

J. PEPPER.  
KNITTING MACHINE.

No. 102,313.

Patented Apr. 26, 1870.

Fig. 2.

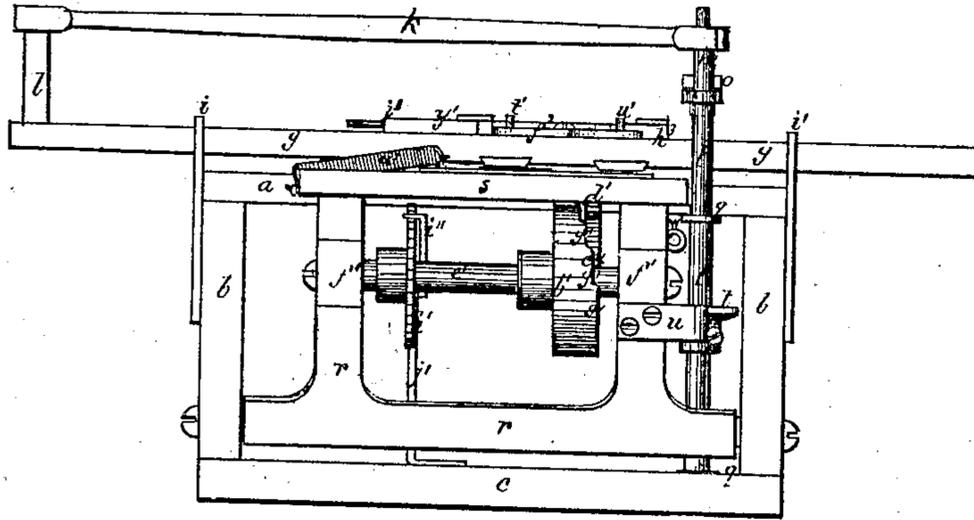


Fig. 1.

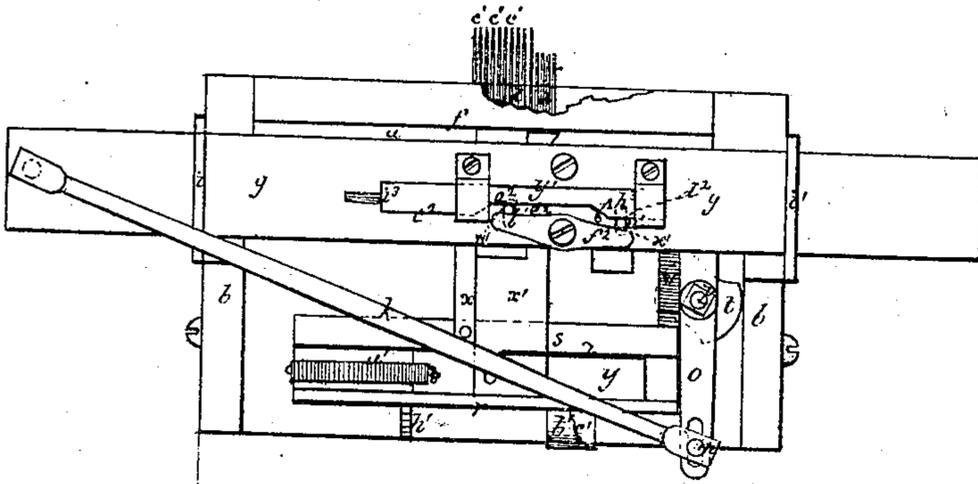
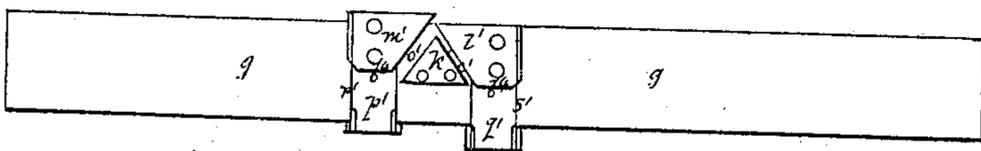


Fig. 5.



Witnesses.

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Fig. 3.

