

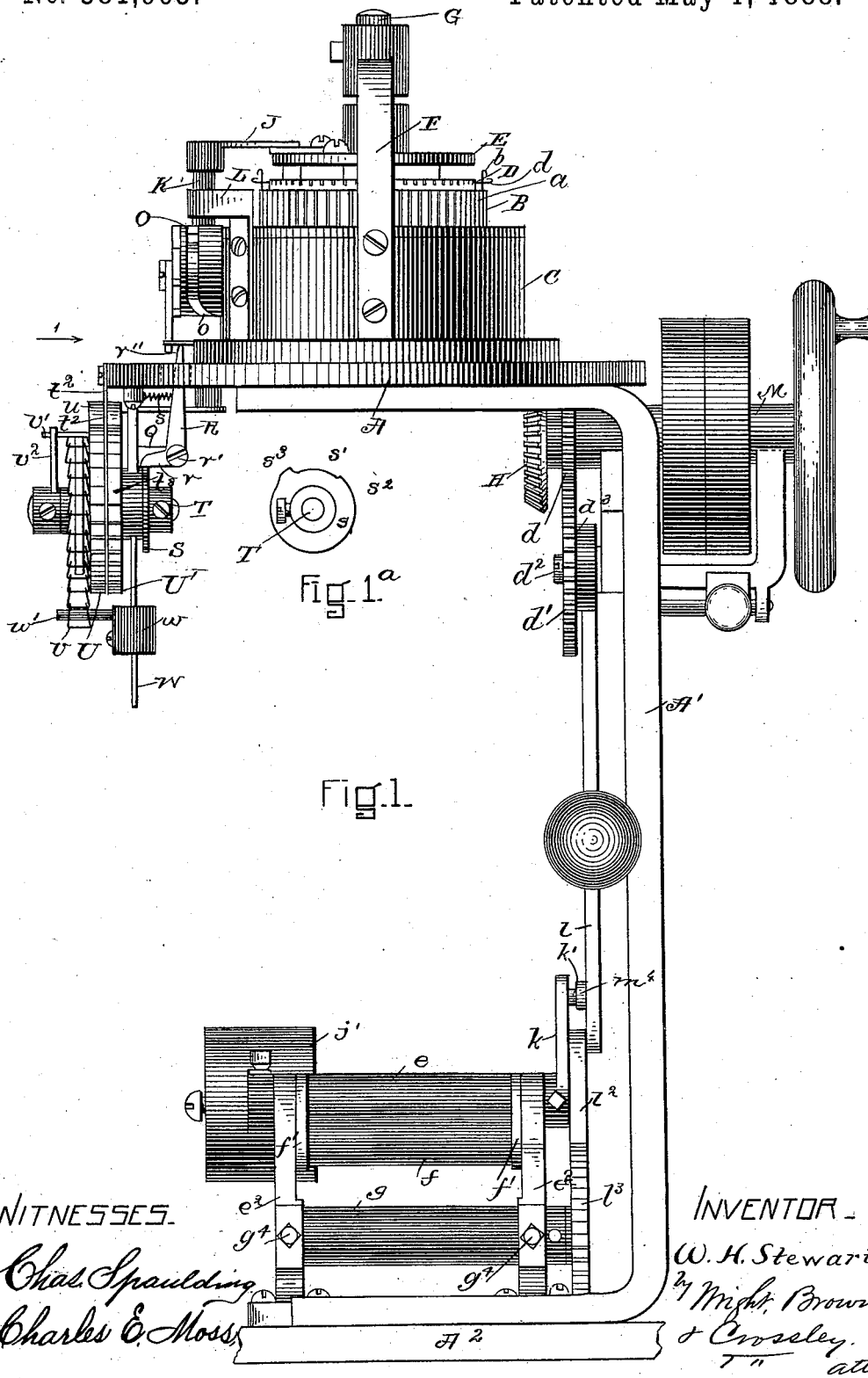
(No Model.)

3 Sheets—Sheet 1.

W. H. STEWART.
KNITTING MACHINE.

No. 381,963.

Patented May 1, 1888.

