

Nov. 8, 1966

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3,283,544

CIRCULAR KNITTING MACHINES

Filed April 10, 1964

4 Sheets-Sheet 1

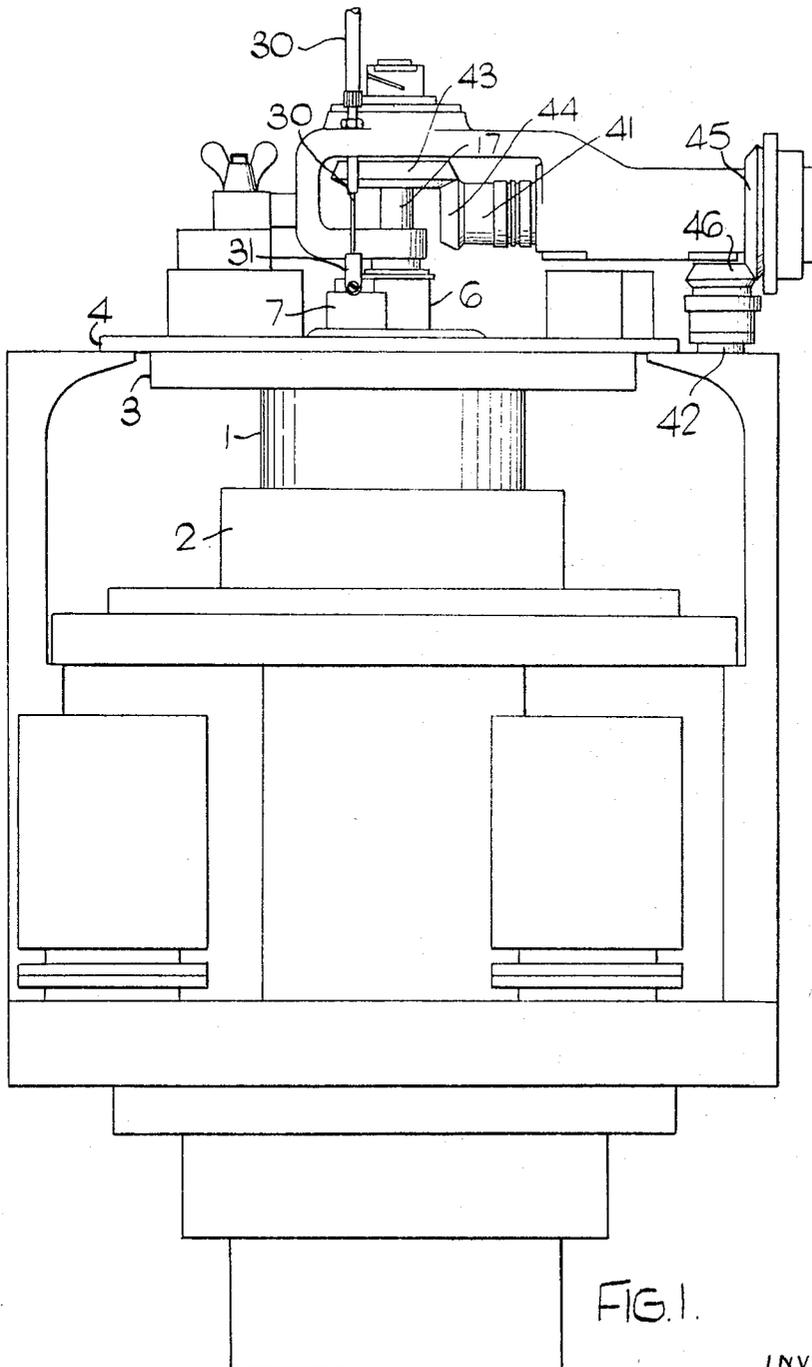


FIG. 1.

