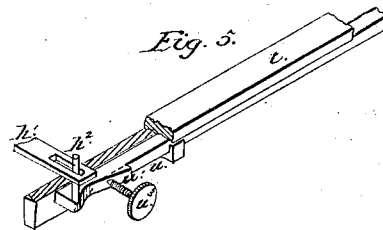
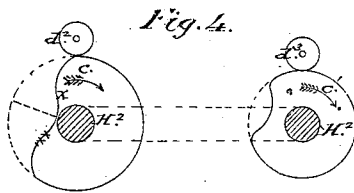
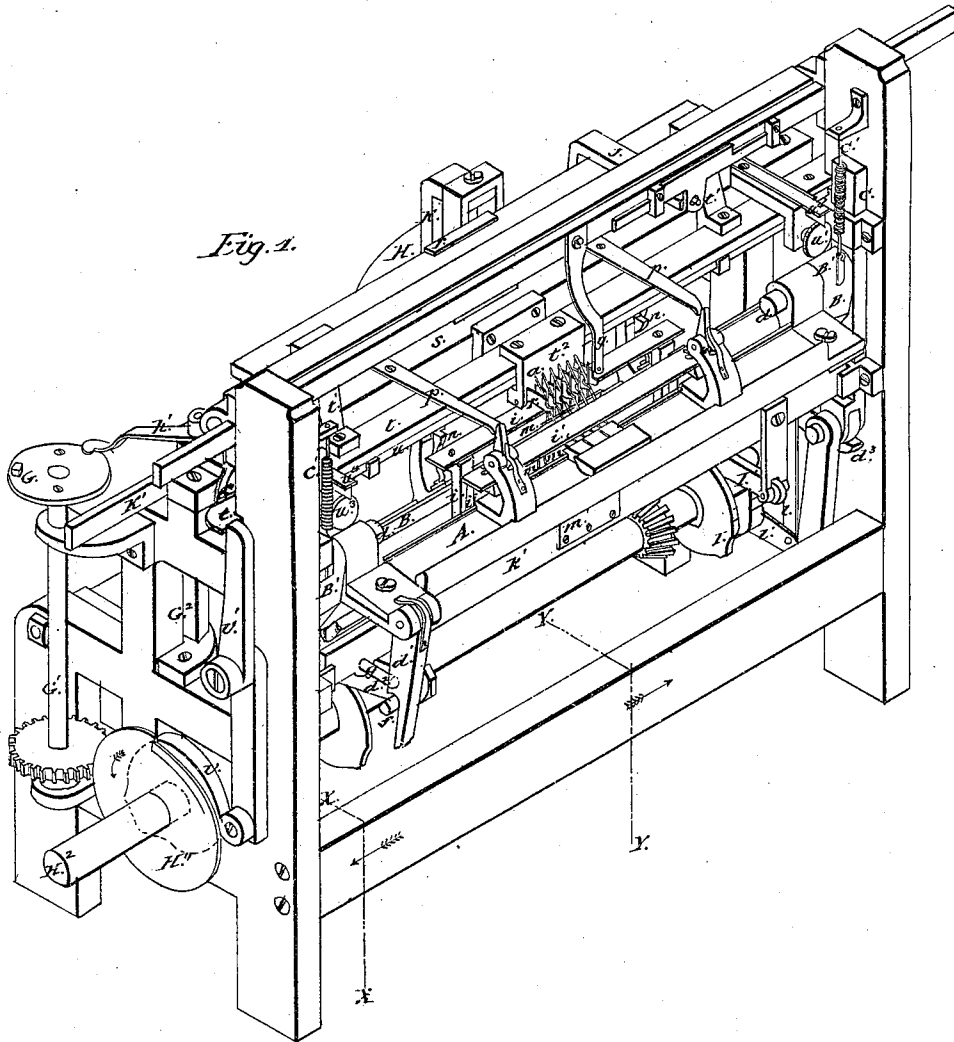


J. Powell,  
Knitting Mach.

Nº 13,621.

Patented Oct. 2. 1855.





# UNITED STATES PATENT OFFICE.

JOSEPH POWELL, OF WATERBURY, CONNECTICUT.

