Feb. 16, 1926. 1,573,018

J. P. PRIMM

KNITTING MACHINE

Filed June 19, 1925 7 Sheets-Sheet 1

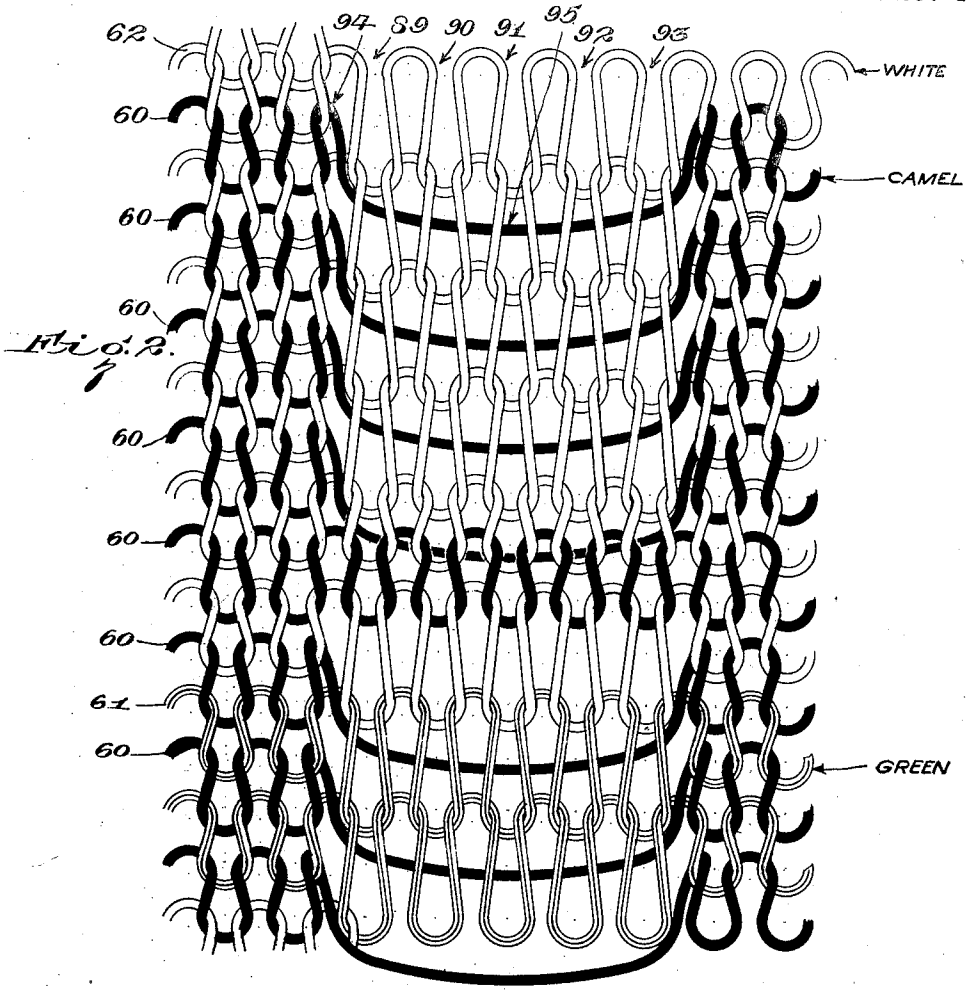

Fig. 2.

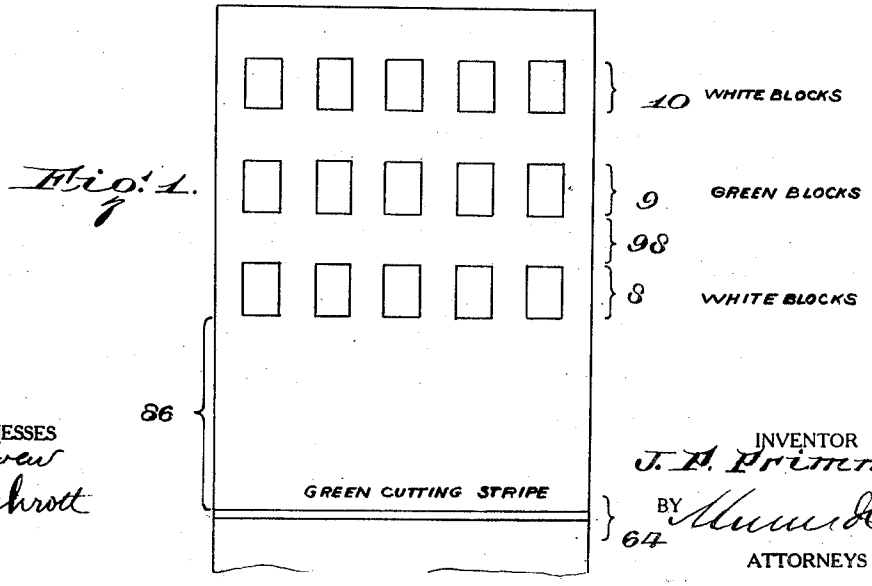

Fig. 1.