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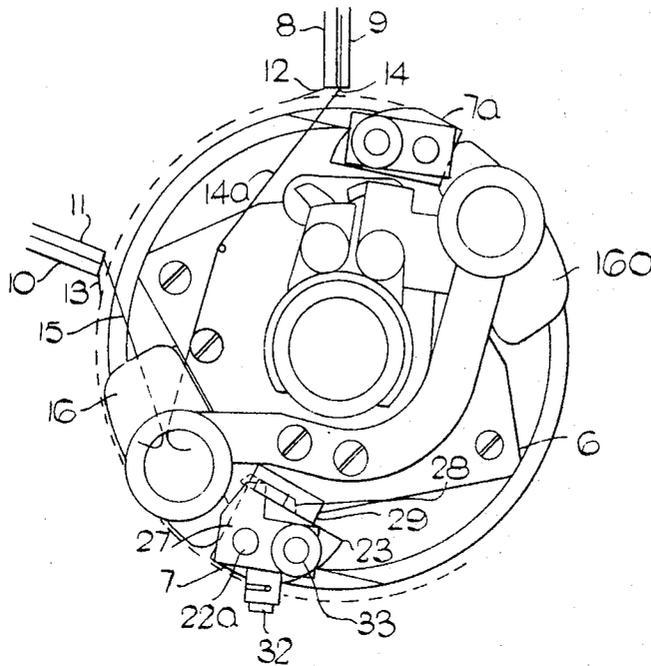


FIG. 2.

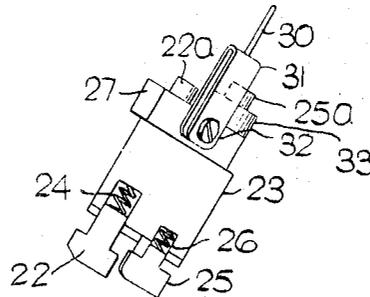


FIG. 3

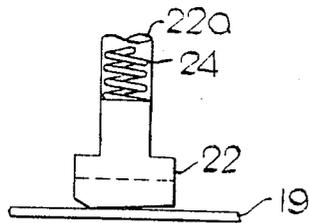


FIG. 5.

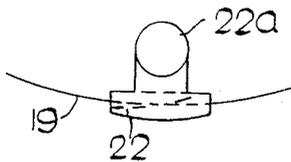


FIG. 4.

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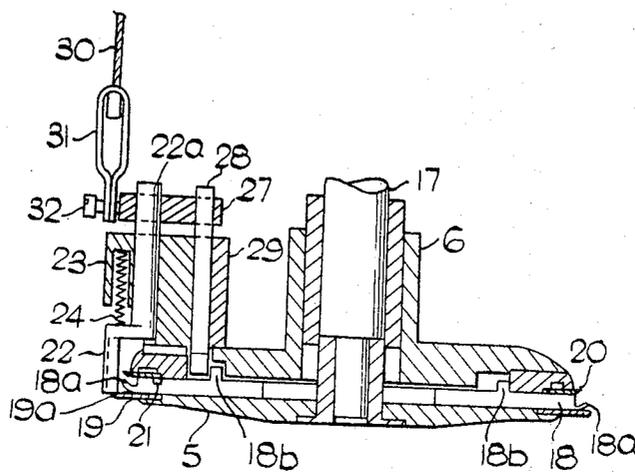


FIG. 6.

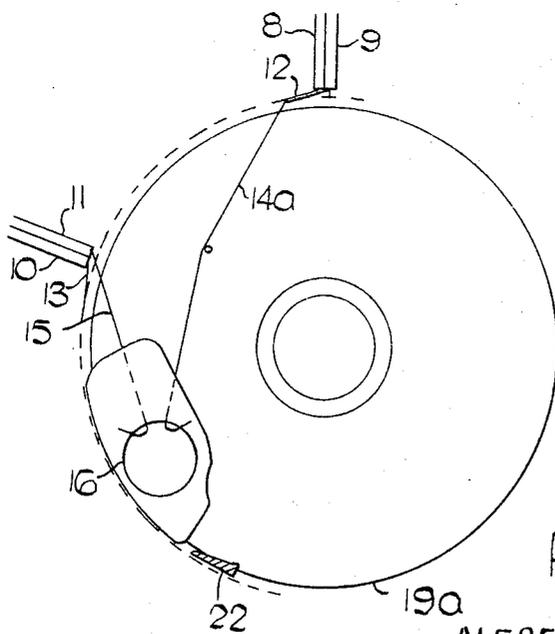


FIG. 7.

