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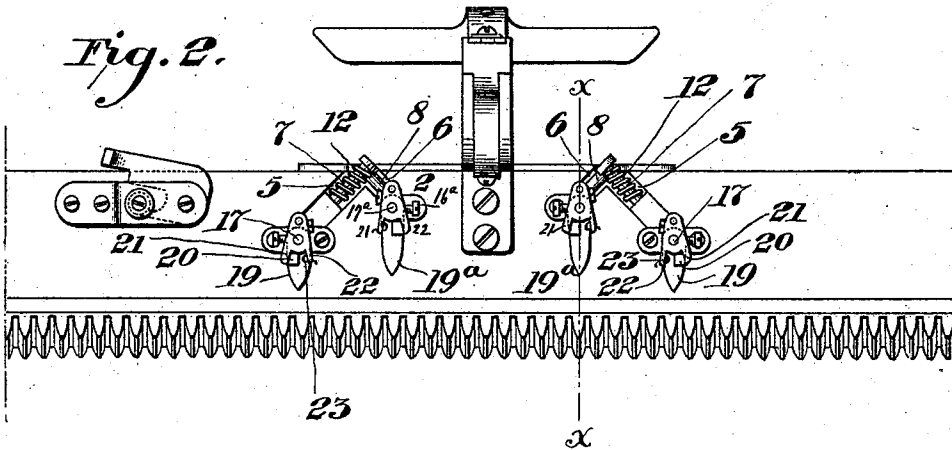
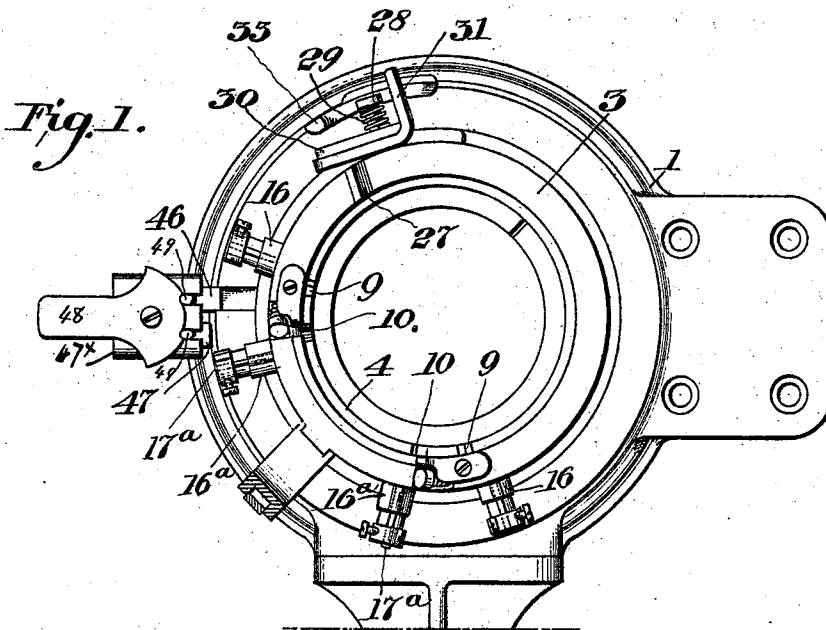
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B. M. DENNEY.

AUTOMATIC CIRCULAR KNITTING MACHINE.

No. 528,864.

Patented Nov. 6, 1894.



Witnesses:

Jesse B. Heller.
Ira S. Heller

Inventor.

Barclay M. Denney.
per John P. Molay
Attorney.

