4 Sheets—Sheet 1.

J. H. KNOWLES, J. K. PROCTOR & F. P. PENDLETON.

WOOL WASHING MACHINE.

No. 187,643. Patented Feb. 20, 1877.

Fig. 1

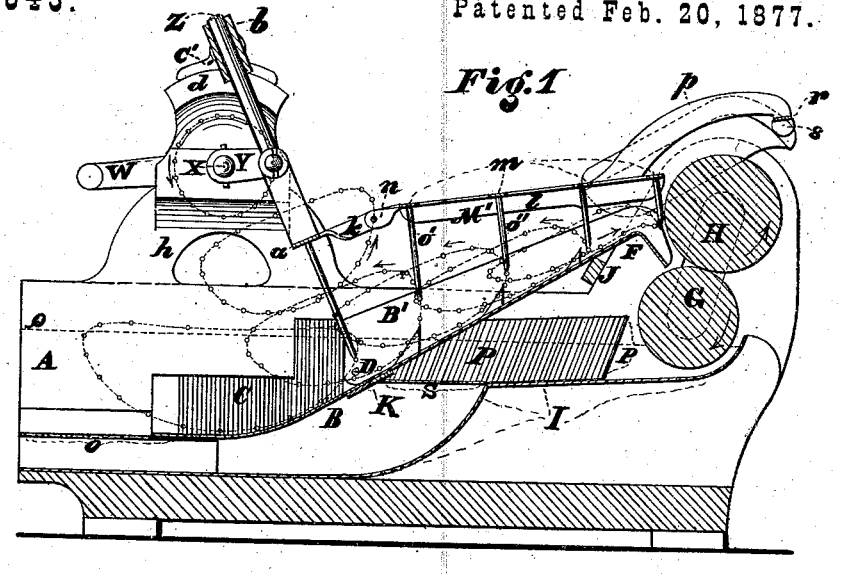

Fig. 2

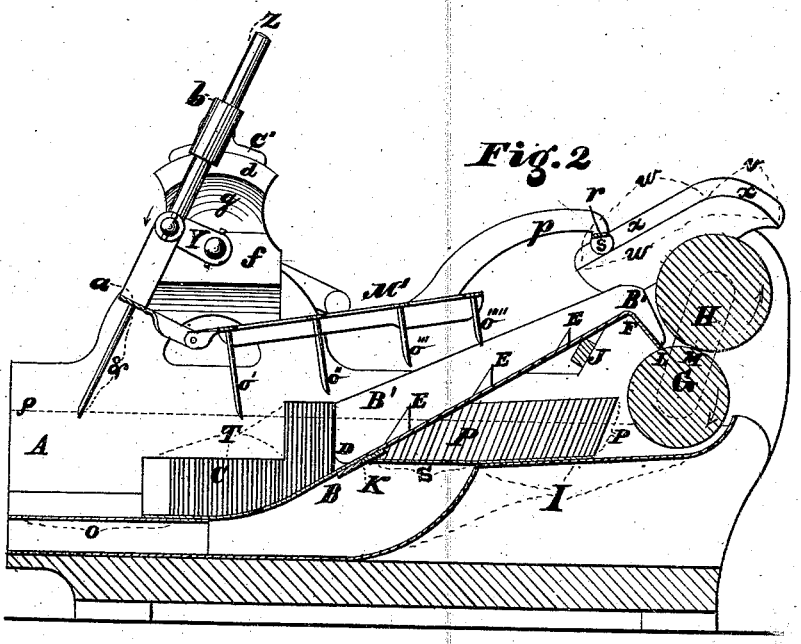

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Fig. 3

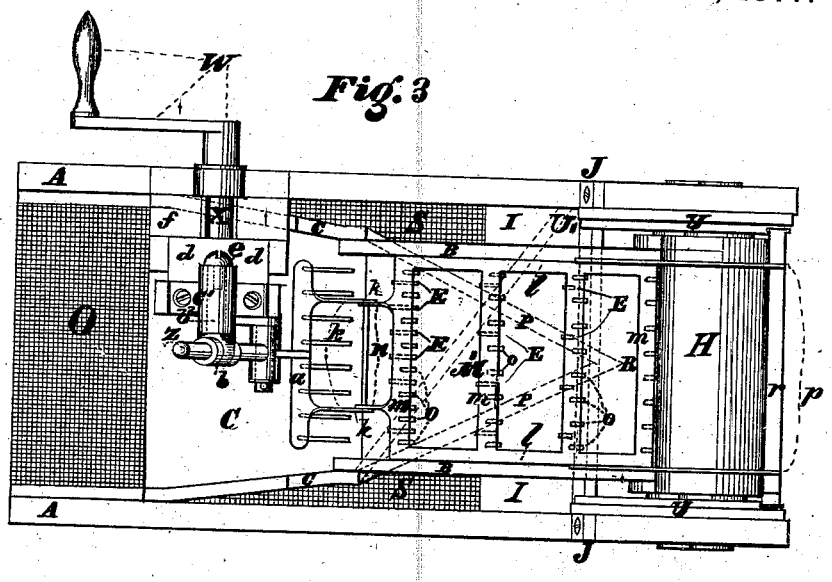

Fig. 4

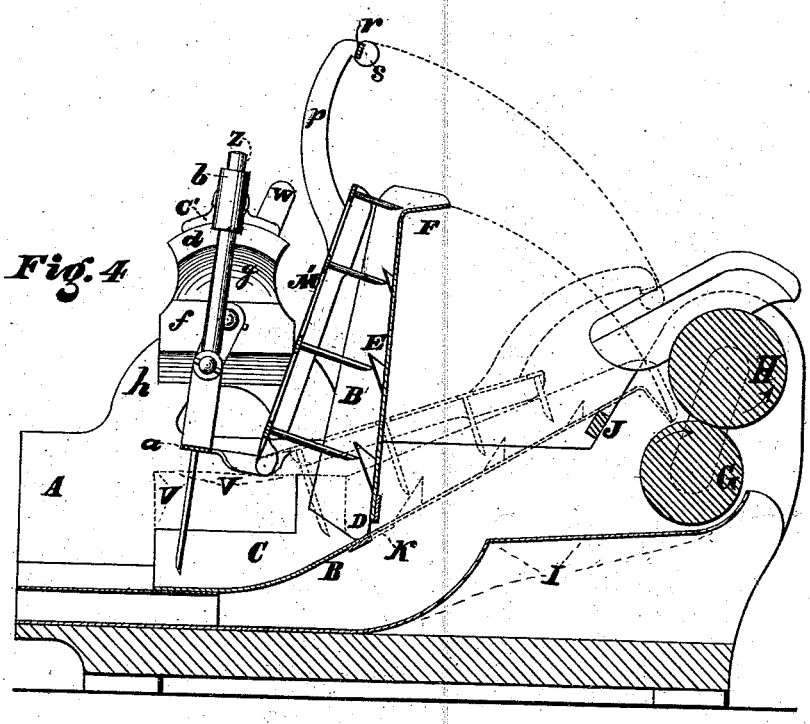