WITNESSES

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KNITTING MACHINE

Filed June 19, 1925 7 Sheets-Sheet 2

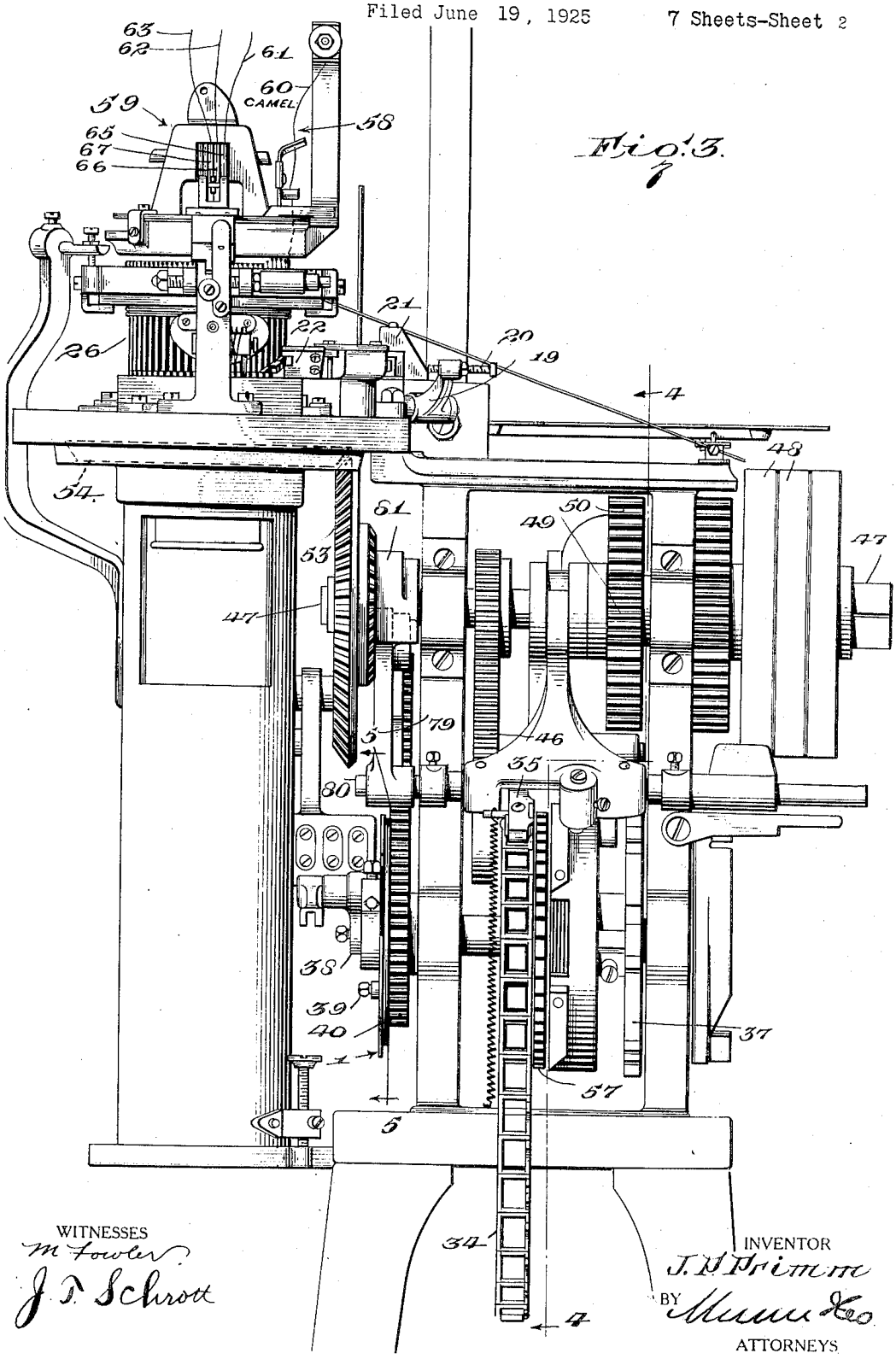

Fig. 3.

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KNITTING MACHINE

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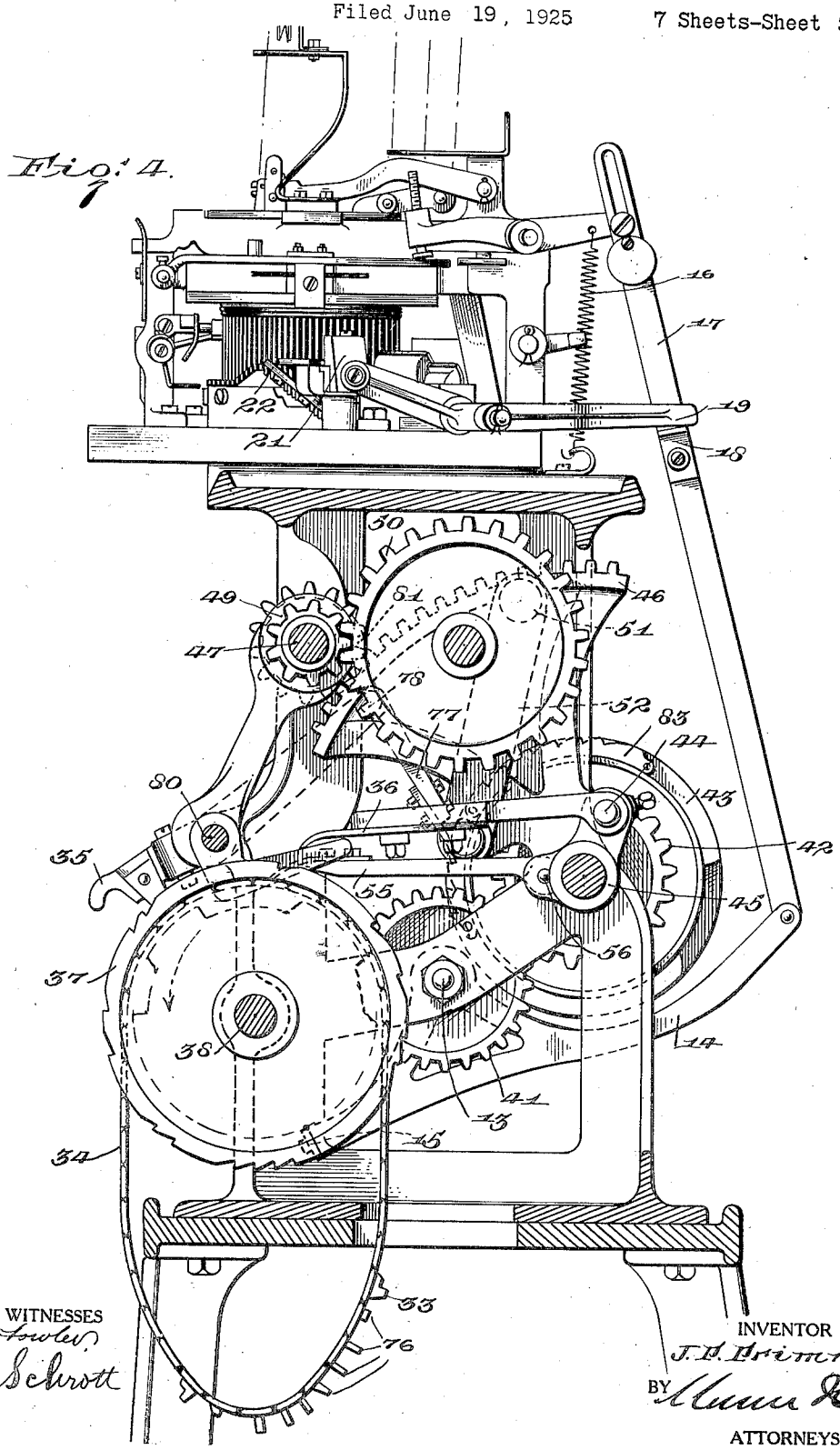
Fig. 4.