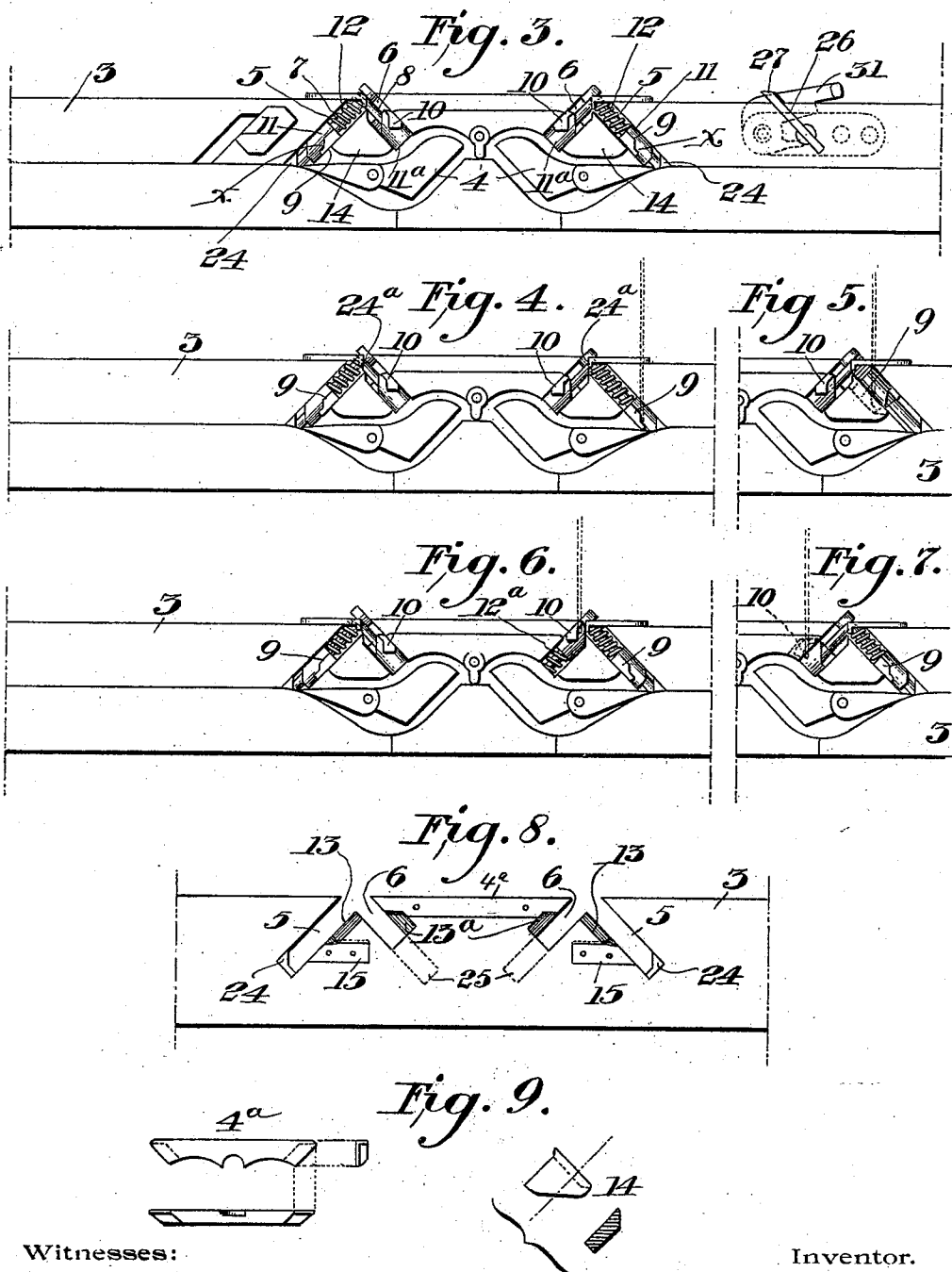
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Barclay M. Denney
per John F. Nolan
Attorney.

