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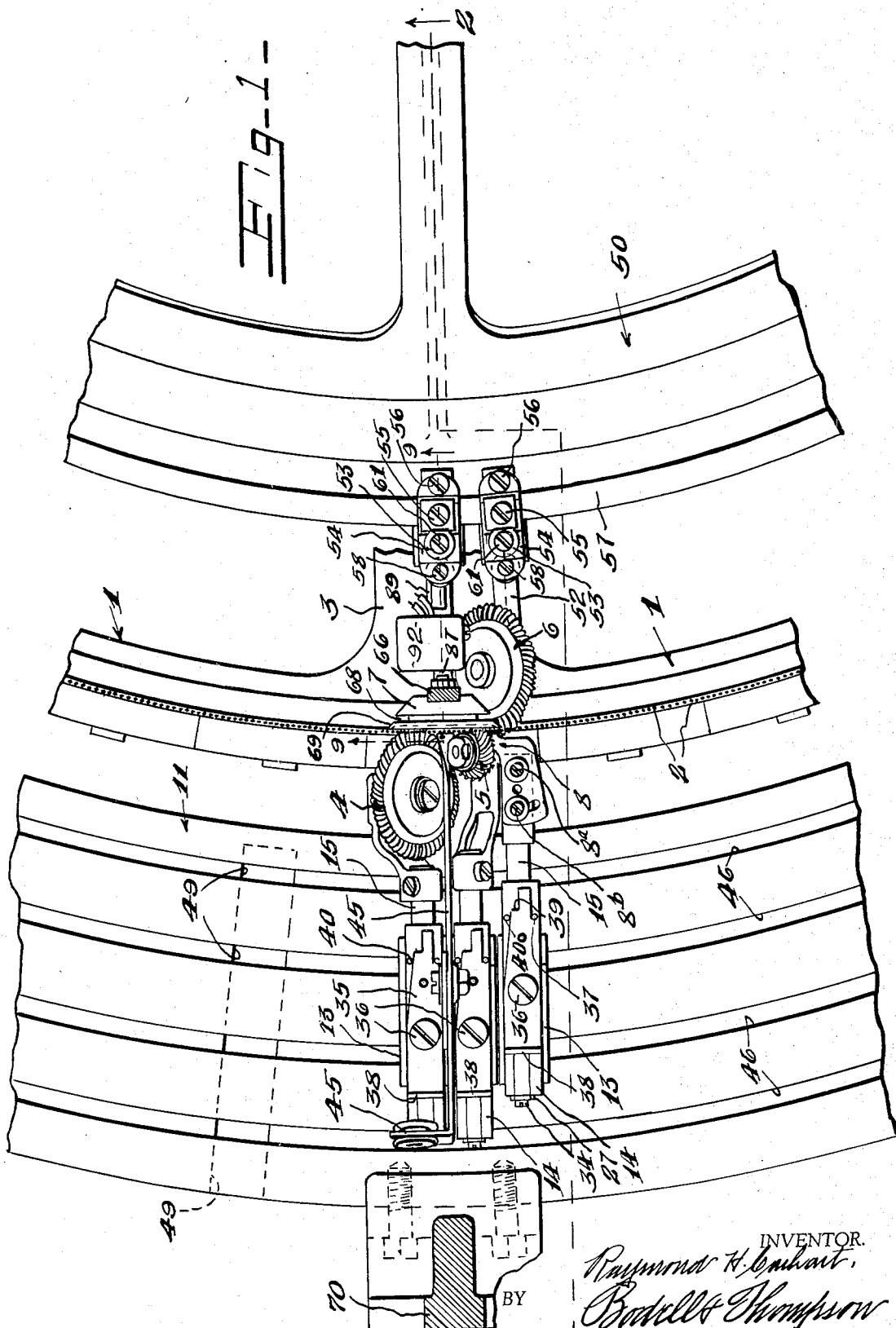
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2,091,467

