

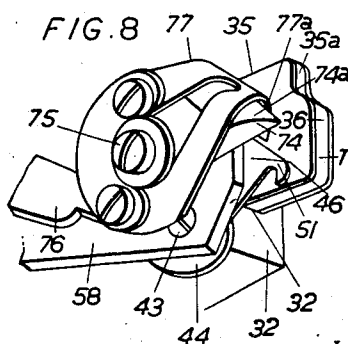
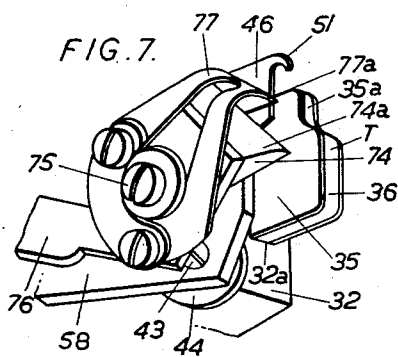
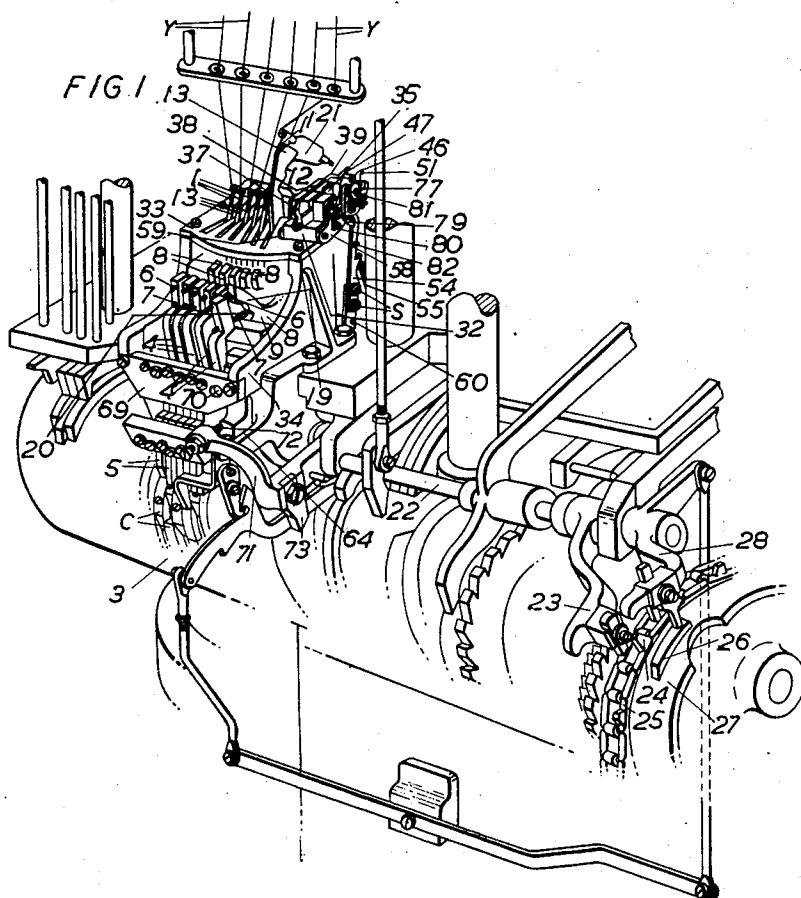
Oct. 12, 1954

A. M. BROWN ET AL  
YARN SUPPLYING AND CHANGING MECHANISM  
FOR CIRCULAR KNITTING MACHINES

2,691,285

Filed Oct. 2, 1952

12 Sheets-Sheet 1



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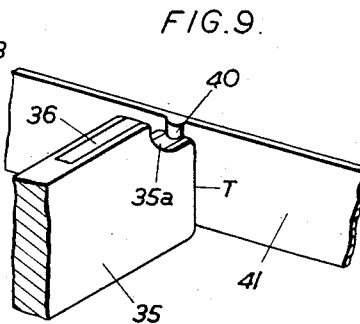
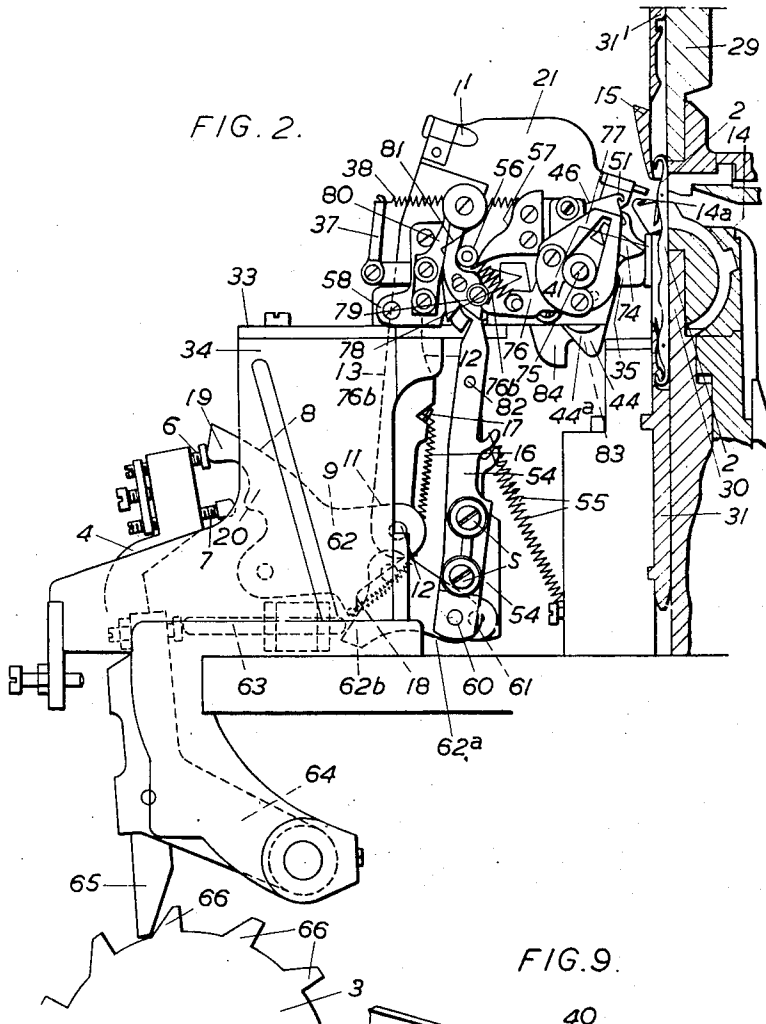
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12 Sheets-Sheet 2



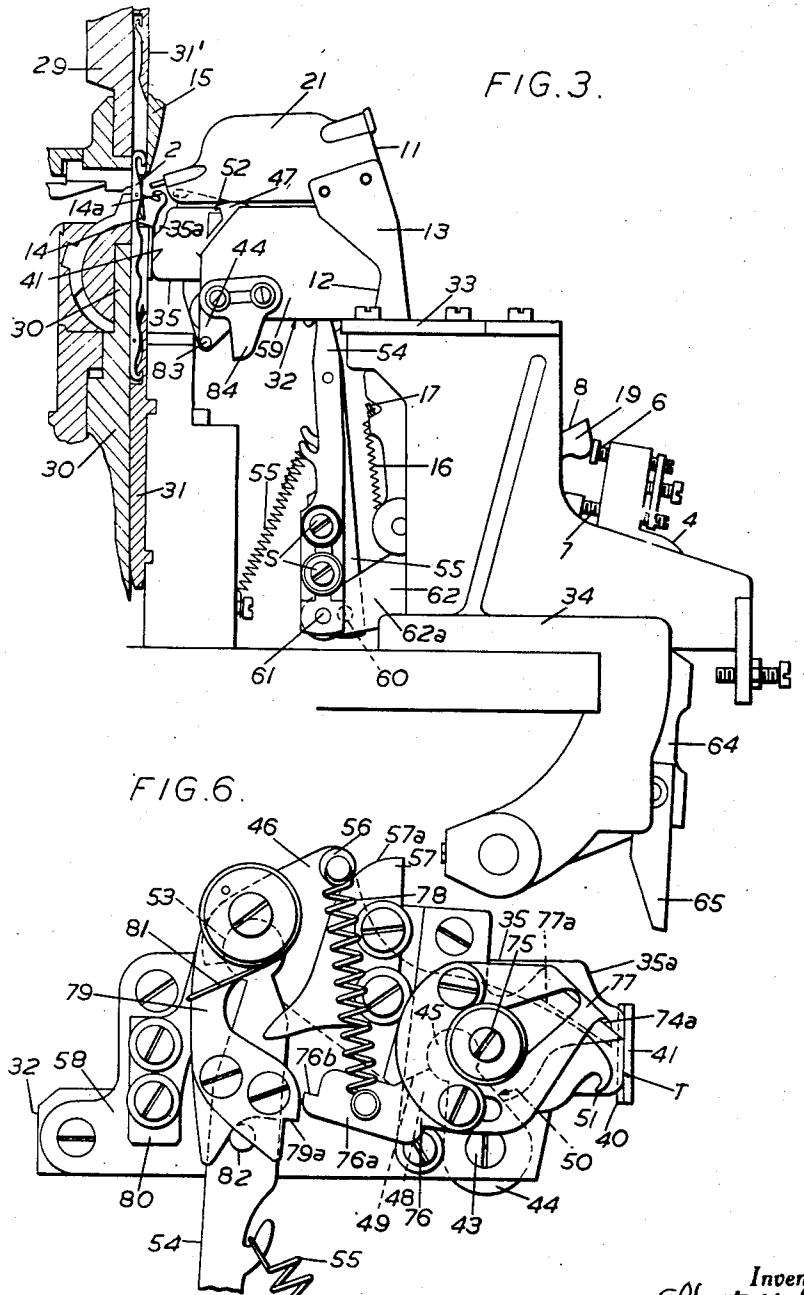
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12 Sheets-Sheet 3



