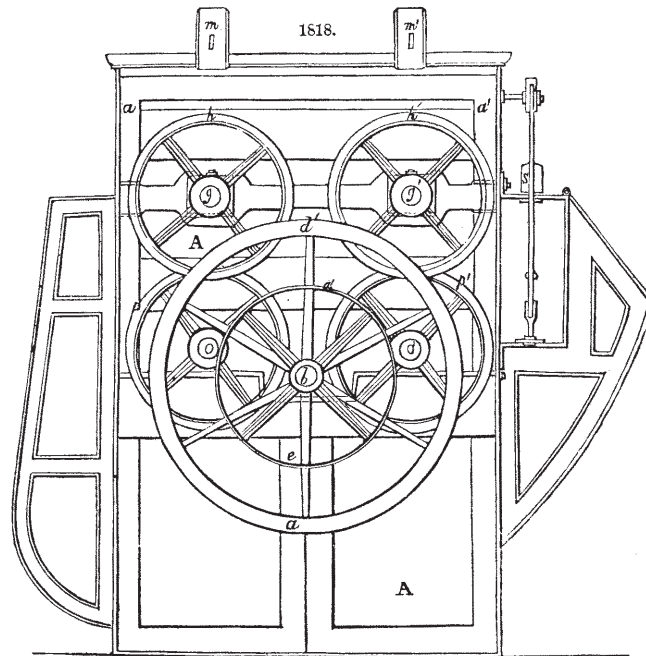


FULLING MACHINERY. Fulling is a process by which woolen cloths are divested of the oil imbibed for the operation of carding, and the texture is at the same time rendered much closer, firmer, and stronger. This process, also called milling, was formerly entirely performed by the fulling-stocks, Figs. 1823 and 1824. The stocks, although still in extensive use, have been greatly superseded by a superior class of machines, in which the cloth passes between squeezers, and is not subjected to heavy blows. By these machines the pressure can be regulated according to the quality and requirements of the fabric, the milling is more perfect, the power expended is less, and, not least, the disagreeable noise consequent on the use of stocks is avoided.

Figs. 1818, 1819, and 1820 represent different views of one of this class of machines. Fig. 1818 is a side elevation, Fig. 1819 a cross-section, and Fig. 1820 a front end elevation of the machine. It

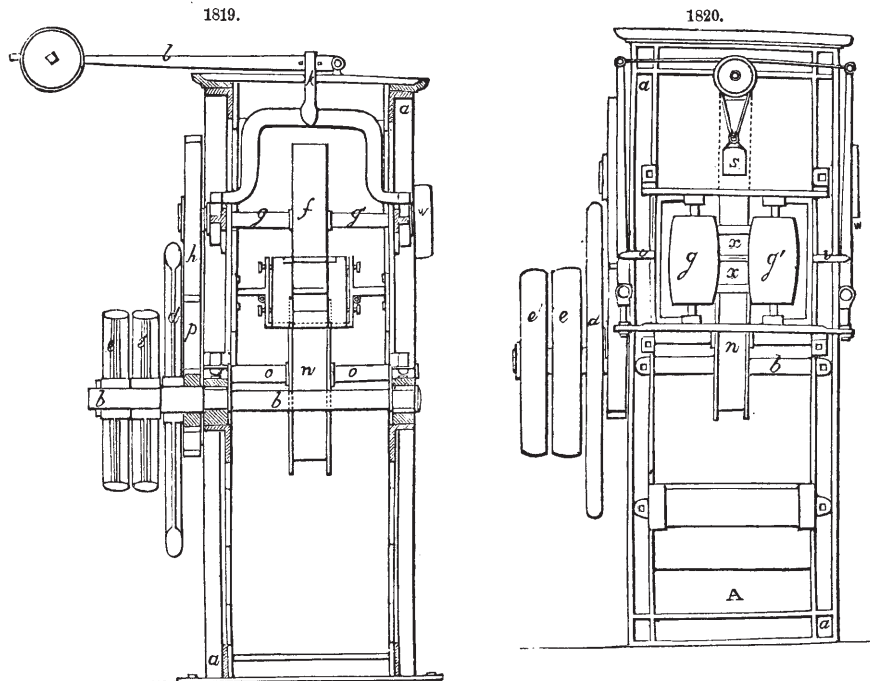


will be perceived that the machine is composed of four cylinders, $n n' f f'$, running horizontally, arranged in pairs one above the other, and two vertical cylinders, $g g'$. Both horizontal and vertical cylinders are subjected to pressure: to the former it is applied by means of the weight movable on the arm of the lever l , which forces down the yoke k on the boxes of the cylinders. The pressure is applied to the vertical cylinders by the variable weight s , through the levers w . In both cases the pressure to be exerted can be varied at pleasure.