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KNITTING MACHINE

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Fig. 5.

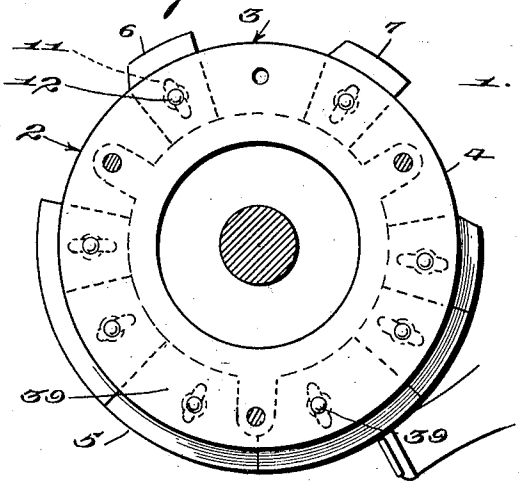


Fig. 6.

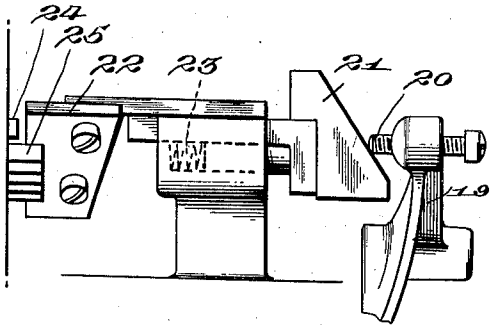


Fig. 7.

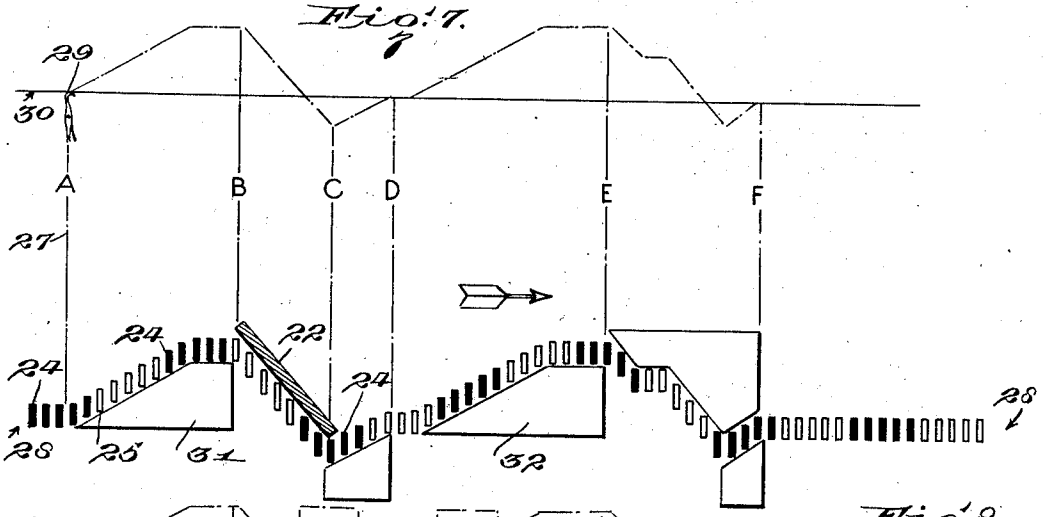
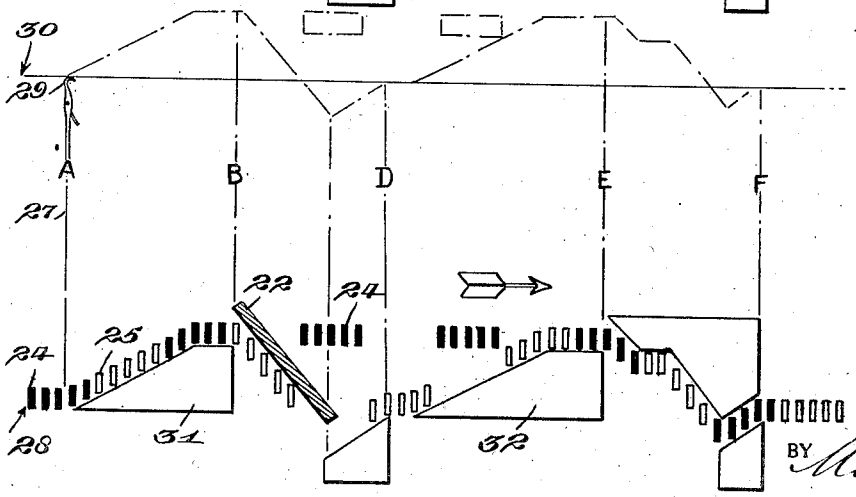


Fig. 8.