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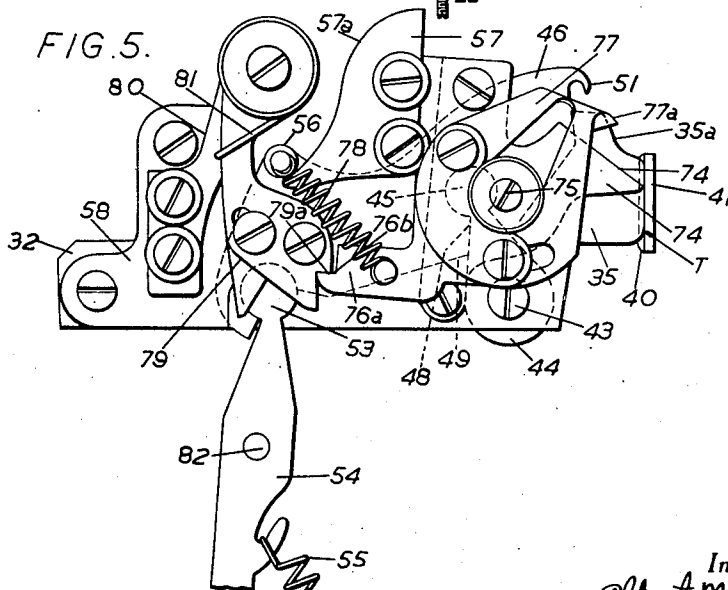
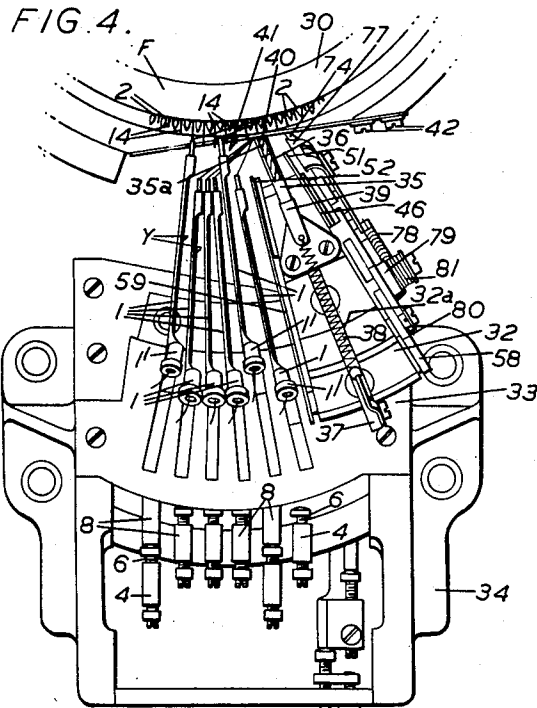
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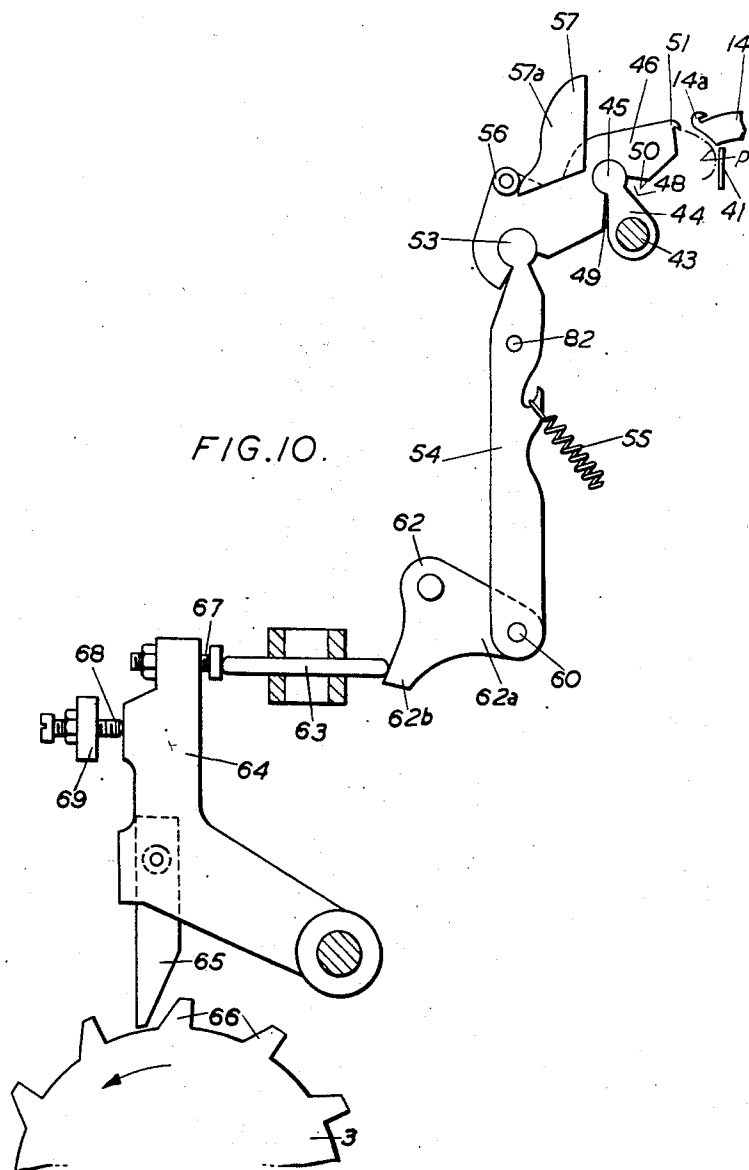
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12 Sheets-Sheet 5



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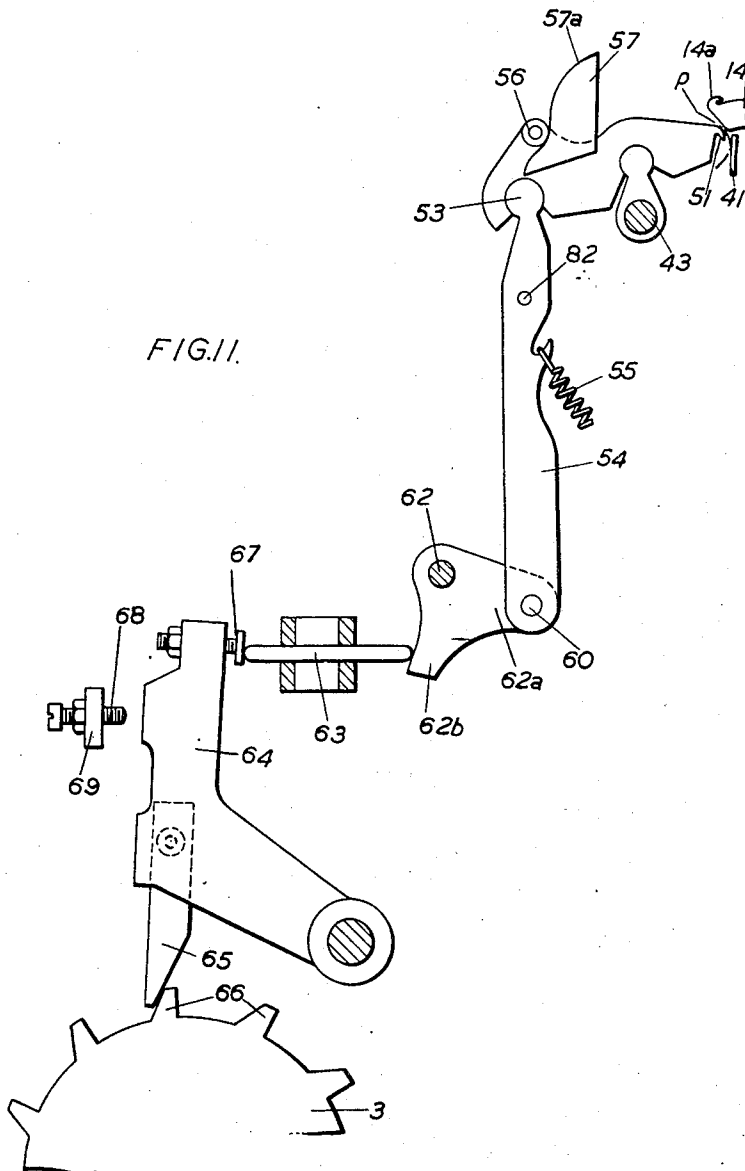
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12 Sheets-Sheet 6