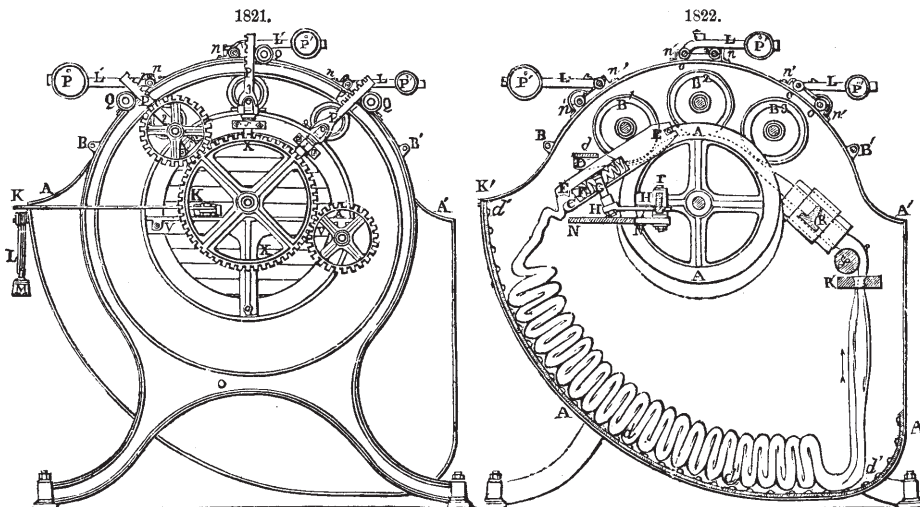
The operation is as follows: One end of the cloth having been passed between the sets of horizontal and vertical cylinders, the two ends of the cloth are then attached together, so as to make an endless band. The machine is now set in motion by the pulley e on the shaft b , and the cloth continues to make the round between the cylinders or squeezers, falling in folds at the front of the machine, and drawn up again at the back till the washing and fulling is finished.

A rotary fulling-mill, still better than the preceding, is given in Figs. 1821 and 1822. Fig. 1821

is the side elevation, and Fig. 1822 the longitudinal section, showing the interior arrangement. *A A* is the main cylinder, driven by a gear; on either side are cheeks, between which the small cylinders or rolls *B¹ B² B³* revolve, and between these rolls and the cylinder the cloth passes. *C* is the lower side or bottom of a trough which receives the cloth after it has passed the roll *B¹*, and down which