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Fig. 5

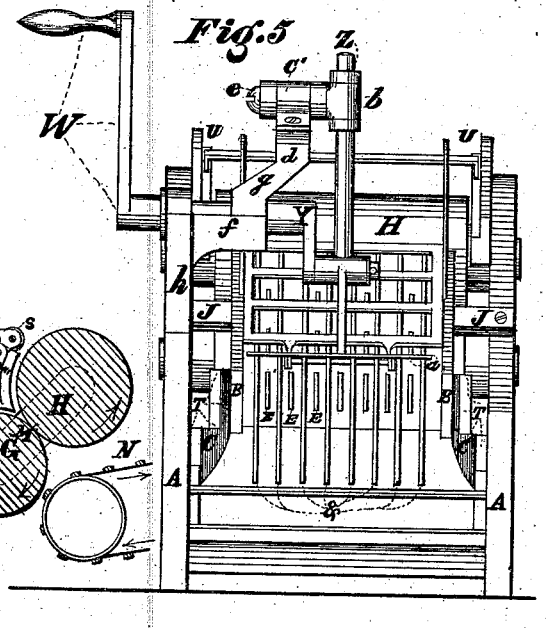


Fig. 6

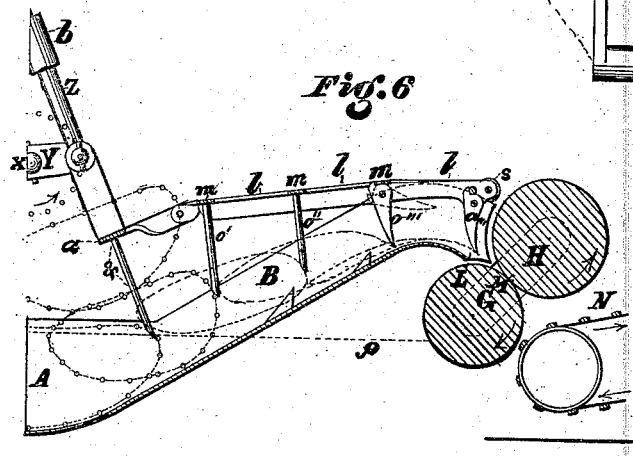


Fig. 7

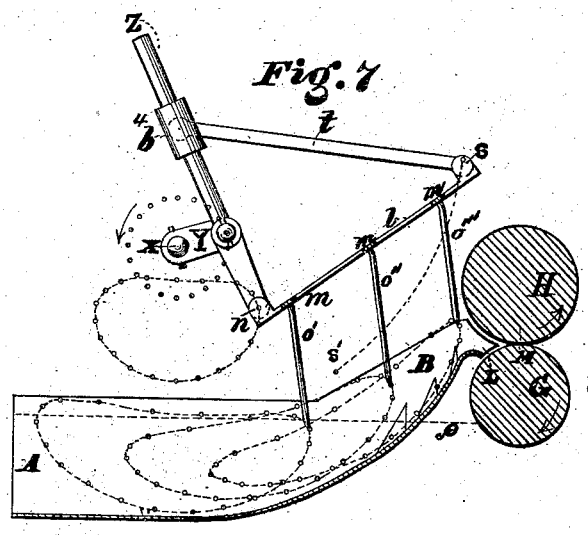
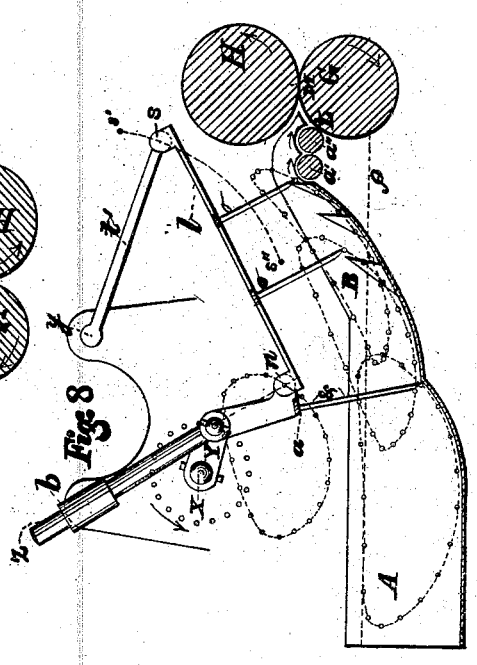


Fig. 8



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WOOL WASHING MACHINE.

