloth is effected by the position of the wheels on which the bands circulate, the direction of the bands being slightly oblique to the lengthways of the cloth. The endless straps are so fitted into grooves or troughs, that they are firmly retained to move straight forwards in their oblique direction; and the direction of the obliquity is such, that the bands are nearest together at that end where their pins take hold of the lists of the cloth; but as the bands move forwards with the cloth, they recede from each other, and extend the cloth in breadth in consequence of their obliquity, which may be increased or diminished as is found necessary. The actual width between the two bands can also be regulated according to the width of the piece of cloth. It is not usual to crop the lists of the cloth, and indeed, as the lists are usually of thicker substance than the other parts of the cloth, they would bear up the fixed blade too high from the cloth to cut the nap quite close.

The bed or support on which the cloth is cut is so constructed, that it can be adapted in length to the breadth of the piece of cloth between the lists, in order that the cloth only may be supported or borne up to the edge of the fixed blade; whilst the lists, being depressed or borne down below the level of the bed, by thin slips of metal called guards, will escape the action of cropping, and thereby remain with the long wool upon their surfaces. The bed by which the cloth is borne whilst it is cut is only a narrow ridge of metal, over which it passes, so as to be bent with a sudden curvature, and in this way the nap can be cut more close and even than upon a flat bed or soft cushion. The operation of cutting is facilitated by a row of pieces of metal screwed to a strong bar, to form a straight edge, very similar to the cutting edge of the fixed blade, but thin and elastic. This edge is placed close to the elevated ridge of the bed, and presses the cloth gently down upon the bed, immediately before it comes to the edge of the fixed blade, against which the nap is to be cut off; this elastic edge being placed on one side of the ridge, and the cutting edge of the lower blade on the other side, the cloth is only exposed for a very narrow space just where it comes to the cutting edge. By this means the cloth can with safety be brought nearer to a level with the upper surface of the fixed blade, so as to shear it closer than could otherwise be done without endangering the cloth. The ends of the ridge part of the bed are composed of a number of narrow plates of metal, accurately fitted together, and placed side by side in a mortise made in the end of the solid bed; their upper ends project out of the mortise so as to line with the elevated ridge, and form a continuation of it; but there is a sliding piece in the bottom of the mortise on which they all bear, and the point of it is of a wedge form. By removing this wedge any number of the moveable pieces may be let down, so as to diminish the length of the elevated part of the bed at pleasure, according to the breadth of the cloth. The whole seems well contrived to effect the desired object.

The cloth, having been shorn for the last time, is brushed over and pressed. The former operation is now generally performed by two cylindrical machine brushes, over which a system of rollers passes the piece, brushing both the sides at the same time. Pressing gives it the final smooth coat and polish: preparatory to which it is doubled and laid in even folds, a leaf or sheet of glazed pasteboard being inserted between each fold or plait of the cloth. It is then covered with thin wooden boards or fences in the press, on which are laid iron plates properly heated, and on the whole, by means of a lever turning a screw, the top of the press is brought down with the degree of force judged necessary to give the gloss. A very high finish however is found objectionable, because the slightest shower of rain marks the cloth. Coarser cloths are glossed with a large hot iron in a hollow box, suspended by tackle from the ceiling, and which two men work backwards and forwards over the surface of the cloth.

By stat. 28 Geo. III. c. 38, all the former statutes respecting the exportation of wool and sheep are repealed; and an infinite variety of regulations and restrictions upon the subject is consolidated into that statute. It is given almost at length in 4 Burn's J. title Woollen Manufacturer. The principal prohibitions are, that if any person shall send or receive any sheep on board a ship or vessel, to be carried out of the kingdom, the sheep and vessel are both forfeited; and the person so offending shall forfeit £3 for every sheep, and suffer solitary imprisonment for three months. But wether sheep, by a licence from the collector of the customs, may be taken on board for the use of the ship's company. And every person who shall export out of the kingdom any wool

or woollen articles, slightly made up, so as easily to be reduced to wool again; or any fullers' earth, or tobacco-pipe clay; and every carrier, ship-owner, commander, mariner, or other person, who shall knowingly assist in exporting or in attempting to export these articles, shall forfeit 3s. for every pound weight, or the sum of £50 in the whole, at the election of the prosecutor, and shall also suffer solitary imprisonment for three months. But wool may be carried coastwise upon being duly entered, and security being given according to the direction of the statute, to the officer of the port from whence the same shall be conveyed. And the owners of sheep, which are shorn within five miles of the sea, and ten miles in Kent and Sussex, cannot remove the wool, without giving notice to the officer of the nearest port as directed by the statute. Much contest having arisen as to the policy, in the present times, of several acts heretofore made for the regulation of the woollen manufactories; these acts were by 43 Geo. III. c. 136 (a temporary act continued by several subsequent acts), suspended with a view to the framing of a new law on the subject. At length by stat. 49 Geo. III. c. 109. several acts, and parts of acts (nearly forty in number), on this subject from the 2 of Edw. III. to 5 Geo. III. are repealed: and persons having served apprenticeship to any branch of the woollen manufactories, and their wives and families, are allowed to set up and exercise that trade, or any other, in any part of Great Britain, notwithstanding the restrictions in stat. 5 Eliz. c. 4. There are other miscellaneous woollen goods of considerable importance; and we propose, in a history of the WOOLLEN MANUFACTURE of Great Britain, to give a summary of those of each of its branches.