

Sept. 16, 1947.

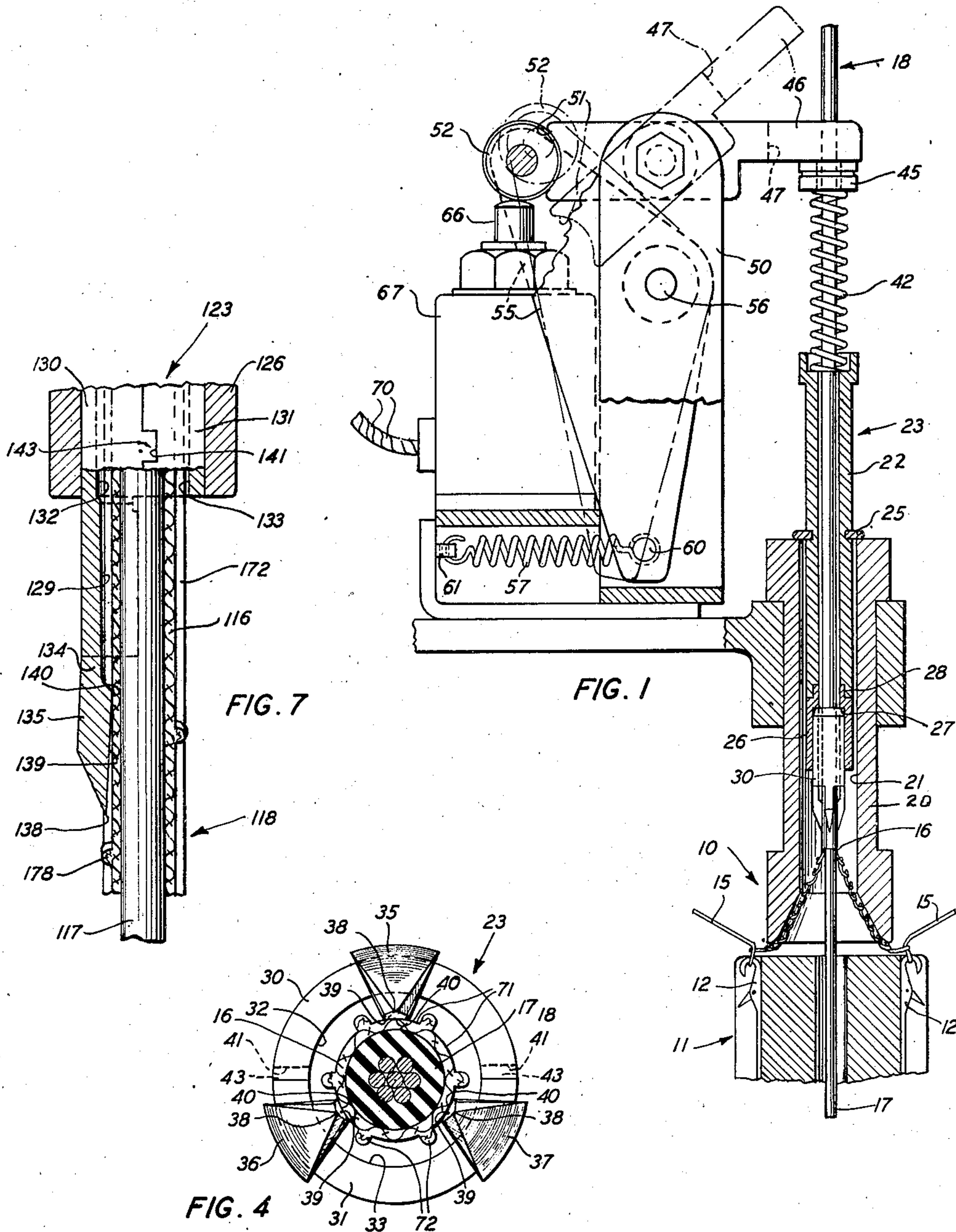
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DETECTOR FOR LOCATING IMPERFECTIONS IN KNITTED FABRICS