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Fig. 9

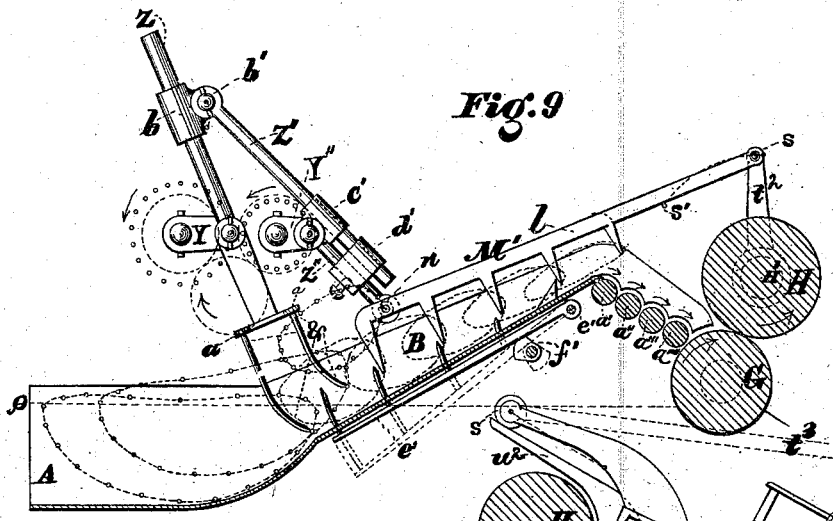


Fig. 10

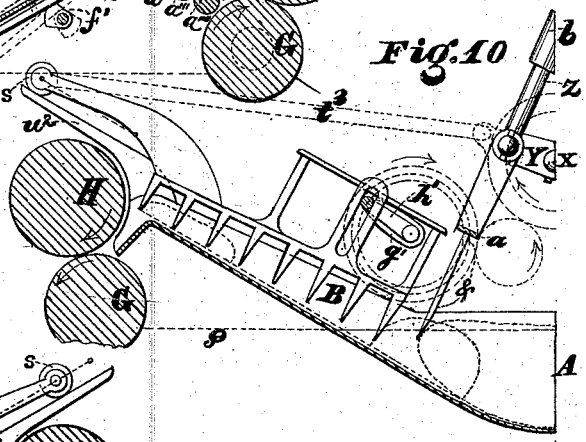


Fig. 11

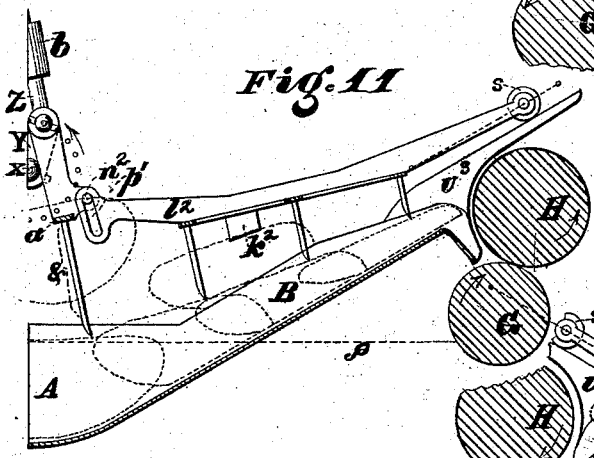
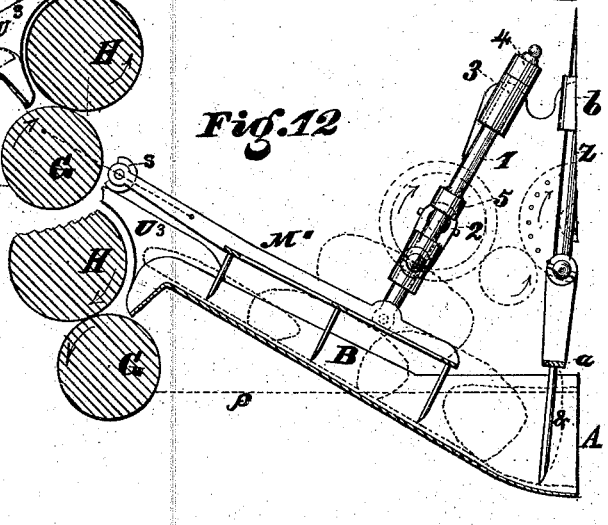


Fig. 12



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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN WOOL-WASHING MACHINES.

