

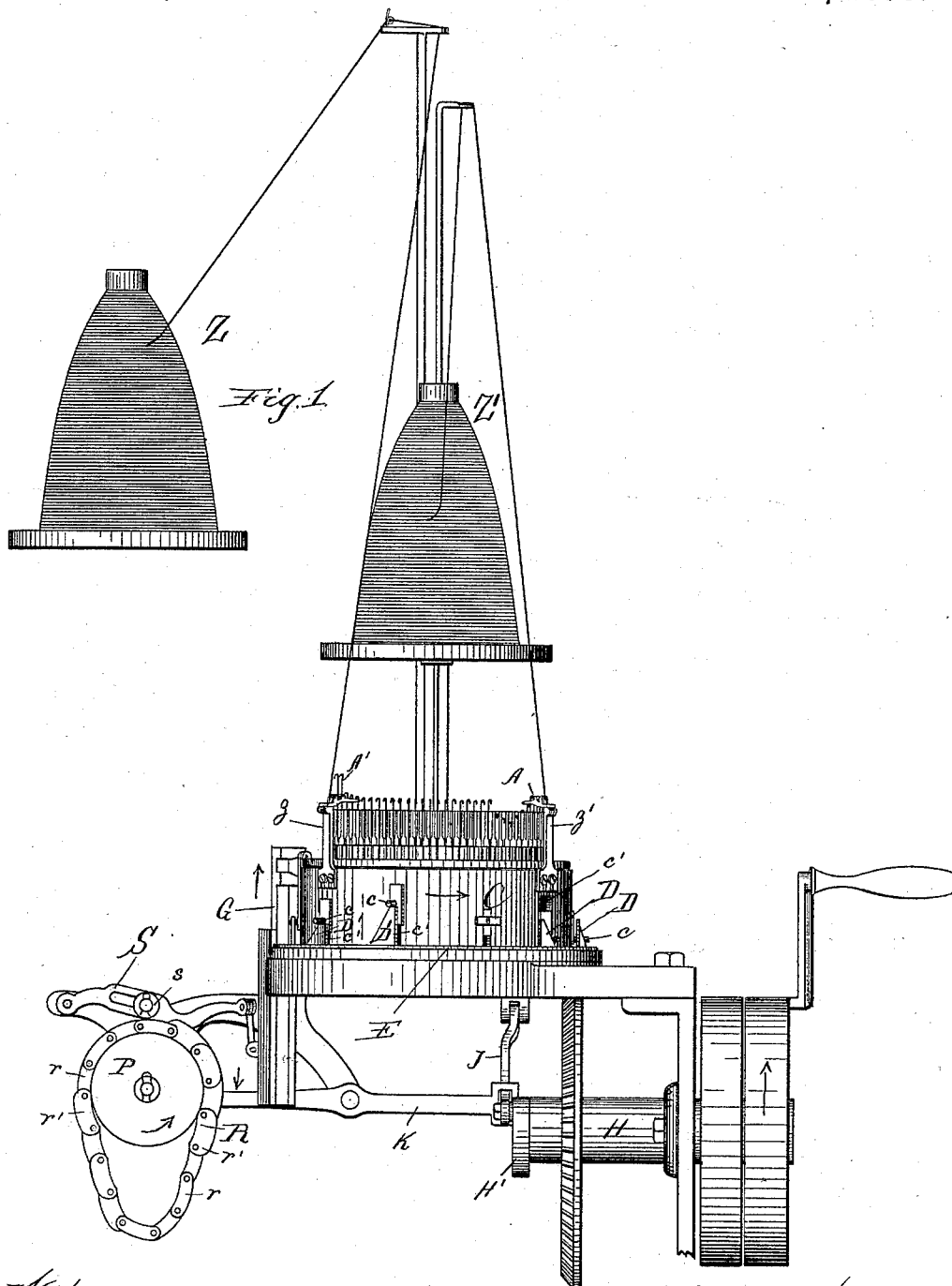
(No Model.)

4 Sheets—Sheet 1.

A. P. GRIFFITH & T. N. CASWELL.  
CIRCULAR KNITTING MACHINE.

No. 493,924.

Patented Mar. 21, 1893.



Witnesses:

Lew. C. Curtis.