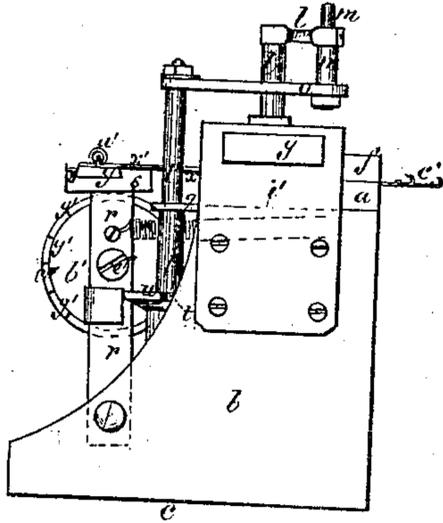


Fig. 4.

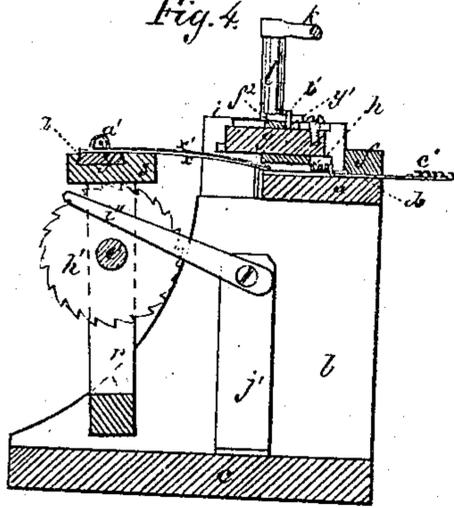
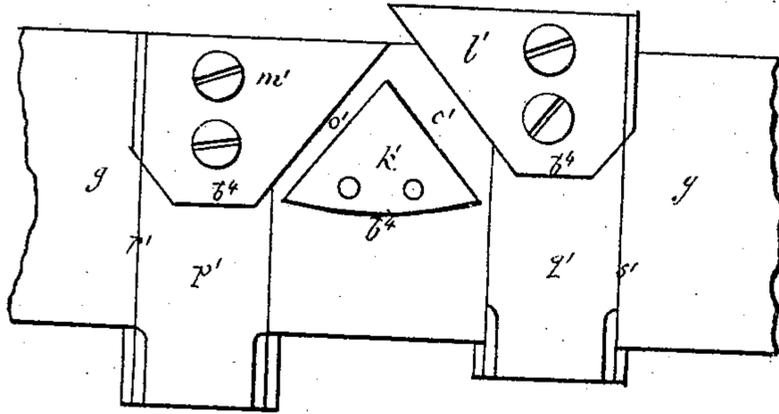


Fig. 6. Enlarged view of cams.



Witnesses.  
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# United States Patent Office.

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Letters Patent No. 102,313, dated April 26, 1870.

## IMPROVEMENT IN KNITTING-MACHINE.

The Schedule referred to in these Letters Patent and making part of the same.

To all to whom these presents shall come:

Be it known that I, JOHN PEPPER, of Lake Village, in the county of Belknap and State of New Hampshire, have made an invention of certain novel and useful Improvements in Machinery for Knitting Looped Fabrics; and do hereby declare the following to be a full, clear, and exact description thereof, due reference being had to the accompanying drawings making part of this specification, and in which—

Figure 1 is a plan.

Figure 2, a side elevation.

Figure 3, an end elevation.

Figure 4, a transverse section.

Figure 5, an under-side view of the cam-bar of a knitting-machine containing my invention.

The invention herein described, and constituting the subject matter of these Letters Patent, is based upon a class of machinery for knitting looped fabrics, in which a single series of direct-acting needles is arranged in parallel grooves cut in a stationary bed.

The primary object of my present invention is to adapt, in a simple and effective manner, a machine of the above nature, to the knitting of "fashioned" and figured fabrics.

My invention, then, as embodied in this context, consists substantially, by suitable instrumentalities, in forcing into action any given number of needles in machinery of the class herein first premised, by which I am enabled not only to effect variations in the outline of the fabric produced by the machine, but to vary the disposition and grouping of the stitches throughout such fabric, in order, when desirable, to produce fabrics of variegated designs or figures.