TUBULAR FABRIC KNITTING MACHINE

Filed June 12, 1936

5 Sheets-Sheet 1



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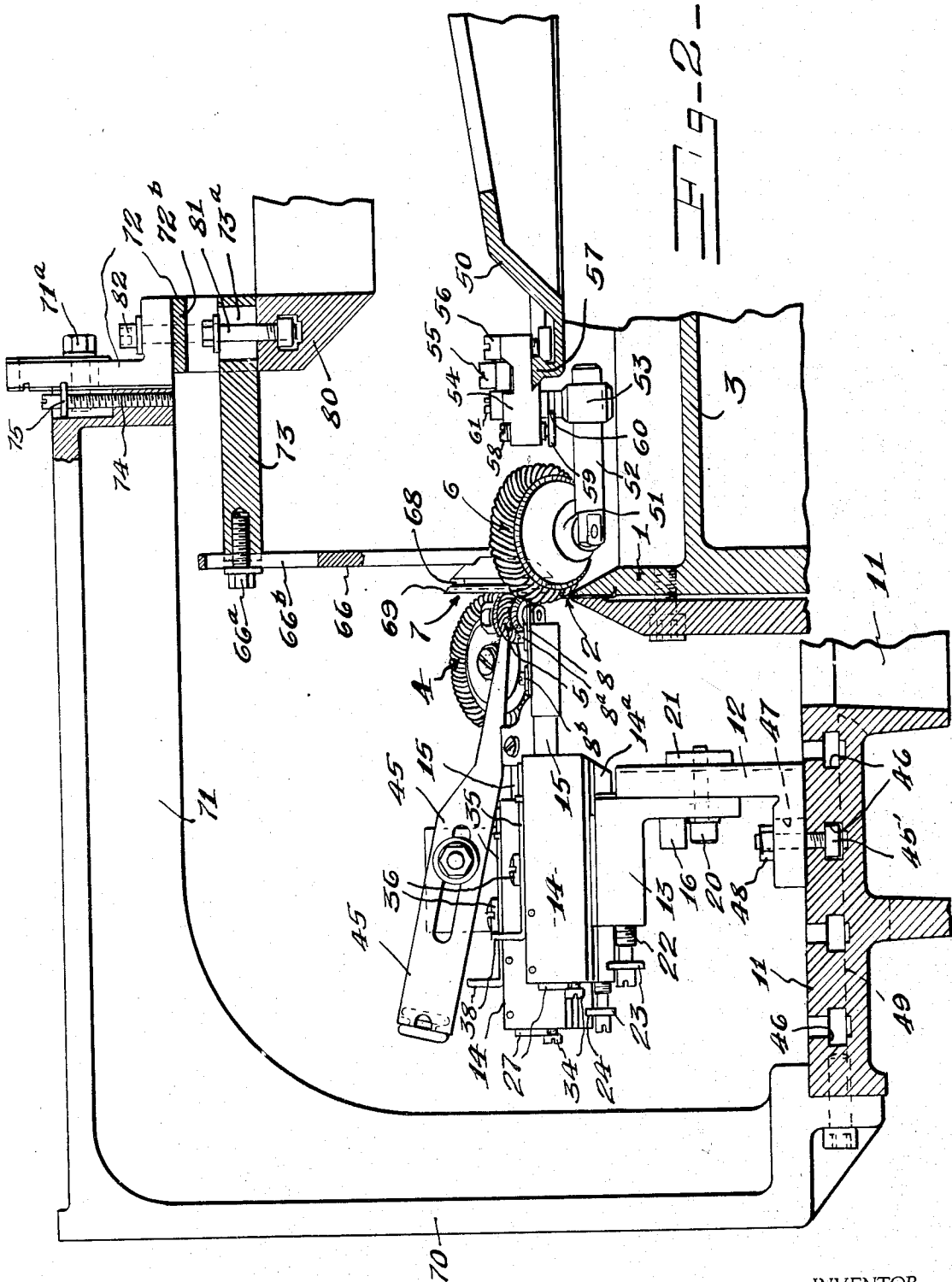
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TUBULAR FABRIC KNITTING MACHINE

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5 Sheets-Sheet 2



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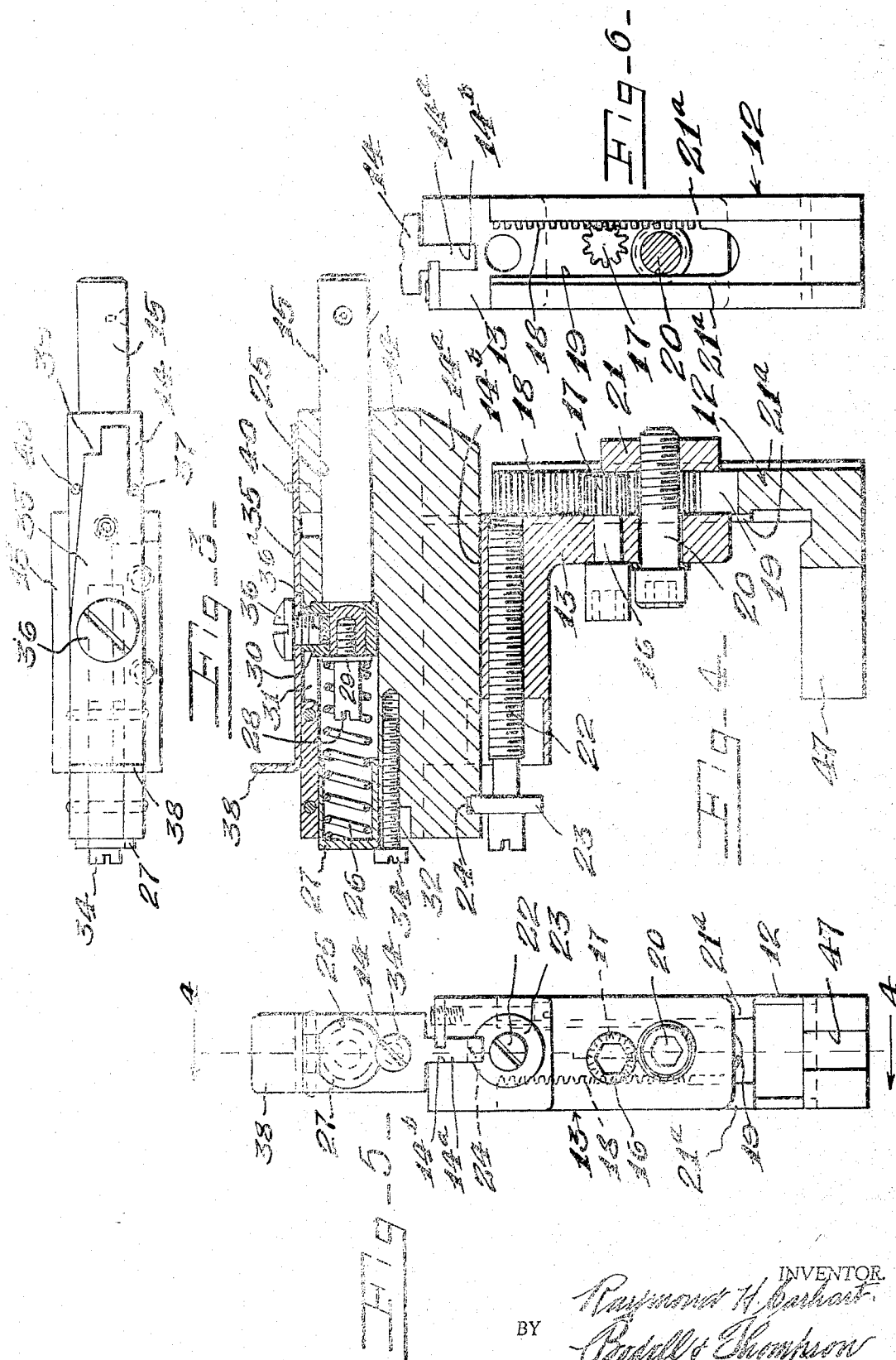
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TUBULAR FABRIC KNITTING MACHINE