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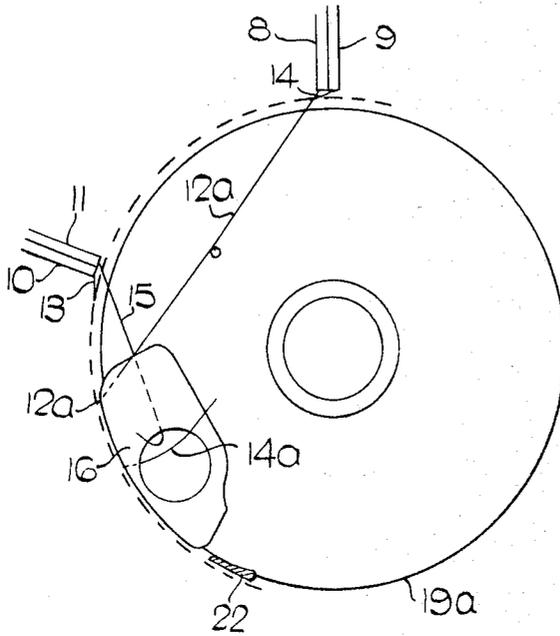


FIG. 8.

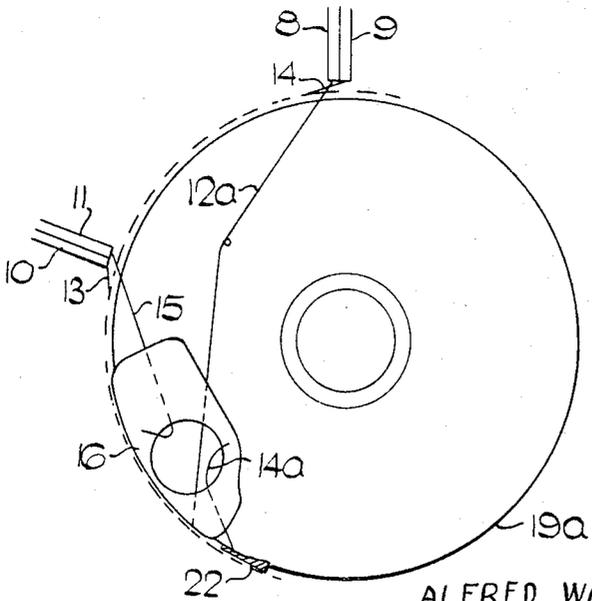


FIG. 9.

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CIRCULAR KNITTING MACHINES

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Claims priority, application Great Britain, Apr. 17, 1963,

15,092/63

4 Claims. (Cl. 66—140)

This invention is for improvements in or relating to circular knitting machines and is concerned more particularly with the trimming of yarn ends in the manufacture of seamless hosiery. The invention has for one of its objects to provide a trimming device in a circular knitting machine, so arranged as to enable yarn ends to be trimmed close to the knitted fabric.

In the manufacture of seamless hosiery, and particularly ladies seamless stockings, it is generally necessary to make yarn changes, for example in changing from yarn used for knitting the welt to yarn for knitting the leg, and introducing a reinforcing or splicing yarn. Furthermore, when a splicing yarn is used it is ordinarily incorporated in parts where it is required to extend only partly around the tubular fabric, such as at the heel area and the foot bottom area. When a change is made from one yarn to another and when only partial courses of splicing yarn are incorporated in the fabric, the ends of the yarn extending from the fabric require to be trimmed. To avoid a subsequent operation, trimming of the yarn ends is often carried out during the knitting of the fabric by a cutting device fitted to the knitting machine and operated to cut the yarns being taken out and introduced at a short distance from the fabric and also to cut out floats of yarn which occur between the ends of partial courses of splicing yarn. Cutting devices at present in use on circular knitting machines are subject to the limitation that they cannot trim the yarn as close to the fabric as is generally desirable in the case of certain of the yarn ends, particularly those extending from partial courses of splicing yarn, and the invention seeks to provide a trimming device in which this disadvantage is largely or wholly eliminated.