## KNITTING-MACHINE.

Specification of Letters Patent No. 13,621, dated October 2, 1855.

*To all whom it may concern:*

Be it known that I, JOSEPH POWELL, late of Great Britain, of Waterbury, county of New Haven, and State of Connecticut, have  
5 invented certain new and useful Improvements in Knitting Machinery; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being made to the annexed drawings,  
10 making a part of this specification, in which—

Figure I is a view in perspective of my machine; Fig. II is a transverse vertical section on the plane Y Y of Fig. I; Fig. III  
15 is a like section on the plane X X; Figs. IV, V, VI and VII are of parts in detail fully described herein, and similar letters refer to similar parts throughout.

My invention consists in certain improvements in the knitting frame, which improvements have for their object the making of both kinds of fabric known as "plain" and "ribbed" work, by a machine operating as a power loom. The ribbed and plain work  
20 may be continued in courses, first plain and then ribbed, or vice versa. In the making however of fabrics wholly ribbed, as shirts, the plain course is generally run in only for the forming the "welt," or place where one  
25 garment terminates, and the other begins. It is also adapted to the making of cuffs and all those parts of ribbed work now employed for terminating shirts, stockings, &c., which have their bodies plain. Heretofore  
30 all ribbed stocking frames were to be operated by hand, and the products are accordingly more expensive than if a power loom were to be employed.

In my machine two distinct sets of needles are made to weave in joint operation so that loops are formed on both at the same time, each course of ribs being formed together, and cast off complete at the same moment, while at the same time there is a  
35 mechanical provision which can be set to come into play at any required time and by a self operating arrangement to disengage one set of needles so that plain work will then be made for the distance necessary to give a complete finish to the article.  
40 One set of sinkers and jacks operate on one or both sets of needles at the proper times respectively. The two sets of needles, which are of the ordinary construction, are  
45 arranged upon two bars lying horizontally and near together and supported at their

ends in slides secured to the sides of the main frame so that they are permitted to have a vibrating motion vertically.

At A, is seen the front needle bar, and at 60 B, the back one. At C, are the slides whereby the needle-bars are connected to the frame. The needles are therefore carried up and down with these bars, but with very different motions, for the bars themselves  
65 alter their relative positions toward each other while falling and rising. The effect intended to be produced by this is to keep one set of needles, viz., the back set on bar B, moving up and down in a vertical position while the front set are to start in the vertical position when at the bottom of the motion of the bar, and rise along with and like the other set until the latter has attained its greatest elevation and come to a state of  
70 rest, when a new motion is given to those on A, as they then tip over and go from a vertical to an inclined position by which means they cross and interlock with the back set, forming a cross as shown at (a, b,) Figs. 80 I and II, (a) being the needles on the front bar and (b) those on the back bar. These motions are produced by the action of dissimilar cams placed on the main shaft. One of these cams is seen at (c), Figs. III and 85 IV, another at (c') Figs. II, III and IV, and another at (c<sup>2</sup>), Figs. II and III. These two latter are in pairs, there being one of each at each end of the frame. The cams (c') act to raise the slides C, the cams 90 (c<sup>2</sup>) to lower them, and the cam (c) acts to cause the tipping of the front needle bar A, and consequently of the needles (a).

In order that it may make the double motion above described, the front bar A is supported upon two sets of bearings, the one set being a pin (d), Figs. I and III, projecting from each of the slides C, and on which pins the bar hangs as by hinge joints, the other bearing being at the front edge of the bar, 100 where a vibrating link (d') extends down and connects with the cross lever (d<sup>2</sup>), Figs. I and III, and which lever is moved by the cam (c).