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5 Sheets-Sheet 3



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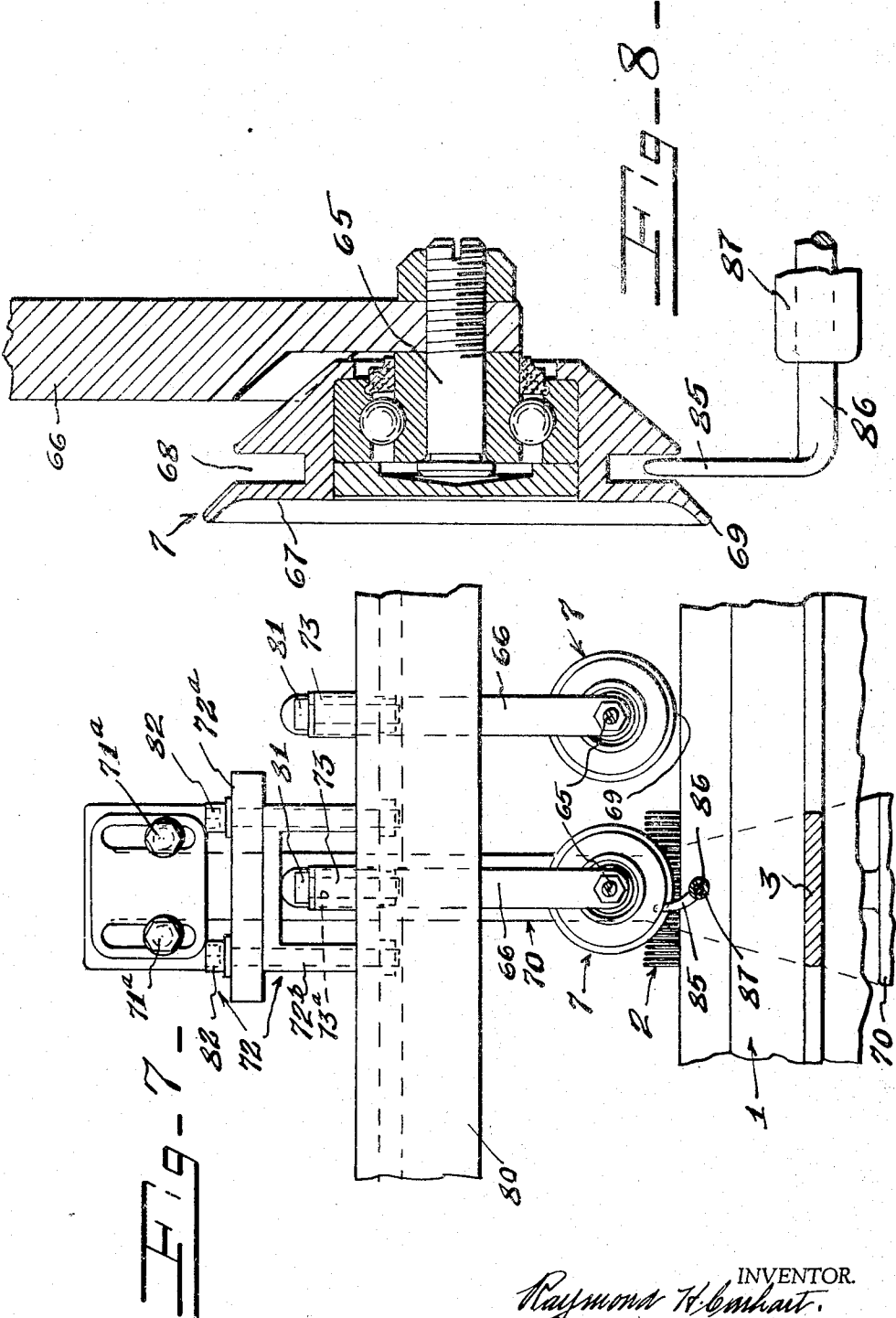
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TUBULAR FABRIC KNITTING MACHINE