In accordance with the invention there is provided in a circular knitting machine a cutting device comprising a circular cutter which is positioned adjacent to and within the needle circle and a cutter blade cooperating therewith, the circular cutter and blade being so mounted that during the operation of the machine relative rotation takes place between them about the axis of the needle cylinder, to cause a yarn extending inwardly from the needle circle to be engaged between said cutter parts and severed by the cutting device. By this form of device it is possible to sever a yarn at a position which is extremely close to the fabric being knitted, for example at about $\frac{1}{8}$ " therefrom.

In a machine of the rotary needle cylinder type it is convenient to have the circular cutter mounted to rotate with the needle cylinder and positioned in the region of the cylinder throat to have the co-operating cutter blade fixed at an appropriate position in the needle circle in advance of a yarn feeding station so that when a yarn feeder is taken out of action the yarn extending from the last needle on which it has been knitted will be caught up between the cutter parts and severed by them.

The invention may be applied to a machine for knitting ladies hose and having a welt dial equipped with welt hooks by the aid of which an inturned welt can be produced and in such a machine the circular cutter may be mounted on the welt dial which rotates with the cylinder at the same speed as the latter. When such a machine is equipped with the improved cutting device

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the projection of the welting instruments from the dial during the formation of the welt forms an obstacle preventing the circular cutter from being employed to trim the yarn ends close to the fabric, and for this purpose a second cutting device is conveniently provided for operation to trim yarn ends at the change from the welt to the leg of a stocking.

The improved cutting device is conveniently provided in association with a suction device for carrying away the cut ends. This may comprise a suction pipe having an opening positioned over the top of the cylinder close to the position at which the cutter blade and circular cutter cooperate to sever the yarn.

In the case where a second cutting device is provided, this may be constituted by a further circular cutter and a cooperating cutter blade which are positioned at a level above the welt dial, such circular cutter being concentric with the welt dial and preferably mounted thereon.

The foregoing and other provisions of the invention are embodied in a convenient form of construction which is illustrated by way of example in the accompanying drawings showing the invention as applied to a circular knitting machine for knitting ladies' seamless stockings.

In the drawings:

FIGURE 1 is an elevation view of the head of the knitting machine,

FIGURE 2 is a plan view of the feeder unit and cam plate as seen from above the head of the machine,

FIGURE 3 is a detail elevation of part of the cutting mechanism,

FIGURES 4 and 5 are respectively detail plan and elevation views of the cutting device,

FIGURE 6 is an elevation view in central cross-section of the welt dial with circular cutters fitted to it and showing a cooperating cutter blade, and

FIGURES 7, 8 and 9 are diagrammatic plan views showing different stages of a yarn change operation.

As shown in FIG. 1 the machine has a rotary needle cylinder 1 mounted within stationary cam boxes 2 and driven by orthodox drive means for rotating the cylinder continuously or, if desired, oscillating it to perform a reciprocatory knitting at appropriate intervals between continuous rotary operating. The cylinder 1 carries the usual sinker unit 3 at its upper end at which is a latch guarding and yarn feeder carrying member 4 surrounding the needle circle just above the top of the needle cylinder. Above the sinkers there is a rotary welt dial 5, FIG. 6, equipped with a stationary cam plate 6. The dial 5 is driven to rotate in unison with the cylinder 1 by shafts 17, 41, 42 and gears 43, 44, 45, 46. The drive may be arranged as described in U.S. Patent No. 3,230,743 dated January 25, 1966.

As seen in FIG. 2 the cam plate 6 has mounted on it parts which make up a yarn cutting station indicated generally at 7. A plurality of yarn feeders are seen at 8, 9, 10 and 11 those designated 8 and 10 being shown as feeding yarns 12 and 13 to the needles of cylinder 1 while feeders 9 and 11 are out of action. Yarns 14 and 15 extending from the feeders 9 and 11 lie above the cam plate 6 and the ends of such yarns are held by being drawn lightly into a suction unit 16 through which air is drawn in an upward direction.

As shown in FIG. 6 the dial 5 carries welting instruments 18 having hooked ends 18a and butts 18b. Immediately below the instruments 18 there is a cutting ring 19 extending around the dial 5 and having a sharpened edge 19a. Above the dial instruments there is a second cutting ring 20 of a slightly smaller diameter than the ring 19 but otherwise similar. The ring 20 is rotated with the dial 5 by means of dogs 21 secured to it and engaging between the instruments 18. A stationary cutter 22 cooperating with the cutting ring 19 is carried by a

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spindle 22a which is slidable vertically in a bracket 23 being normally urged against the cutting ring 19 by a spring 24. A second and rather similar cutter 25 also carried by the bracket 23, see FIG. 3, is urged by a spring 26 normally into engagement with the cutting ring 20.