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KNITTING MACHINE

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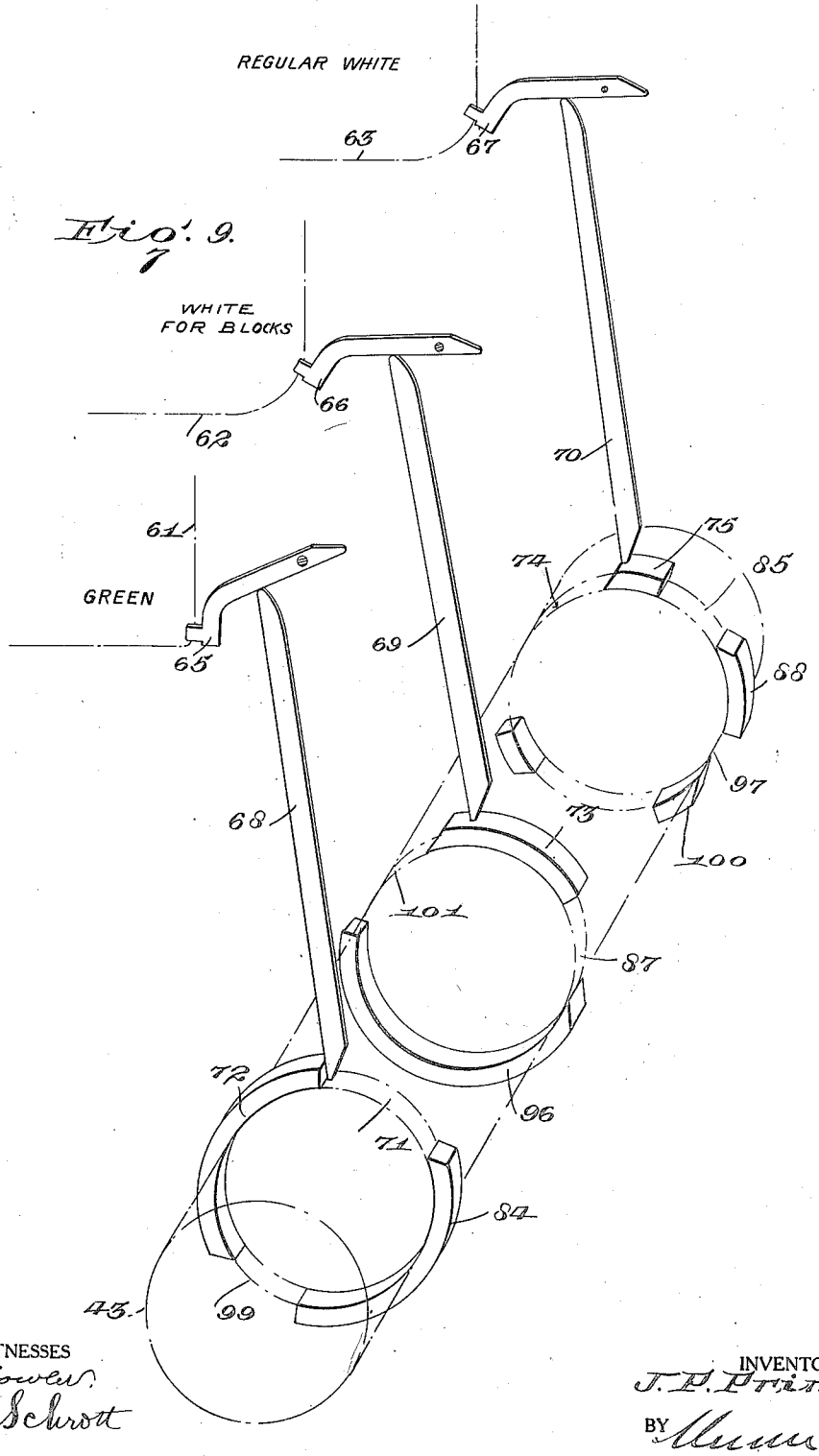

Fig. 9.