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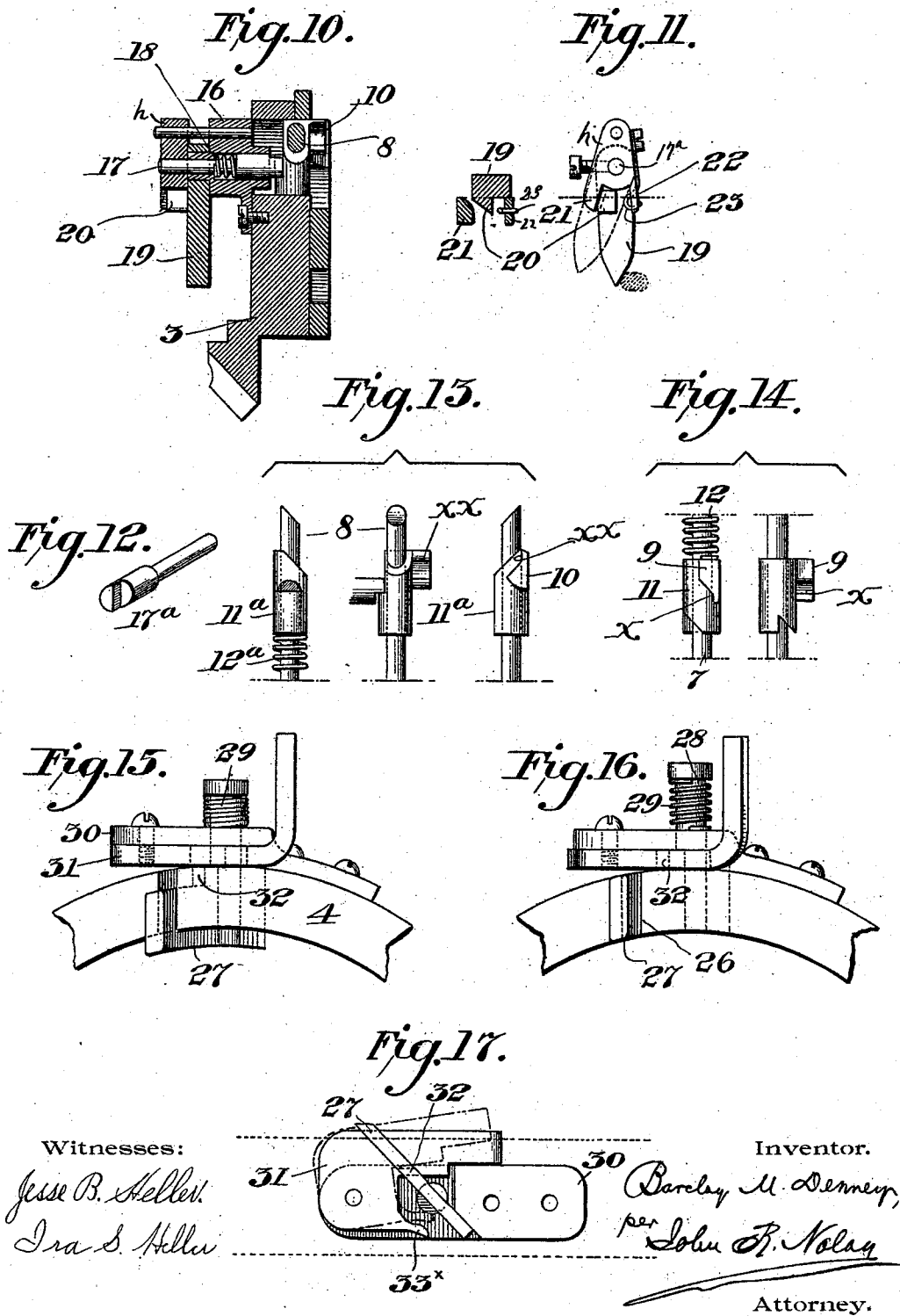
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UNITED STATES PATENT OFFICE.

BARCLAY M. DENNEY, OF CAMDEN, NEW JERSEY.

AUTOMATIC CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 528,864, dated November 6, 1894.

Application filed November 24, 1893. Serial No. 491,843. (No model.)

To all whom it may concern:

Be it known that I, BARCLAY M. DENNEY, a citizen of the United States, residing in the city and county of Camden and State of New Jersey, have invented certain new and useful Improvements in Automatic Circular-Knitting Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates to knitting machines of the so-called "automatic" type, in which are provisions for periodically raising out of action and subsequently depressing into action those needles usually manipulated during the formation of the heel and toe parts of a stocking.

The present improvements apply more especially to machines in which the needle elevating and depressing devices are in the nature of spring-controlled cams, that are projected into the path of the active and inactive needles, respectively, at predetermined intervals, to effect the requisite disposition of the needles in respect to the knitting cams, suitable locking and releasing mechanism being employed to maintain said elevating and depressing cams inactive during the knitting of tubular work and during the knitting of each course of stitches after the initial needle of the course has been rendered inactive or active, as the case may be.