Enlarged plan and elevation view of the cutter 22 and cutting ring 19 are shown in FIGS. 4 and 5 from which it will be seen that a sharp edge of cutter 22 presents a very acute angle to the sharp edge of cutting ring 19. Thus a yarn being carried round into the angle between them will be severed immediately it reaches the point where the cutters meet, see also FIGS. 7 to 9. The cutter 25 for cutting ring 20 is arranged similarly.

The cutter 22 is slidable up and down in brackets 23 mounted on the stationary cam plate 6 and is coupled by means of a yoke 27 to a cam plate 28 which slides up and down in a member 29 attached to the inner side of bracket 23. The cutter 22 can be raised out of action as later described and the cam 28 will rise and fall with it. At its lower end cam 28 has inclined edges and the cam 28 is so positioned that when the cutter 22 is lowered against the cutting ring 19 the lower end of cam 28 cooperates with the butts 18b of instruments 18 to cam back to their retired position any instruments that have worked outwards at all. In the lowered position the downward pressure of spring 24 urges the cutter 22 in contact with cutting ring 19.

The cutter 22 can be raised out of action by a Bowden wire 30 attached by a shackle 31 and screw 32 to the yoke 27. A first upward movement of the yoke by means of the Bowden wire 30 raises the cutter 22 out of action and the cam 28 out of range of the butts 18b of the instruments 18 without affecting cutter 25 which remains pressed against its cutting ring 20 by spring 26. A further upward movement of the yoke 27 caused by operation of the Bowden wire 30 will cause the yoke 27 to engage a collar 33 on spindle 25a of cutter 25 and raise the cutter 25 out of engagement with its cutting ring 20.

The first upward movement of the yoke 27 is used during the period of welt formation so as to free the instruments 18 for operation at this time. The cutter 25 and cutting ring 20 will then operate to sever the yarns of any yarn changes taking place when forming the welt. The further upward movement of the yoke 27 is caused to occur whenever it is desired to have both cutters 22 and 25 out of action.

The operation of a yarn change while the cutter 22 is in action will now be described and, while only two yarns are shown at each of two feeding stations obviously several may be provided at each station and any number of stations may be used, and each cutting station may serve one or a greater number of yarn feeding stations.

Referring to FIG. 2, let it be assumed that yarn 14 is to be substituted for yarn 12. First yarn feeder 9 is lowered into operation and the needles rotating in a counter clockwise direction take hold of, and knit, its yarn 14. The piece 14a within the needle circle then starts to travel round the cam plate 6 as shown in FIGS. 7 and 8 its end being maintained in the suction unit 16. Feeder 8 then rises out of action, taking its yarn 12 away from the needles after both yarns have been knitted for a sufficient overlap, and yarn 12, due to the rotation of the needle cylinder also starts to travel over the top of the cam plate 6 as shown at 12a in FIG. 8. Continued rotation of the cylinder brings the piece of yarn 14a into the V formed between the cutter 22 and ring 19, as in FIG. 9, and the yarn is severed close to the fabric. Since the end of the yarn is still within the suction pipe 16 this end of yarn is immediately sucked away to a receiver (not shown). Just following, is the yarn 12a from the newly withdrawn feeder 8. This passes below the suction pipe 16 and then comes to the cutters where it is severed, and the end of the yarn 12a is sucked into the pipe 16, causing it to be held with a light tension. The yarn 12 is thus in the position previously occupied by

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yarn 14, ready for insertion when required. The same general operation takes place when part round splicing is effected by inserting a splicing yarn course by course to a group of needles. Conveniently the needles in the group are selected by being raised to take the splicing thread as well as the ground thread, the remainder taking only the ground thread. When the last needle of the splicing group has taken the splicing yarn, the yarn passes over the cam plate 6, below the suction pipe 16 and into the cutters to be severed in similar manner as at a yarn change, and then is retaken by the first of the raised splicing group of needles, the float passing over the cam plate 6 and into suction pipe 16, being severed by the cutters. The float of yarn is then sucked away to the cut end receiver.