H. M. Munday

Inventors:

Thomas N. Caswell

Alfred P. Griffith

By Munday, Everts & Adcock

their Attorneys

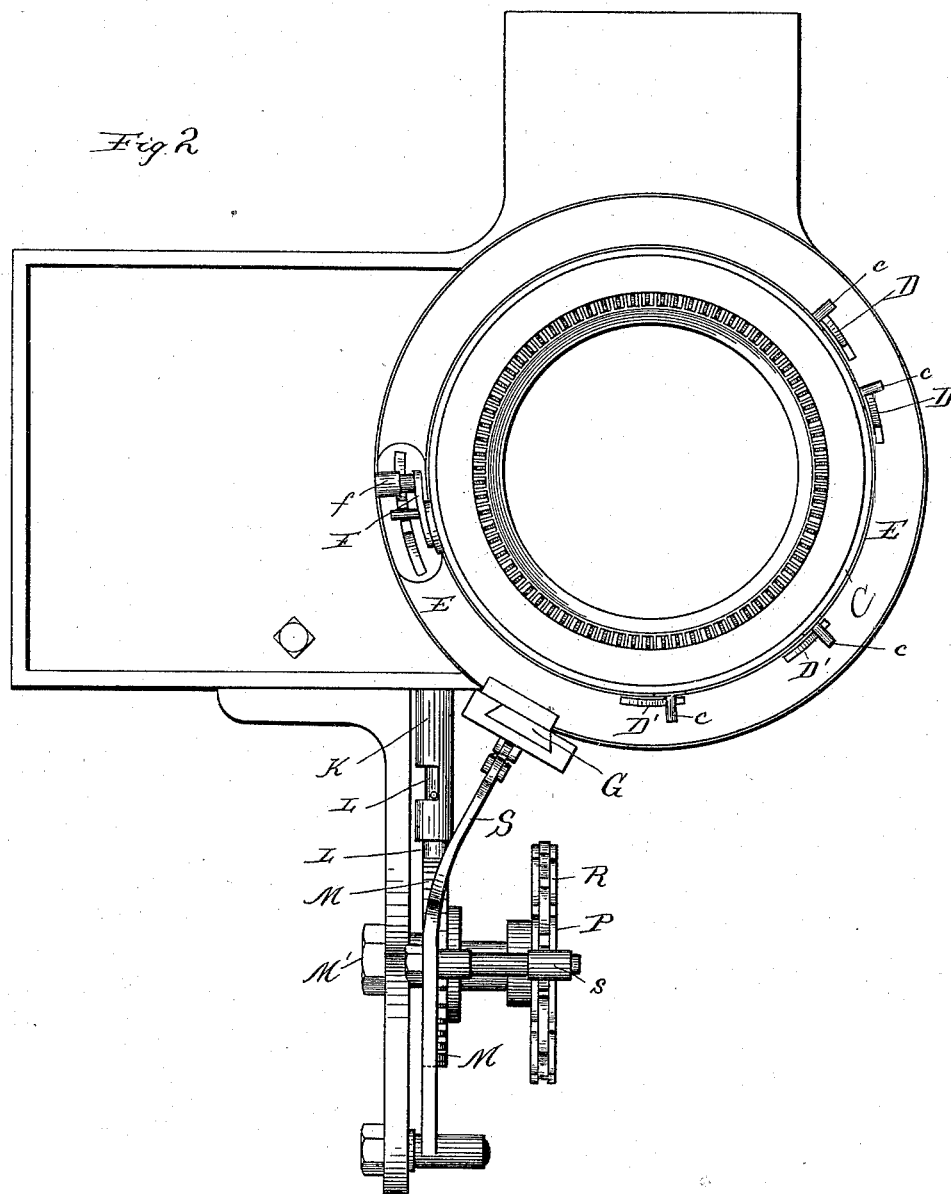
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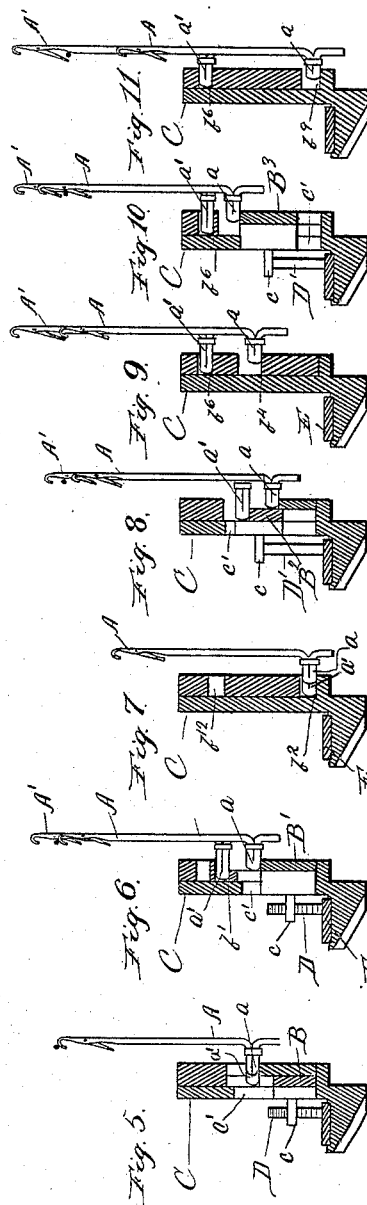
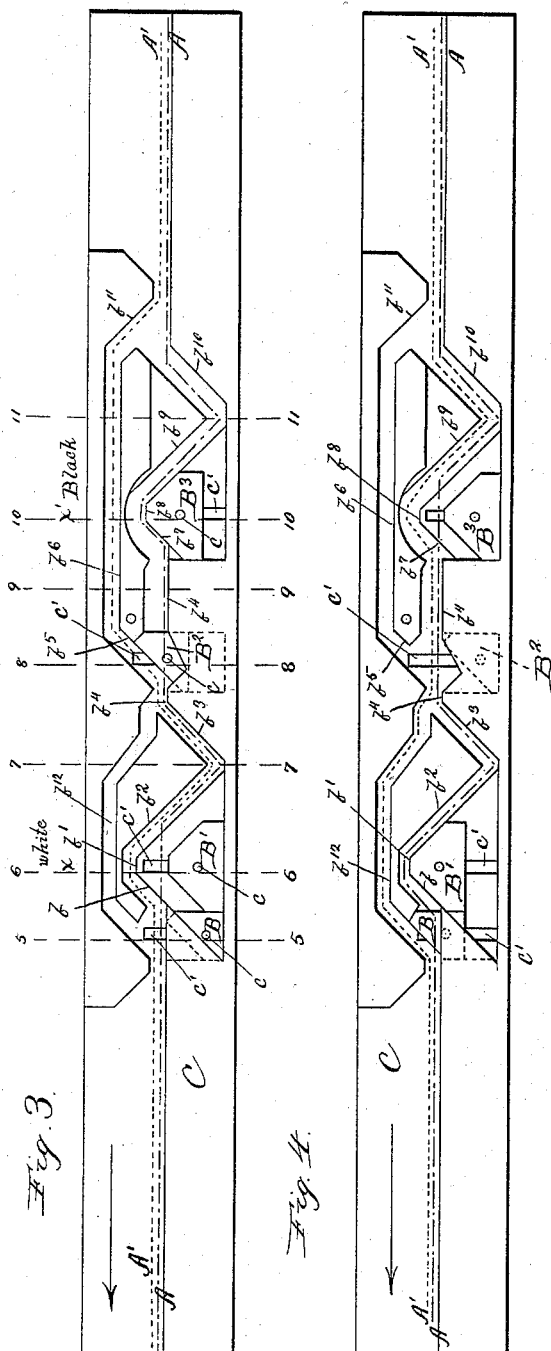
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their Attorneys:

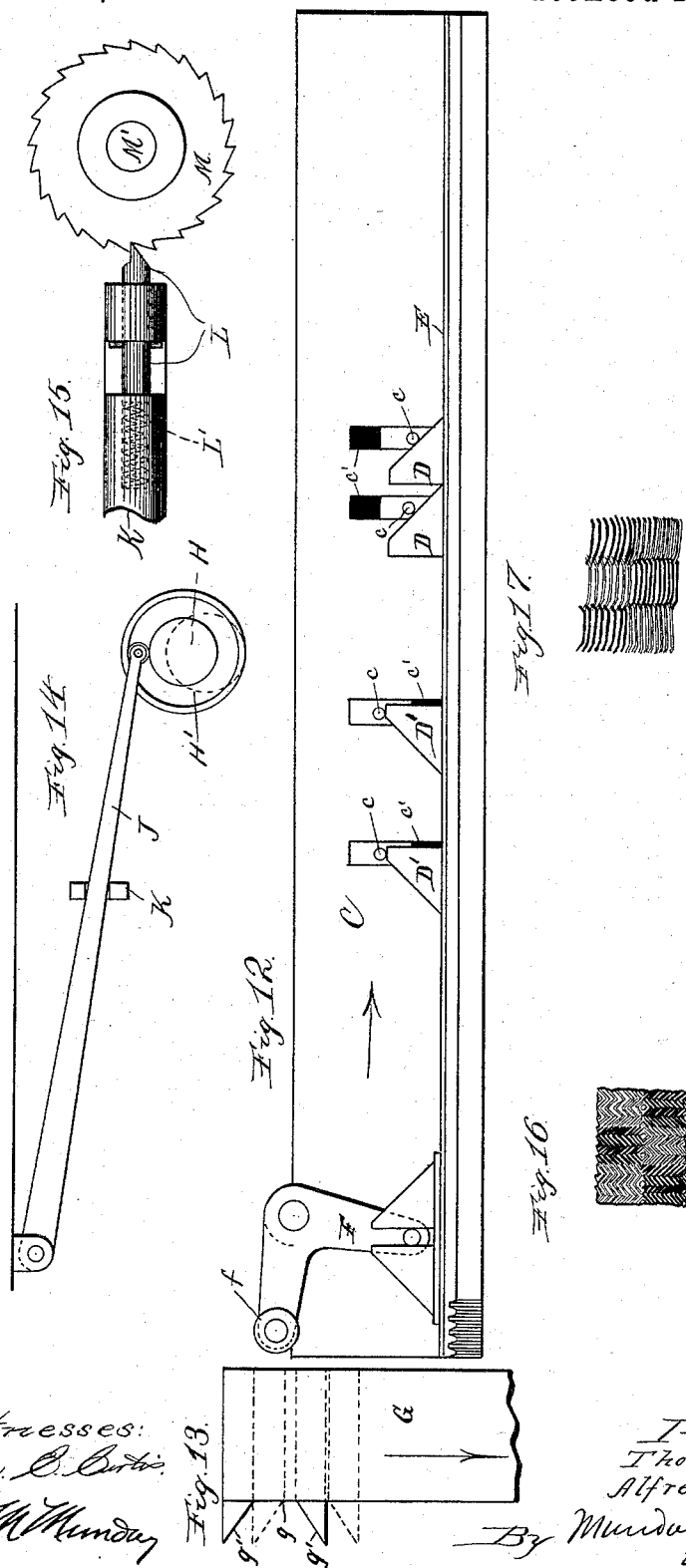
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4 Sheets—Sheet 4.