Filed April 14, 1945

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

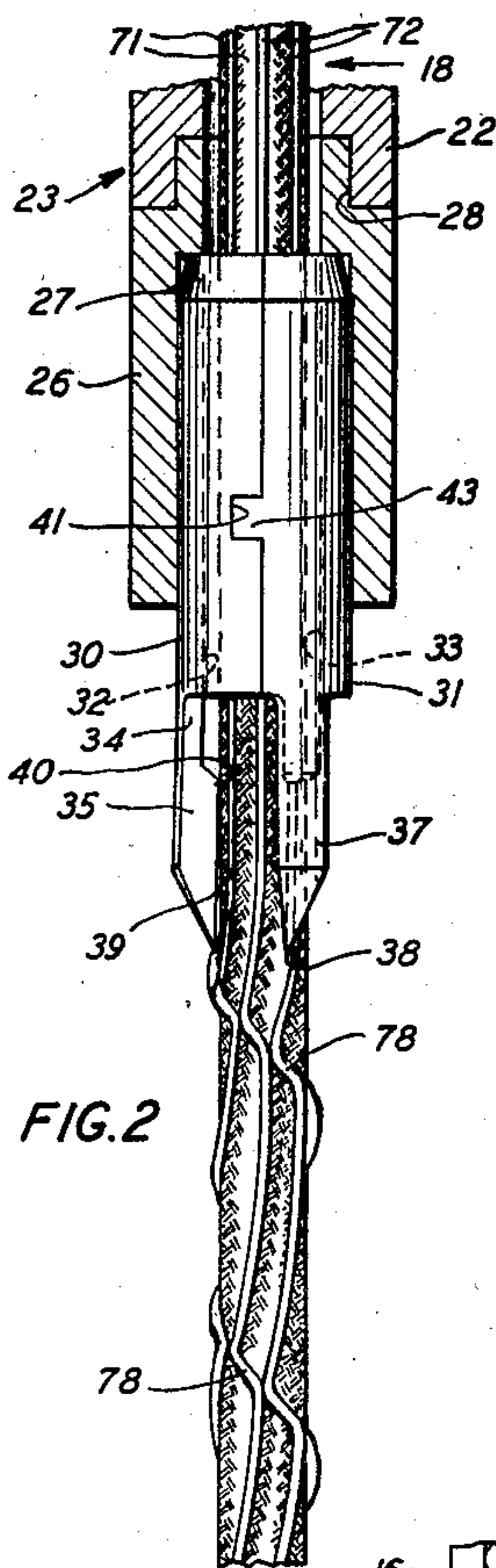


FIG. 2

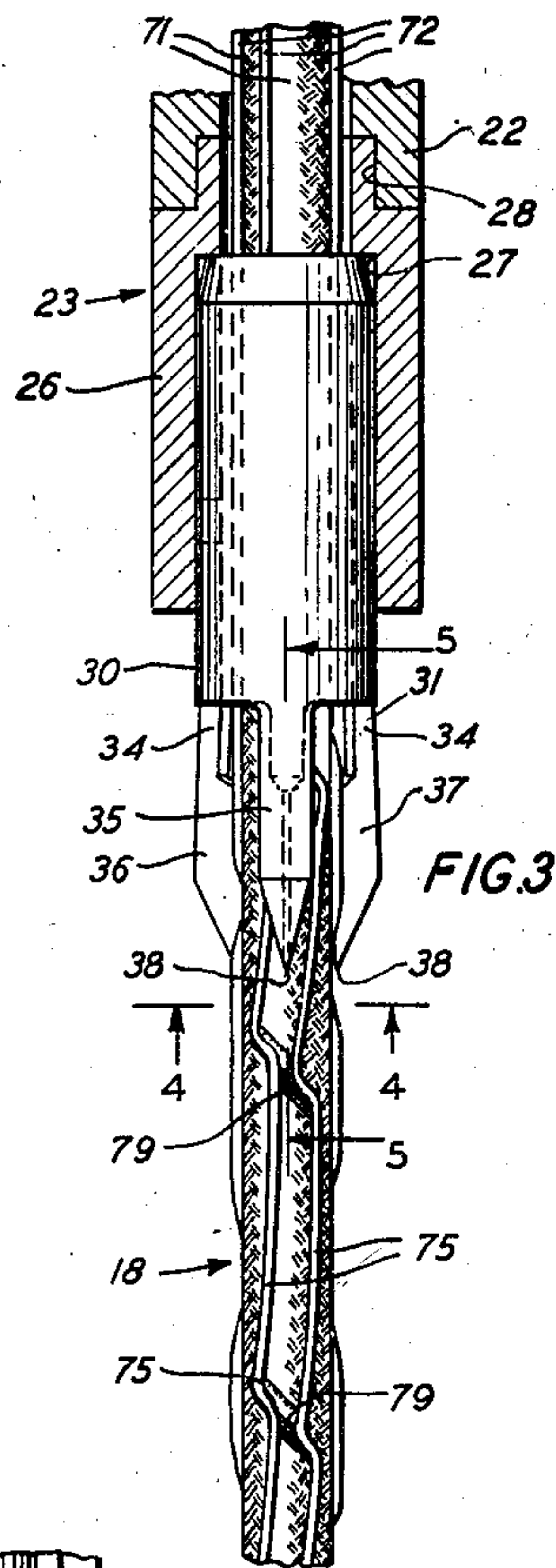


FIG. 3

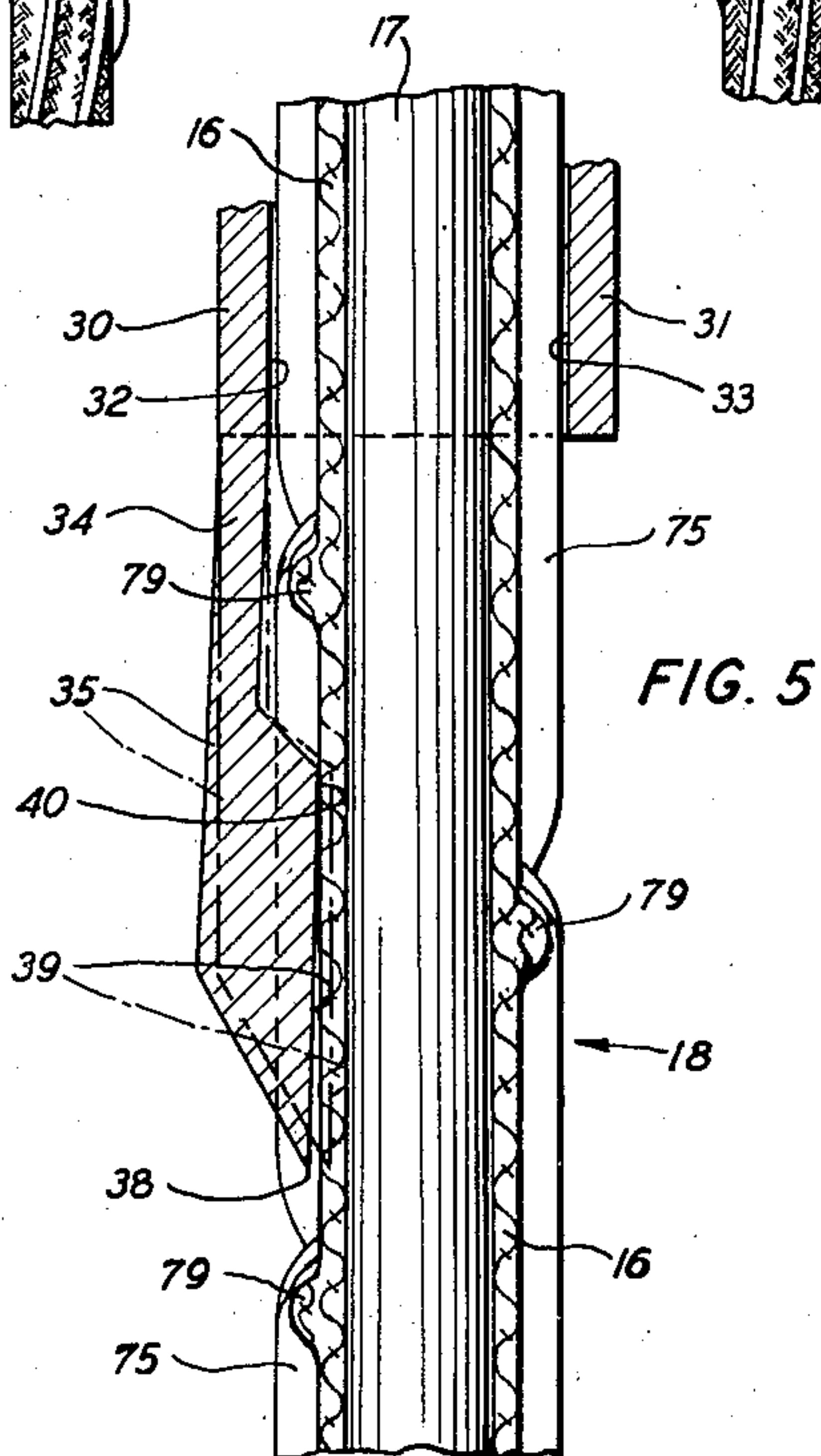


FIG. 5

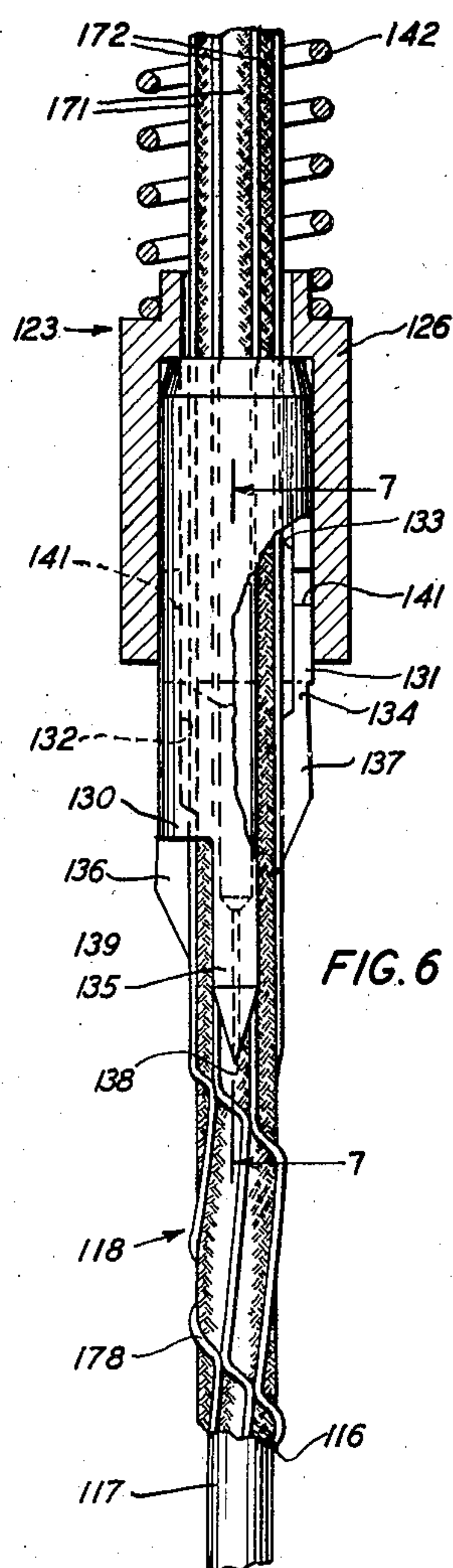


FIG. 6

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## UNITED STATES PATENT OFFICE

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## DETECTOR FOR LOCATING IMPERFECTIONS IN KNITTED FABRICS

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12 Claims. (Cl. 66—166)

1

This invention relates to detectors for locating imperfections in knitted fabrics, and has for its object the provision of new and improved detectors for this purpose.

In the operation of known machines for knitting a plurality of textile strands into a fabric upon a conductor, such a knitting machine sometimes operates imperfectly and forms an imperfect fabric upon a conductor advanced there-through. In order to adjust or repair the knitting machine and to minimize the length of the imperfect portion of the fabric, the imperfect portion of the fabric should be detected as soon as possible after it is formed.

A detector forming one embodiment of the invention, which is designed to be associated with a knitting machine, for locating imperfections in knitted fabrics, includes an apertured member having a plurality of fingers formed thereon so as to rest on a knitted fabric on a covered conductor