It also consists in a divided or changeable bearing-surface or edge of the said forwarding device or bar or beam, the same being governed by a platform or shaping-barrel or its equivalent, in such manner that the said bar drives forward a greater or lesser number of needles.

It also consists in certain devices by which means the extent of the working-edge or surface of the said forwarding-bar is varied automatically, according to the form or figure of fabric to be produced, in combination with certain other devices for operating the needles, these devices and their relationship to the needles being duly referred to under this head of the specification.

### Description of Mechanism.

The drawings hereinbefore mentioned as accompanying this specification, and which illustrate my invention, exhibit a portion only of a knitting-machine of the class upon which these improvements are based.

In these drawings—

*a* denotes the needle-bed or rail, as supported upon or within the end standard *b b* of the machine frame, the base of the frame, or the floor of the structure in which the machine is placed, as the case may be, being shown at *c*.

The needle-bed is horizontal, and is scored at right angles to its length at equal distances, as shown at *d d*, to receive the needles, a portion of a series of such needles being shown at *e e*, &c., and as confined in place within the scores by an overlying plate, *f*, such disposition of needle-bed and needles, as well as the form of the latter, being the same as now in use in machinery of the class to which they relate, and thus far containing nothing characteristic of my present invention.

The device for operating the needles or the cam-bar or plate, as the object is termed, which occupies an analogous position in other machines, is shown in the drawings at *g*, as sliding horizontally over and in alignment with the "nibs" *h h*, &c., of the needles, and guided and supported in ears *i i* making part of the end standards of the machine frame, the endwise reciprocal traversions of the said cam-bar being effected by the agency of a pitman, *k*, one end of which is pivoted to a post, *l*, erected upon the remote end of the needle-cam bar, while to the opposite end is pivoted the wrist *m*, of a horizontal crank, *o*, affixed to the upper extremity of an upright shaft, *p*, such shaft revolving in bearings or supports *q q*, rising from the floor *b*, and immediately adjacent to that end of the cam-bar most remote from said crank.

The shaft *p* is the driving-shaft of the machine, and is to be driven by suitable means. Revolutions of this shaft in either direction will cause corresponding longitudinal traversions of the cam-bar over the needles.

In carrying out portions of my invention, as expressed in this context, and in one form of adaptation of its principles, I dispose in rear of, or opposite the "nibs" of the needles, a vibrating or rocker-frame, *r*, the base of this frame being pivoted in a suitable manner to the end standards, while its upper and horizontal rail *s*, or "forwarding-bar," as I term it for want of a more convenient title, rises into a position parallel to, and with its upper surface slightly below, or on a level with said needle "nibs."

Vibrations of the frame *r*, and consequently the incidence and departure of the forwarding-bar with respect to the needles, are effected in the present instance (although various means may be adopted to produce the result,) by means of a wiper or cam or double eccentric *t*, mounted upon the shaft *p* before mentioned, and about midway of the height of the frame *r*, the periphery of such cam impinging against a stud or arm, *u*, projecting laterally from the adjacent end of the

contact with the working periphery of the cam  $t$  by the contraction of a coiled spring,  $w$ , one end of which is secured to the frame, while its opposite end is made fast to the under side of the needle-bed.

The revolutions of the cam  $t$ , in correspondence with the movements of the "cam-bar," effect, through the agency of the pitman  $k$ , one vibration of the frame  $r$  to each traverse of the "cam-bar."

Projecting inwardly from the upper face of the "forwarding-bar"  $s$ , at  $x x'$ , is a number of flat plates or needle "drivers," as they may properly be called, one of which,  $x$ , is affixed rigidly to the "forwarding-bar," and its fellow, which overlaps and plays over it at  $x'$ , the latter being in turn affixed to and carried by a sliding plate  $y$ , moving in a dovetailed or shelf groove or way  $z$ , formed in the upper face of the "forwarding-bar," as represented in the drawings.