A. P. GRIFFITH & T. N. CASWELL.  
CIRCULAR KNITTING MACHINE.

No. 493,924.

Patented Mar. 21, 1893.



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# UNITED STATES PATENT OFFICE.

ALFRED P. GRIFFITH AND THOMAS N. CASWELL, OF MICHIGAN CITY,  
INDIANA.

## CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 493,924, dated March 21, 1893.

Application filed January 14, 1889. Serial No. 296,322. (No model.)

*To all whom it may concern:*

Be it known that we, ALFRED P. GRIFFITH and THOMAS N. CASWELL, citizens of the United States, residing at Michigan City, in the county of La Porte and State of Indiana, have invented a new and useful Improvement in Circular-Knitting Machines, of which the following is a specification.

The object of this invention is a knitting machine which will knit automatically of two different colored yarns a fabric with either a striped or a checkered pattern; the stripes or checks of the one color on the face side being free from mixture of the other color.

The nature of the invention residing as it does in the peculiar mode of operation of the needles and the arrangement of cams and their capacity for adjustment will be best understood from the subjoined description and claims and the accompanying drawings, which form a part of this specification, and in which:—

Figure 1 is a side elevation of the entire machine; Fig. 2 a plan view of the same with the bobbins and their supports removed. Fig. 3 is a view of the interior of the cam ring by which the needles are operated, said ring in this and the next view being supposed, for purpose of better illustration, to be cut in two at one point and laid out flat. Fig. 4 is a view similar to Fig. 3 with the cams automatically adjusted to the other position. Figs. 5, 6, 7, 8, 9, 10, and 11 are vertical sections, respectively, on the lines 5—5, 6—6, &c., of Fig. 3, the needles being added to the view. Fig. 12 is a view similar to Figs. 3 and 4 of the flattened cam ring, but showing this time the exterior of the ring. Fig. 13 is a view of the stationary ring adjusting cam. Fig. 14 is a detail subsequently referred to, Fig. 15 a detail of the spring pawl, Fig. 16 a view of the face of one of the patterns of fabric wrought by the machine, and Fig. 17 a view of the back of Fig. 16.