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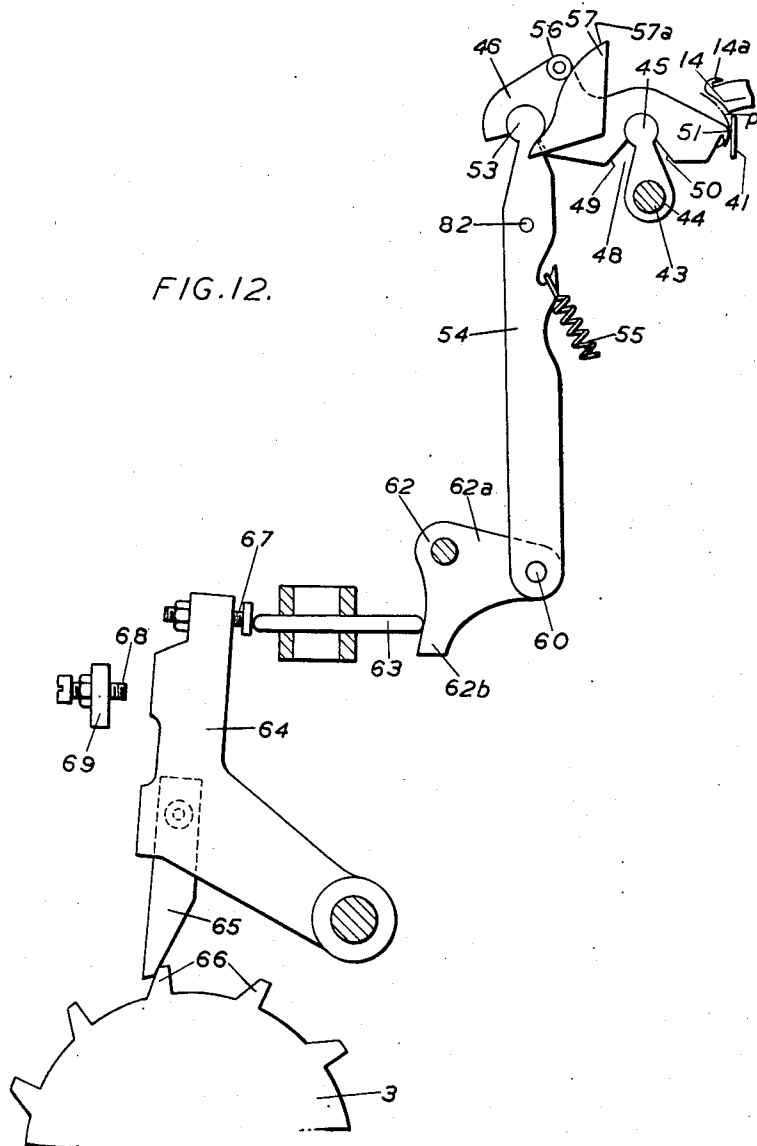
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12 Sheets-Sheet 7



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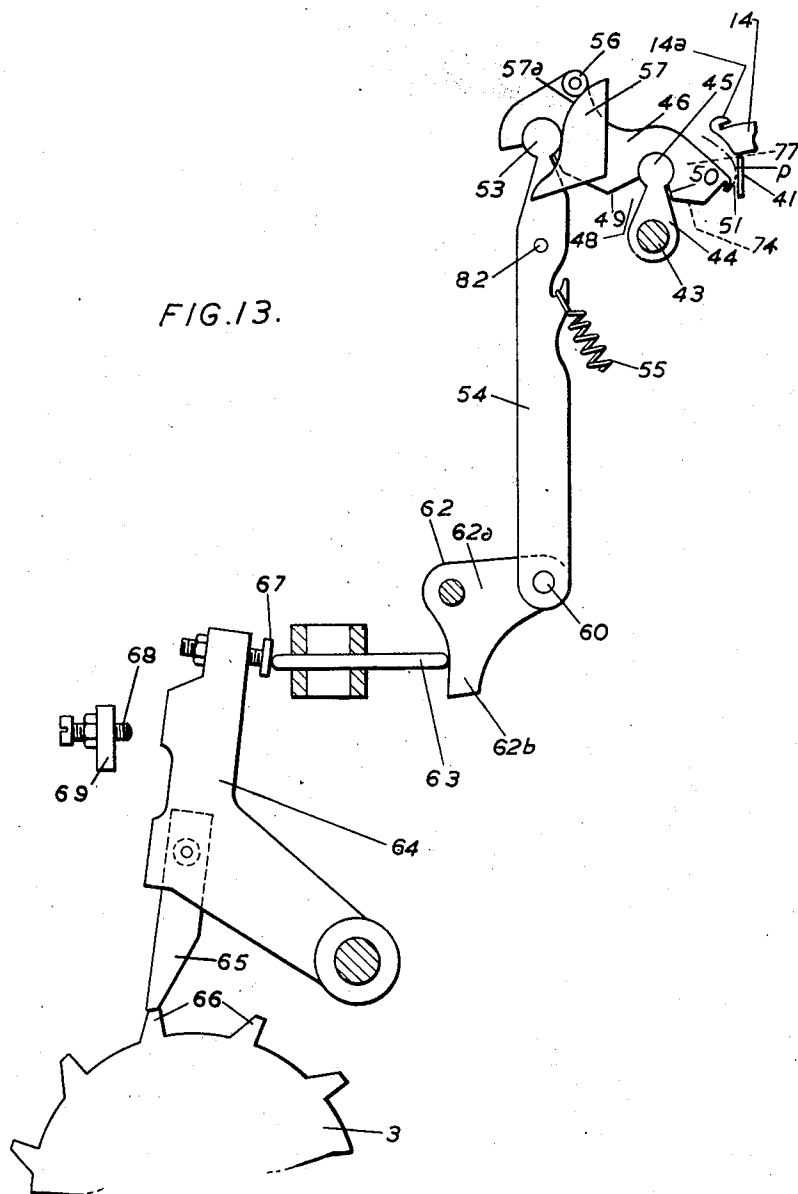
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12 Sheets-Sheet 8



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12 Sheets-Sheet 9

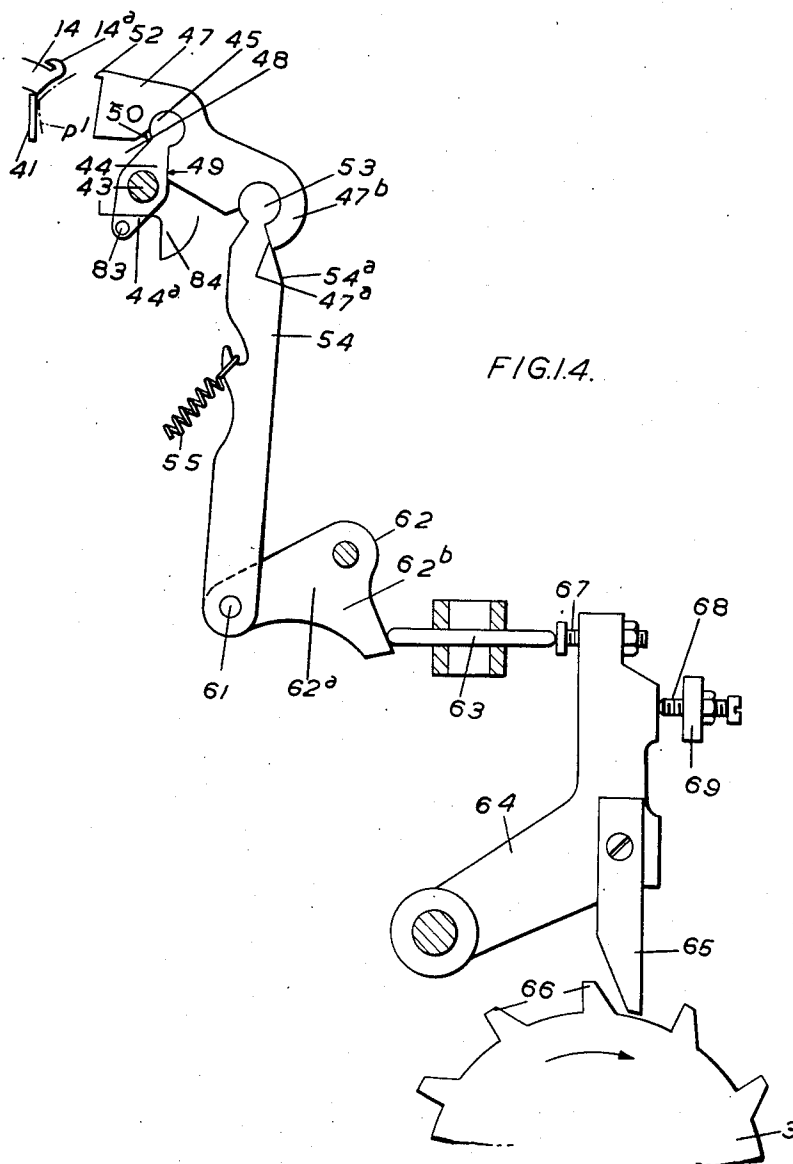


FIG. 1.4.