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5 Sheets-Sheet 4



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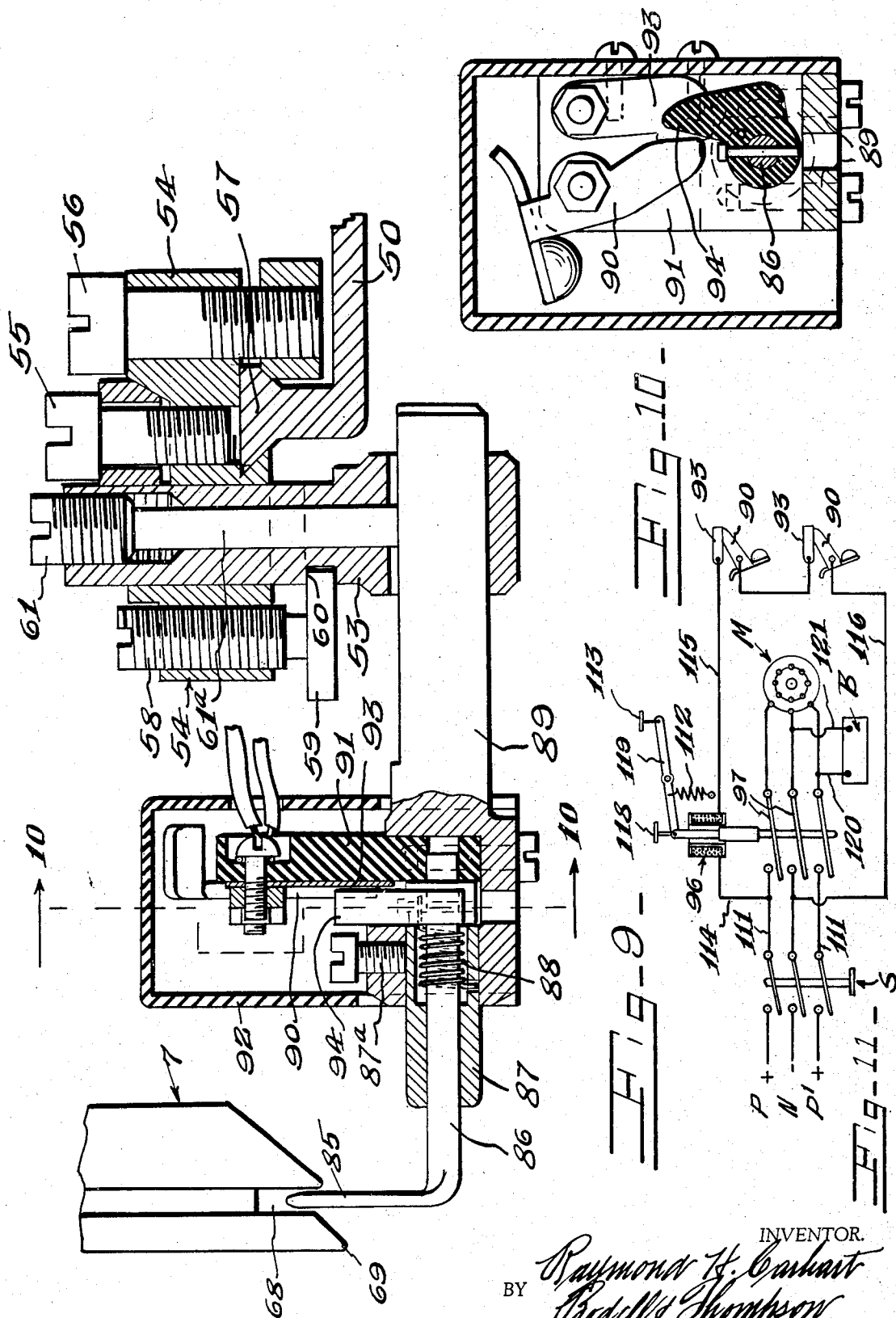
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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

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TUBULAR FABRIC KNITTING MACHINE

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Application June 12, 1936, Serial No. 84,920

6 Claims. (Cl. 66—166)

This invention relates to tubular fabric knitting machines of the general type of machine shown in Cummings Patent No. 467,534, issued January 26, 1892 and has for its object means for automatically controlling the stopping of the machine when there is a defect in the knitting operation or a hole in the cloth, which means coacts with the cloth presser or cloth presser wheel, and which occupies a minimum space, and also the mounting and locating of such devices, so that one of such devices can be used, if desired, with each set of knitting mechanism.

The invention consists in the novel features and in the combinations and constructions hereinafter set forth and claimed.