When a yarn change takes place in the welt, while the cutter 22 is raised out of action, the other cutter 25 and ring 20 operate to sever the yarn, though the end attached to the fabric is then a little longer due to the position of ring 20.

In order to reduce wear between the cutting elements, not only the cutter 22 but also the cutter 25 may be lifted clear of its ring 20 during parts of the knitting operation at which no yarn changing or splicing takes place, by raising the yoke 27 through the second upward movement.

The cutting rings 19 and 20 may have plain sharp edges as shown, or the edges may have teeth or serrations.

The construction shown in the drawings has the cutting station 7 serving two feeding stations with which the feeders 8 and 9 and the feeders 10 and 11 are respectively associated. In the case of a four feed machine the two further feeding stations may be positioned diametrically opposite those just referred to and may be served by a further cutting station indicated generally at 7a in FIG. 2 and associated with a suction pipe 16a, with these additional parts operating in the same manner as those already described.

I claim:

1. In a circular knitting machine, the combination comprising a welt dial, welt hooks carried by said dial by which an intumed welt can be produced, a cutting device consisting of a circular cutter, means mounting said circular cutter on said welt dial adjacent to and within the needle circle, a cutter blade, means mounting said cutter blade for co-operating with said circular cutter, and means for causing relative rotation to take place between said circular cutter and said cutter blade about the axis of the needle cylinder during the operation of the circular knitting machine for causing a yarn extending inwardly from the needle circle to be engaged between said circular cutter and said cutter blade for being severed by said cutting device and a second cutting device for trimming yarn ends at the change from the welt to the leg of a hose, said second cutting device consisting of a second circular cutter, a second cutter blade positioned for co-operating with said second circular cutter, and means positioning said second circular cutter and said second cutter blade at a level above said welt dial with said second circular cutter mounted concentric with and on said welt dial.

2. In a circular knitting machine, the combination as claimed in claim 1 including means mounting said first circular cutter for rotation within the needle cylinder at a position in the region of the cylinder throat and means mounting said first cutter blade in a fixed position at an appropriate position in the needle circle in advance of a yarn feeding station whereby when a yarn feeder is taken out of action the yarn extending from the last needle on which it has been knitted will be caught up between and severed by said first cutting device.

3. In a circular knitting machine, the combination as claimed in claim 1 including a suction withdrawal device associated with said first cutting device for carrying away

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cut ends of yarn, said suction withdrawal device consisting of a suction pipe having an opening positioned over the top of the cylinder close to the position at which said first cutter blade and said first circular cutter cooperate to sever the yarn.

4. In a circular knitting machine, the combination comprising a welt dial, welt hooks carried by said dial and having butts, a cutting device consisting of a circular cutter, means mounting said circular cutter at a position adjacent to and within the needle circle, a cutter blade for cooperating with said circular cutter, means mounting said cutter blade for movement into and out of cooperation with said circular cutter, means for providing relative rotation between said circular cutter and said cutter blade about the axis of the needle cylinder during the operation of the circular knitting machine, means for moving said cutter blade into cooperation with said circular cutter whereby a yarn extending inwardly from the needle circle will be engaged and severed by said cutting device, a movable cam member for cooperating with said welt hook butts, means for moving said cam member at the same time as said movable cutter blade is moved for causing it to control the positions of said welt hooks at the region of the cutting station, a second cutting device having a circular cutter and a cutter blade for cooperating with said second circular cutter, means mounting said second circular cutter and said second cutter blade for cooperating at a different level from that of said first cutting device, said mounting means also mounting said second cutter blade for movement into and out of cooperation with said second circular cutter, a common

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support carrying the cutter blades of said first and second cutting devices and which support is mounted for movement into any one of three alternative settings, namely, one in which said first cutter blade is operative, a second setting in which said first cutter blade is inoperative and said second cutter blade is operative, and a third setting in which both of said cutter blades are inoperative, and said cutter blade mounting means consisting of stems carrying said cutter blades of both of said cutting devices, a common fixed block having said stems slideable therein, a cam plate mounted above the needle cylinder, and means mounting said block on said cam plate.

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