passing through the apertured member after the fabric has been knitted thereon, said fingers serving to engage imperfections in a knitted fabric as the fabric is moved therealong, whereby the apertured member is carried with the fabric to cause a suitable mechanism to stop the knitting machine promptly.

A complete understanding of the invention may be obtained from the following detailed description of detectors forming embodiments thereof, when read in conjunction with the appended drawing, in which

Fig. 1 is a fragmentary, partially sectional, side view of a knitting machine and a detector embodying the invention;

Fig. 2 is an enlarged fragmentary, vertical section of a portion of the detector;

Fig. 3 is an enlarged fragmentary, vertical section of a portion of the detector;

Fig. 4 is an enlarged, horizontal section taken along line 4—4 of Fig. 3;

Fig. 5 is an enlarged, vertical section taken along line 5—5 of Fig. 3;

Fig. 6 is an enlarged, fragmentary, vertical section of a portion of a detector forming an alternative embodiment of the invention, and

Fig. 7 is an enlarged, fragmentary, vertical section taken along line 7—7 of Fig. 6.

Referring now in detail to the drawing, there is shown a portion of a knitting machine 10 (Fig. 1), of the type shown in co-pending application, Serial No. 551,336, filed August 26, 1944, by D. G. Scrantom for "Detector and automatic stop device for textile machines." This knitting machine includes a knitting head 11 having a plu-