The needles are all alike in general construction and all have the usual operating arm projecting into the groove of the cam ring. These operating arms are however of unequal lengths, thus dividing the whole body of needles into two classes, sets or

groups, one class A having short arms *a* and the other class A' having longer arms *a'*. By this construction, which is not a new one, the two classes of needles may be given different movements. The long arm needles project into the ring C far enough to ride in a cam-groove of different line from that in which both needles have a common path or in which the short arm needles solely ride. These needles are arranged in groups, the different kinds alternating with each other, and the groups may consist of two needles each.

Referring to Fig. 3 which shows the interior face of the cam ring C unrolled or flattened into a plane surface for convenience of illustration, the path of the needles or rather of their projecting arms is indicated, that of the short arm class A by a broken line A, and that of the long arm class A' by a dotted line A'. The cam ring moving in the direction of the arrow on said figure it will be seen that the path of both classes of needles is normally along a common plane until they reach a certain point, and at this point the long arm needles A' diverge from said common path by rising up the incline *b*, to a short plane, *b'*. At this latter point the long arm needles A' take the yarn fed at X, which for sake of clearness let us say is the white yarn. The short arm needles A in the mean time not reaching to the innermost groove are uninfluenced by the path *b, b'*, but pass along on the normal or common plane not taking any yarn, as in this position the needles cannot reach the strand. When the other or long arm needles A' pass from the short plane *b'* they are forced down by the decline *b<sup>2</sup>* and join the needles A so that all the needles are carried down, one set A' having white yarn which is pulled through or knitted and the other set without yarn or idle. Both sets of needles now rise along the incline *b<sup>3</sup>* to the common plane at *b<sup>4</sup>*. The next knitting operation being designed to knit the black yarn and loop the white, the long arm needles pass up the incline *b<sup>5</sup>* to a plane *b<sup>6</sup>* which is so far above the infeding yarn that these needles can not take it, and the short arm needles in the mean time pass along the common plane to the incline *b<sup>7</sup>* which raises them to the

short plane  $b^8$  on the level with  $b'$ —that is to say on the feeding or taking level, where they take the black yarn fed at  $X'$ , and descending the decline  $b^9$  knit the black yarn and bring it to the face of the fabric. After thus knitting the black yarn the short arm needles A pass up the incline  $b^{10}$  to the common plane where they are joined by the long arm needles A' the latter being brought down from their elevated position by the decline  $b^{11}$ . Upon this common plane the needles continue until the cam ring in its farther revolution causes them to repeat the above described operation. So long as this operation continues the machine with black and white yarn will knit a striped fabric alternately black and white, the width of the alternating stripes depending upon the number of the needles of class A or A' in each group. Of course it will be understood that both the black and the white strand are being constantly fed into the fabric; but that strand which is momentarily not being acted upon by the needles is caught at a later stage and therefore loops across the portion of the other strand coming to the inner surface. The yarn is supplied by suitable feeding devices shown at Z Z' in Fig. 1.

Portions of the sides of the cam groove or grooves above described are made movable for the purpose of changing the path of the needles, causing the one class to knit when the other class is idle, and vice versa, to produce a checkered pattern. Movable blocks B, B', B<sup>2</sup>, B<sup>3</sup> the edge surfaces of which constitute portions of the walls or sides of the groove or grooves are provided upon the cam ring. Of these blocks B and B<sup>2</sup> come out toward the inner surface of the ring only far enough to affect the long arm needles, while B' and B<sup>3</sup> come out far enough to be also in the path of the short arm needles.