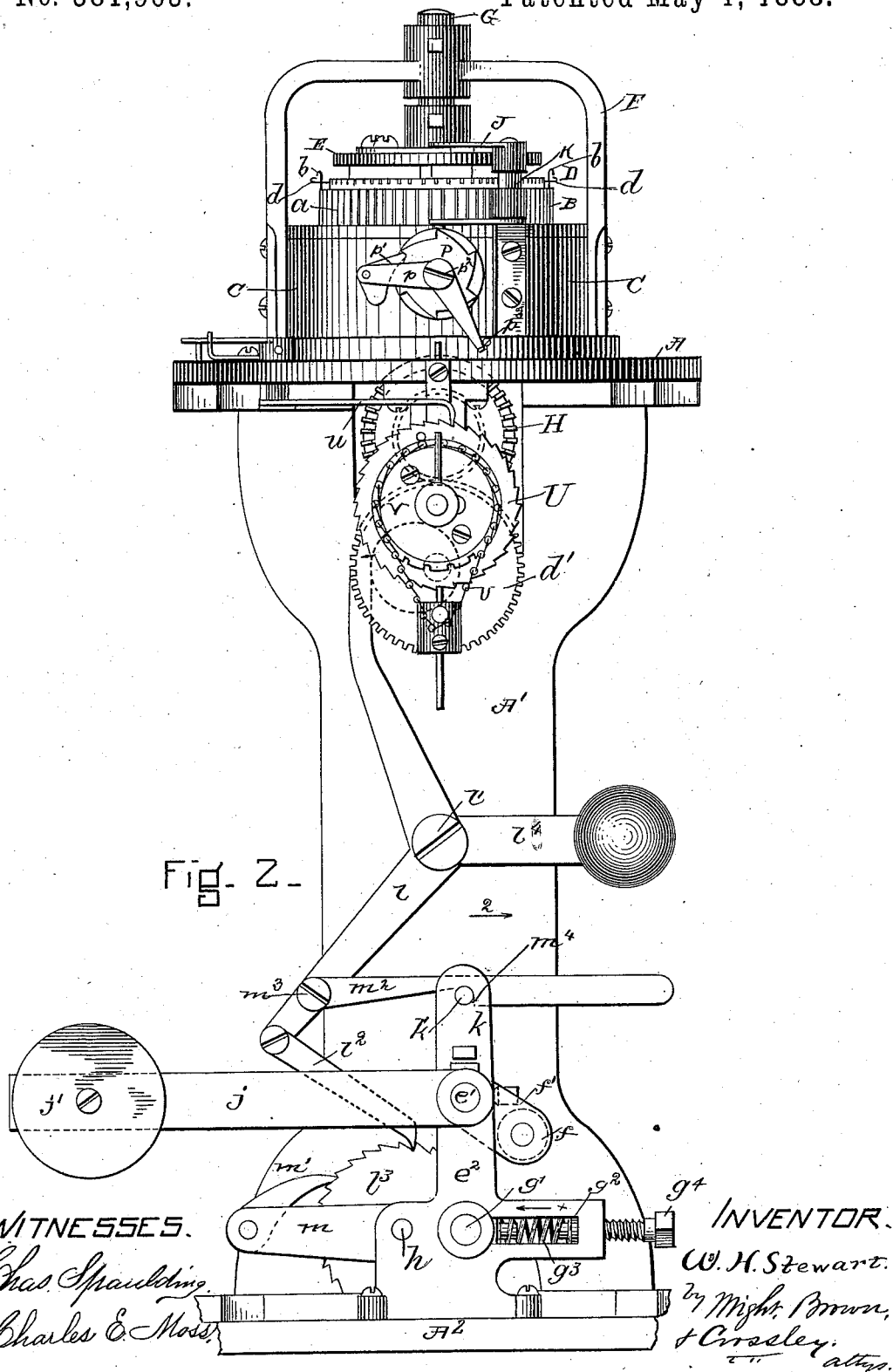


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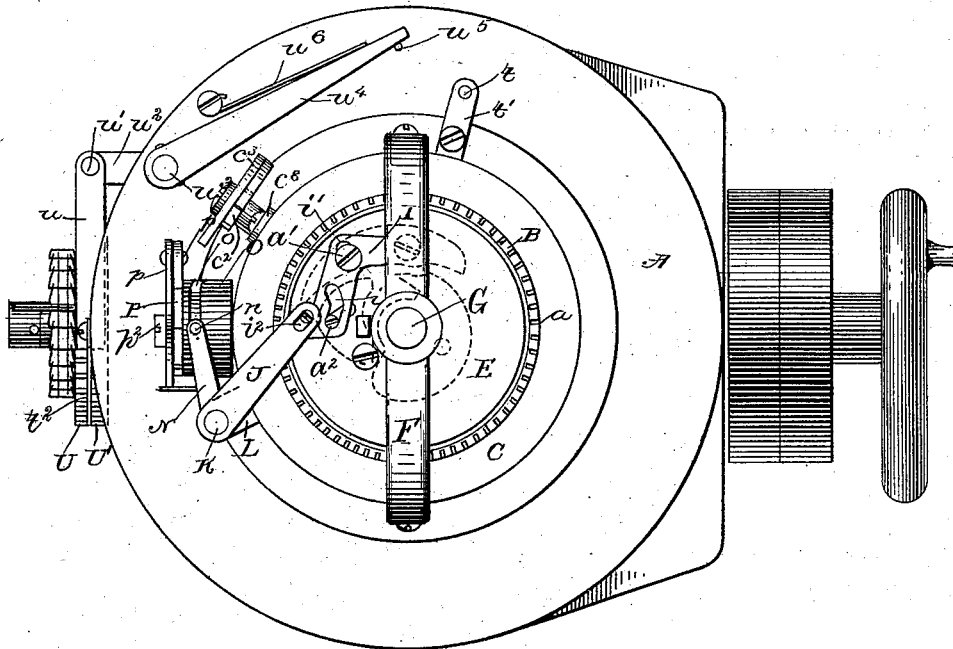


Fig. 3.

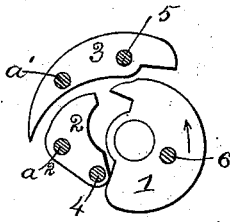


Fig. 4.

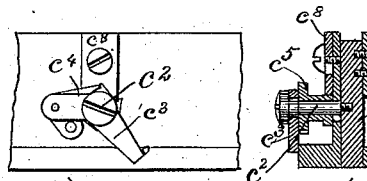


Fig. 5.

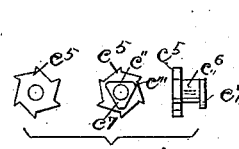


Fig. 6.

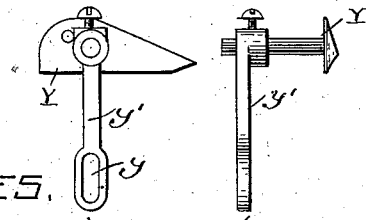


Fig. 7.

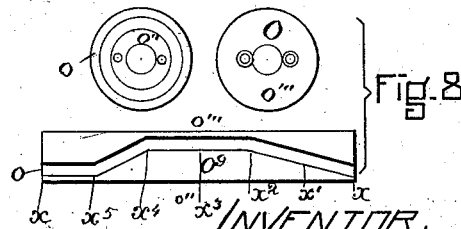


Fig. 8.

WITNESSES.

Chas. Spaulding
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by *Wm. Brown & Cooley*
attys.

UNITED STATES PATENT OFFICE.

WALTER H. STEWART, OF FRANKLIN, NEW HAMPSHIRE.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 381,963, dated May 1, 1888.

Application filed June 6, 1887. Serial No. 210,377. (No model.)

To all whom it may concern:

Be it known that I, WALTER H. STEWART, of Franklin, in the county of Merrimac and State of New Hampshire, have invented certain new and useful improvements in Knitting-Machines, of which the following is a specification.

My invention relates to knitting-machines of the class adapted for the production of ribbed fabrics, such as are used for the tops of half-hose, cuffs for shirts, Cardigan-jacket sleeves, leggings, drawers, &c., which machines employ two sets of needles, one set working horizontally and the other set vertically.

It is the object of my invention to simplify and render certain of operation the means in machines of the class mentioned for automatically producing welts, slack courses, &c., employed in making circular-ribbed fabrics of the character mentioned.

It is also the object of my invention to provide improved means for taking up and maintaining uniform and proper tension on the fabric as it is knitted by such machines.

I will now proceed to describe my invention, so that others skilled in the art may be able to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, forming a part of this specification, the same letters indicating the same parts wherever they occur.