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KNITTING MACHINE

Filed June 19, 1925 7 Sheets-Sheet 6

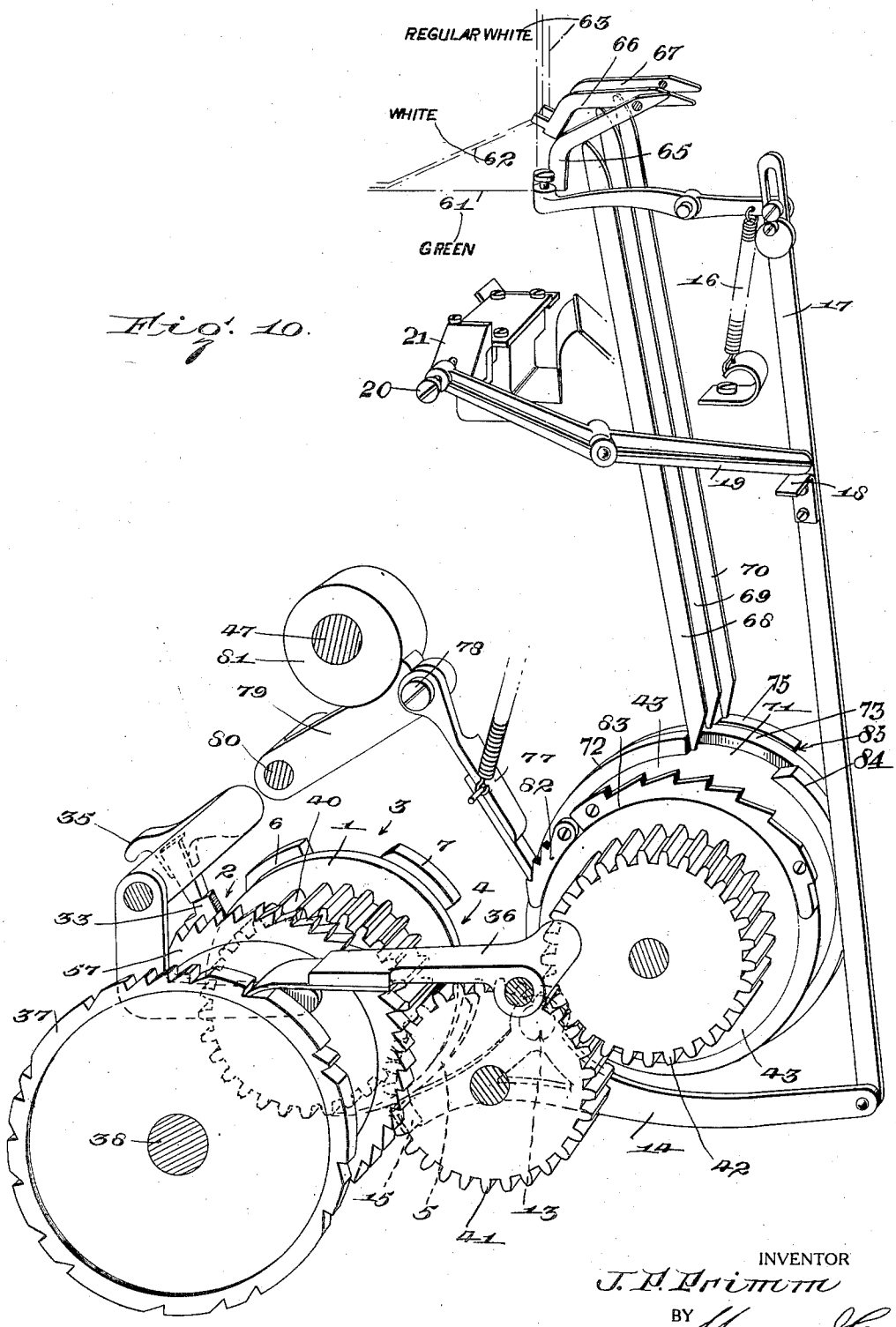

Fig. 10.

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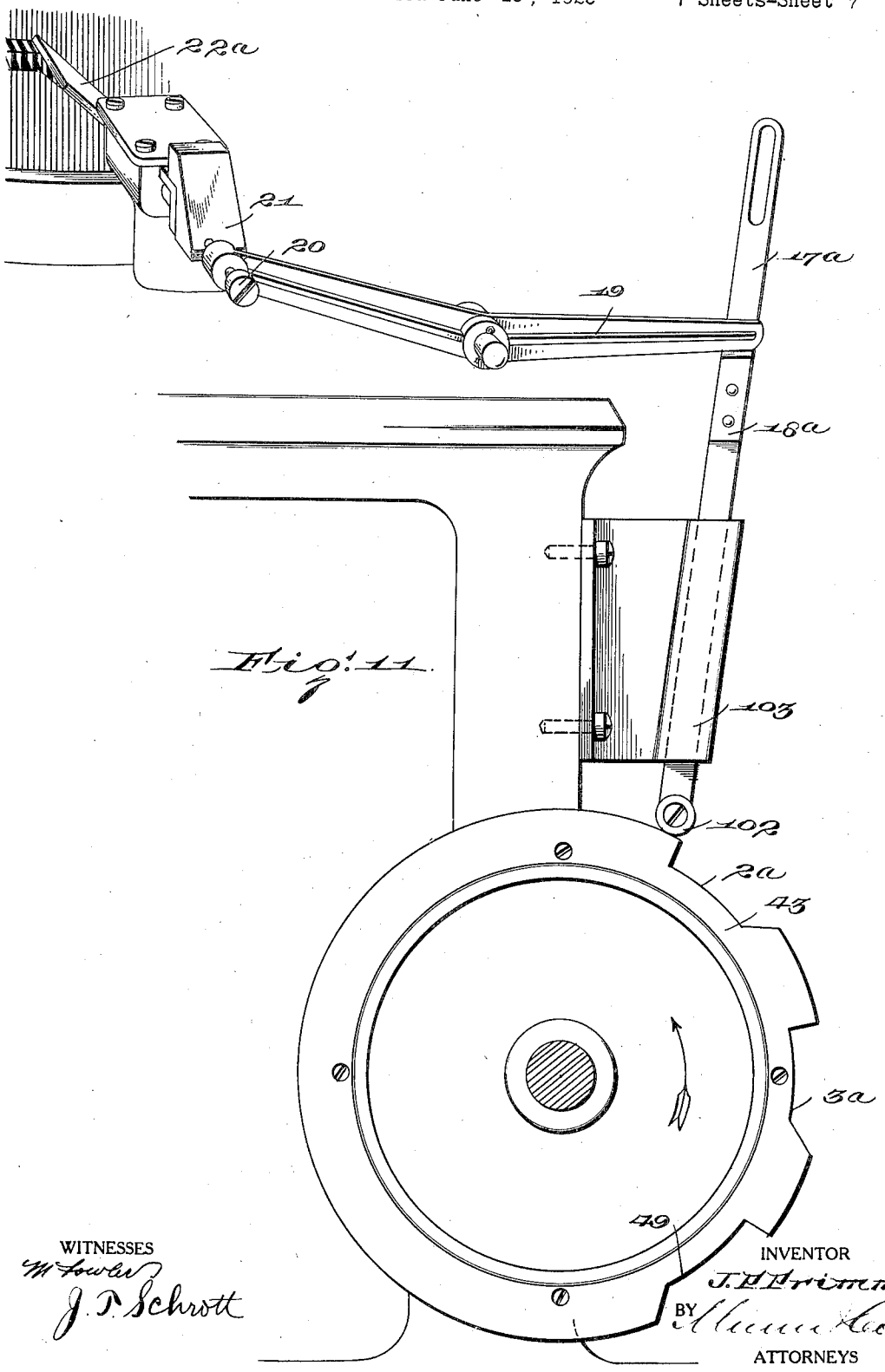

Fig. 11.

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Patented Feb. 16, 1926. 1,573,018

UNITED STATES PATENT OFFICE.

JOSEPH PARKS PRIMM, OF ROME, GEORGIA, ASSIGNOR OF ONE-THIRD TO HENRY R. BERRY AND OF ONE-THIRD TO JOHN M. BERRY, BOTH OF ROME, GEORGIA.

KNITTING MACHINE.

Application filed June 19, 1925. Serial No. 38,263.