Specification forming part of Letters Patent No. **187,643**, dated February 20, 1877; application filed October 16, 1876.

To all whom it may concern:

Be it known that we, J. HENRY KNOWLES, JOSIAH K. PROCTOR, and FRANK P. PENDLETON, of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Wool-Washing Machines; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification, in which—

Figures 1, 2, and 4 are longitudinal vertical sections of a machine embodying our inventions. Fig. 3 is a plan of the same. Fig. 5 is a rear elevation of the same. Figs. 6, 7, 8, 9, 10, 11, and 12 are longitudinal vertical sections of different modifications.

The objects of our inventions are, first, to provide an improved mechanism for lifting or pushing the stock up out of the bowl and delivering the same to the press-rolls; second, to provide an inclined chute so constructed as to readily be lifted or swung upward, so as to afford access to the bowl of machine for cleaning; third, to provide an improved conduit back into the bowl for the liquor squeezed out by the press-rolls; fourth, to provide an improved construction for supporting and adjusting the rake, crank-shaft, and swivel, also an improved construction of swivel; fifth, to provide press-rolls having the top roll inclined or set back out of perpendicular with the bottom roll, for a certain useful end hereinafter fully set forth, the same being combined with an inclined or curved chute and a carrier or device for lifting stock over the latter to said rolls.

Referring to the accompanying drawings, A designates the bowl or tank, and B the chute or incline of a wool-washing machine. This chute is composed of two sections, B′ and C, hinged or pivoted together so as that the part B′ can be swung upwardly, as shown in Fig. 4, the center of motion being at D. The part C is curved on the bottom, its sides sloping inwardly, as shown in Fig. 3, like any ordinary chute, and is immovably fixed to the sides of the bowl A. The part B′ has a straight or flat bottom, and is provided with the fixed teeth E E. We have shown three rows of teeth, but more or less rows may be used, if desired. In these rows of teeth a tooth may be placed between every two teeth of the carrier, as shown in the bottom row, Figs. 3 and 5, or one may be used only between every other two teeth of the carrier, as shown in the upper two rows, Figs. 3 and 5. At F, Fig. 2, the extreme upper end of the part B′ of chute is bent or deflected downwardly. The object of this is to provide a short downward pitch, so that the material lifted up by the carrier may not be thrown all at once upon the bite of the rolls, as then the material would be passed between the rolls in one mass, and, while the carrier would be moving over its return and the first portion of its upper stroke, no stock would pass between the rolls, and the latter would "jump." When the chute is in the position shown in Fig. 4 free access may be had to the upper part of the bowl, and under the press-rolls, thus affording convenient opportunities for cleaning the bottom I. J is a rod or bar extending across the machine and fastened at either end, being used to support the upper end of the part B′ of the chute, and is so adjusted as to maintain the bottom of the part B′ always in the same right line with the upper part of the bottom of the section C, and also to permit the edge of the incline F to come near to, but not quite touch, the roll G. The junction of sections B′ and C is shown at K, their adjacent edges being made thicker than the other parts of the bottom, so as to secure an even joining.

The object of the inclined arrangement of the press-rolls is to secure more extended receiving-surface on the bottom roll G, where the material is deposited, than would be obtained if the shafts of said rolls were in the same vertical line. It sometimes happens when the rolls are arranged perpendicularly that in working very short staple or fiber the friction is not sufficient to raise the stock up over the short pitch from L to M on the roll