Of the drawings, Figure 1 represents a side elevation of a knitting-machine embodying my improvements. Fig. 2 represents a similar view looking in the direction of the arrow 1, Fig. 1. Fig. 3 is a top plan view of the same. Fig. 4 is a plan view of the cams for operating the dial-needles, the pivot-pins connected therewith being shown as in section. Fig. 5 represents a front elevation and a sectional view of the devices immediately connected with the stitch-cam of the cam-cylinder for moving the same to effect the knitting of loose or slack courses. Fig. 6 represents a front, a rear, and a side view of a part shown in Fig. 5, and hereinafter referred to. Fig. 7 represents front and side views of the yarn-guide detached. Fig. 8 represents a front and rear view and a development of the cam for operating and controlling the operation of the devices for moving the dial-cams.

As a glance at the drawings shows, my im-

provements have been wrought upon a circular-knitting machine employing two sets of needles—a set operating vertically in grooves of a cylinder, commonly called “cylinder-needles,” and a set operating horizontally in grooves of a dial-plate, commonly called “dial-needles.” In the production of plain ribbed work both sets are operated, the dial-needles intermediate of the cylinder-needles knitting from the same yarn. To produce what are commonly known as “slack courses”—that is, a course by which to “cut off” and a course for “picking on”—the stitch-cam of the cylinder-needle is moved so as to make said needles form a course of longer or slacker loops than are formed in the body of the web, and for knitting a welt—that is, courses which form a finished edge to the cuff or top of the stocking—the cams which project and retract the dial-needles are so controlled as that for one or more courses they may be projected far enough to take the yarn, but not sufficiently far to carry the loops thereon beyond or below the latches, and then retracted, holding two or more loops in their hooks, while two or more courses are knit on the cylinder-needles alone, when the dial-needles are again brought fully into operation and knitting proceeded with, as before. In the performance of this work it is necessary that the knitted work should be kept under a certain uniform degree of tension in order to secure the desired results.

The methods by which the recited objects are accomplished and with which my improvements have to deal are matters of common knowledge to knitting artisans, my invention extending only to the means whereby the methods are practiced, such means being made simpler in construction and arrangement and entirely certain of operation.

Referring to the drawings, A represents the base of the machine, and A' the supporting-frame.

B indicates the needle-cylinder, secured to the base and provided with vertical groove *a*, to receive and guide the cylinder-needles *b* in their movements.

C indicates a revoluble cam-cylinder provided on its interior with cam-grooves and cams of common form for engaging the heels of the cylinder-needles *b* to reciprocate the same in their grooves *a*. Of these needle-operating

cams I have not deemed it necessary to show more than the stitch or drawing-down cam *c*, which is represented in section in Fig. 5 and hereinafter referred to.

5 D represents the dial-plate, provided with radial grooves for the reception and guidance of the dial-needles *d*, adapted to operate at right angles to and between the cylinder-needles *b*.

10 E represents the dial-cam plate, provided with the cams 1, 2, and 3, (shown in Fig. 4 and in dotted lines in Fig. 3,) which cams are constructed and arranged to engage the heels of the dial-needles and project and retract the same, the push-out cam 2 and drawing-in cam 3 being adapted to be moved and controlled so as to effect the knitting of a welt, as hereinbefore mentioned.

20 F indicates the yoke or arch, secured at its ends to cam-cylinder C and embracing and being secured to the center arbor or shaft, G, to which arbor G cam-disk E is also secured.

H represents a bevel-gear secured to the driving-shaft M, the teeth of said gear H engaging like teeth (not shown) formed on the lower part of cam-cylinder C, whereby said cam-cylinder and, through the medium of yoke F and arbor G, cam-disk E may be rotated, needle-cylinder B and dial D being held stationary with the bed A.

The foregoing description is considered as being sufficiently full to give a knitting artisan of common skill an understanding of my improvements.

35 Having reference to Figs. 3 and 4, 1 represents the stationary cam of the cam-disk, 2 the push-out cam, and 3 the drawing-in cam; and the position in which said cams are pictured is that requisite for the performance of plain work; but when a welt is to be formed the position of cams 2 and 3 is changed, cam 2 being first moved inward slightly, so as to project the dial-needles far enough only to take yarn from the yarn-guide, but not so as to carry the loops thereon beyond the latches, and subsequently moved inward, so as not to project the dial-needles at all, cam 3 with this last operation being also moved inward, with the effect of holding the dial-needles in retracted position with two or more loops in the hooks of the same until the cylinder-needles knit two or more courses, as before explained, when cams 2 and 3 are moved outward together, so as to cause the dial-needles to knit, as before.