A cross lever (d<sup>4</sup>) at each end acted upon 105 by the cam (c<sup>2</sup>) effects the lowering of the slides C. The cams (c) and (c') are shaped nearly alike although they are of different diameters in their circular part, and are as seen in the separate Fig. IV. Their joint 110 action upon the needle-bars will be as follows: Suppose the rollers (d<sup>2</sup> and d<sup>3</sup>) to be

resting upon that portion of their cams which is circular and where the roller ( $d^2$ ) is just on the edge of the depression of its cam. When in this position the slides C, are at their full height and the front needle bar A elevated so as to engage the front set of needles with the back ones and as shown in Figs. I and III. Now it is required that before the needles descend to cast off their loops the front row must be elevated to a vertical position, and stand so as to form a line parallel with the back ones. In order to accomplish this the bar A must be allowed to turn on its hinge pin ( $d$ ) so that the front edge may drop down. As the cams ( $c$ ) and ( $c'$ ) rotate, the lever ( $d^3$ ) will drop first into the cavity and descend to some point, as say X on ( $c$ ), Fig. IV, while the slides C are still held up by the cam ( $c'$ ) by reason of the roller ( $d^3$ ) not yet having reached its depression as clearly seen in the Fig. IV. From ( $x$ ) on ( $c$ ) to the bottom of the cavities the descent is alike, thus allowing the two bars A and B to descend together and thereby keep their respective sets of needles in the proper vertical position. In ascending the same order is preserved. The roller ( $d^3$ ) reaches the top of its cam by the time the roller ( $d^2$ ) has reached the point X X so that the back needle bar will have attained its full length and become stationary, in order that the crossing of the front set may take place, which is accomplished by the movement of ( $d^2$ ) from the point X X out by the edge of its cam. At ( $d'$ ) is a link connecting the front edge of the needle bar A with the tipping lever and this is fixed in such manner as to become disengaged from the end of its lever ( $d^2$ ) at certain times, that is, when the machine is engaged on plain work, for when out of gear the bar A no longer tips over, although it moves up and down with the guides C, consequently its row of needles is not engaged and no loops are formed upon them, the action of the back row being then to weave a plain web as on a common frame.

The lever end of the link ( $d'$ ) is notched out so as to rest upon a pin ( $f$ ) in the end of the lever. Immediately behind the link ( $d'$ ) there is a horizontal draw bolt ( $g$ ) Figs. I and III, the forward movement of which will thrust the end of said link from the pin ( $f$ ) and keep it off for the given length of time for weaving the number of plain courses required to finish the garment or form what is technically called the "welt." This disengagement takes place on every revolution of a stop shown at G, Figs. I and III. The end of the bolt is secured to an arm ( $h$ ) Fig. III projecting from an upright post  $G^2$ , a second arm extending from the top of this post terminates so as to come into contact with the stop G as seen at ( $h'$ ) Figs. I and III; when the stop G strikes

( $h'$ ) the bolt ( $g$ ) is thrust forward and disengages the link ( $d'$ ). The reengagement of the link upon the pin ( $f$ ), on the withdrawal of the bolt, is effected by a spring on its upper end as seen in Figs. I and III.

The two sets of needles are arranged on their bars so that their barbs shall be turned outward. Each set has a presser-bar as seen at ( $i$   $i'$ ) supported upon standards ( $i^2$ ,  $i^3$ ) which are hinged, to plates bolted fast to a cross bar ( $k$ ) seen in Figs. II and III. There is a spring between the standards, tending to force the bars apart and which keeps them clear of the needles until such time as they are to be brought into action by other mechanism.

To cast the loops off as fast as the courses are formed, two rails or plates are so placed between the two sets of needles that the top edges of the rails shall be about on a level with the presser bars. One of the cast off plates is secured to the permanent rail ( $k$ ), as seen at ( $m$ ), and belongs to the back row of needles. The other is represented at ( $m'$ ) and is fixed to a movable rail ( $k'$ ) Figs. I, II and VII, which rail lies parallel with ( $k$ ) and at a short distance from it, in front. The web hangs between these casting off plates and passes down under the frame to the take-up roller. At this part of the machine some delicate movements have to be performed in order to insure certainty in its working, and these relate to the casting off of the loops. As loops are formed at the same time on both sets of needles, which have to be cast off together, it is found that the weight of the web hanging between was such as to cause a great strain or drawing upon the needles, especially when the loops had got over the barbs and near the top of the needles, the needles here being of double thickness. To overcome this an easement is effected by a slight vertical motion of the back set of needles, and immediately after that by a like motion of the front cast off bar ( $m'$ ). As these two motions occur almost in combination they will be described together.