In Fig. 3 above considered the blocks B<sup>2</sup> and B<sup>3</sup> are shown elevated to form some portion of the path, while blocks B and B' in said figure are lowered out of the path entirely. We have just seen that the effect of this arrangement of the paths of the two sets of needles is to cause the long arm needles A' to take white thread at X and the short arm needles A to take black thread at X'. Now referring to Fig. 4 it will be noticed that in this latter figure the blocks B, B' are elevated into the path and blocks B<sup>2</sup> B<sup>3</sup> lowered out of the path of the needles. Following, as in Fig. 3, the paths of the two sets of needles in Fig. 4 by the dotted and broken lines, it will be seen that in this latter case the long arm needles A' are shunted by the block B into the elevated path  $b^{12}$ , corresponding in level to the path  $b^6$ , at which elevation the needles will not take the yarn, while the short arm needles A are by block B' raised to the plane  $b'$  which is the height at which the needles take the yarn. The short arm needles now take the white yarn and knit it. The lowering of the block B<sup>2</sup> permits the long arm needles to pass

along on the common plane so that they are not, as previously, shunted up into the elevated plane  $b^6$ , but enter the incline  $b^7$  and reach the plane  $b^8$  where they take the black yarn. The lowering of the block B<sup>3</sup> permits the cam ring to turn without at this point operating the short arm needles so that they do not rise to take the yarn at this point. The result of this change in the position of the cam blocks B B' B<sup>2</sup> B<sup>3</sup> from that shown in Fig. 3 to that shown in Fig. 4, is to cause that set of needles which were taking white yarn at X to take black yarn at X', and those needles which were taking black yarn at X' to take white yarn at X. It will thus be seen that having knitted a few, say six, rounds with the cams in the condition shown at Fig. 3, producing alternate black and white stripes, a change of the cams to the condition shown at Fig. 4 will cause the machine to knit the same kind of stripes with the difference that the black stripe will now be where the white stripe was and the white stripe where the black stripe was. And by thus alternating the condition of the cams a checkered pattern is produced in the fabric. The long arm needles, to get them out of knitting action, are elevated by the cam above the knitting position while the short arm needles are kept out of operation, as by being permitted to stand in the normal, intermediate or inactive position. By this simple means of placing the different sets of needles at different heights, neither set interferes with the operation of the other and a clean black and white stripe or check may be knitted.

In order that the blocks B B' B<sup>2</sup> B<sup>3</sup> may be shifted automatically in the operation of the machine, an arm  $c$  passes from each block through a slot  $c'$  in the cam ring and projects upon the outside of said cam ring where the arms may come into contact with inclined cam projections D D' D', which are more clearly indicated at Fig. 12. These projections D D' D' are mounted on a loose ring E, movable upon the cam ring of the machine. When this loose ring E is moved in one direction the blocks B<sup>2</sup> B<sup>3</sup> are raised by the cams D' D' coming in contact with and lifting the pins  $c$ , while at the same time the weight of the blocks B B' causes them to assume the lower position and vice versa. The movement of the ring E in either direction need only be great enough to effect this purpose. This movement is given by the bell-crank lever F, one end of which is connected to the ring E while the other end bears a projecting roller  $f$ . This lever F being pivoted to the cam ring revolves with the latter, and located in the proper point in its path is the sliding piece G supported upon the stationary part of the machine, and having on its inner face a guide groove  $g$  with flaring ends  $g'$ . This slide G is arranged to be moved up and down by automatic mechanism, presently to be described. When the slide G is in its upper position the roller  $f$  of the lever F coming

into the groove will be raised thereby, and the lower end of the lever attached to the ring E swung in one direction, so that the cams D' D' are brought into operation, as previously described; and when the slide G is lowered, the contrary effect is produced upon the lever F and the cams D D brought into operation.

To automatically change the slide G from the main shaft of the machine the following mechanism is provided. H is said main shaft. Upon the end of this main shaft is an eccentric cam H' which at each revolution of the main shaft vibrates the pivoted arm J, which in turn communicates vibration to one end of the lever K, to the other end of which is attached the pawl consisting of the rod L in the cavity in the end of the lever K, and forced outward by a spring L'. The end of this rod or pawl where it engages the ratchet teeth is made beveled upon one side and straight upon the other. M is a ratchet wheel mounted on the shaft M' which also carries a pulley P, made to receive and carry a chain R. This chain R is composed of links r and r', the links r' being thicker than the links r. A roller s connected to a lever S rests upon this chain, and the end of this lever S is connected to the slide G. Now, as the main shaft H revolves, causing the levers J and K to vibrate, the pawl upon the lever K communicates through the ratchet M and its shaft M' a step by step rotation to the pulley P which carries the chain R, the elevated links r' of which raise the lever S as they pass under the roller s and said lever falls when the elevated links have passed out from beneath it.