55 Cam 2 is pivoted to the cam-disk by means of stud or pivot 4 and cam 3 by means of stud or pivot 5, stud 6 being the means whereby cam 1 is secured to the cam-disk.

I represents an angular lever pivoted at its inner end to the cam-disk and provided at its angle point with a slot, *i'*, and at its outer end with a slot, *i*, a stud or pin, *a'*, secured to drawing-in cam 3, extending up through a slot in cam-disk E and into slot *i'*, and a similar stud or pin, *a''*, secured to push-out cam 2, extending also through a slot in cam-disk E and into slot *i* of lever I. The form of slots

i i' is such that lever I may be moved inward toward arbor G one-half the distance of the movement of which it is capable or permitted to have and effect a slight moving inward of push out cam 2, but without affecting the position of drawing-in cam 3, and then lever I may be moved fully inward, with the result of moving both cams 2 and 3 fully inward, when lever I may be moved fully outward, bringing cams 2 and 3 back to their first-mentioned position, all for the purpose of assisting in the formation of a welt, as hereinbefore explained.

The means for moving lever I to effect a change in position of the cams 2 and 3 will next be described.

J indicates a lever rigidly secured at its outer end to an arbor, K, arranged so as to rock in bearings in a bracket, L, secured to cam-cylinder C, the inner end of lever J being loosely connected, as at *i'*, to lever I. A lever, N, is rigidly connected at its inner end to arbor K, and at its opposite end extends out over a small barrel or cylinder, O, provided with a cam path or groove, *o*, into which a stud or roller, *n*, from the free end of lever N extends, as most clearly seen in Fig. 3. To the outer side or end of barrel or cylinder O is secured in any suitable way ratchet-wheel P, which is adapted to be operated by a pawl, *p'*, secured to one end of an angular lever, *p*, pivoted on a stud, *p''*, secured to the cam-cylinder C, the barrel O and ratchet-wheel P being also adapted to turn on said stud *p''*. The end of lever *p* opposite that at which the pawl *p'* is pivoted thereto extends downward and in its normal position rests against a pin, *p''*, extending outward from the base of the cam-cylinder, as seen in Fig. 2.

R indicates an elbow-lever, pivoted at *r'* to a portion of a bracket, Q, secured to the base A. The vertical arm of lever R extends through a slot in base A, and the horizontal arm *r* extends out over and rests upon a cam, S, adapted to turn with an arbor, T, having bearings in bracket Q.

s represents a spring secured at one end to the vertical arm of lever R and at the other end to the bed, whereby arm *r* is held in contact with cam S. By this construction, as cam S is rotated, the upper end, *r''*, of the vertical arm of lever R will by the form of said cam be moved into the path of travel of the end of the downwardly-extending arm of lever *p*, resulting in the rocking of said lever on its fulcrum *p''*, so as to move ratchet-wheel P, and with it barrel or path cam O, the distance of one tooth of said ratchet-wheel, pawl *p'* being carried back, so as to take another tooth of the ratchet-wheel by the gravity of that portion of the lever to which it is attached, and the upper end of lever R being moved out of the path of travel of the downwardly-extending arm of lever *p* by means of spring *s*. When arm *r* of lever R is on the lower face, *s'*, of cam S, (see Fig. 1^a.) the upper end of the vertical arm of lever R will be in position

to strike lever p ; but when it is on the higher part, s^2 , it will be moved out of the path of said lever p .

U U' represent ratchet-wheels on arbor T and adapted to be operated intermittingly by means of a two-part pawl, u , pivoted at u' to the outer end of an arm, u^2 , secured at its inner end to a stud, u^3 , extending up through the base A , and to the upper end of which is rigidly secured one end of a lever, u^4 , adapted in its normal position to be held pressed against a pin, u^5 , on the base A by means of a spring, u^6 .

t represents a stud extending downward from a small bracket, t' , secured to the cam-cylinder C and adapted as said cam-cylinder is revolved around cylinder B to strike lever u^4 , move it back against the tension of spring u^6 , and so, through the medium of the parts connecting lever u^4 with pawl u , move said pawl, so as to rotate either ratchet-wheel U or U' , or both, the distance of one tooth.