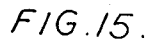
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12 Sheets-Sheet 10



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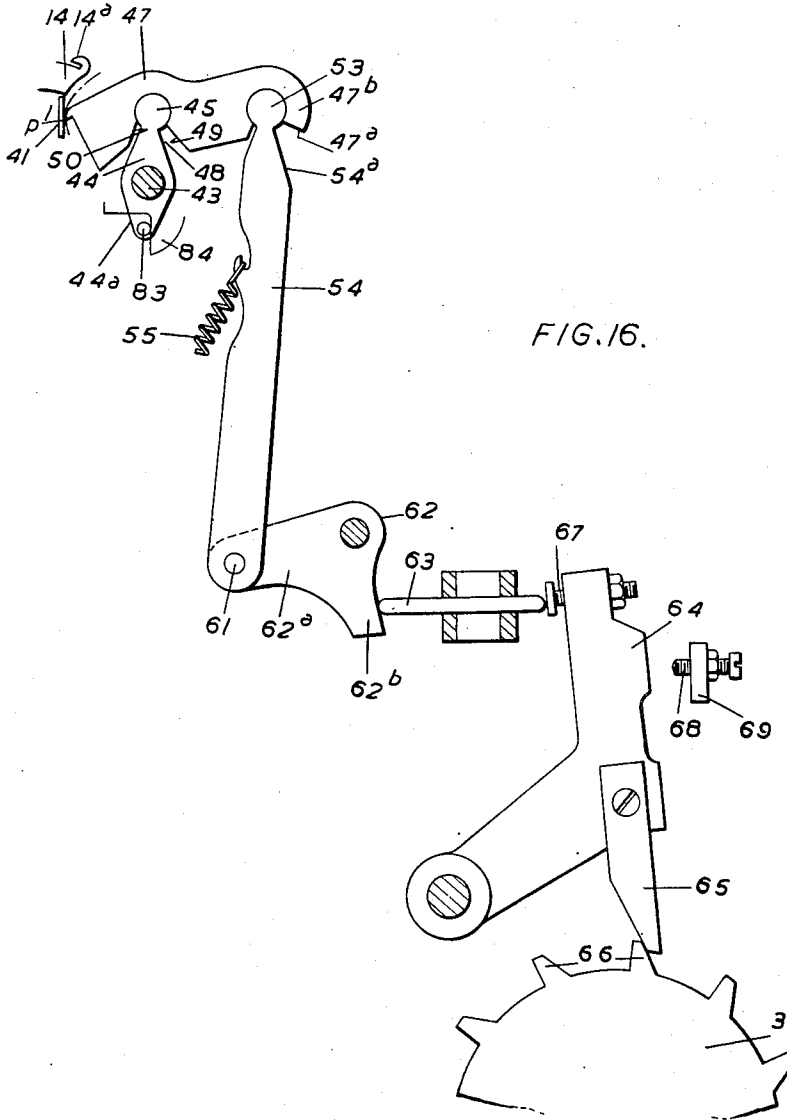
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12 Sheets-Sheet 11



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12 Sheets-Sheet 12

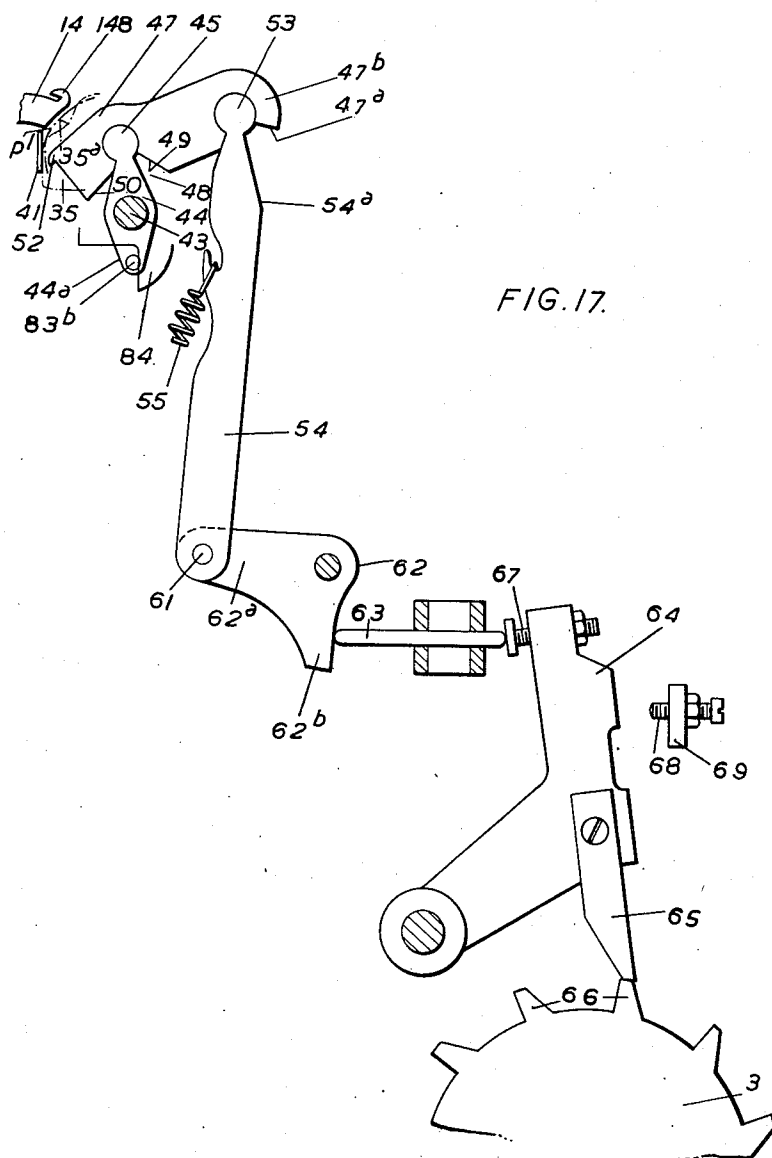


FIG. 17.

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## UNITED STATES PATENT OFFICE

2,691,285

## YARN SUPPLYING AND CHANGING MECHANISM FOR CIRCULAR KNITTING MACHINES

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Application October 2, 1952, Serial No. 312,717

Claims priority, application Great Britain  
October 2, 1951

17 Claims. (Cl. 66—140)

1

This invention appertains to circular knitting machines of the class equipped with inside sinkers or web holders and which are furnished, on the outside of the needle circle, with yarn supplying and changing mechanism of the kind comprising, in combination, individually operable yarn guides, or "feeders" as they are termed, for feeding one or more yarns to the needles at a time, these feeders being operable selectively suchwise as to effect periodic substitution of at least one yarn for at least one other yarn of a different character, and means associated with the feeders for trapping and severing yarns withdrawn from knitting.

The expression "yarn" is used generically as including yarn or thread of any suitable kind which may be used for the intended purpose.

Thus, in a circular knitting machine of the class concerned, a yarn when withdrawn from knitting is drawn away from the needles to the outside of the needle circle where it is trapped and severed.

The invention has reference particularly to the yarn trapping and severing means in which regard the object of the invention is to provide generally improved trapping and severing devices designed to trap withdrawn yarns with certainty and to sever these yarns as closely as possible to the needles.

Although broadly applicable to a circular knitting machine of any appropriate type (within the class specified), it is principally the intention to apply the invention to automatic rib machines of the superimposed needle cylinder type, including seamless hose and half hose machines.

According to this invention there are provided, in combination, in a yarn supplying and changing mechanism of the kind herein referred to, a single trapper device common to all of the feeders and having at least one spring loaded trapper blade co-operating with a member against which the operative end of the blade is yieldingly held, and a hooked member which is movably mounted at one side of the trapper blade and is adapted to have imparted thereto, at a yarn change, a compound movement, viz. first forwardly to enable it to engage a yarn withdrawn from knitting and position the same near to the trapping faces of the trapper device, along a path ensuring that the hooked member avoids the operative ends of the inside sinkers or web holders, and then in a direction to place the engaged yarn between the said trapping faces.