In describing this invention, reference is had to the accompanying drawings in which like characters designate corresponding parts in all the views.

Figure 1 is a fragmentary plan view of the frame or bed of a machine, one set of knitting mechanism and one stopping device.

Figure 2 is a transverse sectional view taken approximately on the plane of line 2—2, Figure 1.

Figure 3 is a plan view of one of the mountings for one of the knitting elements, as the looping burr, sinker burr, or needle presser or closer.

Figure 4 is a sectional view on line 4—4, Figure 5.

Figure 5 is an end view, looking to the right, in Figures 3 or 4.

Figure 6 is a fragmentary elevation, looking to the left in Figure 4.

Figure 7 is a fragmentary elevation, partly in section, looking to the left in Figure 2.

Figure 8 is an enlarged vertical sectional view through one of the cloth presser wheels and contiguous parts.

Figure 9 is an enlarged sectional view on the plane of line 9—9, Figure 1.

Figure 10 is a sectional view on line 10—10, Figure 9.

Figure 11 is a diagrammatic view illustrating the operation of the stop device.

A tubular fabric knitting machine of this class comprises, generally, a suitable bed or frame, a rotating needle ring or cylinder, a rotating cloth frame, not shown, including mechanism for winding up the cloth, as it is knitted, knitting mechanism carried by the bed and stationary with respect to the rotation of the needle ring, and suitable actuating mechanism for actuating the needle ring and winding the cloth. As this type of machine is old and well known, it is thought that further general description for the

purpose of understanding the present invention is unnecessary.

1 designates the rotating needle ring or support for the needles 2. This ring 1 is provided with suitable spokes 3 which are supported on a suitable central shaft, not shown. The ring 1 is in effect a turn-table supported by the frame or bed of the machine. The cloth is carried the same as in any knitting machine of this type and the cloth takes a generally tubular form, as shown in the Cummings patent above referred to, with the exception to be hereinafter pointed out, and the cloth is wound in a roll by the usual mechanism.

The knitting mechanism comprises a clearing burr wheel 4, a sinker burr 5, a land and cast-off or double burr 6, a cloth presser or cloth wheel 7, and a needle presser or closer 8. The needles are in the form of hooks, the bills of which are flexible and which are pressed to close and open by the presser 8. The burr wheels mesh with the series of needles and are turned thereby during the turning of the needle ring or turntable 1. The clearing and sinker burr wheels and the presser 8 constitute what are known as the "outside" elements of the knitting mechanism, and the cloth wheel and double burr the "inside" elements, the former being located outside of the cloth but inside of the needle ring and the latter inside of the cloth and also the needle ring.

Each of the elements 4, 5, and 8 is mounted on the frame or the bed of the machine, in order to have a micrometer adjustment vertically and horizontally, and also they are so arranged relative to each other as to take up a minimum width-wise space.

Referring to Figures 2, 3, 4, 5, and 6, 11 designates the outer stationary ring constituting one part of the bed of the machine on which the mounting for the knitting elements 4, 5, and 8 are supported. The mounting for each of these elements comprises a bracket 12 mounted on the bed or outer ring 11, a carriage 13 vertically adjustable of the bracket 12, a horizontally adjustable carriage 14 mounted on the carriage 13 and adjustable radially relative to the axis of the outer ring 11 or of the needle ring 1, and a second carriage 15 movable horizontally of the carriage 14.

The knitting element 4, 5, or 8 is carried directly by the carriage 15.

As seen in Figures 4, 5, and 6, the carriage 13 has mounted therein a small shaft or spindle 16 having a pinion 17 thereon meshing with a rack 55

12 at one side of the slot 10 formed in an upright arm of the bracket 12. The shaft 16 has a suitable head, by means of which it can be turned by a suitable tool to rotate the pinion and cause the pinion to move upwardly or downwardly along the rack 18, moving the carriage 13 therewith. The carriage 13 is held in the position in which it has been adjusted by the pinion 17, by clamping means, here shown as a bolt 20 extending through an opening in the bracket 12 through the slot 19 and threading into a nut 21 of sufficient width to span the slot 19 and bear on the portions of the bracket 12 on opposite sides of the slot. The carriage 13 and nut 21 move in ways 21^a in the bracket 12 on opposite sides of the slot. Obviously, by loosening the nut 20 and turning the shaft 16, a micrometer adjustment vertically of the carriage 13 can be obtained.

The carriage 14 is slidably mounted on the bracket 13 and shiftable radially relatively to the axis of the needle ring 1. It has a rib 14^a on the lower side thereof slidable in a way or groove 14^b in the top face of the carriage. This radial adjustment is effected by a micrometer consisting of a screw 22 threading radially into the carriage 13 and having an annular flange or head 23 which works in a groove 24 in the lower side of the rib 14^a of the carriage 14. Thus, by turning the screw, a micrometer adjustment of the carriage 14 readily can be effected.

The carriage 15, which directly supports the burr wheel 4 or 5 or the presser foot 8, is slidably mounted in a bore 25 in the carriage 14. This bore extends radially relatively to the axis of the needle ring 1. The carriage is spring-pressed in one direction by a spring 26 located in the bore 25 and thrusting at one end axially against the rod or carriage 15 and at its other end against the head of a thimble-shaped spring abutment 27 slidable in the bore.