Ratchet-wheel U' has one tooth cut away, as at t^8 , so as that it will not be rotated when pawl u reaches the point where such tooth is cut away, and said ratchet-wheel U' is moved, so as to cause pawl u to engage the teeth thereof by means of ratchet-wheel U , which is mounted loosely on arbor T , all as will be presently explained. Pawl u is slotted or divided in the center of the end which engages the teeth of the ratchet-wheels, so that one part of said divided end engages one ratchet-wheel and the other part the other ratchet-wheel, a thin strip of metal, t^2 , extending down from the base A between said ratchet-wheels.

To ratchet-wheel U is secured a sprocket-wheel, V , over which runs a chain, v , and to the chain v is secured the laterally-projecting pin v' , adapted as ratchet-wheel U is rotated to engage a pin, v^2 , extending radially from arbor T , to which said last-mentioned pin is rigidly secured, so that the movement or rotation of said arbor T will also rotate ratchet-wheel U' and so carry its mutilated tooth past the operative point of pawl u . When pin v^2 is carried around to a position slightly beyond an imaginary horizontal line, pin v' will slip off therefrom and both ratchet-wheels will be operated in unison by pawl u until said pawl reaches the cut-away tooth in ratchet-wheel U' , when the latter will remain quiescent until again moved by pin v' on pattern-chain v , as before explained. This provision of chain v and ratchet-wheel U and their adjuncts is, as will be readily understood, for the purpose of economizing or reducing the size of ratchet-wheel U' and cam S , the latter, as has been seen, being rotated by ratchet-wheel U' , fast on arbor T .

W indicates a rod depending from bracket Q , to which rod is secured a collar, w , provided with a laterally-extending pin, w' , under which chain v passes, and by which said chain is kept in proper place or position.

In Fig. 8 I have shown front and rear end views of path-cam o , as also, as at o^9 , a development of the periphery or face of said cam, o''

being the front end of said cam and o''' the rear end.

When the machine is being operated to produce plain ribbed work, the dial-cams will be in the position represented in Figs. 3 and 4, with stud or roller n of lever N in cam-groove o at the point x , Fig. 8. A point in the knitting having been reached for the production of a welt, arm r of lever R will have dropped on the lower surface, s' , of cam S , bringing the upper end of arm R into the path of travel of lever p , so as to turn path-cam o the distance of one tooth of ratchet-wheel P at each revolution of the cam-cylinder C , at the first operation of which path-cam o stud n will move to the point x' , moving the push-out cam inward slightly, so that the dial-needles will take the yarn from the yarn-guide, but not pass their latches through the loops held by said needles. At the second operation of path-cam o stud n will move to the point x^2 , which will effect the full drawing in of both cams 2 and 3, so that the dial-needles will not be projected at all. At the next two movements of path-cam o stud n will move successively to the points x^3 x^4 , knitting being performed on the cylinder-needles only. When next path-cam o is operated, stud n will be moved from the point x^4 to the point x^5 , effecting the drawing out of the cams 2 3 to their first-mentioned position and operating the dial-needles with the cylinder-needles to complete the welt, the next and (for the present) final operation of path-cam o carrying stud n to the point x , the place of starting, and arm r , riding up on the raised faces s^2 of cam S , moving the upper end of the vertical arm of lever R out of the path of travel of arm p , and so stopping the rotation of path-cam o .

Before the knitting of a welt was begun a slack course was formed by the vertical needles, as before explained, and the manner in which this was or is accomplished will next be described.