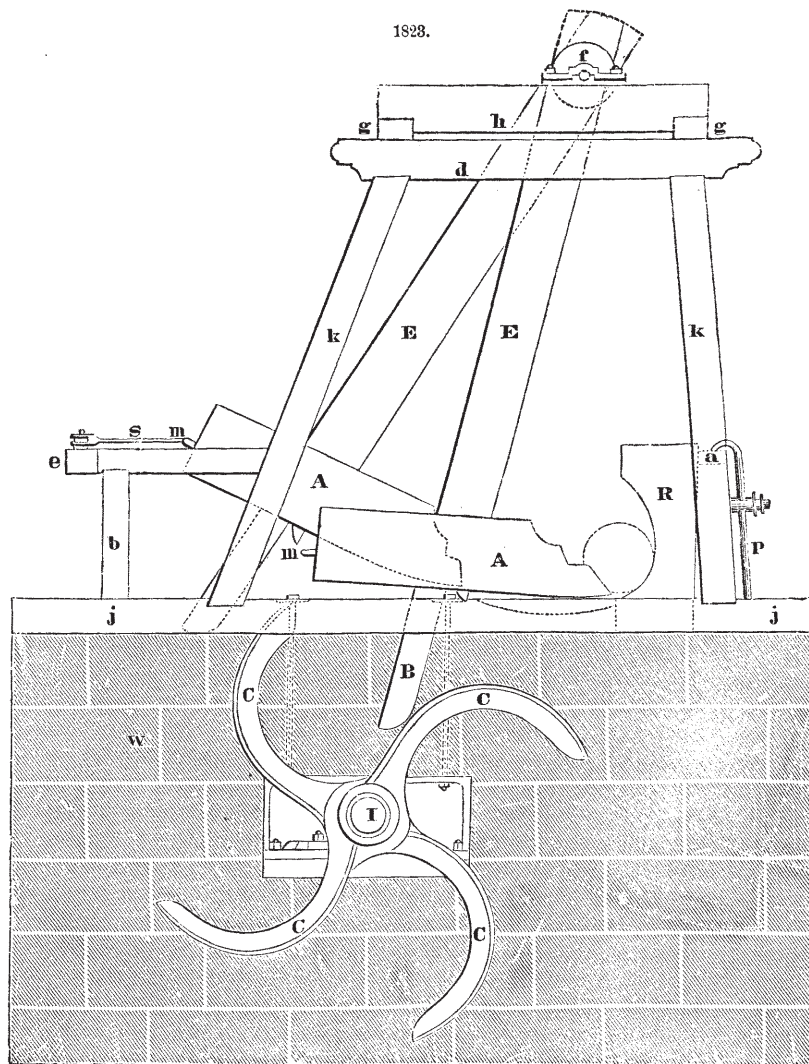


it slides into the tub *d d d*, curved, as shown in Fig. 1822. *D* is the top of the trough, and is supported by the cross-piece *d*; its upper extremity touches, but without friction, the surface of the roll *B¹*. *E E* are the grooved sides of the trough; their upper extremities are held by small iron straps attached to the frame by screws, and to *E E* by pins; the centres of the sides are fastened to small iron plates *F F*, which are supported on the standards *G G*, on which they turn freely; the



standards themselves, attached to the plates *H H*, can turn on the pivots *I I*. *L* is a cord attached to the ends of the levers *K K*, by which, through the aid of a pulley, the weight *M* tends to draw them together. *N N*, a cross-piece attached to the frame and supporting the pivots *I I*, and guide-plates *C¹*. The journals 2, 3, 4, of the rolls *B¹ B² B³*, run in bearings inserted in the bars *P P P*,