The said hooked member, when actuated, may advantageously have imparted thereto a com-

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pound movement which is so extended that at the termination of a trapping operation the member is turned to effect retraction of its hook, thereby enabling it to pull a trapped yarn outwardly away from the sinkers or web holders for severance at a point as close as possible to the trapping faces.

Preferably, the yarn supplying and changing mechanism of this invention also includes a second hooked member movably mounted at the opposite side of the trapper blade and adapted to have imparted thereto a compound movement somewhat similar to that imparted to the first described hooked member for the purpose of assisting a withdrawn yarn to move over the operative end of the trapper blade into the trapper device.

In this regard, when, as would usually be the case, the needle cylinder or cylinders of the machine rotates or rotates anti-clockwise then, viewing the machine in plan, the hooked member to which the extended movement is imparted would be that located at the right-hand side of the trapper device. For the sake of convenience in the following further description (although there is no limitation in these respects) the said member will be referred to as the "right hooked member," whilst the other hooked member (the movement of which it is unnecessary to extend in the manner described) will be referred to as the "left hooked member."

According to a convenient embodiment of the invention, the or each hooked member is mounted to fulcrum, within limits, upon an arm which is in turn capable of pivotal movement about a fixed axis. At least one of the said limits may be defined by an appropriate one of spaced edges or abutments provided on the hooked member for engagement with an edge of the associated pivoted arm. In this embodiment the or each hooked member is normally held, e. g. by spring means, with the rearmost of its spaced edges or abutments held in contact with the rear edge of the associated pivoted arm. Thus, whenever this hooked member is acted upon to engage a yarn and place the same in the trapper device, it will first be swung forward about the fixed axis of the pivoted arm so that the hook will travel in a slightly arcuate path close to and conforming with the contour of the operative ends of the inside sinkers or web holders. As the hook approaches the member against which the operative end of the aforementioned trapper blade is yieldingly held, continued forward movement of the said hooked member in this arcuate path is

arrested, whereupon the hooked member will then fulcrum about the pivoted arm suchwise as to change the direction of the hook and cause it to move rectilinearly or substantially so in a line coincident with the plane of the trapping faces. The forward movement of the or each hooked member may be arrested by co-operation of the said member, or its actuating connections, with relatively fixed stop means. Where, as is preferred, two hooked members are provided as aforesaid, both of the hooks may advantageously be arrested just as they come or are about to come into contact with the member against which the trapper blade is yieldingly held. Moreover, by suitably profiling the appropriate relatively fixed stop means, or part of or on the right hooked member or its actuating connections, the right hook can, at the appropriate instant, be retracted to pull a trapped yarn away from the sinkers or web holders and place it in a cutter device.

Since, in a circular knitting machine of the class herein referred to, the portion of a yarn withdrawn from knitting located between the needles and the operative end of the relevant feeder extends non-radially away from the needle circle, it is necessary for the right hook to move forwards initially in advance of the left hook, thereby ensuring that both hooks properly engage the yarn. The compound movements of the hooks are, however, such that the left hook initially moving behind the right hook is so speeded up that both hooks ultimately move together for forcing the withdrawn yarn between the trapping faces.

Thus, as will be appreciated, the idea of the compound movements so far broadly described is first to enable the yarn-engaging hooks to move in very close to the sinkers or web holders (without, however, fouling the same) for the purpose of engaging a withdrawn yarn, and then, after the yarn has been trapped, to enable the right hook to be retracted by an extended movement thereof in a direction away from these sinkers or web holders to pull the yarn clear for severance. In this way, the trapper device can be disposed near to the sinkers or web holders, and a withdrawn yarn can be severed at a point closely adjacent to the trapper device thereby leaving only short cut ends of yarn on the knitted fabric or article.

A specific constructional example of the invention as applied to a circular seamless hose or half hose machine equipped with a horizontal striping attachment will now be described with reference to the accompanying drawings, wherein,

Figure 1 is a general perspective view of so much of the said machine, as is necessary to illustrate the application thereto of the improved yarn supplying and changing mechanism, and the control means for selectively controlling the same,

Figure 2 is a right-hand side view of the complete yarn supplying and changing attachment depicting the right hook and showing also a fragmentary portion of the adjacent bottom needle cylinder of the machine in vertical section,

Figure 3 is a left-hand side view of parts of the said attachment illustrating more especially the left hook and the fixed stop for arresting forward movement of the left hooked member,

Figure 4 is a plan view of the complete attachment shown in relation to the bottom needle cylinder,

Figure 5 is a right-hand side view of the yarn trapping and severing devices per se, with the right hook in its inoperative position and the single cutter device shown open,

Figure 6 is a view similar to Figure 5 but illustrating the right hook as it appears after having been moved to draw a trapped yarn into the cutter device and with the latter shown closed,

Figures 7 and 8 are detail perspective views of the yieldable trapper blade, the right hook and the cutter device shown in the same positions as in Figures 5 and 6 respectively,

Figure 9 is a detail perspective view of the yieldable trapper blade and the flat band or strip, with which it co-operates,

Figures 10-13 are side views of the right hooked member and the controlled connection for imparting the aforementioned compound operative movement to the same, these views depicting successive stages in this movement, and

Figures 14-17 are four views somewhat similar to Figures 10-13 respectively of the left hooked member and its actuating connections, the views illustrating successive stages in the compound movement of this member.

Like parts are designated by similar reference characters throughout the drawings.

Referring to the drawings it will be seen that the yarn supplying and changing mechanism comprises a plurality of individually and selectively operable feeders 1 adapted to feed one or more of the yarns Y at a time to the latch needles, such as 2, of the machine. These feeders and the manner in which they are operated are substantially the same as described in greater detail in the specification of prior co-pending U. S. application No. 259,052. As depicted in Figure 1, the feeders 1 are selectively controlled from a drum 3 having thereon a plurality of circumferential rows of cams designated generally by the reference letter C, there being one row of such cams to each feeder, and the cams being of different heights. To be acted upon by the cams C in each circumferential row there is provided a pivoted cam lever 4 which has a toe 5 for contact by the cams C and is furnished with adjustable abutment screws 6 and 7 for contact with one arm 8 of a two-armed fulcrumed lever 9 the other arm 10 of which is articulated at 11 to the tail end of the corresponding feeder 1. The front edge 12 of the shank 13 of each of the feeders is profiled to provide a cam edge which is slidable over and permanently maintained in contact with an edge of an adjacently disposed relatively fixed plate (not shown), the arrangement being such that as a feeder is either sprung forward and upwards into a feeding position or withdrawn into its non-feeding position at the dictates of the appropriate drum cams C and through the medium of the relevant pivoted cam lever 4 and the associated two-armed fulcrumed lever 9, the cam edge 12, in sliding over the edge of the aforesaid fixed plate, determines the path followed by the yarn guiding extremity of the feeder 1. In the case of a superimposed needle cylinder machine such as that illustrated in Figures 1 and 2, equipped with independent latch needles 2 and inside sinkers or web holders 14, the shaping of the cam edge 12 on each feeder shank is such that, whenever the feeder is either withdrawn to its non-feeding position, or sprung forwards and upwards into a feeding position (like the feeder or feeders 1' in each of Figures 1, 2, 3 and 4) the yarn guiding extremity thereof follows a path conforming with the contour of the latch guard 15 and of the nibs or noses 14a

of the sinkers or web holders 14. Maintenance of the shaped front edge 12 of each feeder shank 13 in permanent contact with the relatively fixed plate is effected by a tension spring 16 (see Figure 2) one end of which is connected to the said shank at 17 while the other end is anchored to a lug 18 on the corresponding two-armed lever 9. The two abutment screws 6 and 7 with which each pivoted cam lever 4 is furnished are arranged one above the other for contact respectively with outer and inner humps such as 19 and 20 on the arm 8 of the corresponding two-armed lever. Withdrawal of any of the feeders 1 from a feeding position to its non-feeding position is controlled in two stages, viz. first by action of the relevant upper abutment screw 6 on the outer hump 19 and then by action of the associated lower abutment screw 7 on the inner hump 20. That is to say, the lower screw 7 takes over from the upper screw 6 and completes the withdrawal of the feeder.

As illustrated in Figure 4, the various feeders 1 are so arranged as to converge as close as possible to a common feeding location F.

The yarn guiding extremities of the said feeders are associated with flexible parts 21 on, or extensions of, the feeder shanks 13. The said flexible parts 21 are accordingly capable of deflection laterally when feeders are moved relatively in contact with each other, this enabling feeders to be disposed closely side by side (see Figure 4) and to pass each other, by deflection, and yet be capable of returning to their normal un-deflected positions when permitted so to do.

In the specific striper now being described there are six feeders in all, one being reserved for a heel and toe yarn, and the five main feeders being separately controllable for coloured yarn changes.