2

rality of knitting needles 12 for knitting a plurality of feeder threads 15 into a single-stitch tubular fabric 16 upon an insulated tinsel conductor 17 to form a fabric-covered conductor 18 as the conductor 17 is advanced through the knitting head. The knitting machine includes a web holder 20 having a bore 21 therein through which the fabric-covered conductor 18 is advanced from the knitting head.

A detector 23 forming one embodiment of the invention is shown in Figs. 1 to 4, inclusive, and includes an actuating tube 22 having a collar 25 secured thereon and designed to extend into the bore 21 of the web holder 20 with the collar 25 resting upon the web holder. A bushing 26 having a shoulder 27 formed thereon (Figs. 2 and 3) is secured to a reduced portion 28 of the actuating tube 22 by pins (not shown), and serves to receive and hold frictionally a pair of semicylindrical bushings 30 and 31, which are provided with semicylindrical bores 32 and 33, respectively.

The semicylindrical bushing 30 has an elongated finger 35 projecting therefrom and the bushing 31 has two elongated fingers 36 and 37 projecting therefrom. Since the bushings 30 and 31 are made of spring steel and shanks 34 of the fingers 35, 36 and 37 are thin, the fingers are very resilient. The fingers 35, 36 and 37, which are of equal lengths, taper to points 38 and are provided with contacting surfaces 39, which extend to the points 38.