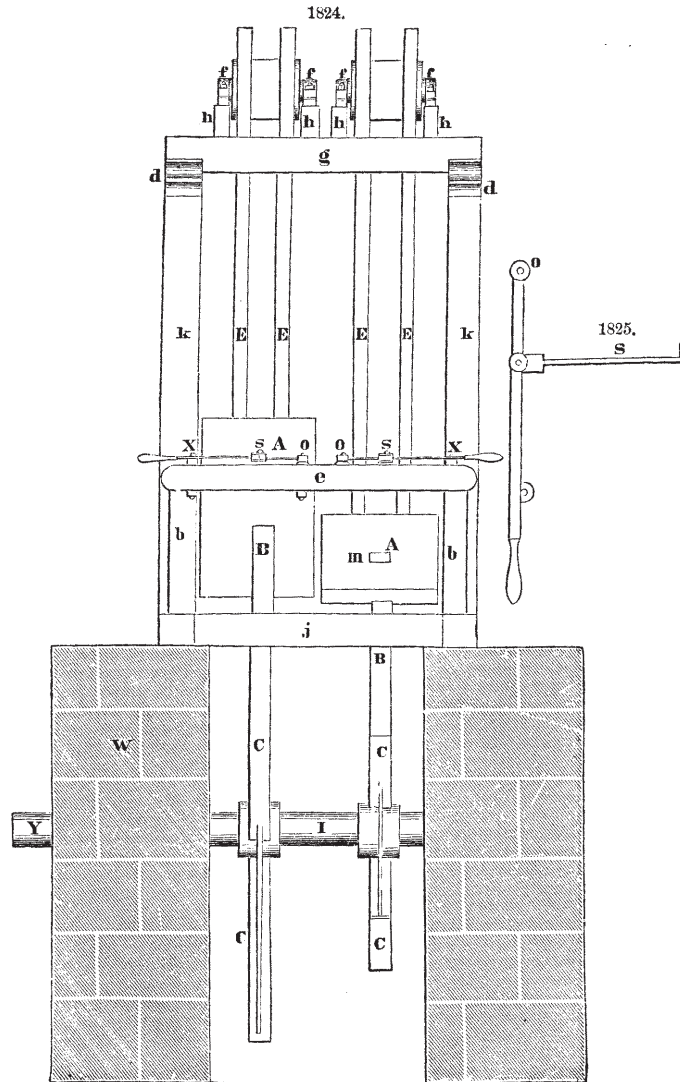
whose lower extremities are maintained in a position by the guide-rings *s*, attached to the frame, which admits of a motion in the direction of their length; while at their upper extremities are racks into which play the toothed segments *p p p*, fixed in pairs on the shafts *n n n*. *P P P*, weights movable on the arms of the levers *L' L' L'*, whose fulcra are at *n n n*, and attached to the toothed segments *p p p*; by these weights the force with which the rolls *B¹ B² B³* press on the cylinder *A* is regulated. *Q Q Q*, guide-rolls which keep the racks in gear with the segments. *R'*, a plate perforated with an oval hole, through which the cloth is first passed, the effect of which is to straighten the folds; thence the cloth passes over a conducting roll *S*, through the short tube *R*, to the main cylinder; the tube *R* is supported by a cross-plate attached to the frame. The draught or drawing in of



the cloth is occasioned by the pressure of the roll *B¹* on the main cylinder, which cylinders are geared together by the pinion *X'* and the gear *X*, on their respective shafts.

Operation of the Machine.—The cloth is first passed through the aperture *R'*, over the roll *S*, through the tube *R*, to the groove or space between the cheeks of the main cylinder *A*, thence beneath the rolls *B³ B² B¹*, and is delivered through the trough *C D E* at the back of the machine. The ends of the cloth are now fastened together, the mill is set in motion, and the operation is performed as in the preceding machine. The cloth is presented successively in a continuous round to the action of the squeezers till the fulling is finished. It will be easily perceived that the effect of the passage of the cloth beneath the rolls *B³ B² B¹* is a stretching of the cloth in the direction of its length, which causes a thickening or fulling of it in the width. The cloth should also undergo a compression or fulling lengthwise. This is effected by the sides *E E* of the trough *C D E*; these

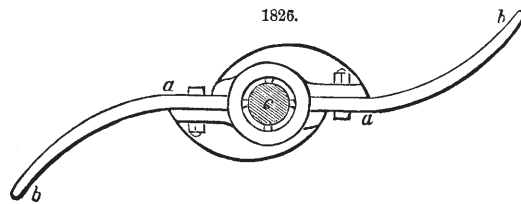
sides hold by iron straps at their upper extremities, at a constant distance equal to that between the checks of the main cylinder, while their lower extremities, by means of the pivots *G G* and *I I*, admit of a lateral motion at these extremities. The weight *M* is made to act through the levers *K K*, which brings them together and prevents the discharge of the cloth; the result is that the cloth, being still delivered by the roll *B¹*, is forced into the guide-box till the pressure is sufficient to overcome that with which the two sides of the box are brought together by the weight *M*. The sides of the box then take a nearly parallel position. The cloth escapes gently, and falls into the circular box or tub which composes the lower part of the machine. As by the weights *P P P* the pressure on the cylinders *B¹ B² B³* can be regulated, and consequently the fulling breadthwise of the



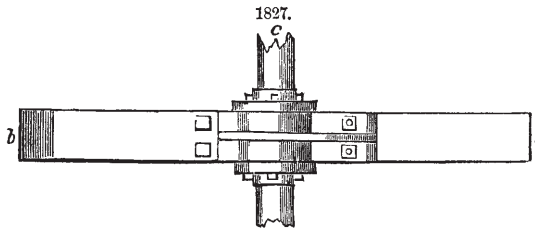
cloth, so by varying the weight *M* more or less resistance can be opposed to the discharge of the cloth, and by this means the fulling of the cloth lengthwise can be increased or diminished. A system of percussion has also been added to this machine. Small revolving or reciprocating beaters, making their blows on a fulling table, strike the cloth as it leaves the expanding trough.