The timing of the parts is such, in the machine illustrated in the drawings, that the slide G is raised or lowered once for each six revolutions of the knitting machine, so that a checkered pattern is produced each check of which is six rows in length. Any other relative timing may be given to the slide G by removing the chain shown and supplying its place with another having a different arrangement of links. When it is desired to knit plain striped goods, the chain may be thrown off from the pulley entirely, or the lever S disconnected from the slide G, in either of which cases said slide will not be operated, the cams in the cam ring will not be changed, and a continuous stripe will be, therefore, knitted.

We claim—

1. The knitting machine having two classes of needles, combined with yarn feeding devices, and operating means for the said classes of needles whereby one class is raised above the delivery point of the feeding devices and rendered incapable of knitting during some portion of the revolution of the machine, substantially as specified.

2. In a knitting machine the combination of two sets or classes of needles and actuating and holding mechanism therefor acting to maintain one set of said needles too high to

knit and the other set too low to knit during some portion of each revolution of the machine, substantially as specified.

3. The combination in a knitting machine of the needles arranged in groups distinguished by long and short projecting arms, and a cam ring having grooves adapted to maintain the long armed needles above the plane at which they will knit while the short armed needles are knitting and maintain the short armed needles below the plane at which they will knit, while the long armed needles are knitting, said grooves having means, such as cam surfaces for operating the active needles to cause them to knit while the passive needles are maintained out of action, substantially as specified.

4. The combination in a knitting machine of the needles arranged in groups distinguished by long and short projecting arms, and a cam ring having grooves adapted to maintain the long armed needles above the plane at which they will knit while the short armed needles are knitting, and maintain the short armed needles below the plane at which they will knit, while the long armed needles are knitting, said grooves having means such as cam surfaces for operating the active needles to cause them to knit while the passive needles are maintained out of action, and said cam surfaces having movable portions whereby the grooves are made changeable at will, so that the two sets of needles may be changed from one yarn to the other, substantially as described.

5. The combination in a knitting machine of the needles made with long and short arms, the cam ring having cam surfaces for operating the same constructed to maintain some of the needles above the plane at which they will knit and to maintain the other needles below the plane at which they will knit, said cam surfaces having blocks or movable slides B B' B<sup>2</sup> B<sup>3</sup> connected by intermediate mechanism to the moving parts of the machine to be automatically shifted or moved at regular intervals, substantially as described.

6. In a knitting machine the combination of the cam ring having a set of grooves for operating the needles constructed to elevate one part of the needles above the knitting point while the other part is knitting and to maintain in the common plane the other part of the needles while the one part is knitting, and the needles A, A', said grooves having means such as cam surfaces for operating the active needles to cause them to knit while the passive needles are maintained out of action, substantially as described.

7. In a knitting machine the combination of the cam ring having a set of grooves for operating the needles constructed to elevate one part of the needles above the knitting point while the other part is knitting and to depress the other part of the needles while the one part is knitting, and the needles A, A', said grooves having means such as cam sur-

faces for operating the active needles to cause them to knit while the passive needles are maintained out of action, said cam surfaces having movable blocks B, B', B<sup>2</sup>, B<sup>3</sup> forming some portion of the grooves, substantially as described.

8. In a knitting machine the combination of the needles A A' and the cam ring having the grooves with the various horizontal and inclined surfaces *b, b', b<sup>2</sup>, b<sup>3</sup>, b<sup>4</sup>, b<sup>5</sup>, b<sup>6</sup>, b<sup>7</sup>, b<sup>8</sup>, b<sup>9</sup>, b<sup>10</sup>, b<sup>11</sup>, b<sup>12</sup>*, the common groove and the movable blocks B, B', B<sup>2</sup>, B<sup>3</sup>, substantially as specified.

9. In a knitting machine the combination of the needles A A', the cam ring having grooves constructed to elevate the needles A'

while the needles A are knitting and to maintain in the common plane the needles A while the needles A' are knitting, said grooves having the blocks B, B', B<sup>2</sup>, B<sup>3</sup>, forming some portion of the grooves, the loose ring E carrying cams D D', the lever F, the slide G, the lever S, the pulley P, the chain R, *r, r'*, the lever K, the lever J, the cam H' and the shaft H, and the pawl L and the ratchet M, substantially as set forth.

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