The inner and working edges of the needle-drivers,  $x x'$ , should be as near as possible in the same horizontal plane as the "nibs" of the needles with which they act in unison, and against which they at times abut, and the latter plate  $x'$ , or its carrier  $y$ , should be provided with a spring  $a'$ , or its equivalent, for retracting it to its normal position, or in correspondence with the pattern-barrel hereinafter mentioned, which position is directly over and coinciding with the lower plate  $x$ , the two plates, when in this position, constituting the most contracted line or driving edge of the forwarding-bar, or the driving portion of the same, and, when separated, its most extended, portion, and thus forward a greater or lesser number of needles, it being understood that the contracted edge of the two plates is supposed to impinge against and forward such a number of needles as may be necessary to knit the narrowest portion of the fabric, as, for instance, the wrist of a sleeve, the ankle of a pair of drawers, the toe of a sock, &c.

I prefer in the practical use of this machine, for certain obvious reasons of economy, to begin at the narrowest point in the width of the fabric, and fashion only by "widening" or increasing the width of such fabric at successive stages in its accumulation, for the reason that such "widening" may be accomplished with less complexity of details in the mechanism, since I am not compelled to provide a means of taking up the stitches left in the narrowing.

The necessary intermittent or progressive traversions of the movable "forwarding-bar" or "driver"  $x'$ , in the "forwarding-bar"  $s$ , are affected by a pattern or "shaping-barrel," which is represented in the drawings at  $b^1$  as a semi-drum or flanged disk, the working periphery  $c^1$  of which is of such diversified or varying outline as to effect, by means of a ratchet and pawl, as hereinafter stated, such end or step-by-step advances of the plate  $x'$ , or its equivalent, as practice shall determine necessary to insure the proper extent of driving edge to act upon the needles.

A stud,  $d^1$ , depends from the movable plate or its carrier, impinges and is held against the working edge of the periphery of the barrel by the action of the spring  $a^1$ , before mentioned, the said pattern-barrel being mounted upon a horizontal shaft,  $e^1$ , supported and revolving in bearings  $f^1 f^1$  affixed to the end rails of the frame  $r$ , before alluded to, thus completing, in combination with the shaft  $p$  and wiper-cam  $t$  and their auxiliaries or equivalents, the devices for varying the extent of the actuating-edge of the forwarding-bar.

The intermittent partial rotations of the pattern-barrel are effected by means of a ratchet-wheel,  $h^1$ , fixed to a convenient part of the barrel-shaft, and operating in connection with a "drag-pawl,"  $i^1$ , which engages with it and is pivoted to a post  $j^1$ , erected upon the floor  $b$  and in rear of the frame  $r$ , in such

needles by the action of the cam  $t$  shall effect a one-tooth movement of the ratchet, and consequently a corresponding movement of the barrel  $b^1$ .

The working periphery of the pattern-barrel  $b^1$ , is represented in the accompanying drawings as formed with a series of gradually-increasing inclined grades or steps  $g' g'$ , &c., in regular succession.

This is merely for the purpose of demonstrating the ease with which, under my system, the driving-edge of the "forwarding-bar" may be expanded and contracted, as it will be apparent at a glance that a revolution of the "pattern-barrel," with the aid of the stud  $d^1$ , has the effect of first causing intermittent expansions of the said forwarding-bar, and a consequent covering of an increasing number of needles, until the greatest width of the periphery of such barrel is passed, when, by the action of the spring  $a^1$  or its equivalent, the driving-bar is retracted to its normal position, and a certain number of needles released from service.

It only becomes necessary, therefore, in producing different forms of fabric, to ascertain the form of the "pattern-barrel" which is to produce at the proper time the requisite variations, and to provide for each different form of fabric a corresponding barrel. It may, however, be found that one barrel may be so constructed as to fashion several pieces of fabric.

It will be seen, by referring to Figure 6 of the accompanying drawings, which gives an under-side view of the "cam-bar," that I employ three oblique-faced plates or inclined cam-grades  $k' l' m'$ , the center one,  $k'$ , which is V-shaped, being immovable upon the "cam-bar," while the two outer ones,  $l' m'$ , are movable, and slide upon the bar in order to direct the "nibs" of the needles into the passage  $o$  between the center plate and its adjacent inclines. Each movable plate is alternately advanced beyond the heel of the center cam, thus allowing it to seize the needles.