Figs. 1823 and 1824 are side and end elevations of the older form of fulling-mill. *k k* is the side-framing of the machine, made of strong rectangular pieces of wood, connected together at the top by the cross-beams *d d* and the cross-rails *g g*, upon which the four pieces *h h h h* rest in positions parallel to *d d* and at right angles to the rails *g g*. The use of the beams *h h h h* is, besides affording additional stiffness to the framing, to carry the four pedestals *f f f f*, in which are the working centres of the *feet* or beaters *A A*. These are suspended by the *legs* or pieces *E E*. From the under side of the feet, the *lifters* or wipers *B B* project; and by means of these the feet are con-

tinually thrown back by the two pairs of wipers *C C C C* upon the common driving-shaft *I*. The upright framing is secured at bottom by cross-beams, into which the uprights *k k* are mortised; and these are bolted down usually to a solid foundation of stone. *R* is the *rowhead* of the receptacle or trough into which the cloth to be washed is put, and in which the beaters *A A* are suspended. The end *R* of this receptacle is formed of two or more blocks of wood, commonly oak, firmly jointed together, and is shaped internally into a parabolic curve, against which the cloth is pressed by the beaters *A A*, alternately, during the operation of washing. By this means the cloth is continually, but slowly, being turned round by the action of the beaters upon it. Water is meantime supplied from the cistern *a*, which extends across the back of the framing, through a series of small holes pierced in the back of the trough *R*, and is let off through holes pierced in the bottom of the same. The centre *a* is filled from a well or other reservoir, by the pipe *P*. The feet *A A*, as above described, are worked by the double wipers *C C C C* on the wiper-shaft *I*. These wipers, being set pair and pair at right angles to each other, work the feet alternately; so that when one foot is being caught by its wiper, the other is at that moment being released. The feet thus rise and fall alternately, and make each two strokes during one revolution of the shaft *I*. Into the *heel* of each foot is screwed a staple of iron *m*, which receives a hook-catch *s*, jointed upon a lever, having its centre of motion at the stud *o*. The use of this arrangement is to keep up the feet when the cloth is being taken out of the trough. This lever and catch are represented separately by Fig. 1825. The



liable to break by concussion with the lifters *B B*; and, being cast pair and pair, in one piece, they are difficult and costly to replace. The most approved, and now the most common mode, is to cast strong centres which fit upon the shaft *I*, and to attach to these malleable-iron wipers, which are not only less liable to fracture, but are also replaced with more facility in cases of failure from accident or decay. This arrangement is represented by the annexed woodcuts, of which Fig. 1826 is an elevation, and Fig. 1827 a plan of a pair of the wipers. *C* is the wiper-shaft, upon which the cast-iron



centre is keyed. This centre is cast with two flange-pieces projecting in the plane of the axis, and strengthened by feathers on one side. These pieces are of the same breadth as the malleable-iron arms *a b*, *a b*, which are to be bolted to them at *a a*. In Dusseaux's improved fulling machine exhibited at the Paris Exposition of 1878, free fall-hammers inclined at an angle of about 60° are employed. These are lifted by cams placed at right angles on the driving-shaft. The hammer-heads are of wood and stepped underneath. The machine is run by an ordinary belt-pulley. The time of ascent of the hammers is to the descent as 5 to 1. Desplas's fulling machine, which was also exhibited in the same Exposition, has rubber cylinders between which the fabric is pressed. For other machines for treating cloth, see CLOTH-FINISHING MACHINERY.

wiper-shaft is usually connected to one of the main shafts of the works by a friction-coupling of some kind, for the purpose of starting the machine with as little shock as possible. Various efficient and simple couplings for this purpose are described under COUPLINGS AND CLUTCHES.

In the machine from which these drawings were made, the wipers are of cast-iron. This, however, is not to be recommended, as the wipers are