The control drum 3 of the machine is fitted at one end with a ratchet wheel (not shown) and is adapted to be racked round by an associated pawl mounted upon a racking arm. This arm is formed with a tooth and is thereby adapted to be controlled by engagement at appropriate times, by a control detent—all as clearly described in the specification of our co-pending application aforesaid. The detent is secured upon the end of a rock shaft 22 fitted with a lever 23 adapted to be acted upon and raised to lift the detent clear of the tooth, at appropriate times, by studs or bits such as 24 on a timing chain 25.

At each completion of a garment, or after a press off and a manual re-start of the knitting machine, the yarn supplying and changing mechanism is automatically re-timed at the dictates of a cam 26 on a timing drum 27 and through the medium of a further lever 28 on the rock shaft 22.

It is convenient here to mention that in each of Figures 2 and 3 the superimposed top or rib and plain or bottom needle cylinders are indicated at 29 and 30 respectively. The bottom hook of the double-ended latch needle 2 depicted in each of these figures, moreover, is shown engaged with a needle-actuating slider 31; an empty slider in the top needle cylinder is indicated at 31'.

The yarn trapping and severing means associated with the feeders 1 and presently to be described, are mounted in and on a block 32 of tapered form (see Figure 4). This block is secured in position upon a flat plate 33 in turn fixed on a bracket 34 which serves also to carry the feeders 1, the cam lever 4 and the two-armed levers 9 and is adapted to be bolted upon the machine in the manner illustrated more clearly in Figure 1. The block 32 is tapered for economy of space and is located adjacent to the group of yarn feeders 1.

Moreover, the block 32, which is positioned on the outside of the bottom or plain cylinder 30 of the machine, is longitudinally slotted at 32a to receive a single trapper blade 35 the inner, i. e. operative, end of which has a relatively narrow trapping face. As shown more clearly in Figures 7, 8 and 9, this operative end of the trapper blade 35 is deeply recessed to receive an insert 36 of hard rubber or the like capable of exercising a frictional grip upon trapped yarns. The trapper blade 35, which is free in the slot 32a, is disposed in a vertical plane and the upper edge of the blade, immediately adjoining the trapping face T is made concave at 35a to support a withdrawn yarn prior to this being trapped. At its tail end, the trapper blade 35 has secured thereto an upwardly directed element 37 to which is anchored one end of a controlling tension spring 38 the opposite end of which is connected to a part 39 fixed upon the top of the tapered block 32. The hard rubber or the like of the trapping face T is also made concave, and, by virtue of this arrangement, the blade 35 is held with the said face in yielding contact with a vertical rib 40 presenting another trapping face on a flat band or strip 41 of spring steel constituting a further trapper member secured in position by screws 42 (Figure 4) immediately beneath the operative ends of the inside sinkers or web holders 14.

Alternatively, the operative end of the spring-influenced trapper blade may be serrated. Or, in lieu of a single blade, there may be provided a plurality of thinner blades disposed side by side and contrastingly serrated to exercise control over trapped yarns.

In any event, the opposite sides of the tapered block 32 converge towards the trapper, that is to say in a direction towards the needles 2. Arranged to turn about a fulcrum 43 at each side of the said block is an upwardly directed arm 44 which is wholly of flat section and arranged to lie flat against the block. The upper end of each such arm is formed with a part-circular formation 45 constituting a second fulcrum engaged in a complementarily rounded recess provided in a hooked plate 46 or 47. In this regard, the hooked plate at the right-hand side of the block, viewing this in plan, is designated 46, whilst that at the left-hand side is designated 47. Each of the hooked plates 46 and 47 is also of flat section and of the same thickness as the corresponding arm 44. As shown to best advantage in Figures 10-17 the lower edge of each hooked plate has formed therein a gap 48 which leads into the rounded recess in the plate and has relatively inclined edges 49 and 50. These gaps 48 provide the necessary space to enable the hooked plates 46 and 47 to fulcrum about the partly-circular upper ends 45 of the corresponding fulcrumed arms 44. Each gap 48 is widest at its mouth, and the relatively inclined edges 49 and 50 thereof define the maximum limits of the permitted pivotal movement of the relevant hooked plate upon the associated arm 44. The double-fulcrumed mounting just described constitutes an important feature of the invention. At its operative, i. e. inner, end the right hooked plate 46 is formed, adjoining its upper edge, with a small yarn-engaging hook 51. Similarly, the left hooked plate 47 is formed at its operative end with a hook 52 which, unlike the right hook 51, has a flat underside. At its outer or tail end each of the hooked plates 46 and 47, which lies flat against the relevant side of the block 32, has formed in its lower edge a rounded recess in which

is engaged a practically circular knuckle 53 at the upper end of a downwardly extending actuating link 54 of flat section. Each of these links, which is thus articulated to the relevant hooked plate, extends downwards and is pulled in this direction by an appropriately arranged tension spring 55 serving to spring load the hooked plate towards the cylinder 30 and normally to hold it in its inoperative position with its yarn-engaging hook 51 or 52 withdrawn clear of the nibs or noses 14a of the sinkers or web holders 14. So far as the right hooked plate 46 is concerned, the movements thereof are controlled throughout by contact of a roller 56 on the said plate with a small relatively fixed cam 57; in this connection, the operative edge 57a of the cam 57 is so profiled as to exercise a control over the movements of the right hooked plate, both forwardly and rearwardly, as will be hereinafter more fully explained. The inoperative position of the left hooked plate 47, on the other hand, is at least in part determined by contact of an edge 47a, defining the extremity of the curved tail portion 47b thereof, with the rear edge 54a of the corresponding actuating link 54, immediately below its knuckle 53 (see Figure 14). Moreover, whenever the left hooked plate 47 is fully withdrawn to its inoperative position, the edge 49 thereof is in contact with the rear edge of the associated pivoted arm 44. A flat cover plate 58, disposed at the outer sides of the right hooked plate 46 and the associated pivoted arm 44, is secured to the block 32 by means of screws. The cam 57 is attached to the cover plate 58. Similarly, a cover plate 59, secured to the opposite side of the block, is provided on the outer sides of the left hooked plate 47 and the other pivoted arm 44. The left hooked plate 47 is normally positioned somewhat behind, that is to say to the rear of, the right hooked plate 46, this being clearly seen in Figure 4. The lower ends of the pair of actuating links 54 articulated to the two hooked plates are pivotally connected, at spaced fulcrum points 60 and 61 one behind the other, to one arm 62a of a bell crank 62. Thus, as will be seen in Figures 2 and 3, the fulcrum point 61 of the left actuating link 54 is in advance of the fulcrum point 60 of the right actuating link so that the left and the right hooked plates 47 and 46 will have imparted thereto comparatively long and relatively shorter throws respectively. The other arm 62b of the bell crank 62 is arranged to be acted upon by a push rod 63 operable by means of a pivoted cam lever 64 which is furnished with a toe 65 actuated by cams or cam-like formations such as 66 on the control drum 3 of the machine.

The full extent of the compound operative movements of the two hooked plates 46 and 47, and accordingly the depth of the downward component of the movement each of the hooks 51 and 52 is determined by contact with the outer end of the push rod 63 of an adjustable abutment screw 67 fitted in the upper end of the cam lever 64. Thus, by an appropriate adjustment of the screw 67, with the toe 65 of the lever 64 on the top of any one of the cam or cam-like formations 66, the extent of the downward movement of the hooks can be readily adjusted to a nicety, according to requirements. This adjustment naturally also determines the extent of the downward movement of the actuating links and hence also the inoperative positions of the hooked plates 46 and 47.

Although, in Figures 10-17, the actuating links 54 are, for simplicity, shown as being made in

one piece they are, in practice, and as clearly depicted in Figure 1, formed in two parts which are relatively adjustable to enable the lengths of the said links to be varied, one in relation to the other. Screws S are provided to secure the lever parts after such an adjustment.

An adjustable stop screw 68 arranged for contact with the appropriate edge of the cam lever 64 may be provided for determining the extent of the downward movement of this lever. The stop screw 68 is mounted in a bar 69 extending across the main bracket 34 of the attachment. The tapped hole in the bar 69 into which the screw 68 is screwed is indicated by the reference numeral 70 in Figure 1.

The cams or cam-like formations 66 are relied upon to act upon the cam lever 64 and so initiate the required yarn changes during horizontal striping. It is to be clearly understood, however, that, the timing being different, a separate control of the lever 64 is necessary when initiating yarn changes preparatory to, and at the termination of, knitting a heel or a toe pouch. For this purpose, there is provided for action on the cam lever 64, when going into or out of a heel or toe, an auxiliary control lever 71 (Figure 1) furnished with an abutment screw 72 for contact with the lever 64 and also with an adjustable toe piece 73 for engagement by additional cams (not shown) either on the drum 3 or on an auxiliary timing unit.