To all whom it may concern:

Be it known that I, JOSEPH PARKS PRIMM, a citizen of the United States, and a resident of Rome, in the county of Floyd and State of Georgia, have invented certain new and useful Improvements in Knitting Machines, of which the following is a specification.

This invention relates to improvements in knitting machines, and it consists of the constructions, combinations and arrangements herein described and claimed.

An object of the invention is to convert a single-feed stocking knitting machine into a two-feed striping machine.

Another object of the invention is to provide a special cam plate for so controlling the auxiliary stitch cam of a two-feed stocking knitting machine that said auxiliary stitch cam can be thrown out periodically to miss predetermined groups of short butt needles and temporarily stop the knitting function thereof thereby to "float" the yarn (which would otherwise be employed by said needles) under the latches of said short-butt needles and produce a prearranged design.

Another object of the invention is to provide appropriate lugs on the pattern chain to cause a step motion of the special cam plate at appropriate times.

Another object of the invention is to provide a special cam plate for so controlling the auxiliary cam that said cam will be moved out only sufficiently far to avoid or release the short needle butts thereby to "float" the yarn under the latches of the short butt needles.

Other objects and advantages appear in the following specification reference being had to the accompanying drawings in which—

Figure 1 is a diagram of a portion of stocking produced by the machine, illustrating the design hereinafter referred to.

Figure 2 is a diagram of a portion of the fabric on an enlarged scale to particularly illustrate the effect of "floating" the yarn.

Figure 3 is a front elevation of a knitting machine to which the invention is applied.

Figure 4 is a cross section taken substantially on the line 4—4 of Figure 3.

Figure 5 is a detail cross section taken substantially on the line 5—5 of Figure 3 particularly illustrating the improved cam plate and the adjustable lobes thereon.

Figure 6 is a detail elevation of the auxiliary cam showing it in the displaced position wherein it misses the short butt needles.

Figure 7 is a diagram illustrating the action of the needle butts while the auxiliary cam is in.

Figure 8 is a similar diagram illustrating the action of the needle butts while the auxiliary cam is displaced.

Figure 9 is a diagrammatic perspective illustrating the cam action upon the various yarn fingers.

Figure 10 is a diagram illustrating the action occurring when making the cutting stripe.

Figure 11 is a diagram of a modification wherein the existing cam drum is employed for the purposes of the invention.

This invention, while being concerned more particularly with the conversion of an ordinary stocking knitting machine into a machine for producing a fabric of prearranged design, has embodied therein the principles of the improved cam box disclosed in my co-pending application for Letters Patent filed June 14, 1924, Serial Number 720,030.

According to the invention in that application, the arrangement is such that the stitches, when looped by the needles, rest immediately below the needle hooks where they are held by the sinkers. This provision preserves an initial looseness in the looped stitches, resulting in a number of advantages principal among which are a reduction in the tension on the yarn, a more remote likelihood of breaking the yarn, reducing the wear on the needles, etc.

Excepting the foregoing brief statement it is deemed unnecessary to enlarge upon the prior invention because that is covered by the disclosure mentioned. The present invention consists largely of an attachment to an existing stocking knitting machine of the rotary needle cylinder type. To make a direct statement, the invention comprises a cam plate generally designated 1 (Figs. 3 and 5). It has a plurality of depressions

2, 3 and 4 produced by a plurality of outstanding portions or lobes 5, 6 and 7. Each depression represents one of the courses of rectangles, blocks or checks 8, 9 and 10 (Fig. 1), of a prearranged design. The machine has been referred to as a striping machine. The courses 8, 9 and 10 may be regarded as stripes, but by virtue of the fact that one color of yarn is "floated" beneath the latches of certain groups of needles, the strands thus floated are not knitted into the fabric and the ultimate appearance is that of courses of checks or blocks.

Provision is made for the addition or subtraction of cam plate lobes. Taking any instance as an example, the lobe has a slot 11 through which a threaded pin 12 may be screwed into the cam plate 1. In practice the cam plate will be made so that more or less depressions can be produced by simply adding, subtracting or adjusting lobes, thereby in turn controlling the number of courses of blocks in the ultimate design.

Pivoted upon a countershaft 13 is a rocker 14 the hardened end 15 of which is held against the periphery of the cam plate 1 by a spring 16 that exerts its contracting influence through the connected auxiliary bar 17. Dropping of the end 15 into a cam plate depression is accompanied by a downward motion of the auxiliary bar.

A rest 18 on the auxiliary bar provides the support for one end of a pivoted lever 19, the opposite end of which has an adjustable screw 20 (or the like) to bear against the beveled head 21 of the auxiliary cam 22. When the end 15 drops, as stated, the left end of the lever 19 moves upward permitting a spring 23 (Fig. 6) to displace the cam 22 outwardly sufficiently far to miss the short butts 24 but not the long butts 25. Riding of the end 15 upon any lobe of cam plate 1 will have the reverse effect of moving the cam 22 inwardly so that both the long and short butts are deflected.

The rotary needle cylinder 26 carries needles 27 (Fig. 7) according to custom. The short and long butts, previously mentioned, are for convenience regarded as being those of the needles, although the butts may in fact be those of needle jacks that are sometimes used. In Figures 7 and 8 the short butts 24 are shown in solid black to distinguish from the long butts 25 that are left open. According to the example chosen, the needle cylinder carries needles arranged in groups of five of long and short butts, but it is an obvious expedient to divide the total number of needles into groups of more or less of each kind.

Figures 7 and 8 illustrate the effect of the operation of the auxiliary cam 22. The needles are idle while the butts 24 and 25 traverse the horizontal circumferential plane 28. At this time the needle hooks 29 are housed within the sinkers represented by the line 30. While traversing the zone from A to B the needle butts are elevated by the cam 31 when the cheeks and latches of the needles are thrust through previously looped stitches to clear the latches. While traversing the zone from B to C the needle hooks 29 take hold of the yarn at the auxiliary feed point preparatory to looping the stitch in the zone from C to D.