It becomes necessary to direct the needles into one and then the other straight portion of the channel  $o$ , at each traverse. To accomplish this I affix each twin cam or wing,  $l'$  or  $m'$ , upon an independent slider  $p'$  or  $q'$ , such sliders being disposed in like manner upon each side of the central cam  $k'$ , and sliding in grooves  $r' s'$  cut in the under face of the cam-bar, and at right angles to its longest plane, a pin or post  $t' u'$  rising from each plate and extending through lateral slots  $W' X'$  cut through the cam-bar as represented in said fig. 6, by means of which studs the alternating sliding of the plates or carriers  $p' q'$ , are easily effected.

The means adopted in the present instance to effect these slidings of the carriers  $p' q'$  consist in disposing upon the upper surface of the cam-bar a sliding duplex wedge,  $y'$ , or a rod or bar carrying two oppositely-disposed twin-shaped inclined grades,  $a^2 b^2$ , the said wedge-bar  $y'$  sliding longitudinally upon the cam-bar, and being so disposed, with respect to the posts  $t'$  and  $u'$  of the carriers  $p'$  and  $q'$ , as to effect alternate outer slidings of the same, the position of the said inclined grades  $a^2 b^2$  being such that, at the instant one post is passing over the summit of one, the opposite post has just arrived at the base of the opposite grade; consequently, while one post, whichever it may be, is impinging against the straight portions  $e^2 d^2$  of the outer edge of the wedge-bar  $y'$ , its fellow-post is situated within the depression  $e^2$  of such bar, created by the formation of the inclines  $a^2 b^2$ , it being observed that the two posts, and with them their respective sliders, are compelled to move in unison, and maintained in contact with the wedge-bar by an oscillating compound-lever or tripper,  $f^2$ , which is pivoted at its center to the upper surface of the cam-bar, and alongside of the two posts against which its opposite ends impinge.

The length of the wedge-bar is such that its ex-

tremities shall abut alternately against the ears  $i$   $i'$  before mentioned, as they approach in their journey one or the other of such ears.

The arrangement of parts is such that at the time the crank approaches its extreme point in one direction, the adjacent end of the wedge-bar shall abut against the contiguous ear  $i$ , in sufficient season to so actuate the wiper  $f^2$  as to advance or drive out the forward carrier or slider and wing  $l'$  or  $m'$  which is most remote from the ear, and, as a consequence, uncover the remote end of the center cam, to allow the nibs of the needles to pass into the remote passage  $o'$ .

Following a semi-revolution of the crank from this point, the opposite end of the wedge-bar abuts against its ear  $i$ , and reverses the last-mentioned position of parts, that is, advances the slider  $p'$  and wing  $l'$ , and withdraws the slider  $q'$  and wing  $m'$ .

In this manner, when a wing is advanced beyond its fellow, the center plate or cam is allowed to strike and actuate the needles in succession, provided they have been advanced after having been withdrawn by the forwarding-bar, so as to bring their nibs in range of the base of the center cam.

As that wing  $l'$  or  $m'$  which is foremost or in advance of the center or V-shaped cam  $k'$  during the traverse of the cam-bar recedes or falls away from the base of such center  $k'$ , which is a fixture of the bar, and allows such bar to seize and advance the nibs of each needle presented to it, the opposite or rearward wing approaches the center  $k'$  and the path of movement of the base thereof, but yet serves to retract and return the needles to their original position, after passing the apex of the center. This alternate advance and retreat of the two wings, with respect to the center cam  $k'$  or the base of the same, producing a change in the position of such cams, to enable the center cam to seize and actuate the needles in proper routine, and after the needles have been thus moved, they remain free from control of the cam-bar until it returns, except such as would be exerted upon them by the tension of the yarn which is looped upon them.

As to the duplex cam  $t$ , operated by the shaft  $p$  and in connection with the spring  $w$ , other mechanical means for effecting a like result would readily occur to any good mechanic.

I would further call attention to the fact that the rear faces  $b^4$   $b^4$  of the wings  $l'$   $m'$  should be of sufficient length to overlap two or three needles, or the "nibs" of such needles, in order to prevent their misplacement, which might occur were these wings reduced to a point at this locality.