The back needle bar is attached to the slides C by the pin ( $d$ ) by means of an eye at B'. This eye is enlarged or elongated so as to allow of some play and as seen by the dotted lines below ( $d$ ) in Fig. III. Attached to the eyes are two springs C' which pull upward as shown. To each eye B' there is a down pull ( $l$ ) which connects with a cross lever ( $l'$ ) passing beneath the main shaft and hinged to the back of the frame, and to operate upon this pull is a cam having an acute point seen at ( $l^2$ ), the operation of which is such that when the needles have descended so that the loops to be discharged have been pushed up the shanks, and over the barbs, and approach that point where the strain before named commences, the

point of the cam ( $l^2$ ) shall be just passing along the top of its bearing piece ( $l^3$ ) on the cross lever ( $l'$ ). The top of the back casting-off plate stands a little higher than that of the front one, as shown Figs. II and VII, whereby the cast off will be effected from the back set of needles first, and so soon as this has taken place, the point of the cam ( $l^2$ ) must have passed the top of its bearing piece, thereby permitting the back needle-bar B to rise on the pin ( $d$ ) to the extent of the elongation of its eye, shown under the pin in the dotted lines Fig. III, and which rising is effected by the action of the spring  $C'$ , since the needle bar is not now held down by the cross-lever ( $l'$ ). The front casting-off plate now rises by the cam I, Figs. I and II, acting to raise the bar ( $k'$ ) through the lever  $I'$  and this throws off the loops on the front row of needles. The front presser-bar is to be disengaged at those times when no work is to be done on its row of needles. This will be made clear during the following description of the manner of causing both bars to act on their respective sets of needles. On both needle bars are fixed two sets of beveled latches which are alike as regards their operation on the pressers, but the front pair have a provision whereby they may be disengaged at certain times. Their operation is such that when the needle-bars descend to carry down the needles, so soon as the barbs of the latter are in their proper position, the presser bars are pushed together and thus close the barbs upon the new laid course to allow of the last or finished course being discharged, in a manner well known in the common knitting frame. The latches then become disengaged and allow the presser-bars to fly back by the force of the springs in the standards ( $i^{12}$   $i^{13}$ ), before described. At ( $n$ ) Figs. I and VII are seen the latches on the back needle-bar. The under edges are beveled and they are hinged to the top of the studs as shown in Fig. VII, a feather spring keeping them up in the position represented. As the needle-bar descends the beveled edges strike against the edge of the presser bar and force it against the barbs of the needles, holding them closed until the new loops are up and the last course thrown off; they then get clear and the presser-bar flies back. When the needles ascend again the flat tops of the latches strike against the edge of the presser-bar so as to turn them down against the force of their feather-springs and this allows them to pass by without acting on the presser-bar until the next downward movement. The latches on the front needle-bar have a different arrangement for setting. This is because the bar tips over and shifts the place of the studs which hold said latches and also because they are to be wholly dis-

engaged at all times when the front set of

needles are not in action. The inner lower ends of these latches are beveled as seen at ( $n'$ ) to press the bar on descending, as is the case with the back ones. On the back is a locking spring seen at ( $o$ ) Fig. VII, which can ride into two recesses ( $o'$   $o^2$ ) on the back. This sets the latch in the positions in which it is thrown on passing by the presser-bar on the upward ascent of that bar, for as the top of ( $n'$ ) strikes on the under side of the bar the latch is bent down to clear it and the spring rides into the recess ( $o^2$ ). Thus if there were nothing in the way to shift the latch back, it would go by said presser-bar without acting on it on the next downward stroke. To set the latch therefore it is provided with a short arm ( $o^3$ ) which is brought up to strike against a pin or arm ( $p$ ), by the elevation of the front edge of the needle bar A, when that is raised by the link ( $d'$ ) before described. This throws over the latch and sets it, as in Fig. II, ready to act upon the presser bar. When however the link ( $d'$ ) is unhooked, as the needle-bar will be no longer tipped over, the arm ( $o^3$ ) does not reach the pin ( $p$ ) and the arm accordingly plays up and down clear of the presser-bar, which it should do, as at that time no loops are formed on the front set of needles.