In my pending applications Serial No. 408,082, filed October 8, 1891, and Serial No. 482,743, filed August 9, 1893, to which reference may be had, machines embodying the "automatic" features above mentioned are set forth.

The precise nature and scope of the present improvements will fully appear from the following description and claims in connection with the accompanying drawings, in which—

Figure 1 is a partial plan of a circular knitting machine equipped with my improvements. Fig. 2 is a side elevation of the cam cylinder on a flat plane or "developed." Figs. 3 to 7, both inclusive, are developed views of the cam cylinder showing the relative positions of the needle-controlling cams at different stages of the knitting operation, as hereinafter described. Fig. 8 is a partial view of the cylinder with the knitting and the needle-

controlling cams removed, the upper knitting cam (4^a) and the fixed deflecting cam (14) being shown in Fig. 9. Fig. 10 is a vertical section, enlarged, as on the line *x-x*—of Fig. 2. Fig. 11 is a detail of one of the tripping devices. Fig. 12 is a separate view of the bolt controlled thereby. Figs. 13 and 14 are views of the needle depressing and needle-elevating cams, respectively. Figs. 15 and 16 are plans of the needle depressing cam plate, and its adjuncts, the parts being shown in the active and inactive positions, respectively. Fig. 17 is a view of the said parts as removed from the machine.

The bed 1, rotatable carrier or cam cylinder 3 and knitting cams 4, are of usual construction excepting the cam-cylinder which is preferably constructed somewhat thicker than usual to permit the application thereto of my improved needle-controlling mechanism in its most efficient and desirable form.

Cut in the wall of the cam cylinder at or adjacent to each end of the knitting cams, are downwardly diverging slots 5, 6, in which are rigidly supported and confined correspondingly inclined rods 7, 8, upon which the needle elevating cam 9 and needle-depressing cam 10 are mounted, respectively. As in my above mentioned applications, the two sets of cams, and their supporting and operating parts are identical, save that they occupy reversed positions.

The needle elevating cam 9 projects beyond the inner wall of the cylinder, its lower forward corner being notched or recessed as at *x* to afford ample purchase for the heel of the needle when it engages said cam as below described. This cam is secured to or forms a part of a sleeve 11 which is mounted on the rigid rod 7 so as to be longitudinally movable and, at the same time, partially rotatable, thereon. Said cam is normally depressed to the bottom of the slot by means of a spiral spring 12 interposed between the sleeve and a head on rod 7. When the cam is thus depressed the recessed corner thereof being in the line or track of the heels of the active needles, encounters the first opposed needle heel during the traverse of the cam carrier and is thereby thrust upward against the pressure of the spring precisely as the needle elevating cam is operated in the construction

illustrated in my above mentioned pending application, Serial No. 482,743. In the last mentioned construction, the lower end of the guide rod for the needle elevating cam is pivoted so that said cam, upon reaching the limit of its upward movement and bearing against the heel of the needle is swung outward to free the needle therefrom. That construction, while effecting satisfactory results, necessarily occasioned considerable strain upon the heels of the needles during the outward movement of the needle elevating cams, mainly to avoid which I have devised the present construction. In this case, the rod is rigidly secured to the cylinder within the slot, while the forward wall of the latter is suitably beveled off or cut away on its inner edge, as at 13. Hence, the cam, being partially rotatable on the guide rod, as above stated, is deflected into this cut away portion by the pressure of the needle when the cam has reached its upward limit, and as a result, such needle is discharged. A suitably located fixed cam 14 receives the needle thus freed and directs it above the active path of the knitting cams, the adjacent edge of this cam 14 being beveled to permit the needle elevating cam to swing rearwardly thereof.

I preferably let into the wall of the cylinder, adjacent to the recessed portion of the slot 5, a steel plate 15, the edge of which is shaped coincidentally with that of the slot. Thus the plate receives the pressure of the moving cam and prevents undue wear of the cylinder. When the uplifted cam is freed from the needle, the tendency of the spring 12 is to depress the cam to its former or active position, in which position it would interfere with the succeeding needles during the stroke of the cylinder. I have, therefore, provided novel means whereby the cam is automatically locked in its raised position.