#### Operation of Machine.

The operation of a machine organized as herein set forth is as follows, taking as a starting-point the position of parts which will exist with the pitman parallel with the cam-bar; with the forwarding-bar retracted to its utmost extent, and entirely out of contact with the needles, owing to the longest axis of the cam  $t$  being at the time in contact with the stud  $u$ ; with the needles also retracted to their greatest extent, and their "nibs" out of the path of travel of the cams or inclines  $k'$ ,  $l'$ , or  $m'$ , or the channel  $o'$  created by them; and, finally, with the cam-bar starting upon or having already effected a portion of its traverse, it being observed that both the cam-bar and the crank are at or near their extreme position to the left of the observer.

The post  $u'$  at this time impinges against the widest portion of the wedge-bar  $y'$ , while *vice versa*, the opposite post  $l'$ , which was previously in contact with the widest but opposite portion of said bar, is now disposed within the depression  $e^2$  thereof. As a natural result of this relative position of parts, the cam or inclined grade  $l'$ , which is now, or to be during the next succeeding traverse of the cam-bar, in ad-

vance of the center cam  $k'$ , has receded from such center cam, and stands to one side of or out of coincidence with the "nibs" of the needles, thus exposing the base of the said center cam in such manner as to compel it to assume such condition as to strike the first of the series of needles presented to it, it being understood, however, that the cam-bar and its adjuncts effect one traverse of the machine without actuating the needles, as the device which advances such needles into the path of movement of the cam-grades does not begin its functions until after such cams have passed the needles.

The arrangement of the different members of the machine is such that, during the continuance of the movement of the crank, and immediately after the cam-grades have passed beyond without actuating the entire series of needles, the first approaching concavity of the cam  $t$  arrives at the stud or follower  $u$ , when the continued passage of the crank, its shaft  $p$ , and the cam  $t$ , permits the aforesaid stud or follower to enter the concavity of the cam, owing to the contraction of the spring  $w$ , and permits the latter to effect an advance of the rocker-frame and forwarding-bar or plate, such plate standing, as it did at first, in immediate proximity to the nibs of a portion of the needles of the series, the advance of such bar driving forward such nibs and their needles as may be in coincidence with it, and forcing them into a position to be seized by the cam  $k'$  upon its return traverse.

The crank  $o$ , shaft  $p$ , and cam  $t$  continue their movements until they have performed a semi-revolution, the end  $i^2$  of the wedge-bar  $y'$  by this movement of parts having abutted against the ear  $i$  before the completion of the semi-revolution of the crank, the cam-bar continuing to move until, with the crank, it arrives at the limit of its traverse, at which time the post  $l'$  has mounted and is impinging against the widest portion of the wedge-bar, while, *vice versa*, the opposite post  $u'$ , which was at our starting-point in contact with the widest portion of the wedge-bar, is now, by the said ascent of the post  $l'$ , through the agency of the palate  $f^2$ , forced into the depression  $e^2$  of the said bar  $y'$ .

As a natural result of this relative position of parts, the cam or inclined grade  $m'$  which is now, and will be during the next succeeding traverse of the cam-bar, in advance of the center cam  $k'$ , has receded from such center cam, and stands to one side of or out of coincidence with the nibs of the needles, thus exposing the base of the said center cam in such manner as to compel it to strike and force into the advanced side of the channel  $o'$  such portions of the said nibs of the needles as were advanced by the previous forward movement of the forwarding-bar.

We have now completed a semi-revolution of the crank  $o$  and cam  $t$ , and one traverse of the cam-bar, as well as an advance or forward vibration of the rocker-frame and forwarding-bar, and we will now start upon a return or repetition of such movements.

First, then, and immediately preceding the start of the cam-bar upon its return, the concavity of the cam  $t$  has left the stud or follower  $u$  and caused it to mount the greatest diameter of such cam, by this act returning the forwarding-bar to its original position, isolated from the needles, the retreat of such forwarding-bar, or rocker-frame supporting such bar having the effect, through the agency of the pawl  $l'$ , in producing a one-tooth movement of the ratchet, and, consequently, a partial intermittent rotation of the pattern-barrel  $b^1$ .

Should either one of the sloping steps of the pattern-barrel be at this time in contact with the stud  $d^1$  of the forwarding-bar, the movable portion of such bar will be advanced beyond its fellow, and, by increasing the combined effective edge of such forwarding-bar, push forward one or more additional needles to the action of the cam  $k'$ .