The sinkers lie horizontally, being arranged at the back of the needles and at right angles to the back set, as shown at ( $r$ ) Figs. I and II, and their jacks hinged in a line parallel at ( $r'$ ), the sinkers and jacks being held in place by passing through a metal rack supported by a bar ( $s$ ) on the frame. The motion of both jacks and sinkers is horizontal. The sinker is finished at the end which plays between the needles with the usual fork to sink the loops in the ordinary form. The sinkers are also pushed between the needles by the action of a slur-cock ( $s'$ ) Fig. II, which in this case plays against the ends of the jacks instead of on their tops, as in some of the old frames. There are two springs acting upon the jacks, one is a locking spring and the other is to force the sinker forward the full distance it is allowed to go after the slur-cock has driven it past the notch where the locking spring takes hold; the locking spring is at ( $r^2$ ) Fig. II, and there is a projection on the jacks at ( $r'$ ) which shows how the sinkers are held back. The springs ( $r^3$ ) are the other ones named as always tending to force the jacks forward. The slur-cock as it passes along strikes the ends of the jacks just below the end of the spring ( $r^3$ ) and pushes them so far as to force the projection ( $r'$ ) beyond the spring ( $r^2$ ), the other spring ( $r^3$ ) then forcing them along their full distance.

H, Fig. II, is a cam working by a bevel gear from the main shaft, being a groove

cut in the side of an eccentric wheel. In this a pin having on it a friction wheel  $H'$  travels, the pin being attached to a lever  $K$  and thus a vibratory motion is imparted. The upper end of  $K$ , is connected with a slide bar  $K'$  to which the slur-cock is attached, and from this slide bar connection is formed with another one standing over the needles as seen at  $J$ . This effects the movement of the yarn-guide. There is nothing peculiar in this particular part of the machinery. The yarn-guide may be provided with a locking-spring and catch to hold it in place at the end of each course until the slur-cock goes by, as the yarn-guide must always precede the latter to lay the yarn before the sinkers come into play, as well known.

The part for returning the sinkers and carrying them clear of the needles in peculiar, as it provides a self-adjusting means for varying the depth of the loops and thus weaving the course "slack" or "stiff" as may be required. This part consists principally of two bars, one within the other, and suspended to the frame so as to move back and forth in the direction of the sinkers. The first or outer bar is seen at  $(t)$  and the arms by which it is suspended at  $(t')$  Figs. I and II. Upon this is a rack  $(t^2)$  through which the sinkers play. It is by the vibrations of this bar that the sinkers are pushed back after having been operated upon by the slur-cock, as it also regulates the distance the springs  $(r^3)$  can throw them forward, and thus it determines the character of the web as to whether it shall be slack or stiff. On each jack there is a notch cut as seen at  $(r^4)$  Fig. II. When the sinkers are to retreat the bar  $(t)$  moves back; and as is evident, the back edge of  $(t)$  must carry along the sinkers. The locking springs  $(r^2)$  ride past the projections  $(r')$  and thus lock the whole row.

The bar now moves toward the front of the frame and stops at such distance as it is intended to allow the sinkers to return in forming the loops. The second bar before spoken of is for the purpose of regulating the extent of forward motion the bar  $(t)$  shall have at different times in order that the slack or stiff work may be woven as before mentioned. The second bar is seen at  $(u)$  and lies under  $(t)$  extending the whole length inside of the main frame. It has at each end a sloping part as seen at  $(u')$  Fig. V; while it is carried back and forth with the movement of the main bar  $(t)$  it has also a motion of its own along the bar from right to left, and by this means different parts of the slope are brought opposite to the point of a regulating screw  $(u^3)$  Figs. I, and V, which is fixed permanently to some convenient part of the frame. It has a milled head, which receives the edge of a gage spring  $(u^4)$ . Thus it will be seen that the main bar

$(t)$  will be stopped by the point of the regulating screw striking against the sloping part of the bar  $(u)$  and therefore by shifting the bar  $(u)$  along to the right or left the movement is arrested sooner or later as may be.