G, and the rolls become clogged up, thus causing damage to the machinery, or rendering it necessary to stop the machine and remove the gathered mass by hand. But with the rolls arranged on an incline, as in Fig. 2, the pitch from L to M is so slight as not to prevent the stock from being carried forward to the bite of the rolls. If so desired, the rolls may be still more inclined, as shown in Fig. 6, when, as may be seen, the pitch from L to M is toward instead of from the bite of the rolls, thus making the gravity of the mass assist in feeding toward the bite of the rolls. In case the rolls are inclined as much as shown in Fig. 6, we use an apron, N, to convey the stock away instead of the ordinary beater-cylinder. O, in Figs. 1, 2, and 3, represents a portion of the false bottoms of the bowl A. At P, Figs. 1, 2, and 3, is shown a guide extending from the bottom I of the bowl upward above the water-level represented by the dotted line Q. This guide comes to a point in the middle of the bowl and near the press-rolls, as at R, flaring therefrom toward each side of the bowl A, the ends of the two branches impinging against the upper end of the sides of the part C of the chute. The rear parts of these branches are cut away on an incline, so as to fit up under the part B′ of the chute, as may be seen in Figs. 1 and 2. S represents a false bottom, foraminated, if desired, and fitted from the point of commencement of the curve in the bottom I to the sides of the part C, and from the sides of the bowl A to the lower edge of the rail P. A portion of the sides of the part C is cut away, as shown at T, Figs. 2 and 5, so as to allow the passage of the liquor from the press-rolls back into the bowl. With the described construction, the liquor pressed out of the fiber by the press-rolls falls upon the bottom I of the bowl and would flow directly back into the cavity of the bowl under the chute, were it not for the guide P, which causes it to diverge at the point R, a portion flowing along either branch of the guide, over the perforated bottoms S, and through the openings T into the body of the bowl. The objection to having the liquor flow from the rolls directly into the bowl under the chute is as follows: The liquor that falls from the rolls is always sure to carry with it certain particles of fiber which fail to pass through the rolls. If the liquor passed directly under the chute these fibers would be carried along and finally lost by being washed out through the drain-pipe. But with the construction described all these particles of fiber are washed back into the bowl through the openings T, and mixing with the approaching material are again brought up to the press-rolls. By making the bottom S perforated, some of the heavy dirt with which the liquor from the press-rolls is always saturated will be permitted to drop through to where it is finally washed out of the bowl during the cleaning process, while at the same time, if wire gauze be used for said bottom, none of the fiber will pass through.

The guide P is brought to a point at R, so as to present a sloping side (see Fig. 3) toward the sides of the bowl. This construction renders it easy for an operator to insert a hand or instrument under the chute and draw along toward the openings T any fiber that may have accumulated on the bottoms I or S, and not previously been carried toward the openings because of the sluggishness of the flow from the press-rolls.

Instead of having two branches to the guide P, meeting at R, a guide may be used formed by one rail only, as at U^1, extending from one side of the bowl A, near the press-rolls, across to and abutting against the side of the part C of the chute, as described in the case of the guide P.

The single rail U^1 may start from either side of the machine; but, for convenience, we prefer starting it from the same side as that on which the driving power is applied, and on the side where the rake-shaft stands are supported, as shown in Fig. 3. This arrangement presents the open side of the rail toward the side of the machine where the operator usually stands, and is more convenient for cleaning.

In case a single rail, U^1, is used, one side only of the part C of the chute will be cut away, while the other side, or the side next to the side of the bowl A from which the rail U^1 starts, is left the full height, as shown by the dotted lines V, Fig. 4.

W is a crank-arm handle and shank to move the rake or fork and carrier. X is the crank-shaft, and Y the crank on which the rake-lever is pivoted. Z is the rake-lever, and & are the tines of the rake.

The lever Z may be made straight, as in Fig. 1; or, for convenience, it may be bent, as in Fig. 8.

The rake-tines may be made straight, as in Fig. 1; or they may be curved, as in Fig. 9.

a is the rake-head to which the tines are affixed. One rake-head and one row of tines may be used, as in Fig. 1, or two rake-heads and two rows of tines may be used, as in Fig. 9.

The rake-swivel consists of a sleeve, *b*, through which passes the rake-lever Z. (Seen in section in Fig. 1.) C′ is the bearing for the swivel, fastened to the support *d*. Attached to the sleeve *b* is an arm, b^2, which passes through the bearing C′, as may be seen in the dotted lines in Fig. 3, being cast with or forged onto said sleeve *b*. This arm is prevented from lateral movement by the shoulder next to the sleeve *b* on one side, and by the screw *e*, Figs. 3 and 5, or its equivalent, on the other side, while said sleeve *b* and its attached arm turn freely around in the bearing C′.

The upper surface of the support *d* is made in the arc of a circle having its center in the center of the shaft X, to allow the bearing C′ to be set over to the right or to the left with-

out increasing the distance from the center of the swivel *b* to the center of the shaft X, thus maintaining the sweep of the points of the tines & of exactly the same length wherever the center of the swivel *b* may happen to be placed on the surface of the support *d*. The object of right and left adjustment in the swivel *b* is to vary the position and not the length of the stroke of the points of the tines of the rake.

The support *d* is connected with the table *f* by the standard *g*. (Seen most clearly in Figs. 2 and 5.) The table *f* is attached to the wide-spreading legs or supports *h*, Figs. 1 and 5, which, in the drawing, form a part of the sides of the bowl A, but which, in practice, would be detached from the bowl sides on a line with the top of the bowl, as shown by the dotted lines in Fig. 1, the support *d*, standard *g*, table *f*, and legs *h* being all cast in one piece. Fixed to either end of the table *f* are suitable bearings for the shaft X. (See Figs. 3 and 5.)