Should the stud  $d^1$  be in contact with the plane portion of the barrel, no change in the bearing-extent of the forwarding-bar will occur.

It is presupposed, however, at the starting-point of our explanation of the operations of the machine, that the stud or actuator  $d^1$  is in contact with the lowest step of the series; hence, by the revolutions of the crank and the repeated alternations of the swinging or rocker-frame  $r$ , the sloping steps or irregularities of the pattern-barrel are presented in succession to the stud  $d^1$ , until all have passed it, the extent of actuating-surface of the forwarding bar, and the number of needles driven forward by it, being in direct correspondence with the contour of the said pattern-barrel; the spring  $a^1$ , hereinbefore mentioned, or its equivalent, having the effect of retracting the stud  $d^1$  to its starting-point against the lowest step of the series when the latter is reached, the working edge of the forwarding-bar being, as a matter of course, returned to its original position, which it at first assumed.

Having thus explained how, during the first traverse of the cam-bar, the forwarding-bar, by the action of the concavity of the cam  $t$ , has been advanced, and driven forward the needles, and subsequently, by the action of the cam, returned to its original position, and a one-toothed movement of the pattern-barrel effected, while the position of the cam-grades  $k' l' m'$  remains in the position last stated, we shall see that, by the continuation of the movement of the crank and of the advance of the cam-bar, the advance side of the center cam  $k$  reaches and impinges against the series of needles, and guides them, one after another, along its sloping side, until they reach the next succeeding inclined grade  $l$ , against the sloping face of which they successively impinge, and by whose advance they are guided in an opposite direction, obliquely to the travel of the cam-bar, until they are returned, one by one, to their normal position, or that first occupied by them, it being observed, as a distinguishing feature of this invention, that the needles not advanced by the forwarding-bar, as before explained, remain in their original position, and motionless and inert during the completion of the traverse of the cam-bar.

Before the cam-bar completes its traverse or reaches the position first assumed in this explanation, the end  $h^2$  of the duplex wedge-bar  $y$  abuts against the ear  $e$ , when the completion of an entire revolution of the crank and the return traverse of the cam-bar reverses the position of the posts  $t'$  and  $u'$ , and also the cams

$k, l$ , and  $m'$ , and presents the next succeeding concavity to the stud or follower  $u$ , and permits the rocker-frame  $r$  and forwarding-bar  $s$  to be advanced as hereinbefore stated, and drive forward into position to be acted upon by the cam  $k$ , during its third traverse, such needles as the said forwarding-bar has impinged against, whether such needles are the same in number as during the last advance of such bar, or whether such number is increased by the expansion of such bar at the hands of the pattern-barrel.

Having now described the operation of the machine through a complete circuit or revolution, it is believed that the explanation given will afford a clear understanding of the operation of my invention, or at least one sufficient to enable persons skilled in the art to comprehend its construction, purposes, and functions,

#### Claims.

1. The forwarding-bar, composed of movable plates, substantially as described, mounted in a movable frame, and acting on the needles to drive them forward in position to be actuated by the needle-operating cams.

2. The forwarding-bar, composed of movable plates, substantially as described, mounted in a movable frame, in combination with pattern-mechanism for varying the width of the operating edge of the forwarding-bar or device, for the purpose set forth.

3. The combination of the stationary needle-bed  $a$  and its needles, the rocker-frame  $r$ , the pattern-barrel  $b^1$ , and the forwarding-bar  $s$ , when constructed substantially as described, and combined and sustaining the relations to each other and to the rest of the machine as herein set forth.

4. The combination of the stationary needle-bed, the cam-bar with its described members, the forwarding-bar  $s$ , pattern-barrel, and rocker-frame, constructed substantially as described, and sustaining the relations to each other and the rest of the machine as herein set forth.

5. The stationary cam  $k$  and sliding bar  $y$ , the movable side-wings  $l' m'$ , carriers  $p' q'$ , or their substitutes, posts  $t' u'$ , and compound lever or tripper  $f'$  for actuating the needles, the whole being combined and operating as herein explained.

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Witnesses:

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