On the outer side of the right cover plate 58 is secured a fixed scissor blade 74 of a cutter device. Pivotaly mounted at 75 adjacent to the outer face of the fixed scissor blade 74 is a carrier lever 76 for an adjustable and relatively movable scissor blade 77. As clearly shown in Figures 7 and 8, the operative portion 77a of the scissor blade 77 is bent inwards laterally and then curved down for cooperation with the upper edge 74a of the fixed scissor blade 74. The tail end 76a of the carrier lever 76 is connected to the right hooked plate 46 by means of a tension spring 78. The tip of the said tail end 76a is rebated and shouldered at 76b for engagement with a shoulder 79a on a pivoted catch or trigger 79. This catch or trigger is mounted on a small bracket 80 secured upon the right cover plate 58. A torsion spring 81 is employed normally to maintain the catch or trigger 79 in engagement with the tail 76a of the scissor blade carrier lever 76, and the underside of the catch or trigger is so shaped as to enable it to be acted upon and tripped by a pin 82 on the actuating link 54 whenever the hooked plates 46 and 47 and the cutter device are conjointly operated.

The full extent of the forward movement of the left hooked plate 47 is determined, and the said plate arrested, by contact of a pin 83, on a downwardly directed extension 44a of the relevant pivoted arm 44, with a stop plate 84 mounted so as to be capable of adjustment on the left cover plate 59.

Thus in the illustrated example, when, upon the withdrawal of a yarn Y from knitting, the actuating links 54 are raised against the action of the tension springs 55 (serving at all times to urge the hooked plates 46 and 47 forward towards the cylinder 30), these hooked plates first swing about the fixed axes of the associated pivoted arms 44 as a consequence of which the hooks 51 and 52 move close in to the taper along slightly arcuate paths conforming to the inwardly and downwardly sloping edges of the sinkers or web holders 14—beneath the nibs



or noses 14a thereof. In this regard the right hook 51 moves initially in advance of the left hook 52, as hereinbefore described. The inward projection of the right hook 51 is arrested, as it closely approaches a line coincident with the plane of the opposed trapping faces of the trapper parts 35 and 40, by engagement of the roller 56 on the right hooked plate 46 with a depression in the profiled edge 57a of the cam 57 (see Figure 11). Similar inward projection of the left hook 52 is arrested by engagement of the pin 83 with the stop plate 84 (see Figure 15). At the full extent of their inward projection, the hooked plates 46 and 47 themselves turn on the pivoted arms 44 as a consequence of which the hooks 51 and 52, which have by now engaged the withdrawn yarn, move vertically downwards along lines in the plane of the trapping faces to force the yarn into the trapper. Meanwhile, the spring 73 connecting the scissor blade carrier lever 76 and the right hooked plate 46 has been tensioned, and the tail end 76a of this lever is maintained in engagement with the catch or trigger 79 to hold the cutter open. Next, the right hook 51 is retracted in a downwardly and outwardly curving path shown in Figure 13 and determined by the profile of the fixed cam 57, so that a portion of the trapped yarn adjoining the trapper is placed between the open scissor blades 74 and 77. The catch or trigger 79 is then swung back by the pin 82 to release the loaded scissor blade 77 whereupon the latter closes under spring action as depicted in Figure 6, to sever the yarn. Finally, the actuating links 54 are released for movement downwardly, under the action of the tension springs 55, thereby restoring the hooks 51 and 52 to their original starting positions and opening the cutter. All this will be made clear by a consideration of the movements of the hooked plates separately and in more detail with reference to Figures 10-17 of the drawings.

In this regard, Figures 10-13 relate to the right hook 51. In these figures the paths P and P' followed by the right and left hooks 51 and 52 respectively are indicated in bold chain lines. In Figure 10, the hooked plate 46 is shown fully retracted in its inoperative position clear of the sinkers or web holders 14 and with the roller 56 in engagement with the tail of the cam 57. The toe 65 of the cam lever 64 is shown in its lowest position determined by engagement of the abutment screw 68 with the said lever. In Figure 11, the cam lever 64 is shown in the course of being lifted by a cam or cam-like formation 66 as a consequence of which the actuating link 54 has been partially raised against the action of the spring 55 to move the hooked plate 46 forwards about the fulcrum 43. As a result, the right hook 51 moves, in a downwardly curving path P avoiding the sinkers or web-holders 14, from its inoperative position shown in Figure 10 to the position shown in Figure 11 close to the trapper band 41. Next, and as shown in Figure 12, the hooked plate 46, still controlled by the cam 57, and with the roller 56 in the position shown, turns about the second fulcrum constituted by the part-circular formation 45 so that the right hook 51 moves straight down the flat band 41 to a point sufficiently low to force an engaged yarn into the trapper. Finally, the toe 65 of the lever 64 rises to its highest position so that the hooked plate 46, meantime turning about the formation 45 and being urged forwardly by the spring 55, under the control of the cam 57, reaches the stage

depicted in Figure 13 at which the right hook 51 has moved further down and away from the flat band 41 to the lower extremity of its path P for the purpose of drawing the trapped yarn between the scissor blades 74 and 77 of the open cutter device. At this instant, the pin 82 functions to release the loaded scissor blade 77 as hereinbefore described.

Considering now the left hooked plate 47, this is shown in its inoperative position in Figure 14, with the rear edge of the arm 44 in contact with the edge 49 of the said plate, and the edge 47a at the tail end of the latter in contact with the rear edge 54a of the corresponding actuating link 54. In this figure, the toe 65 of the lever 64 is shown in the same relation to the nearby cam or cam-like formation 66 as in Figure 10. In Figure 15, the cam lever 64 is shown in the course of being lifted by the said cam or cam-like formation 66, as in Figure 11, and as a consequence the actuating link 54 articulated to the left hooked plate 47 has been partially raised against the action of its spring 55 to move this plate forwards about the fixed axis of the associated pivoted arm 44. The left hook 52 accordingly moves, in an initially downwardly curving path P' avoiding the sinkers or web-holders 14, from its inoperative position (Figure 14) to the position shown in Figure 15 close to the trapper band 41. Any further forward movement of the left hooked plate is at this stage arrested by contact of the pin 83 with the fixed stop plate 84. As previously pointed out, although the left hook 52 is initially a little farther away from the sinkers or web holders 14 than is the right hook 51, the left hook 52 travels forwards more quickly than the right hook, the two hooks approaching the flat band 41 at practically the same instant. Next, and as shown in Figure 16, the hooked plate 47, with the pin 83 firmly in contact with the stop plate 84, turns about the part-circular formation 45 so that the left hook 52 moves straight down the flat band 41, in company with the right hook 51, first to the point indicated to assist in forcing an engaged yarn into the trapper, and then further down to the lower extremity of the path P'—see Figure 17. It will be noted that after the hook 52 has moved up to the band 41, and has had sufficient time to assist in moving an engaged yarn into the trapper, it then moves straight down in a line inclining slightly outwardly and away from the said band.

If desired, the placing of a withdrawn and trapped yarn in the cutter, and the actuation of the latter may be effected by means independent of the hooked plates and their actuating links.

What we claim then is:

1. In a circular knitting machine, in combination, a circle of needles, a set of inside web-holding sinkers for co-operation with said needles, individual feeders for feeding yarns to said needles, these feeders being operable selectively to effect periodic substitution of at least one yarn for at least one other yarn, a single trapper device common to all of the feeders for trapping yarns withdrawn from knitting, said device having at least one spring loaded trapper blade and a co-operating member against which the operative end of the said blade is yieldingly held to provide trapping faces between them, a cutter device which is arranged close to the trapping faces and is operable for severing trapped yarns, a hooked member movably mounted at one side of the trapper blade, and means for

imparting to said hooked member, at each yarn change, a compound movement, first forwardly to engage a yarn withdrawn from knitting and position the same near to the trapping faces, along a path ensuring that the hooked member avoids the operative ends of the aforesaid web-holding sinkers, then in a direction to place the engaged yarn between the said trapping faces and, at the termination of the trapping operation, in a direction to effect retraction of the hook of the hooked member whereby the trapped yarn is pulled outwardly away from the web-holding sinkers and into the cutter device for severance thereby.

2. In a circular knitting machine, in combination, a circle of needles, a set of inside web-holding sinkers for co-operation with said needles, individual feeders for feeding yarns to said needles, these feeders being operable selectively to effect periodic substitution of at least one yarn for at least one other yarn, a single trapper device common to all of the feeders for trapping yarns withdrawn from knitting, said device having at least one spring loaded trapper blade and a co-operating member against which the operative end of the said blade is yieldingly held to provide trapping faces between them, a cutter device which is arranged close to the trapping faces and is operable for severing trapped yarns, a pair of hooked members movably mounted at opposite sides of the trapper blade, and means for imparting to said hooked members, at each yarn change, compound movements, viz. first forwardly from their inoperative positions to points at which the hooks engage a yarn withdrawn from knitting and position it adjacent to the trapping faces, long paths conforming closely to the contour of, but avoiding the operation ends of the aforesaid web-holding sinkers, and then in a direction such that the hooks of the hooked members move along lines coincident with the plane of the trapping faces to force the engaged yarn between the latter, one of said hooked members being provided simply to assist the withdrawn yarn to move over the operative end of the trapper blade, and the compound movement imparted to the other hooked member being extended so that its hook, at the termination of the trapping operation, is retracted to pull the trapped yarn outwardly away from the web-holding sinkers and into the cutter device for severance thereby.