Attached to the rake-head *a* are two arms, *k*, Figs. 1 and 3, projecting outwardly from the head toward the carrier M′, composed of the side bars *l*, cross-bars *m*, ears *n*, teeth *o*, levers *p*, cross-bar or shaft *r*, and rolls or slides *s*. *l l* are two longitudinal bars extending lengthwise of the carrier, and to which the cross-bars *m* and levers *p* are attached, said bars being right-angled in cross-section, having one lip of the angle projecting downwardly, and the other lip extending horizontally across the carrier. Another shape of this bar is represented in Fig. 11. If necessary, to secure strength, more of these longitudinal bars may be employed—as, for instance, three—one on each side and one in the middle. To the side bars *l* are attached the cross-bars *m*. There will be as many of the bars *m* as there are rows of teeth in the carrier. The teeth *o* are riveted or otherwise securely fastened into the bars *m*, and may be round or oval or of any other desirable section; and may be either pointed or blunt on their ends. Said teeth may also be either straight or curved in outline, and may have parallel sides, as in Fig. 1, or beveled sides, as in Fig. 9. In some cases the row of teeth that comes next to the press-rolls will be curved, while the remaining teeth in the carrier are straight, as in Fig. 6. The reason of curving the forward row of teeth is that their points, being in advance of the bar which supports them, will force the fiber farther forward toward the bite of the roller, the bar *m* being necessarily kept at a distance by the bulge of the roll H. Especially is this the case where press-rolls are used having the rolls arranged perpendicularly. To the rear bar *m*, Fig. 3, are attached two ears, *n*. These ears are hinged or pivoted to the arms *k* in such manner that when the stirrer-rake moves, the ears *n*, and consequently the whole rear end of the carrier, is made to travel with said rake. In the drawings, two of these ears are represented, but only one ear, or more than two ears, may be used. The levers *p* are firmly fastened to the side of the bars *l*, and extend upwardly and over the press-roll H, being there attached to a cross-bar, *r*. The bar *r* may be a rigid bar, as in the drawings; but in practice we prefer to use a shaft, provided with suitable bearings, in the ends of the levers *p*. On either end of the bar *r* are fastened slides *s*, which move over the track or way U. Instead of the slides *s* a friction-roller may be used, running on the end of the shaft or bar *r*. Nearly over the press-roll H is fixed the stationary way or track U, provided with raised sides *x* to keep the rolls or slides *s* always upon it. The outline of the track *w* may be either a straight, a convex, a concave, or a combination of a straight with a convex or a concave, or of a convex with a concave line, just as may be found most desirable in order to give any desired movement to the points of the teeth *o*.

The operation of the carrier is as follows: The crank Y, revolving in the direction of the arrow, gives motion to the stirrer-rake Z, and consequently to the arm *k*. The point in the arm *k*, where it is pivoted to the ears *n*, moves in the track represented by the dotted lines in Fig. 1. Motion being communicated to the carrier through the ears *n* connected with the arms *k*, the rear end only of the carrier is lifted, while its forward end remains down by its own gravity, and through the connection with the ears *n* is pushed forward and dragged back over any points prepared for its support, which in this case are the tracks U. Now, it is obvious that while the rear end of the carrier is lifted up in its return-stroke, its extreme forward end at the point *s* will not be lifted at all, but will slide forward and back in the same plane or line, while every point in the carrier intermediate between the ears *n* and the point *s* will be lifted some, the highest lift being near the ears *n*, while the degree of lift will be less and less as the point *s* is approached, until at *s* the lift is nothing. When the material is delivered forward by the stirrer rake at the point D, Fig. 1, it is still some inches under water, and just at the bottom of the chute.

While the material is submerged at the point D it occupies a large space, being floated by the water, and, in order that the teeth of the carrier may lift over and come down behind the mass, it is necessary to give considerable rise to the rear teeth *o* of the carrier, but as the material is lifted out of the water it gradually drains, and so occupies less height on the chute, until when it arrives near the point F at the top of the chute, comparatively little rise is required in the teeth *o* to enable them to lift over the material on the chute. Now, as previously described, the forward teeth of the carrier do not lift so high as the rear teeth. The point *s* of the carrier is extended so far forward of the teeth *o* as to give the front row of teeth just sufficient rise to lift over the material on the top of the chute. The rear row

of teeth have as much or nearly as much lift as do the teeth of the stirrer-rake.

When the parts are proportioned, as in Fig. 1, the rear row of teeth have two and three-quarters as much lift as the front row of teeth.

In Fig. 1 the rows of teeth are arranged so that the spaces between them shall diminish gradually toward the forward end. We arrange the rows in this way because the rear rows of teeth do not require to come so far back in order to engage the fiber as do the forward rows, for the reason that the fiber on the rear end of the chute, being very wet, lies high up from the chute, and is readily caught by the teeth *o'*, but on the upper part of the chute, the fiber being closer to the chute, and being spread out by the action of the previous teeth of the carrier, the forward rows of teeth have to come farther back over the material delivered by the previous rows in order to carry up the same quantity as is brought up by the rear rows.

In Fig. 1 the tracks followed by each row of teeth is shown by the dotted lines, while the direction of motion is indicated by the arrows.

As may be seen, the track followed by the rear row of teeth *o* is elliptical in outline, somewhat like the track followed by the teeth of the stirrer-rake.