Figure 7 shows the auxiliary cam 22 in position to deflect all needle butts downwardly for the performance of the looping function. Should one of the cam plate depressions 2, 3 or 4 have caused the displacement of the auxiliary cam (Fig. 6) only the long butt needles 25 would be deflected downwardly in the stitch looping zone C to D while the short butts 24 pass on in the plane to which they were elevated by the cam 31. The result is that the yarn supplied at the auxiliary feed point simply floats behind the groups of five of short butt needles thus left elevated, producing the effect in Figure 1 and the fabric in Figure 2.

While traversing the zone from D to E a cam 32 elevates the needles to take the yarn from the main feed point preparatory to again loop stitches in the zone from E to F. After the stitches are formed the needle butts traverse the zone 28, mentioned before, the needle hooks remaining situated within the sinkers and thereby holding the stitches in a loose condition immediately below the hooks.

A lug 33 on the pattern chain 34 is the second added element forming part of the invention. At the appropriate time this lug rides beneath and raises the dog 35 thereby permitting the pawl 36 to fall upon the periphery of the cam ratchet 37. At this time it becomes necessary to describe the structure of the existing machine because it is necessary to understand this, in part at least, so that the association of the invention may in turn be understood. The cam ratchet 37 is fixed upon the cam shaft 38 by which the cam plate 1 is carried. The cam plate is secured at 39 to one of a train of gears 40, 41 and 42, the last of these turning the cam drum 43.

The pawl 36 has an eccentric mounting at 44 upon the hub 45 of the quadrant 46, and when the pawl 36 is permitted to drop upon the periphery of the cam ratchet 37 the reciprocatory motion of the pawl (of which it constantly partakes) serves to turn the shaft 38 in the counter-clockwise direction by virtue of the engagement of the pawl with an appropriate one of the numerous recesses or teeth of the cam ratchet. This turn results in a corresponding turn of the cam plate 1.

Rotation of the main shaft 47, by power applied at the fast pulley 48, causes turning

of gears 49 and 50 (Fig. 4) and the oscillation of the quadrant 46 by virtue of the crank pin and link connections at 51 and 52. The main shaft 47 also carries a beveled gear 53 (Fig. 3) to drive the needle cylinder 26 by means of a gear 54 upon the latter. The oscillation of the quadrant produces a continuous step motion of the pattern chain 34 by virtue of the action of a second pawl 55 that is eccentrically connected at 56 to the hub 45. This pawl actuates a ratchet 57, the side of which carries a sprocket upon which the pattern chain is hung.

Supplementing the striper lug 33 (so called because of its function) is a plurality of lugs 76, these being incorporated in the pattern chain according to a spacing determined by practice. These lugs have a coaction with a "kick-off" pawl 77, pivotally carried at 78 upon an arm 79 which rocks freely and independently upon the same rod 80 upon which the dog 35 rocks. The rocking of the arm 79 occurs at each revolution of the main shaft 47, and is produced by a cam 81 with which the rocker arm makes contact. The resulting reciprocating motion of the "kick-off" pawl produces turns of the cam drum 43 at such time when one or the other of two sets of teeth 82 and 83 has been advanced into range of the kick-off pawl.

Such advancement occurs upon turning of the cam drum through the gear train 40, 41 and 42 by the cam ratchet 37 and cam shaft 38. The subsequent action of the kick-off pawl 77 for a brief period then turns the cam drum, the train of gearing, the shaft 38 and the cam ratchet 37. This latter action is coincidental with the knitting of what is herein known as the green cutting stripe 64, and contributes to the advancement of the cam plate 1 from the particular relative position in Figure 4 (at which time the green cutting stripe is about to be made) to such position when the rocker end 15 drops into the first depression 2.

The auxiliary and main feed points, mentioned in connection with Figures 7 and 8 are respectively designated 58 and 59 in Figure 3. Yarn 60, of a color herein known as "camel," is supplied at the auxiliary feed 58. Yarns 61, 62 and 63 are fed at the main point 59. Of these 61 is green, for the cutting stripe 64 and the green blocks 9 (Fig. 1), 62 is white for the white blocks 8 and 10 and 63 is the regular white to alternate with the camel in the spaces between the courses mentioned.

Suitable bobbins (not shown) supply the various colors of yarn, and in the case of the main feed 59 the various yarns 61, 62 and 63 are guided by yarn fingers 65, 66 and 67 (Figs. 9 and 10). When the fingers are up the respective yarns are held out of reach of the needles, but when down dispose the yarns into reach of the needles so that the particular colors of yarn are knitted into the fabric. Bars 68, 69 and 70 support the respective yarn fingers. These are capable of being lifted by cams on the drum 43. To avoid needless duplication of description, such of the cams involved are specifically mentioned in the description of the operation. The reader can understand that continuous rotation of the main shaft 47 (Fig. 4) will produce continuous reciprocation of the pawls 36, 55 and 77. The pawl 55 acts each time to move the cam shaft 38 forward one step, but the pawl 36 does not become active until one of the several lugs on the pattern chain 34 raises the dog 35 and lets the pawl 36 down upon the cam ratchet 37.

Assume the striper lug 33 as having reached and raised the dog 35 (Fig. 10). The resulting engagement of the pawl 36 with the cam ratchet 37 and reciprocation thereof produces a sufficient turn of the cam drum 43 to let the bar 68 (Figs. 9 and 10) drop into the depression 71 and lower the green yarn finger 65 for the knitting of the course 64 (Fig. 1), already known as the green cutting stripe.

Up to the time of dropping into the depression 71 the bar 68 was held up by a cam 72. The bar 69 is held up upon a cam 73, but the bar 70 occupied a depression 74 so that regular white yarn 63 was knitted in alternation with camel yarn 60. Upon dropping of the bar 68 the bar 70 is raised by a cam 75 so that green yarn only is knitted in alternation with camel yarn.