The stitch-cam c for the cylinder-needles—that is, the cam which draws down or depresses said needles—is secured to a slide, c' , which is adapted to have a limited vertical movement in cam-cylinder C , and to said slide is secured a stud, c^2 , extending outward through a vertical slot in the cam-cylinder, as shown in section in Fig. 5. A lever, c^3 , similar to lever p , is fulcrumed on stud c^2 , and is provided with a pawl, c^4 , similar to pawl p' , which engages a small ratchet-wheel, c^5 , adapted to turn loosely on stud c^2 . Said ratchet-wheel is provided with an elongated hub, c^6 , to the inner end of which is secured a cam, c^7 , (see Fig. 6,) adapted to rest and operate against the lower end or face of a block, c^8 , secured to cam-cylinder C , so that, supposing the lower face, c^9 , to be resting against the lower face of block c^8 , by the rotation of ratchet wheel c^5 the distance of one tooth said cam c^7 will be carried around so as to bring one of its high points c''' to bear on the lower face of block c^8 , and in this way depressing slide c' and its attached stitch-

cam c , and the next rotation of ratchet-wheel c^3 will bring a lower face, c'' , of cam c^1 opposite of or to bear on the lower end of block e^3 , thus permitting stitch-cam c to be raised by the action of the heels of the cylinder-needles there-
 5 against. When arm r is on either the depressed surface s^1 or raised surface s^2 of cam S , the upper end, r'' , of lever R will be out of the path of travel of lever c^3 ; but when said arm r rides up on the projection s^3 of cam S the end r'' of lever R will be moved into the path of travel of lever c^3 , though out of the path of travel of lever p , and so strike and operate lever c^3 and effect the rotation of cam c^1 , so as
 10 for one course to depress stitch-cam c and in the next course operate ratchet-wheel c^3 , so as to move cam c^1 again to permit stitch-cam c to rise. This operation of knitting a loose course, which will now be readily understood, occurs before the welt is formed, and may be accom-
 15 plished twice for the formation of a slack course to cut off by and another to pick on by by constructing two raised points, s^3 , on cam S at the proper points, or but one, as shown in the drawings, for a slack pick-on course.

It will be understood, of course, that the ratchet-wheels U U' , cam S , pattern-chain v , and their adjuncts are so constructed and timed as to have the knitting of slack courses and a
 20 welt take place at the proper times or points in the operation of the machine.

Y represents the yarn-guide, (shown in front and side view in Fig. 8,) which yarn-guide is adapted to be attached to any suitable part of the machine by means of the slot y in the shank
 25 y' . For the sake of clearness of description, I have not shown the yarn guide, which is old and of common construction, as attached to the machine in the full general views thereof.

It is essential to the knitting of perfect work that the goods or fabric should be taken up in such manner as to keep the stitches on the needles under even tension, and to secure this end I have produced the "take-up mechanism," so called, which will next be described.
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Secured to main shaft M is a gear, d , which engages and drives a tooth-gear, d' , journaled on a stud, d^2 , secured to the frame A^1 .

d^3 indicates a cam secured to gear d' , and adapted, also, to turn on stud d^2 .
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e indicates a roller adapted to turn loosely on an arbor, e' , having bearings in uprights e^2 e^3 , secured to the bed A^2 .

f is a roller similar to roller e , journaled in the outer ends of arms f' f'' , the inner ends of which arms are rigidly secured to arbor e' .
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g indicates a fluted roller journaled in boxes g' , adapted to slide in slots g^2 , formed in the lower part of the uprights e^2 , said journal-boxes g' being held pressed in the direction of the arrow x , Fig. 2, by means of springs g^3 , bearing at one end against said journal-boxes and at the other against the forward ends of screws g^4 , by which latter means the tension
 45 or force with which the springs bear on the journal-boxes is regulated. Another fluted roller similar to roller g , and in Fig. 1 hidden

from sight by said roller g , is secured to or forms a part of journal-studs h , also adapted to turn in bearings formed in the lower part of uprights e^2 . The fluted rollers mentioned are adapted in their normal positions to have their peripheries or surfaces roll in contact with each other. The work on leaving the needles passes down by and under roller e ,
 50 up and over roller f , and down between fluted rollers g , which are operated to draw it off or take it up, as is to be presently explained.

j indicates an arm rigidly secured at its inner or forward end to arbor e' and provided on its outer end with a weight, j' , secured to and preferably adjustable on said arm. To the end of arbor e' opposite that at which arm j is secured thereto is rigidly attached the lower end of an arm, k , from the upper end
 55 of which there projects laterally a stud or pin, k' .