The normal positions of the fingers 35, 36 and 37 are such that the elongated contacting surfaces 39 lay upon equally spaced points of a circle whose diameter is slightly smaller than that of the fabric-covered conductor, and the longitudinal axes of the contacting surfaces are parallel when the fingers are in such positions. When the semicylindrical bushings are positioned over the fabric-covered conductor 18 and are assembled in the bushing 26, the fabric-covered conductor forces the fingers slightly apart so that heel portions 40 thereof engage the conductor and the points 38 are spaced slightly outwardly from the fabric 16, as illustrated by the point 38 when in the position shown in full lines in Fig. 5. This prevents the points 38 (Fig. 4) from engaging unobjectionable deviations in the fabric 16 as it is carried therepast.

The bushing 30 has a pair of notches 41 (Figs. 3 and 4) formed therein and the bushing 31 is provided with a pair of tongues 43 complementary to the notches 41. The tongues 43 are designed to fit into the notches 41 and prevent relative



longitudinal movement between the semicylindrical bushings 30 and 31.

A compression spring 42 (Fig. 1) and an annular collar 45 are positioned between the actuating tube 22 and a latch 46. As the knitting operation proceeds, the fabric-covered conductor 18 is advanced upwardly, as viewed in Fig. 1, through the semicylindrical bushings 30 and 31, the actuating tube 22, the compression spring 42, the collar 45 and a slot 47 formed in the latch 46. The latch 46 is pivotally mounted upon a bracket 50 and is provided with a notch 51 designed to engage a roller 52 mounted on levers 55. The levers 55 are secured by a bolt 56 to the bracket 50 for pivotal movement with respect thereto and are urged in a clockwise direction, as viewed in Fig. 1, by a tension spring 57 secured to a pin 60 connecting the levers 55 and to a bracket 61.

The latch 46, when in the position shown in full lines in Fig. 1, serves to engage the roller 52 and hold the roller 52 in the position shown in full lines in Fig. 1, in which position the roller 52 engages a spring-pressed button 66 of a microswitch 67. The microswitch 67 is connected by conductors 70 to control means (not shown) of the knitting machine 10, which control means are identical with the control means disclosed in the above-mentioned application, Serial No. 551,336. When the spring-pressed button 66 is engaged by the roller 52, the microswitch 67 permits the knitting machine to operate, but when the button is not engaged by the roller 52, the microswitch serves to stop the knitting machine through the control means.

In the operation of the detector 23, the knitting head 11 serves to knit the feeder threads 15 into the tubular fabric 16, which is drawn on the conductor 17 as the fabric and the conductor 17 are drawn upwardly at a predetermined rate of speed from the knitting head 11, through the web holder 20. The fabric-covered conductor 18 is advanced through the semicylindrical bushings 30 and 31, the actuating tube 22, the compression spring 42, the annular collar 45, and the slot 47 and then engages a power-driven capstan of suitable design (not shown) which draws the fabric-covered conductor through the knitting machine and through all the above-mentioned elements. At this time, the latch 46 is in a position in which it holds the roller 52 in a position engaging the spring-pressed button 66 of the microswitch 67, whereby the microswitch 67 permits the knitting machine 10 to operate.

When the knitting head 11 operates perfectly, it knits the feeder threads 15 into the fabric 16, which includes thin portions 71 (Figs. 2 and 3) alternating with ridge portions 72 formed of the interlocking portions of the feeder threads. The thin portions 71 and ridge portions 72 extend along the fabric 16 in parallel relationships with respect to each other and with respect to the longitudinal axis of the conductor 17. The fingers 35, 36 and 37 are spaced around the fabric 16 in such positions that the contacting surfaces 39 thereof slidably engage the thin portions 71 of the fabric 16 between the ridge portions 72 with the points 38 on the fingers spaced slightly outwardly from the fabric.

When one of the needles breaks, which sometimes occurs, the fabric 16 is formed imperfectly and wavy ridge portions 75 (Fig. 3) and humps 79 (Fig. 5) are formed in the fabric. The points 38 engage the wavy ridge portions 75 or the humps 79 as the fabric-covered conductor 18 is advanced

upwardly, and are carried upwardly thereby, whereupon the bushings 30 and 31, the actuating tube 22, the compression spring 42, and the collar 45 are drawn upwardly with the fabric 16.

This causes the latch 46 to be moved to the position shown in dotted lines in Fig. 1, in which position the notch 51 in the latch 46 is out of engagement with the roller 52 and the roller 52 is moved away from the spring-pressed button 66 by the levers 55 and the tension spring 57. When the roller 52 is moved away from the spring-pressed button 66, the microswitch 67 causes the knitting machine 10 to be stopped.

An operator then adjusts or repairs the knitting machine 10, and resets the latch 46 and the microswitch 67, after disengaging the fingers 35, 36 and 37 from the fabric 16 and sliding the actuating tube 22, the compression spring 42, the collar 45 and the bushings 30 and 31 downwardly upon the fabric 16 to the positions in which they are shown in Fig. 1. The knitting machine 10 then may be restarted and, as long as the fabric 16 has no imperfections therein, can be operated.