As here shown, a screw 28 threads axially into the inner end of the rod 15. This screw also extends axially into the spring 26 and has an annular flange abutting against the inner end face of the rod 15. The spring 26 thrusts directly against the flange. This flange 29 is for the purpose of holding in position a head 30 mounted on the reduced inner end of the rod 15 and extending through a slot 31 in the top of the carriage 14, which slot opens into the bore 25. The purpose of this head will be presently described.

The outward movement of the rod or carriage 15 by the spring 26 is limited by suitable stop and latch means and the tension of the spring 26 is adjusted by means here shown as a screw 32 threading into the carriage 14 below and parallel to the bore 25 and having its head 34 thrusting against the bed or head of the thimble-shaped abutment 27. By tightening this screw, the spring 26 will be compressed and by loosening the screw, the spring will be released slightly. The spring 26 presses the knitting element in position and permits it to give more or less under abnormal conditions.

35 (Figures 3 and 4) designates a latch and stop means, this lying on the top of the carriage 14 and being pivoted by means of a screw 36 to the block 30, previously referred to. The latch coacts with a stop pin 37 on the carriage 14 for limiting the outward movement of the rod or carriage 15 under the influence of the spring 26. The latch has a finger-piece 38 at its outer end, by means of which it may be pulled back to pull back the rod or carriage 15 against the action of

the spring 26, and the latch also has a shoulder 39 coacting with the pin or stop 40, when the latch is in retracted position, in order to lock temporarily the carriage 15 in retracted position. The latch is moved about its pivot into and out of engagement with the latch pin 40. Upon release of the latch from the pin 40, the spring reacts and resets the carriage or rod 15 with a knitting instrument thereon in its previously set position without further adjustment. While being retracted, the knitting element may be manipulated or set in working order. The carriage 15 is a rod and capable of radial adjustment about its axis to vary the angle of the burr wheels. It is held in its adjusted position by the screw 36 which thrusts against a disk 36^a and sets or clamps the disk against the reduced end of the carriage or rod 15.

In operation, the knitting mechanism element can be quickly and accurately set by means of a micrometer adjustment or screw 16 and the screw 22 is permanently held in its adjusted position. The adjustment is not upset by temporarily retracting the carriage or rod 15 by means of a latch 35. The needle presser 8 is mounted on its carriage or rod 15 to have a pivotal adjusting movement about the pivot 8^a (Figure 1) and is held in its adjusted position by a screw 8^b.

45 designates a suitable guide for the yarn or thread to the sinker burr 5, this being supported by one of the carriages 13.

It will be seen that by reason of the assembly of the bracket 12, carriage 13 and carriages 14, 15 and also the relative arrangement of the adjusting screws 16, 23 and latch, that each carriage assembly takes up a minimum width, as the adjusting means and the latch are in substantially the same vertical plane. All of these adjusting means, screws, etc. are exposed on the outer sides of the carriages 13, 14 and hence readily accessible, even when the supporting bed 11 is crowded or filled with knitting mechanisms. This is one of the features contributing to locating a maximum number or sets of outside knitting elements within a minimum space and hence to increasing the speed of the knitting.

The brackets 12 are secured to the bed 11 in the usual manner, as by bolts 45' (Figure 2) having their heads arranged in T slots 46 in the bed, these bolts extending upwardly through slots 47 in the bases of the brackets 12 and threading into nuts 48. The T slots extend circumferentially of the bed 11 and are provided with suitable slots or passages 49 at intervals by means of which the bolts with their heads can be placed in the T slots or removed therefrom.

The double burr 6 is supported from an inner stationary ring 50 forming a part of the bed of the machine. This double burr is a combined landing and cast-off burr. It is carried by a shiftable axle 51 extending at an angle from a shaft or rod 52 mounted in a vertically adjustable carriage 53, the adjustment of which is effected by a micrometer mechanism, and the shaft or spindle 52 is also adjustable radially relatively to the axis of the needle ring 1 and relatively to the carriage 53. The carriage 53 is adjustably mounted in a block or carriage 54 mounted on the inner ring 50 of the bed of the machine, the block 54 being secured by means of clamping screw 56 to a beveled head or head 57 on the block 54 (see Figure 9). The carriage 53 is adjusted relatively to the block 54 parallel to the carriage 53 and having a flange or head 59 working in a groove 60 in the carriage 53. The screw 55 acting through

the beveled head 55^a clamps against the carriage 53 and holds the carriage 53 in its adjusted position in the block 54. The rod 52 is clamped in its adjusted axial or radial position by suitable means, as a screw 61, threading axially into the carriage 53 thrusting against a rod 61^a. The rod abuts at its end against the rod 52. By means of this mechanism, a fine adjustment of the double burr 6 can be effected both radially or toward and from the needles and in an angular direction relatively to the needles to best cooperate to perform the landing and knock-off or cast-off operations. The heads of all the adjusting screws 58, 61, 55, 56 are presented upward and readily accessible from above.