l indicates an angular lever secured to a stud, l' , adapted to turn in bearings formed in the frame A^1 , the upper end of which lever is adapted to be brought in contact with cam d^3 on stud d^2 , the lower end of said lever being provided with a pawl, l^2 , adapted to engage the teeth of and to operate ratchet-wheel l^3 , secured on one of the journal-studs h of the rear fluted roller. Rigidly secured at one end to journal-stud l' is an arm, l^1 , the outer or free end of which arm is provided with a weight operating with a tendency to keep the upper end of lever l in contact with cam d^3 as the latter is rotated, to cause pawl l^2 to operate ratchet-wheel l^3 , which ratchet-wheel is kept from rotating backward by a holding-pawl, m' , secured to the outer end of an arm, m , attached at its other end to the uprights e^2 .
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m^2 is a lever pivoted at m^3 to lever l , and adapted to rest on pin or stud k' of arm k . Lever m^2 is provided with a notch or offset, m^4 , with which stud k' is adapted to engage when arm k is moved in the direction of the arrow 2, Fig. 2.
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The operation of my take-up will now be readily understood. When the work is loose or comparatively loose, weighted arm j will operate journal-shaft e' , so as to move the upper end of arm k in a direction opposite to arrow 2, and so permit weighted arm l^1 to bring the upper end of lever l in contact with cam d^3 and permit pawl l^2 to operate ratchet-wheel l^3 , operating the fluted rollers to take up the work, which, when being drawn taut or put under more tension, will draw down on roller f , swinging arm k in the direction of arrow 2 and causing stud k' on said arm to engage the offset or notch m^4 of lever m^2 , drawing the lower end of lever l in the same direction and the upper end in the opposite direction and away from cam d^3 , stopping the take-up operation of the fluted rollers. In this way the work will be drawn down in a manner to preserve uniform tension on the stitches held by the needles, and though I have mentioned the work as running slack at times, this slackness is of such a nature as only to
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permit of the operation of pawl l^2 on ratchet-wheel l^3 , the weighted lever j serving to preserve uniformity of tension on the goods, so far as such tension affects the stitches held by the needles.

Although I have given a full description of the form and arrangement of all of the parts comprising my invention, as herein shown, it is obvious that these may be varied within the limits of mechanical skill without departing from the nature or spirit of the improvements.

Having thus explained the nature and object of my invention, what I claim is—

1. The combination, with the dial, dial-needles, and cam-disk, of the push-out and drawing-in cams pivoted to the cam-disk and provided with studs extending through slots formed in the cam-disk, a lever pivoted on the cam-dial and provided with slots to receive the studs of said push-out and drawing-in cams, the slot in said lever for the reception of the stud from the drawing-in cam being constructed to permit the lever to have a limited movement without acting on said stud, while the slot for the reception of the stud from the push-out cam is constructed to permit of no movement of the lever without operating the last-mentioned cam, and mechanism, substantially as set forth, for intermittently operating said lever, as and for the purposes set forth.

2. The combination, with the dial, dial-needles, cam-disk, and its cams 23, pivoted to the cam-dial and provided with studs or pins a' a^2 , of lever I, provided with slots i i' , levers J and N, arbor K, path-cam O, and mechanism,

substantially as set forth, for intermittently rotating said cam, as and for the purposes set forth.

3. The combination, with the stationary base and rotary cam-cylinder, of the path-cam O, journaled on a stud secured to said cam-cylinder, a ratchet-wheel secured to said path-cam, lever p , provided with a pawl to engage said ratchet-wheel, lever R and its support, and rotary cam S, as and for the purposes set forth.

4. The combination, with the needle-cylinder, cylinder-needles, and rotary cam-cylinder, of the stitch-cam e , slide e' , journal-stud e^2 , ratchet-wheel e^3 , provided with the cam e^4 , block e^5 , lever e^6 , provided with pawl e^7 , and means for intermittently operating said lever, as set forth.

5. The combination, with machine frame or support, of the fluted take-up rollers, uprights e^2 , shaft e' , journaled therein, and roller e , adapted to turn thereon, arms f' , secured by one end to said shaft, roller f , journaled in the other end of said arms, weighted arm j , lever l , pawl l^2 , ratchet-wheel l^3 , weighted arm l^4 , notched lever m^2 , arm k , provided with pin k' , and a rotary cam, d^3 , as and for the purposes set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 27th day of May, A. D. 1887.

WALTER H. STEWART.

Witnesses:

S. S. JEWETT,
S. E. BLACKSTONE.