3. A combination according to claim 2, wherein each hooked member is mounted to fulcrum, within limits, upon an arm which is in turn capable of pivotal movement about a fixed axis.

4. A combination according to claim 3, wherein at least one of the said limits is defined by an appropriate one of spaced edges provided on each hooked member for engagement with an edge of the associated pivoted arm.

5. A combination according to claim 4, wherein each hooked member is normally held by spring means with the rearmost of its spaced edges held in contact with the rear edge of the associated pivoted arm whereby whenever the said member is caused to engage a yarn and place the same in the trapper device it first swings forward about the fixed axis of the pivoted arm to enable the hook of the member to travel in an arcuate path close to and conforming with the operative ends of the web-holding sinkers, and then fulcrums about the pivoted arm suchwise as to change the direction of the hook and cause it to move substantially rectilinearly in a

line coincident with the plane of the trapping faces.

6. A combination according to claim 5, wherein each hooked member is caused to fulcrum about the associated pivoted arm by virtue of arrest of its forward movement.

7. A combination according to claim 6, wherein each hooked member is adapted for co-operation with relatively fixed stop means, for the purpose herein described.

8. A combination according to claim 7, wherein the fixed stop means associated with the hooked member to which is imparted the extended compound movement consists of a cam which is so profiled that the said member is, at the appropriate instant, retracted to pull a trapped yarn away from the web-holding sinkers into the cutter device.

9. In a circular knitting machine, in combination, a circle of needles, a set of inside web-holding sinkers for co-operation with said needles, individual feeders for feeding yarns to said needles, these feeders being operable selectively to effect periodic substitution of at least one yarn for at least one other yarn, a single trapper device common to all of the feeders for trapping yarns withdrawn from knitting, said device having at least one spring loaded trapper blade and a co-operating member against which the operative end of the said blade is yieldingly held to provide trapping faces between them, a cutter device which is arranged close to the trapping faces and is operable for severing trapped yarns, a pair of hooked members movably mounted at opposite sides of the trapper blade, one of said members being normally positioned behind the other, links which are connected to the hooked members for actuating the same, a lever to which said links are pivotally connected at spaced fulcrum points one behind the other, and controlled means for operating said lever whereby compound movements are imparted to the hooked members, viz. first forwardly from their inoperative positions, with one moving initially in advance of the other, to points at which the hooks engage a yarn withdrawn from knitting and position it adjacent to the trapping faces, such movement being along paths conforming closely to the contour of, but avoiding, the operative ends of the aforesaid web-holding sinkers, and then, with the retarded hooked member having been speeded up, both together in such a direction that the hooks move along lines coincident with the plane of the trapping faces to force the engaged yarn between the latter, the initially retarded hooked member being provided simply to assist the withdrawn yarn to move over the operative end of the trapper blade, and the compound movement imparted to the other hooked member being extended so that its hook, at the termination of the trapping operation, is retracted to pull the trapped yarn outwardly away from the web-holding sinkers and into the cutter device for severance thereby.

10. In a circular knitting machine, in combination, a circle of needles, a set of inside web-holding sinkers for co-operation with said needles, individual feeders for feeding yarns to said needles, these feeders being operable selectively to effect periodic substitution of at least one yarn for at least one other yarn, a single trapper device common to all of the feeders for trapping yarns withdrawn from knitting, said device having at least one spring loaded trapper blade and a co-operating member against which the opera-

tive end of the said blade is yieldingly held to provide trapping faces between them, a cutter device which is arranged close to the trapping faces for severing trapped yarns, a pair of hooked members movably mounted at opposite sides of the trapper blade, controlled connections for imparting to said hooked members movements enabling them, whilst avoiding the web-holding sinkers, to engage a yarn withdrawn from knitting and force the same between the trapping faces, one of said hooked members being provided simply to assist the withdrawn yarn to move over the operative end of the trapper blade, whilst the movement imparted by the connections to the other hooked member is extended so that the hook of that member, at the termination of a trapping operation, is retracted to pull the trapped yarn away from the web-holding sinkers and draw it into the cutter device, and means associated with the actuating connections of the last mentioned hook member for automatically closing the cutter device and so severing the yarn as a consequence of the said hooked member being retracted as aforesaid.

11. A combination according to claim 10, wherein the cutter device comprises a fixed blade co-operable with a relatively movable scissor blade, and the latter is adapted to be loaded, from the adjacent hooked member, against a spring-influenced element arranged normally to hold the movable scissor blade open, and an operative connection between the connections for actuating the said hook and said element whereby release of this element from engagement with the movable blade permits the latter to close.

12. In a circular seamless hose knitting machine, in combination, superimposed cylinders, a circle of needles for operation in said cylinders, a set of inside web-holding sinkers for co-operation with said needles, individual feeders for feeding yarns to said needles, these feeders being operable selectively to effect periodic substitution of at least one yarn for at least one other yarn, a tapered block positioned next to the feeders and adjacent to the bottom needle cylinder, the said block having formed therein a slot, a trapper blade which is freely mounted in said slot and has a narrow trapping face at its operative end, a substantially flat band which provides a further trapping face and is disposed beneath the operative ends of the web-holding sinkers, spring means whereby the movable trapper blade is held with its operative end in yielding contact with the said band, a cutter device which is arranged close to the trapping faces for severing trapped yarns, a pair of hooked members movably mounted at opposite sides of the tapered block, controlled connections for imparting to said hooked members movements enabling them, whilst avoiding the web-holding sinkers, to engage a yarn withdrawn from knitting and force the same between the trapping faces, one of said hooked members being provided simply to assist the withdrawn yarn to move over the operative end of the trapper blade, whilst the movement imparted by the connections to the other hooked member is extended so that the hook of that member, at the termination of a trapping operation, is retracted to pull the trapped yarn away from the web-holding sinkers and draw it into the cutter device, and means associated with the actuating connections of the last mentioned hook member for automatically closing the cutter device and so severing the yarn as a consequence of the said hooked member being retracted as aforesaid.

13. A combination according to claim 12, wherein the operative end of the freely mounted trapper blade has an insert of resilient material adapted for co-operation with a protuberant formation on the band.

14. In a circular knitting machine, in combination, a circle of needles, a set of inside web-holding sinkers for co-operation with said needles, individual feeders for feeding yarns to said needles, these feeders being operable selectively to effect periodic substitution of at least one yarn for at least one other yarn, a single trapper device common to all of the feeders for trapping yarns withdrawn from knitting, said device having at least one spring loaded trapper blade and a co-operating member against which the operative end of the said blade is yieldingly held to provide trapping faces between them, a cutter device which is arranged close to the trapping faces and is operable for severing trapped yarns, a pair of hooked members located at opposite sides of the trapper blade, associated arms arranged to pivot about fixed axes and upon which the said hooked members are in turn mounted to fulcrum, within limits, and controlled connections for imparting to said hooked members movements enabling them, whilst avoiding the web-holding sinkers, to engage a yarn withdrawn from knitting and force the same between the trapping faces, one of said hooked members being provided simply to assist the withdrawn yarn to move over the operative end of the trapper blade, whilst, the movement imparted by the connections to the other hooked member is extended so that the hook of that member, at the termination of a trapping operation, is retracted to pull the trapped yarn away from the web-holding sinkers and draw it into the cutter device.

15. A combination according to claim 14, wherein the outer end of the pivoted arm associated with each hooked member is formed with a part-circular formation constituting a fulcrum which is engaged in a complementarily rounded recess provided in the hooked member, the latter being in the form of a plate having therein a gap leading into the rounded recess, and this gap providing the necessary space to enable the hooked plate to fulcrum about the pivoted arm.

16. A combination according to claim 15, wherein each hooked plate also has formed therein a further recess in which is engaged a practically circular knuckle at one end of an actuating link which is influenced by a spring serving normally to hold the hooked plate with its yarn-engaging hook withdrawn clear of the web-holding sinkers and the rear edge of the gap in the plate in contact with the rear edge of the associated pivoted arm.

17. A combination according to claim 16, wherein one of the two hooked plates is normally positioned behind the other, and the pair of actuating links therefor are pivotally connected at spaced fulcrum points one behind the other to one arm of a bell crank lever the other arm of which is arranged to be acted upon by connections adapted to be actuated from a control unit.

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