It remains now to describe how the different movements are self-produced by the general operation of the machine. The bar  $(t)$  tends always toward the front of the machine by the pressure of springs one of which is seen at  $(t^4)$  Figs. I and III, where it acts against the projecting end of  $(t)$ . On each end of the main shaft, but outside of the main frame, is a cam  $(v)$ ; these act against levers  $(v')$  Fig. I, the upper ends of which levers strike the bar  $(t)$  as shown; these therefore push back the bar and thus the jacks are set in their locking springs. As the cam releases the bar it comes forward by the force of the springs  $(t^4)$  until arrested by the points of the regulating screws  $(u^3)$  which forward motion is more or less according to the position of the bar  $(u)$  before named. The sloping part of that bar represents adjustments for sinking the loops for ribbed and plain work; the deepest part is when the work is to be woven ribbed, the next when woven plain, on a single set of needles. These come into play during the operation of weaving a garment or cuff of a shirt and are actuated by a cam  $G$ , Figs. I and III.

As at each revolution of  $G$  one set of needles is thrown off, as before described, so at that time must the bar  $(u)$  be shifted to reduce the throw of the sinkers so that only the yarn required for a plain web will be fed. To accomplish this the arm  $(h')$  is extended beyond the vertical shaft  $G^2$  where it takes hold of a pin  $(h^2)$  Figs. III and V connected with the shifting bar  $(u)$ , and the movement occasioned by the striking of  $G$  against  $(h')$  shoves the bar  $(u)$  along so that at the next vibration of  $(t)$  the point of the regulating screw  $(u^3)$  will strike the highest part of the slope on  $(u)$  and keep the bar  $(t)$  from coming so far forward. This then arrests the motion of the sinkers sooner and they accordingly sink the loops shallower and as required for plain work. Every revolution of the main shaft  $H^2$ , produces one complete course, and in weaving a garment, say a shirt, a long piece of web must be woven before any of those shifting parts just described will be brought into play a second time.

At  $H^4$  is a cam or worm-wheel which operates to turn the vertical shaft  $G'$  notch by notch of the toothed wheel shown attached. The number of notches in this wheel is the same as the number of courses required to complete a garment or article, as a "cuff." As such articles are made in a continuous web it is necessary that some

finish be given as well as a means for separating or cutting them apart. This is done by forming at each end what is known as a "welt." This is a few courses woven plain,

5 with a draw thread, which being taken out separates the articles and leaves a row of loops to be taken up by the needles on the frame which is engaged in weaving the shirts to which the cuffs are to be attached.  
 10 In the present described machine the cam G acts upon the lever ( $h'$ ) so as to disengage the link ( $d'$ ) and to shift the bar ( $u$ ) during a time long enough to weave three plain courses, upon one set of needles, the  
 15 middle of them is the draw thread. The rule of this working may be variously changed, for instance, in case the loom is making plain shirts requiring but a short piece of ribbed work at the ends of the arms, the extent of the cam G would in such a  
 20 case be nearly equal to the whole circumference of the wheel, the space left being only to the extent of the ribbed work.

It now remains to describe the general  
 25 operation of the machine. It is supposed that the starting course has been fixed as usual; the front needle bar tipping its needles over so as to combine with the back set at each rise of their cam levers; everything is now in position for working the  
 30 ribbed courses. The yarn-guide ( $y$ ) Figs. I and II then passes along and lays the yarn on in the crotch formed by the two sets of needles; the slur-cock following close after it strikes the ends of the jacks and sends the sinkers forward; these form loops  
 35 only on the back set of needles the loops lying on their shanks below the points of their barbs as in the ordinary machines.  
 40 As soon as the whole course is in this way laid, the first part of the recess on the cam ( $c$ ) on the main shaft comes under the roller on the lever ( $d^2$ ); the front edge of the needle bar A drops down; thus tipping its row  
 45 of needles from their inclined position to a vertical one, while at the same time the sinkers are withdrawn by the backward movement of the shifting bar ( $t$ ) the cams ( $v$ ) coming into play upon the lever ( $v'$ )  
 50 to effect it; by this means all those loops which were held by the sinkers have been taken off and laid upon the shanks of the front needles, as may be clearly seen in Fig. VI. This course is above the course last  
 55 laid and which had been finished, the residue of the web hanging to it and passing down between the casting-off-plates ( $m$ ) and ( $m'$ ); both needle-bars now begin to descend by the other cams ( $c'$ ) and ( $c^2$ ) coming into play. At the proper time, *i. e.*, as  
 60 soon as the loops have been pushed up under the points of the barbs, the latches ( $n$   $n'$ ) strike against the edges of the two presser-bars and close the barbs of the  
 65 needles so that the finished course may pass