The carriage 53 and associated parts are shown in connection with the stop device to be described. The carriages for the double burr 6 and the stop device are duplicates.

The cloth presser 7 is preferably a wheel having suitable antifriction bearings mounted on a spindle 65 carried by an arm or bracket 66 (Figure 2) supported from the bed of the machine. The wheel 7 is preferably mounted on a horizontal axis radial with the axis of the needle ring 1 and is recessed at 67 on its outer side, in order to permit the burrs, particularly the sinker burr, to come close to the edge of the cloth pressed down by the edge of the wheel 7. The wheel 7 is formed with a clearance, here shown as an annular recess or peripheral groove 68 located close to the portion 69 of the wheel which presses down the cloth, and in the rear thereof.

Each cloth presser wheel 7 is supported from the outside ring 11, and as here illustrated is supported from the outer ring 11 by a bracket 70 having an overhanging arm 71 which carries on its inner end a carrier block 72 (see Figure 2) from which extend arms 73 to which the brackets 66 directly supporting the wheels 7 are secured. The carrier blocks 72 are adjustable vertically by a micrometer screw 74 threading in the ends of the overhanging arm 71 and having an annular flange 75 interlocking in a groove in the carrier block 72, and are held in adjusted position by screws 71^a (Figure 4 and 7). Each bracket arm 66 is adjustable vertically relative to its arm 73. As shown, the bracket 66 seats in a vertical way in the end of the arm 73 and a screw 66^a extends through a slot 66^b in the bracket 66 and threads into the arm 73. Each cloth wheel 7 is thus individually adjustable through the adjustment of its bracket 66 and the adjustment of the arms 73 by reason of the slots 73^a and bolts 81, to be described.

The machine here illustrated is provided with a guide for the cloth so located relatively to the cloth wheel that the lowermost zone or band of cloth, where it approaches the cloth wheels 7 is inclined out of the horizontal, rather than out of the vertical, in order to facilitate the placing of the stitches or the loops at the edge of the cloth in a positive cast-off position while being pressed down by the cloth wheels over the needles, this resulting in faster and more perfect knitting. This guide is here shown as a guide ring 80 located to the inward of the cloth wheels 7 and slightly above the level of the lower edge thereof, so that the cloth lies more nearly in a horizontal plane, as it approaches the cloth wheels. The ring 80 is here shown as supported by the carrier block 72. This cloth guide means constitutes the subject matter of a divisional application.

As here illustrated, the carrier block 72 is in two sections 72^a and 72^b, the section 72^b being bifurcated, as shown in Figure 7, with the arms

73 bolted to the ring 80 by means of bolts 81, and the two sections 72^a and 72^b being secured together and also secured to the ring by means of bolts 82 extending through the base of the section 72^a and the bifurcations of the section 72^b. The supporting arm 73 for each bracket 66 of each cloth wheel is secured for convenience to the ring 80 between the bifurcations of the block section 72^b. The ring 80 can be located accurately or leveled by means of the screw 75 and after the ring is adjusted, and further adjustment of the cloth wheels if necessary, can be accomplished by adjusting the brackets 66.

The arm 73 is also adjustable endwise relatively to the ring 80 by reason of a slot 73^a therein (Figure 2) through which the screw 81 extends. The cloth wheels 7 are thus individually adjustable vertically and horizontally. The ring 80 is adjusted to different heights by the screws 75, thicker or heavier cloths requiring that the ring be set higher than for thin cloth.

The stop mechanism for automatically controlling the stopping of the machine when there is a defect in the knitting or a hole in the cloth, comprises a spring-pressed finger 85 supported from the bed of the machine and normally pressing against the under side of the cloth in alignment with the clearance groove 68 of the cloth ring 7. When there is a hole in the cloth, the finger moves through the hole and into the groove 68 and by its movement operates stopping mechanism. There may be one spring-pressed finger for each cloth wheel but one for each cloth wheel is unnecessary and usually several of these stop mechanisms spaced equidistant apart are sufficient to stop the machine before much damage is done or much cloth run off the needles.

The feature of this stop mechanism is that it is located in a space or spaces not required by any other part or mechanism and hence it is not necessary to remove any knitting mechanism to make space for the stop mechanism, and if desired, as many stop devices can be used as there are knitting mechanisms. Each stop device is located in the radial space to the inward of the cloth pressers and coact with the cloth pressers. As the cloth pressers 7 are usually wheels, each stop device is located at or near where one of the wheels presses down the cloth beneath the axial line of the wheel, or each stop device is located between radial vertical planes tangent to the lateral edges of the widest part of the pressers or cloth wheels.

As here shown, the spring-pressed finger 85 is carried by a rock shaft 86 journaled in a bearing 87, the shaft being acted upon by a torque spring 88 located in a recess in the bearing and tending to rock the shaft 86 to hold the finger against the cloth. The bearing 87 is supported by a suitable carriage, as a rod 89, which in turn is supported by a carriage, similar to the carriage 53, of the adjusting mechanism for the double burr 6, the only difference being that the set screw 61 coacts with a flat surface on the rod 89. The bearing 87 is rotatable slightly in the carriage 89 to adjust the torque of the spring 88. It is held in its adjusted position by a set screw 87^a. Because of this finger and the clearance 68 in the cloth wheels 7 and as there is one cloth wheel in each set of knitting mechanism, a greater number of knitting mechanisms can be used within a given space and also the clearance at the thin point does not affect the size of the wheel. Also, a maximum number of stop devices may be employed, one for each wheel, if desired,

and hence the machine stopped within a very short distance after the hole occurs.