Owing to the action previously described, the tracks followed by each row become less and less in height, counting toward the forward row, while the length of the tracks remains the same for each row. If the outline of the track or guide U were a straight line, as in Fig. 11, the outline followed by the forward row of teeth would be elliptical, like that followed by the rear row of teeth, and the teeth of said front row would lift up from the chute before they arrived quite at the end of it. The straight part *w* of the track U is a line parallel with the bottom of the part B' of the chute. The point when the teeth commence to lift from the bottom of the chute is when the teeth of the carrier occupy a position just one-half the distance between the extremities of the stroke, or nearly in the position represented by the dotted lines in Fig. 4. If when the carrier is in the position last described the stirrer-rake be still further rotated, while at the same time the points of the forward row of teeth be made to follow the line indicated by the dotted line just above the letter F in Fig. 1, the edge of the slide or roll *s* will describe the irregular curve *v*, Fig. 2. We therefore conform the guide *u* to the curve *v*, whereby we secure to the points of the forward rows of teeth a motion exactly parallel with the bottom of the chute, and hence a more favorable result in pushing the stock forward.

By making different curves at *v* we can cause the points of the teeth of the carrier to describe a variety of outlines in their tracks—as for instance, in Fig. 6. As may be seen in Fig. 1, the outlines of all the tracks of the teeth are influenced by the curve *v*. Thus the front row of teeth dip slightly downward as they approach the press-rolls, and the second row move exactly parallel with the bottom of the chute.

While the material is still heavy with the liquor in the bowl it is not required to have so straight a motion to the points of the teeth as is required after the stock is pushed farther up out of the liquor. Hence the various tracks followed by each of the rows of teeth is peculiarly favorable for lifting the stock in its successive stages of draining as it comes under each row. The center of the sleeve *b* is placed perpendicularly over the center of the shaft X, in order to cause the tines of the stirrer-rake to describe an ellipse whose longest diameter shall be parallel with the bottom of the bowl, but the ellipse described by the center of the pivot in the ears *n* should have its longest diameter parallel with the bottom of the inclined chute. This may be accomplished either by carrying the center of the swivel *b* farther to the left, and attaching the ears *n* directly to the end of stirrer rake in a line with its center, as in Figs. 8, 9, and 12; or the same end may be accomplished by the extended arms *k*, Fig. 1, in which case the length of the arm is determined by drawing a line perpendicular to the chute-bottom through the center of the swivel *b*, while at the same time the crank Y hangs perpendicularly downward. When the stock is passing over the bottom of the chute it is held from slipping back by the fixed teeth E. The stock is carried up in a mass by the row of teeth *o'*, and pushed over the first row of stationary teeth, where it remains until the row of teeth *o''* comes behind the mass and pushes it forward over the second row of stationary teeth; but the row *o''* does not take up all of the mass delivered by the row *o'*, for the points of the teeth of the rows *o'* do not quite reach the limit of their downward passage when they come over the first row of stationary teeth. Consequently the teeth *o''* catch the top part only of the mass brought up by the row *o'*, and when the row *o''* has finished its work it does not leave the mass in one pile, as was the case in the row *o'*, but spreads it out over the space between the first and second rows of stationary teeth with the ends of the fibers hung over the second row of stationary teeth. This action being repeated by the row of teeth *o'''*, between the second and third rows of stationary teeth, it follows that by the time the mass has reached the upper part of the chute it has become very evenly spread out over the chute. In the case of the row of teeth *o''''*, they come so close to the chute that they rake all of the mass deposited by the row *o'''*, and push it over the pitch of the chute F, where it passes through the press-rolls.

As will be seen in the case of Fig. 1, the carrier makes four successive movements to

deliver any given mass from the bowl to the press-rolls.

In Fig. 6 we have represented a modification of my carrier, where the roller *s* is made to move on the raised edge of the side of the chute forward of instead of over the press-roll H. In this case the forward row of teeth in the carrier must be placed nearly under the center of the roll *s*, in which case the points of the front row of teeth in the carrier have no or very little rise in their backward movement. In this case we may make use of swinging teeth *o'''* and *o''''*, Fig. 6.

Swinging teeth might be used on the rear as well as on the forward rows, but are not necessary on the former.

In Fig. 7 we have represented a modification, where the point *s* of the carrier is supported by an arm, *t*, swinging freely on the center b^4. The track of the point *s* is shown by dotted lines *s s'*, and is the arc of a circle struck from the center b^4. Two arms, *t*, should be employed, one on each side of the carrier. In this figure we have represented the rear end of the carrier as being pivoted to the very end of the rake-lever Z, and no stirrer-rake is used, the row of teeth *o'* of the carrier performing the duty of the stirrer.