I would here state that while Figs. 10 and 11 of the drawings are, strictly speaking, views of the locking devices that coact with the needle-depressing cams, yet as the locking devices for the needle-raising cams are practically identical with those first mentioned, reference will be made herein to Figs. 10 and 11, as if they were views of the locking means for the raising cams, as follows:

16 is a perforated bracket fixed to the exterior of the cylinder directly in front of the slot. In this bracket is contained a longitudinally movable pin 17, the shouldered head of which is normally projected toward and against the sleeve by means of a confined spring 18. The disposition of the pin is such that when the sleeve is raised sufficiently, the shouldered head is thrust beneath the lower edge of the sleeve, thereby maintaining the latter elevated. When, however, the pin is retracted, the sleeve is released and permitted to resume its normal position. On the outer end of the pin is fixed a cam head *h* between which and the bracket is interposed a vibratory trip arm 19. On the face of this

arm is a beveled stud 20 that lies between the members of the cam head. Hence, when the arm is moved forward the stud bears against the opposed member 21 of the cam head (which is beveled) and perforce, pushes said head and the pin outward against the pressure of the spring 18, as above mentioned. The other member 22 of the cam head simply serves as a stop to prevent the trip lever rebounding too far when the pin is shot inward upon clearing the lower edge of the sleeve. The latter member is preferably provided with a cushion spring 23 that receives the impact of the trip lever, and projects it forward into active position—that is, into the path of a trip stud hereinafter mentioned.

With the above described construction, the needle elevating cams are alternately released during each reciprocation of the cam cylinder, thereby rendering inactive the initial needle at the end of each course of stitches, and effecting a gradual narrowing of the web. This done, the up-thrown or inactive needles, by means of devices hereinafter described, are returned to their active positions in reverse order to their elevation to effect a corresponding widening of the web to complete the toe or heel pouch of the stocking.

It will be seen that so far as the periodical elevation and depression of the needles are concerned, they are similar to those of the construction recited in my pending application, Serial No. 482,743, above referred to.

Fitted to the bottom of each of the slots 5, is a cam piece or stop 24, against which the lower edge of the sleeve 11 is pressed by the action of the spring 12, when said sleeve is released as above stated. This edge of the sleeve is beveled coincidentally with the cam or stop so that when it engages the latter, the proper position of the sleeve with its needle engaging portion will be insured, that is to say, there will be no liability of such portion accidentally turning or being turned rearwardly beyond the track of the needle heels.

In the event of one of the needle elevating cams being prematurely depressed, the same will be turned partially around and upward by contact with a needle heel against its lower rearward corner, the beveled edge of the sleeve riding upon the cam. Hence liability of breaking the needle heels under such circumstances is avoided.

The needle-depressing devices which are brought into action when the requisite narrowing has been accomplished are substantially similar to those of the needle elevating devices above described, differing only in occupying reversed positions from the latter; or, in other words, the sleeve 11^a with its cam 10, is held normally elevated by the spring 12^a instead of being normally depressed. The notched or needle engaging part *xx* of the cam is thus on the upper forward corner thereof, so that when the cam is in its elevated position this corner will traverse the path occupied by the heels of the raised or inactive

needles. During the stroke of the cylinder, the notched corner of the cam will abut against the first opposed needle heel and be depressed thereby, the needle remaining in engagement with the cam. The inner edge of the slot 6 is beveled or cut away adjacent to the end of the upper cam as at 13^a, so that when the cam, with the engaged needle, reaches the lower end of the slot, it is opposite this cut away part and the cam is thereupon deflected rearward of the upper cam by the pressure of the needle. Hence the latter is freed in the path of the knitting cams and engaged thereby. The ends of the upper cam 4^a are beveled, as shown, to enable the free rearward movement of the needle-depressing cam.