Sometimes the needles 12 (Fig. 1) operate imperfectly in such a manner that a helical ridge portion 78 (Fig. 2) is formed in the fabric 16. When this occurs the helical ridge portion 78 is advanced to one of the points 38 on the fingers 35, 36 and 37, that point engages the helical ridge portion and the operation of the knitting machine 10 is stopped in the same manner as that described hereinabove.

The fingers 35, 36 and 37 of the bushings 30 and 31 serve to ride on the thin portions 71 of the fabric 16 without positively engaging the fabric 16 as long as no imperfections occur in the fabric 16. The compression spring 42, and the taperedness and the resiliency of the fingers 35, 36 and 37 prevent the actuation of the latch 46 and stopping of the machine by slight variations in the fabric-covered conductor 18. Also, the bushings 30 and 31 may rotate in the bushing 26, which rotation permits the fingers 35, 36 and 37 to float between the ridge portions 72 of the fabric 16. However, when imperfections such as the wavy ridge portions 75 (Fig. 3) and humps 79 (Fig. 5) or the helical ridge portion 78 (Fig. 2) are formed in the fabric 16 and are advanced to the points 38 of the fingers, the points engage the wavy ridge portions, the humps 79 or the helical ridge portion and cause the knitting machine to stop. Thus, the knitting machine 10 is stopped before long lengths of imperfect fabric are formed and the knitting machine can be put into operative condition without the waste of large quantities of fabric knitted thereby and the expense of repairing or replacing long lengths of fabric.

A detector 123 forming an alternative embodiment of the invention is disclosed in Figs. 6 and 7. This detector includes a bushing 126, which is identical with the bushing 26 and which is secured to the lower end of a compression spring 142. The bushing 126 serves to frictionally hold therein semicylindrical bushings 130 and 131 of spring steel, which are provided with semicylindrical bores 132 and 133, respectively. The bushing 130 is provided with a finger 135, and the bushing 131 is provided with fingers 136 and 137.

The fingers 135, 136 and 137 taper to points 138 and are provided with elongated contacting surfaces 139. The fingers 135, 136 and 137 are all of different lengths and have thin shanks 134. The prong 135 is longer than either of the prongs



5

136 and 137 and has an elongated contacting shoulder 129 forming a continuation of the contacting surface 139 thereof, and the contacting shoulder contacts ridge portions such as straight ridge portions 172 of a fabric 116 to hold the bushings 130 and 131 in equilibrium on the fabric, as the fabric, which covers an insulated conductor 117 to form a fabric-covered conductor 118, is advanced through the bushings. Except for their differences in lengths and the shoulder 129, the fingers 135, 136 and 137 are identical with the fingers 35, 36 and 37. A pair of tongues illustrated by a tongue 143 (Fig. 7) are provided on the semicylindrical bushing 130 and are designed to project into notches, such as the notch 141, formed in the semicylindrical bushing 131 to hold the bushings 130 and 131 against longitudinal movement therebetween.

The bushing 126 serves to hold the semicylindrical bushings 130 and 131 in positions around the fabric 116 knitted upon the conductor 117 by a knitting head (not shown) identical with the knitting head 11, with the fingers 135, 136 and 137 thereof pressed against the fabric 116. The fingers 135, 136 and 137 are of such different lengths that, when the semicylindrical bushings 130 and 131 are assembled, the points 138 at the ends thereof lay upon points of a helix, which helix is the same as that along which a helical ridge portion 178 of the fabric 116 is sometimes formed by imperfect operation of the knitting machine with which the bushings 130 and 131 are associated. Normally this knitting machine forms straight thin portions 171 of the fabric 116 alternating with the straight ridge portions 172 thereof, and heel portions 140 of the contacting surfaces 139 ride on the thin portions 171 between the straight ridge portions 172. When the knitting machine knits continuous imperfections into the fabric 116, such as the continuous helical ridge portion 178 of loosely knitted loops, all of the points 138 positively and simultaneously engage the helical ridge portion 178 as it is advanced thereto and are drawn upwardly therewith, whereby a microswitch (not shown) identical with the microswitch 67 is actuated through the compression spring 142 and stops the operation of the knitting machine knitting the fabric 116.

The points 138 engage imperfections such as the helical ridge portion 178 simultaneously and immediately stop the knitting machine without forming long portions of imperfect fabric, whereupon the knitting machine can be adjusted to operate correctly. The points 138 also serve to engage imperfections such as the wavy ridge portions 75 (Fig. 3) and humps 79 (Fig. 5), when such imperfections occur, and stop the knitting machine associated therewith. The resiliency imparted to the fingers 135, 136 and 137 by the thin shanks 134 causes the heel portions 140 of the contacting surfaces 139 to remain at all times in close contact with the fabric 116, while the taperedness of the fingers 135, 136 and 137 and the outwardly spaced points 138 together with the action of the compression spring 142 permit unobjectionable deviations in the fabric-covered conductor 118 to be advanced therepast without engagement by the points 138. However, major imperfections in the fabric are engaged thereby, whereby the knitting machine is stopped.