At the particular time assumed the aforementioned turn of the cam drum brings the first set of teeth 82 into range of the kick-off pawl 77 whereupon the kick-off pawl imparts a succession of turns to the cam drum commensurate with the extent of the depression 71. At the end of this time the bar 68 will be raised by the cam 84 to lift the green yarn finger 65 out of action, and the bar 70 will be dropped into the depression 85 to lower the regular white yarn finger 67. The green cutting stripe 64 (Fig. 1) has now been made and the knitting of the fabric 86, alternating camel 60 and regular white 63, proceeds.

Immediately after the striper lug 33 and the kick-off pawl 77 perform their respective described functions the series of lugs 76 (Fig. 4) successively lift the dog 35 and permit the pawl 36 to produce such succession of turns of the cam ratchet 37 as will advance the cam plate 1 in the counter-clockwise direction from the position in Figure 10 to that position wherein the first depression 2 comes under the rocker end 15 allowing the latter to drop in. The time period over which the action of the lugs

76, dog 35 and pawl 36 extends equals the time period required for knitting the camel and white fabric in the course 86 (Fig. 1).

In the meantime the cam drum 43 has been turned sufficiently far to let the bar 69 (Fig. 9) drop into a depression 87 thus lowering the yarn finger 66 and introducing the substitute white yarn 62. At the same time a cam 88 raises the bar 70 and yarn finger 67 lifting the regular white yarn 63 out of reach of the needles. The foregoing dropping of the end 15 of the rocker 14 into the first depression 2 loosens up on the pivoted lever 19 (Fig. 5) so that the spring 23 (Fig. 6) can move the auxiliary cam 22 out sufficiently far to avoid the short butts 24.

The operation is now changed from that in which both short and long butt needles are deflected by the auxiliary cam 22 (Fig. 7) to knit camel 60 and regular white yarn 63 into the fabric to that in which only the groups of long butt needles 25 are deflected by the auxiliary cam 22 (Fig. 8) to knit substitute white yarn 62 into the fabric. The inaction of the short butt needles 24, resulting from missing the auxiliary cam 22, leaves the hooks of those needles in a plane so high above the sinker line 30 that the camel yarn introduced at the auxiliary feed 58 merely rests or "floats" beneath the latches of said needles.

Reference is now made to Figure 2 for the result. The wales or ridges produced by the segregated groups of long butt needles 25 are indicated at 89, 90, 91, 92 and 93. The first course of white yarn is that of substitute white 62. The next course is that of camel 60. Instead of the courses of camel yarn being meshed with the courses of substitute white yarn at the wales 89, etc., said camel yarn is dropped at the point 94 and permitted to float at 95 behind the five inactive needles involved and behind the stitches produced by the active needles. The stitches in the wales 89, etc., are simply slightly elongated to compensate for the missing camel yarn in the courses 60.

White blocks as in the course 8 (Fig. 1) are the production of floating the camel yarn. After a sufficient period has elapsed to knit the desired length of white blocks 8 a cam 96 (Fig. 9) lifts the yarn finger 66 out of action and the bar 70 drops into a depression 97 to return the regular white yarn finger 67 into action to knit regular white yarn in alternation with camel yarn in the course 98 (Fig. 1) between the first white blocks 8 and the green blocks 9.

The green yarn finger 65 is let into action by the dropping of the bar 68 (Fig. 9) into a depression 99, the regular white yarn finger 67 being lifted by the raising of the bar 70 by a cam 100. The substitute white yarn finger 66 remains held up by the cam 96, and does not come into action again until the bar 69 drops into a depression 101 when the appropriate time arrives for the making of the second course of white blocks 10 (Fig. 1).

It is believed obvious in Figure 2 how the green yarn 61 is meshed with the camel yarn 60. At this time the action of the mechanism will have been such that the second depression 3 of the cam plate 1 has again permitted the displacement of the auxiliary cam 22 (Fig. 6) so that the action in Figures 7 and 8 is repeated in respect to the green yarn. The camel yarn is floated in back of the green yarn producing solid green blocks, the fabric between the green blocks in the course 9 (Fig. 1) being of a dark shade because of the alternation of camel and green. The cam lobe 6 came into action to restore the auxiliary cam 22 to its original innermost position (Fig. 7) for the knitting of the camel and white course 98 after the first white blocks 8 had been completed.

The modification in Figure 11 illustrates an arrangement by which the auxiliary cam 22^a can be controlled by the addition of appropriate cams on the drum 43, instead of by a cam plate mounted upon the cam shaft 38. Here the auxiliary bar 17^a is equipped with a roller 102 to ride upon the face of the cam drum. The auxiliary bar is guided in a suitable bracket 103 on the frame of the machine, and as the bar is lowered when reached by the depression 2^a the corresponding lowering of the rest 18^a permits the spring of the auxiliary cam to throw the latter out as explained in connection with Figure 8 with the result already known. The depressions 3^a and 4^a are similar in function to the depressions 3 and 4 of the cam plate 1.

I claim:—

1. A knitting machine having a normally operative two-color yarn feed to produce a fabric in which said colors alternate, a normally inactive third-color yarn feed, a drum having cams to control the action of the individual feeds, a cam shaft from which is derived power to turn the drum, continuously acting means in readiness to operate the cam shaft, and a pattern chain associated with the cam shaft; in combination a special lug on said pattern chain causing action of said continously acting means thereby to operate the cam shaft and turn the cam drum to render inoperative one color yarn of the two-color feed and render the third-color yarn feed operative to produce a cutting stripe in said fabric.

2. A knitting machine having two classes of needles, a plurality of yarn feeds, cam means including an auxiliary cam for actuating the needles of both classes to loop stitches at the yarn feeds, a cam shaft with

turning means therefor, and a pattern chain associated with the cam shaft; in combination a plurality of lugs on the chain one serving to initially render operative said cam shaft turning means causing inaction of one yarn feed and action of another to produce a cutting stripe, a cam plate on the cam shaft having depressions and lobes, and means coming into range of said depressions and lobes upon appropriate turning of the cam shaft by virtue of the action of the remaining lugs after the completion of said cutting stripe and the knit fabric following to cause a periodic displacement and replacement of said auxiliary cam to alternately avoid the needles of one class, floating the yarn of the adjacent feed under the latches of said needles and producing a prearranged design.

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