The lower end of the rod 8 upon which the sleeve 11^a is supported extends into a chamber 25 in the wall of the cylinder, in which chamber the spring 12^a is contained. When the sleeve is depressed as just explained, said spring is compressed in this chamber. Upon the escape of the needle from the cam 10, the latter is locked in the depressed position by means of suitable devices which, in this instance, are similar in all respects to those previously described in connection with the needle-elevating cam; there being the spring-controlled pin 17^a, its support or bracket 16^a, the cam-head 21, 22, and the trip arm 19^a.

Following the completion of the narrowing process, the respective needle depressing cams, during each reciprocation (two strokes) of the cam carrier, are brought alternately into play, thereby effecting the requisite widening of the web. The upper forward edge of the sleeve 11^a, is preferably beveled, to bear against a stop 24^a on the top of the cylinder, which maintains the sleeve with its cam, in proper active position. Should one of the needle-depressing cams be accidentally or prematurely raised, and its rear upper corner, during the stroke of the cylinder, strike the heel of an inactive needle, the beveled edge of the sleeve pressing against the stop 24^a, will be partially turned and depressed, thereby permitting the cam to escape the needle heel without injuring the latter.

The trip levers of the respective needle controlling cams are, or may be, operated at the prescribed periods by means of suitably disposed studs 46, 47 which are movable into or out of the paths of the said levers by manipulating a suitably-disposed coacting cam lever 48. As the particular means for operating these studs forms no part of the present invention no detailed description thereof is necessary.

Briefly described, the studs are fitted to shouldered holes in a bracket 47^x secured to the base of the machine, the studs being normally retracted by confined springs. (Not shown.) On these studs are upwardly-projecting teats 49 which are engaged by the cam-shaped end of the lever. When the lever is in the central position shown in Fig. 1, both

studs are retracted, but when it is moved to the right or to the left the corresponding stud is projected into the path of those trip arms to be acted upon thereby; that is to say, preparatory to the narrowing operation the stud 46 is projected into the path traversed by the trip arms 19, so that during the reciprocation of the cam cylinder said arms will alternately abut against the stud and be operated thereby. Completing this operation the stud 46 is retracted and the other stud 47 is projected into the path of the trip arms 19^a of the needle-depressing devices, to the end that during the following reciprocations of the cylinder said last-mentioned arms will abut against and be actuated by the stud 47 to effect the requisite operation of the parts controlled thereby.

In my aforementioned application, Serial No. 482,743, there is described and claimed a construction for raising a number of needles above the path of the knitting cams preparatory to proceeding with the narrowing and widening operations. There is no provision, however, for returning these idle needles into action when the fashioning operation has been completed. I have therefore provided a means to this end, the same being clearly illustrated in Figs. 1, 15, 16, and 17, that is to say, 26 is a diagonal slot cut in the wall of the cylinder at a suitable point beyond the knitting cams, and 27 is an offset cam plate fitted edgewise to this slot so as to be radially movable therein. Projecting outwardly from this plate is a rod 28 the outer end of which is headed. A spring 29 surrounding this rod, bears against the head and a bracket 30 on the wall of the cam cylinder, thus normally retracting said cam plate from the interior of the latter. Pivoted between the said bracket and the carrier is a latch arm 31, which drops by gravity upon the offset portion 32 of the cam plate. Hence, when the cam plate is pressed into the cylinder, by pressure applied by the finger of the operative upon the head of rod 28; its offset portion escaping the latch arm, permits the latter to drop upon the rod and thus maintain the cam plate inward against the stress of the spring. When the cam plate is in this inward position, its inclined face during the stroke of the cylinder, bears against the heels of the idle needles, thereby directing them down into action. Rising from the bed of the machine is a suitably disposed trip 33, against which the latch arm abuts when the needles have been lowered, said arm thereupon being raised to free the cam plate and permit the spring to retract the same. Said latch-arm is provided on its lower edge with a projection 33^x, which, abutting against the rod 28, serves as a stop to limit the upward movement of the arm.

I claim—

1. The combination with a cam carrier and its cams, of a diagonally sliding needle engaging cam, constructed to be engaged and deflected by a needle, and means adapted

normally to maintain said cam in active position, there being a cam surface or cut away portion in the path of said needle engaging cam, whereby the latter will engage a needle heel in its path and be moved diagonally thereby until it reaches the cam or cut away portion upon which it will be deflected by the needle, substantially as described.