to the top and be cast off, which is done by the needles sliding down close by the face of the cast-off-plates ( $m$ ) and ( $m'$ ); the back plate being a little higher than the front one pushed off the old loops from the  
 70 back set of needles first, and then the back needles are allowed to rise a little by the passing of the point of the cam ( $l^2$ ) beyond its bearing, consequently liberating the bar B to be acted on by the spring C' as before  
 75 described. This slight rising of the back needles is however sufficient to relieve the strain upon the web, since by it, the loops are transferred from the very top of the bend of the needle to the upright part, and  
 80 this at once gives relief to those on the front row of needles which are now to be discharged by the upward movement of the front plate ( $m$ ) as before described. The whole difficulty arising from the straining  
 85 of the loops by the weight of the web is thus overcome and the united action is performed with the same ease as for plain netting. The needle bars now ascend, the  
 90 needles crossing as before described; the loops upon them slip down on their shanks, and the web now hangs from the needles and between the discharge plates; another course is laid, and the operation is thus continued until enough has been woven to form  
 95 the intended article, when changes must be made to effect the finishing off. For this purpose the stop on G has now arrived at ( $h'$ ) thereby causing the rod ( $g$ ) to throw off the link ( $d'$ ), and also shifting the bar  
 100 ( $u$ ) to reduce the throw of the sinkers. Three plain courses are then to be woven, as before described, thus marking the place for separating the cuff. The stop G will then have passed by the end of ( $h'$ ) and  
 105 the several parts will be restored again to the appropriate positions for forming ribbed work. In this machine however, plain fabrics may be woven and ribbed work included, either for the finishing or for any  
 110 purpose desired without introducing the same as a separate article woven on another frame, as is the case in all the old frames. These and various other changes both as to  
 115 the weaving "slack" and "stiff" and ribbed and plain may be automatically effected by changing the order of the slopes or recesses in the regulating bar ( $u$ ) and also the construction of the cam G, as these effect the  
 120 changes to be made in the shifting bar and also the times for operating the front set of needles.

In the foregoing description the needle-bars are shown as having but one set of  
 125 needles on each, whereas these bars are long enough and are intended to carry several sets, whereby several webs may be woven at one and the same time. In such cases the presser-bars and discharging plates  
 130 must of course be continued out.

What I claim as my invention and desire to secure by Letters Patent is—

1. So combining two sets of needles, such as are commonly employed on knitting  
5 frames, that they may be brought into joint action and have loops formed on both of said sets at one and the same time, and thus form a ribbed fabric, as described.

2. I claim the arrangement of the needle-  
10 bars and the two presser-bars, so combined that when both sets of needles are in action, both pressure-bars will also act upon the barbs of the needles, as described.

3. I claim the self-setting-latches in com-  
15 bination with the needle and presser-bars, as described.

4. I claim the combination of the regulat-  
ing-bar (*u*) with the shifting-bar and the  
set-screws for regulating the throw of the  
sinker and depth of the loops, as described. 20

5. I claim the manner of discharging the  
loops, that is to say, casting off those of one  
set of needles a little in advance of those  
of the other set, and giving to the first set  
of needles an upward motion as soon as the 25  
cast-off has been effected from them, for  
the purpose of relieving the strain as set  
forth.

JOSEPH POWELL.

Witnesses:

CALVIN H. CARTER,  
C. J. GODFREY.