What is claimed is:

1. In a detector for use with a machine for forming a plurality of strands into a cover around a conductor to form a covered conductor

6

which is advanced therethrough, a bushing having a plurality of resilient fingers projecting therefrom in positions spaced around a covered conductor as it is advanced through the bushing, said fingers tapering to points and also being provided with contacting surfaces and being arranged so that the contacting surfaces normally touch a circle whose diameter is less than that of the covered conductor, whereby the fingers are spread outwardly when in engagement with the covered conductor and the points thereof do not engage perfect portions of the cover but do engage imperfect portions thereof.

2. In a detector for use with a knitting machine including a knitting head for knitting a plurality of strands into a fabric upon an insulated conductor to form a fabric-covered conductor as the insulated conductor is advanced therethrough in a predetermined direction, a detector for locating imperfections in a fabric knitted on an insulated conductor by the knitting head, which comprises a tubular member having a plurality of resilient fingers projecting therefrom in parallel relationship, means for positioning the tubular member around a fabric-covered conductor in a position in which the resilient fingers rest on the fabric of the conductor at equally spaced points thereon and point in a direction opposite to that in which the fabric-covered conductor is advanced through the knitting head.

3. For use with a knitting machine including a knitting head for knitting a plurality of strands into a tubular covering upon an insulated conductor to form a fabric-covered conductor as the insulated conductor is advanced therethrough, means for stopping the knitting machine, and a pivotally mounted lever for actuating the stopping means, a detector locating imperfections in a tubular covering of a fabric-covered conductor formed by the knitting machine, which comprises a split bushing having a plurality of fingers provided with tapered points and positioned over the tubular covering, said fingers being of such different lengths that the tapered points thereof lay on a helix and being designed to slide upon the tubular covering as the fabric-covered conductor is advanced relative to the bushing with the tapered points spaced slightly from perfect portions of the tubular covering but laying in the path of imperfections thereof, and a spring for connecting the split bushing to the lever, whereby the lever is pivoted by the bushing when one of the fingers engages an imperfection in the fabric and the knitting machine is stopped.

4. For use in a knitting machine including a knitting head for knitting a plurality of strands into single-stitch fabric around a conductor to form a fabric-covered conductor as the conductor is advanced therethrough, said fabric including raised ridge portions extending along the conductor in parallel relationships therewith and thin portions extending along the conductor in parallel relationships therewith, and means for stopping the knitting machine, a detector for locating imperfections in the fabric of a fabric-covered conductor formed by the knitting machine, which comprises a bushing having a plurality of tapered fingers projecting therefrom and positioned around the fabric, said fingers being spaced around the fabric so as to rest upon the thin portions of the fabric, and means for connecting the bushing operatively to the stopping means, whereby the bushing actuates the stopping means when one of the fingers engages an imperfection in the fabric.



7

5. For use in a knitting machine including a knitting head for knitting over a conductor as the conductor is advanced therethrough a plurality of strands into single-stitch fabric to form a fabric-covered conductor, said fabric including ridge portions extending along the conductor in parallel relationships therewith and thin portions extending along the conductor in parallel relationships therewith, and means for stopping the knitting machine, a detector for locating imperfections in the fabric of a fabric-covered conductor formed by the knitting machine, which comprises a bushing having a plurality of fingers tapering to points and being spaced around the fabric so as to rest upon the thin portions of the fabric with the points pointing in a direction opposite to that in which the fabric is advanced and to lay on points of a helix, and a compression spring for connecting the bushing operatively to the stopping means, whereby the bushing actuates the stopping means when one of the points of the fingers engages an imperfection in the fabric.

6. For use in a knitting machine including a knitting head for knitting upon a conductor as the conductor is advanced therethrough a plurality of strands into a fabric to form a fabric-covered conductor and means for stopping the knitting machine, a detector for locating imperfection in the fabric of a fabric-covered conductor formed by the knitting machine, which comprises a plurality of resilient fingers having surfaces formed thereon for engaging slidably the fabric, said fabric-engaging surfaces tapering to points and laying normally upon a circle whose diameter is less than that of the fabric-covered conductor, and means serving to mount the fingers in positions in which the fingers are spaced around the fabric with the fabric-engaging surfaces thereof in contact with the fabric in floating relationships therewith and to connect operatively the fingers and the stopping means, whereby the stopping means is actuated when one of the points of the fingers engages an imperfection in the fabric.

7. For use in a knitting machine including a knitting head for knitting a plurality of strands upon a conductor as the conductor is advanced therethrough to form a fabric-covered conductor and means for stopping knitting machine, a detector for locating imperfections in the fabric of a fabric-covered conductor formed by the knitting machine, which comprises a tubular member having a plurality of resilient fingers which are of different lengths and which have surfaces formed thereon for engaging slidably a fabric knitted upon a conductor by the knitting head and also provided with points spaced slightly from the fabric, said fingers projecting from the tubular member in positions in which they are spaced around the fabric with the points thereof being positioned on points of a helix, and a compression spring for connecting the tubular member and the stopping means, whereby the stopping means is actuated when one of the points of the fingers engages an imperfection in the fabric, the longest of said fingers also being provided with a shoulder for engaging the fabric to hold the tubular member in equilibrium upon the fabric.