2. The combination with a cam carrier provided with a diagonal slot or opening therein, and the knitting cams, of a guide within said slot, a needle engaging cam mounted on said guide and projected normally into active position, there being a cam surface or cut away portion on said cam carrier, and means for maintaining said needle engaging cam normally beyond or out of engagement with the said cam surface or cut away portion; substantially as described.

3. The combination with a cam carrier, of a diagonally sliding partially rotatable needle engaging cam, means adapted to maintain said cam normally in active position, a guide for said cam, provisions whereby the same may be slid and partially turned on said guide by the pressure of a needle, a latch device to lock the said cam out of action, and means to release said latch, substantially as described.

4. The combination with a cam carrier, provided with a diagonal slot or opening therein, of a diagonally sliding needle-engaging cam, a rigid guide rod therefor in said slot or opening, a spring acting to maintain said cam normally in action, and a spring actuated device adapted to lock said cam out of action, there being a cam surface or cut away portion upon which the needle engaging cam is deflected by the pressure of a needle; substantially as described.

5. The combination with a cam carrier and its cams, of a needle-engaging cam, a guide therefor, and means tending to maintain said cam normally in action, of a spring controlled slide bolt adapted to lock said cam out of action, an outward member on said bolt, and a depending trip arm provided with a cam surface adapted to co-act with said outward member, substantially as described.

6. The combination with the cam carrier, and its cams, of a diagonally-movable needle-engaging cam, means adapted normally to maintain said cam in active position, there being a cam surface or inclined cut away portion in the path of said needle engaging cam, and a fixed needle actuating cam in front of said cam surface or cut away portion, whereby the said needle engaging cam will abut against a needle heel in its path and be moved diagonally thereby until it reaches the cam or cut away portion upon which it will be deflected by the needle, said needle being thereupon delivered to the said fixed cam; substantially as described.

7. The combination with the cam carrier, and its cams, of a diagonally-movable needle-

engaging cam, means adapted normally to maintain said cam in active position, there being a cam surface or inclined cut away portion in the path of said needle engaging cam, and a fixed needle actuating cam in front of said cam surface or cut away portion, whereby the said needle engaging cam will abut against a needle heel in its path and be moved diagonally thereby until it reaches the cam or cut away portion upon which it will be deflected by the needle, said needle being thereupon delivered to the said fixed cam, together with means for temporarily locking said needle engaging cam out of action; substantially as described.

8. The combination with the cam carrier and its cams, of a diagonally-movable needle-engaging cam provided with a sleeve, a guide rod upon which the said sleeve is mounted so as to be partially rotatable, a spring acting upon one end of said sleeve to maintain the cam in action, a fixed cam against which the other end of said sleeve is adapted to rest, said latter end being cut away or beveled coincidently with the fixed cam, substantially as described.

9. The combination with the cam carrier, provided with the oppositely disposed diagonal slots, the guide rods in said slots, the needle-raising and needle-depressing cams partially rotatable on said rods, respectively, the spring acting to depress the raising cam, the spring acting to raise the depressing cam, there being cam surfaces in the paths of said cams respectively, together with the respective locking devices for said cams, and means for operating said locking devices, substantially as described.

10. The combination, with the cam carrier provided with a slot or opening therein, of a diagonally-disposed cam plate fitted edgewise to said slot or opening so as to be radially-movable therein, a guide rod on said plate, a spring tending normally to move the said plate outward, and a latch adapted to lock the plate inward against the action of the spring, said latch being provided with a stop adapted to abut against the said guide rod, substantially as described.

11. The combination with the cam carrier provided with a diagonal slot therein in advance of the knitting cams, the radially movable offset plate in said slot, a guide rod on said plate, a spring tending to maintain said plate normally outward, and a latch arm adapted to engage and lock said plate when the latter is moved inward; substantially as described.

In testimony whereof I have hereunto affixed my signature in the presence of two subscribing witnesses.

BARCLAY M. DENNEY.

Witnesses:

JOHN R. NOLAN,
JESSE B. HELLER.