As seen in Figure 11, a three-wire circuit is shown for a three-phase motor M, which is the motor for actuating the machine. The current flows as follows: From wire P or P' through manually operable switch S, when closed, thence through wire 111, switch 97 to the motor M. The switch 97 is normally open and tends to open either by gravity or by a spring 112, and it is closed by the magnet or solenoid 96, when this magnet is energized. To start the machine, the push button 113 is depressed, this being suitably connected to the core of the solenoid or magnet 96 which in turn is mechanically connected to the switch 97, so that when the push button 113 is depressed, the switch 97 is closed. When so closed, the current passes through wire 114 through the windings of the magnet 96 through wire 115, through the normally closed stop switches 90, which are connected in series, thence through wire 116 back to the neutral conductor N. When one of the stop switches 90 is actuated by reason of a hole or defect in the cloth, it opens the circuit through the wires 115, 116 so that the solenoid 96 is de-energized, and the switch 97 opens under the influence of the spring 112, which is connected to the mechanical connection between the push button 113 and the core of the solenoid 96. Thus, when any one of the stop switches 90 open, the current to the motor M will be cut off and the motor M and machine stopped. When the machine is in operation, it can be stopped at any time by depressing the push button 118 connected to the core of the solenoid 96 and acting alternately with the push button 113. As here shown, the push buttons 113, 118 are mounted on opposite ends of a lever 119, which is connected to the core of the solenoid 96 to transmit motion thereto. Also, a suitable brake B is provided for stopping the machine from coasting under momentum when the motor M is cut out. This brake may be of any suitable construction. Briefly, the brake is held off by a solenoid, not shown, the windings of which are connected in the motor feed circuit by wires 120, 121. Thus, when the motor is energized and the brake is held off against the action of a suitable spring, not shown, which reacts to apply the brake when the circuit through the motor M and the solenoid of the brake B is opened.

What I claim is:—

1. A tubular fabric knitting machine including a suitable bed, a rotating needle ring, and knitting mechanism carried by the bed and stationary with respect to rotation of the needle ring, and including a cloth presser having a clearance therein near the edge of the margin thereof pressing on the cloth, the edge of the cloth normally covering the clearance, a stop device carried by the bed and including a spring-pressed finger alined with the clearance normally pressing on the interposed cloth and movable through a hole in the cloth into the clearance, and means operated by the movement of the finger through the hole into the clearance for stopping the machine.

2. A tubular fabric knitting machine including a suitable bed, a rotating needle ring and knitting mechanism carried by the bed and stationary with respect to rotation of the needle ring and including a cloth pressing wheel arranged to press the margin of the cloth on the needles, said wheel having a circumferential clearance therein near the edge thereof pressing on the cloth, the edge of the cloth normally covering the clearance, and a stop device carried by the bed and including a spring-pressed finger alined with the clearance and normally pressing on the interposed cloth and movable through a hole in the cloth into the clearance, and means operated by the movement of the finger into the hole of the clearance for stopping the machine.

3. A tubular fabric knitting machine including a suitable bed, a rotating needle ring, and knitting mechanism carried by the bed and stationary with respect to rotation of the needle ring, and including a cloth presser having a clearance therein near the edge of the margin thereof pressing on the cloth, the edge of the cloth normally covering the clearance, a stop device carried by the bed and including a spring-pressed finger alined with the clearance normally pressing on the interposed cloth and movable through a hole in the cloth into the clearance, and means operated by the movement of the finger through the hole into the clearance for stopping the machine, said means including an electric circuit with electro-magnetic means therein, and a switch in said circuit operated by the movement of the finger.

4. A tubular fabric knitting machine including a suitable bed, a rotating needle cylinder, sets of knitting mechanisms carried by the bed and stationary with respect to rotation of the needle cylinder and each including a cloth presser wheel, a stop device carried by the bed and including a spring-pressed finger arranged in juxtaposition to the cloth wheel, where the cloth wheel engages the cloth and normally pressing on the interposed cloth and movable through a hole in the cloth, and means operated by the movement of the finger through the hole for stopping the machine.

5. A tubular fabric knitting machine including a suitable bed, a rotating needle cylinder, sets of knitting mechanisms carried by the bed and stationary with respect to rotation of the needle cylinder and each including a cloth presser and a stop device located in the radial space to the inward of the cloth presser and coacting with the cloth where it engages the cloth presser.

6. A tubular fabric knitting machine including a suitable bed, which includes an outer ring, a rotating needle cylinder, sets of knitting mechanisms carried by the bed and stationary with respect to the rotation of the needle cylinder and including a cloth presser supported from the outer ring, a stop device carried by the bed within the needle cylinder in the radial space to the inward of the cloth presser, the stop device coacting with the cloth where it engages the cloth presser.

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