8. For use in a knitting machine including a knitting head for knitting upon a conductor as the conductor is advanced therethrough a fabric to form a fabric-covered conductor and means for stopping the knitting machine, a detector for locating imperfections in a fabric of a fabric-

8

covered conductor formed by the knitting head, which comprises a tubular member for surrounding the fabric-covered conductor as the fabric-covered conductor is advanced from the knitting head, a plurality of resilient fingers projecting from the tubular member in directions parallel with the axis of the fabric-covered conductor, said fingers having points formed at the extremities thereof and also being provided with fabric-engaging surfaces adjacent to the points serving to hold the points away from fabric normally but to permit the points to engage imperfections in the fabric to cause the tubular member to be carried along with the advancing fabric-covered conductor, and means operatively associated with the tubular member for actuating the stopping means when the tubular member has been advanced a predetermined distance.

9. For use in a knitting machine including a knitting head for knitting upon a conductor as the conductor is advanced therethrough a fabric to form a fabric-covered conductor and means for stopping the knitting machine, a detector for locating imperfections in a fabric knitted by the knitting head upon a conductor, which comprises a split tubular member, a bushing for mounting the split tubular member rotatably therein in a position in which it surrounds the fabric-covered conductor as it is advanced from the knitting head, a plurality of resilient fingers having points at the extremities thereof projecting from the tubular member in directions parallel with the axis of the fabric-covered conductor, said fingers also being provided with fabric-engaging surfaces extending to the points and being sprung outwardly by the fabric-covered conductor so that the points formed at the extremities thereof do not engage perfect portions of the fabric but engage imperfections in the fabric and cause the tubular member and the bushing to be carried along with the advancing fabric-covered conductor, and a compression spring connected to the bushing for actuating the stopping means when the tubular member and the bushing have been carried a predetermined distance.

10. For use in a knitting machine including a knitting head for knitting upon a conductor as the conductor is advanced therethrough a fabric having ridge portions and thin portions extending along the fabric parallel with the conductor to form a fabric-covered conductor and a microswitch for stopping the knitting machine when actuated, a detector for detecting imperfections in such a fabric, which comprises a plurality of elongated fingers, a bushing for mounting the fingers in a ring-like fashion around a fabric-covered conductor in positions in which the fingers rest on the thin portions of the fabric, whereby smooth portions of the fabric slide past the fingers but roughened portions of the fabric are engaged by the fingers and move the fingers and the bushing therewith as the fabric-covered conductor is advanced, and a spring for connecting the bushing operatively with the microswitch to actuate the microswitch when the fingers engage a roughened portion of the fabric.

11. For use in a knitting machine including a knitting head having a plurality of needles for knitting upon a conductor as the conductor is advanced therethrough a plurality of strands into a fabric to form a fabric-covered conductor, said fabric having ridge portions extending therealong in positions parallel with the conductor and thin portions positioned between the ridge portions, means for stopping the knitting machine when



9

actuated, a detector for locating imperfections in the fabric, which comprises a split tubular member having pointed resilient fingers projecting therefrom, a bushing for mounting the split tubular member rotatably therein, and a compression spring serving to connect the bushing operatively to the stopping means and to mount the bushing and the split tubular member in positions in which they surround the fabric-covered conductor, said fingers having surfaces formed thereon for pressing against the thin portions of the fabric with the points of the fingers spaced outwardly from the fabric-covered conductor, said surfaces being shorter than the distances between humpy portions of the fabric occurring when one of the needles breaks, whereby the points of the fingers engage the humps in the fabric as the fabric-covered conductor is advanced therepast and cause the compression spring to actuate the stopping means when the fingers have been carried a predetermined distance with the fabric-covered conductor.

12. For use in a knitting machine including a knitting head for knitting a plurality of strands into a fabric, means for advancing fabric formed by the knitting head in a predetermined direc-

10

tion from the knitting head as the fabric is formed and means for stopping the knitting machine, a detector for locating imperfections in the fabric comprising a plurality of elongated resilient fingers having points and heels formed thereon, means for holding the fingers in parallel positions in which the heels on the fingers are pressed against the fabric to hold the points on the fingers slightly away from perfect portions of the fabric but in the path of any imperfection occurring in the fabric, means for mounting the fingers for lateral floating movement with the fabric, and means for connecting operatively the fingers and the means for stopping the knitting machine so that the latter means is actuated when the point on one of the fingers engages an imperfection in the fabric.

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#### REFERENCES CITED

The following references are of record in the file of this patent:

#### UNITED STATES PATENTS

Number	Name	Date
2,190,169	Bardsley	Feb. 13, 1940
2,368,686	Sperzel	Feb. 6, 1945