In Fig. 8 we have represented a modification of the carrier, where the point *s* swings on an arm, t^1, but the arm t^1 in this case has its center of motion at *y*, a point to the right of the point b^4, as in Fig. 7. The point *s* of the arm vibrates over the track represented by the dotted line *s'* and *s''*, which is an arc of a circle, having its center at the point *y*. In this case also, two arms, t^1, would be employed, as in Fig. 7. In Fig. 8 we have employed a stirrer-rake attached to the rake-lever Z, the carrier having only two teeth. In this case we have made the chute of double concave outline on the bottom, as shown. In Fig. 9 we have represented a modification, where the point *s* is supported by the vibrating arm t^2, having its center at H', and swinging to *s'*, as shown in dotted lines. To move the carrier in this case we form an ear, b^2, on the swivel *b*, said ear carrying a pin on which swings the rod Z'. *c'* is a sleeve-pin attached to the pin of the crank, and through which the rod Z' passes. A short rod, Z'', is also attached to the crank-pin. *d'* is a double sleeve, one side being firmly fastened to the rod Z'' by the set-screw, while the rod Z' slides freely through the other side of the sleeve. The operation of this mechanism gives to the ears *n* a motion exactly like what would have been obtained by the use of a lever, as in Fig. 7. The two cranks Y and Y'' are so connected by suitable gearing as to revolve in perfect unison. In this figure we have shown the carrier constructed of bars, arranged longitudinally and attached to the horizontal rods *n* and *s*. Instead of fixed teeth on the bottom of the chute a lever, *e'*, having attached teeth operated by the cam *f'*, may be employed; and draw-rolls *a' a'' a''' a''''* arranged so that a line drawn across their top surfaces will have a considerable incline toward the roll G, may be substituted for the bend F, shown in Fig. 1. In Fig. 10 is shown a cam, *g'*, designed to lift the rear end of the carrier while the reciprocating motion is communicated by the crank and pin *h'*, the roll *s* running on the straight guide U^2. Instead of using the crank *h'* to give the reciprocating motion to the carrier, we may employ an arm, t^3, represented by dotted lines, connecting the rod on which is placed the roll *s* to a pin attached to the side of the rake-lever Z, or to the pin of the crank Y. In either case the cranks Y and *h'* or cam *g'* must be so geared together as to revolve in exact unison.

Fig. 11 represents a modification of the carrier where the roll *s* runs on the straight guide u^3. The pin n^2, attached to the side of the rake-lever Z, coming in contact with the bar l^2 at the upper end of the slot p^1, lifts the carrier during its back stroke until the stops k^2, attached to the bars l^2, come in contact with the edge of the side of the chute B. The further downward motion of the carrier being prevented, said pin *n* slides down in the slot p^1, but at the same time carries the carrier forward, causing the stop k^2 to slide along on the edge of the chute, which is made parallel with the bottom B'. This arrangement gives a straight motion on the bottom to the points of all of the teeth in the carrier.

In Fig. 12 we have represented a modification where the rear end of the carrier is lifted up by a lever, 1, crank 2, swivel 3, and collars 4 and 5. In this case the roll *s* runs on a straight guide, u^3, and the points of the teeth have a straight motion, as in Fig. 11.

We do not claim to be the inventors, broadly, of a chute having an incline at its upper end to conduct the stock to the rolls—specially waiving all claim to this feature in view of the fact that the same is the subject of a claim in an application now pending and in interference with a patent already granted.

What we claim is—

1. In a wool-washing machine, an inclined chute constructed in two parts, B' and C, pivoted at the point D, between the fork-bearing and squeeze rolls, so as to swing freely upward, for the purpose described.

2. In a wool-washing machine, the rolls G and H, arranged on an incline, in combination with an inclined or curved chute and a carrier or device for lifting stock over the latter to said rolls, substantially as and for the purpose described.

3. The combination of the inclined chute B with the guide P or U^1, bottoms I S, rolls G and H, and openings T, for the purpose described.

4. The standard *g* and curved support *d*, in combination with the bearing C', for the purpose described.

5. The table *f*, legs *h*, standard *g*, and support *d*, cast in one piece, in combination with the bowl A, substantially as described.

6. The arms *k*, in combination with the rake-head *a*, the lever-rod Z, ears *n*, and carrier *m'*, substantially as and for the purpose described.

7. In a wool-washing machine, a rigid carrier or carrier formed in one piece, combined with mechanism which moves one of its ends forward and backward in the same line, and raises its other end on the return-stroke, substantially as and for the purpose described.

8. In a wool-washing machine, the combination of the following elements: a rigid carrier combined with mechanism for raising the rear end on its return stroke, while its forward end moves to and fro in the same line, a stirrer rake or fork, inclined chute, and squeezing-rollers, substantially as and for the purpose described.

9. In combination with the reciprocating carrier of a wool-washing machine, having anti-friction rollers or slides *s*, the guides or ways U, secured to or forming continuations of the sides of the bowl A on both sides of the squeeze-rolls G H, substantially as shown and described.

10. In combination, with the reciprocating carrier of a wool-washing machine, having forwardly-projecting arms *p*, united by a cross-bar, *r*, the slides or rolls *s*, substantially as shown and described.

11. The combination of the levers *p* with the slides or rolls *s*, the side bars *l*, and cross-bars *m*, substantially as and for the purpose described.

12. The combination of the bars *l* and *m*, levers *p*, rod *r*, slides or rollers *s*, and ears *n*, forming the carrier-frame, substantially as and for the purpose described.

13. The combination of the bars *l*, bars *m*, and slides or rolls *s* with the swing-teeth *o'''* and *o''''*, for the purpose described.

In testimony that we claim the foregoing we have hereunto set our hands this 13th day of October, 1876.

J. HENRY KNOWLES.
JOSIAH K. PROCTOR.
FRANK P. PENDLETON.

Witnesses:
M. DANL. CONNOLLY,
CHAS. F. VAN HORN.