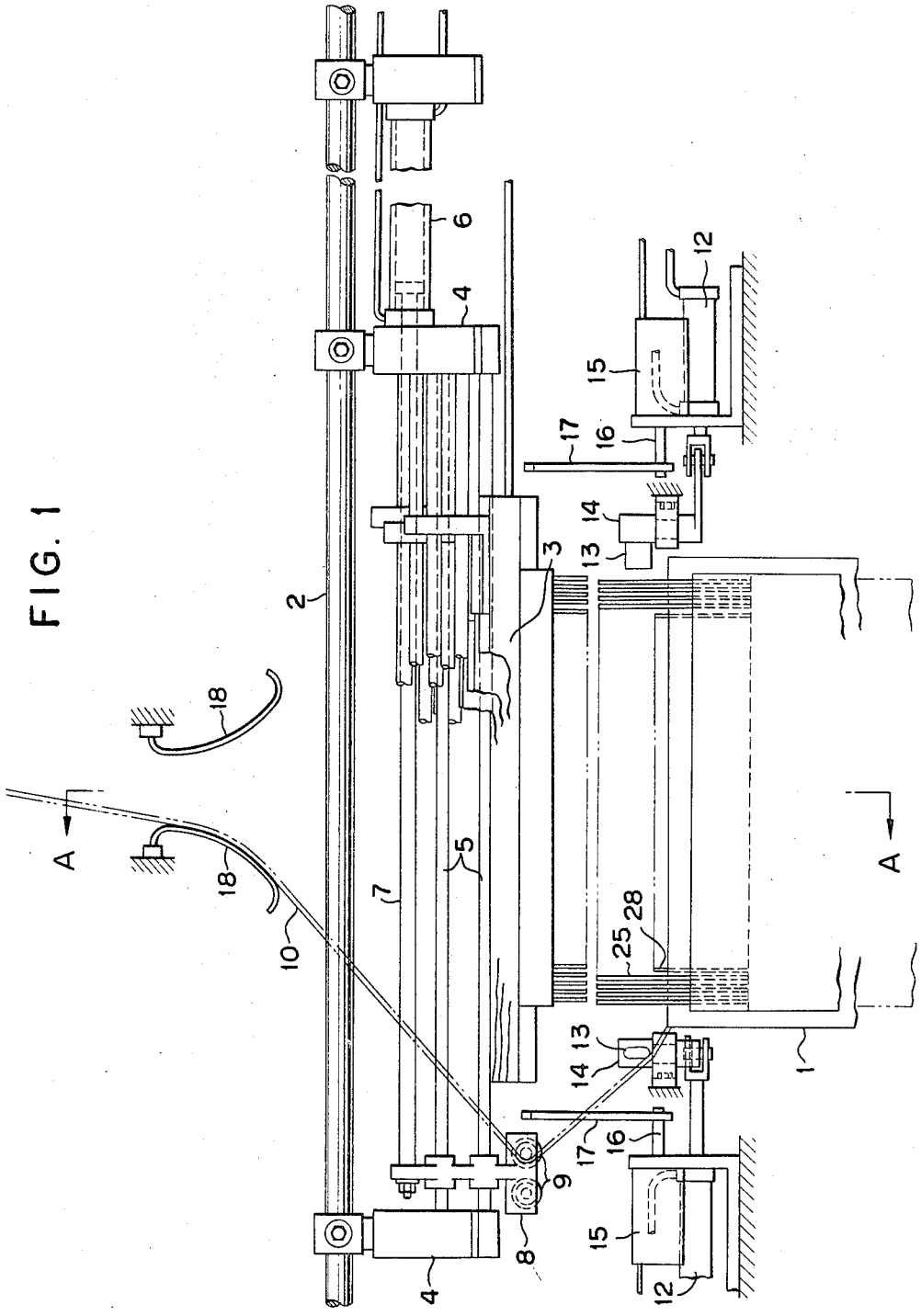
Aug. 11, 1970 TOSHIAKI INUI 3,523,430

HEATING WIRE INSERTING APPARATUS

Filed Feb. 7, 1968 4 Sheets-Sheet 1

FIG. 1



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Aug. 11, 1970 TOSHIAKI INUI 3,523,430

HEATING WIRE INSERTING APPARATUS

Filed Feb. 7, 1968 4 Sheets-Sheet 2

FIG. 2

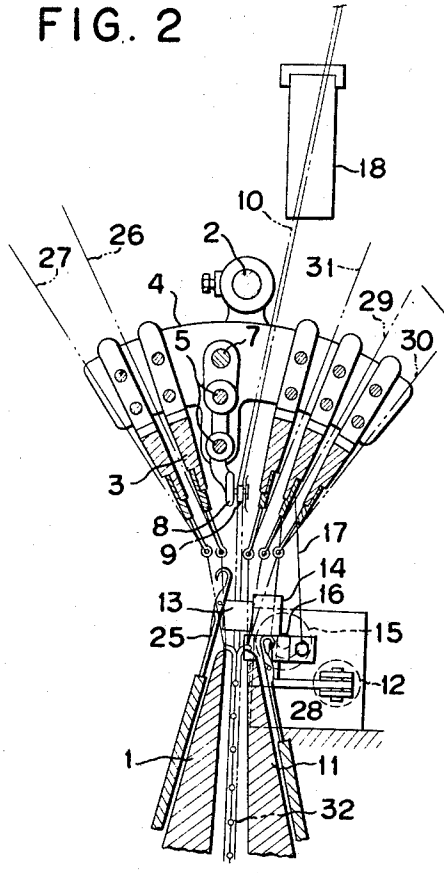
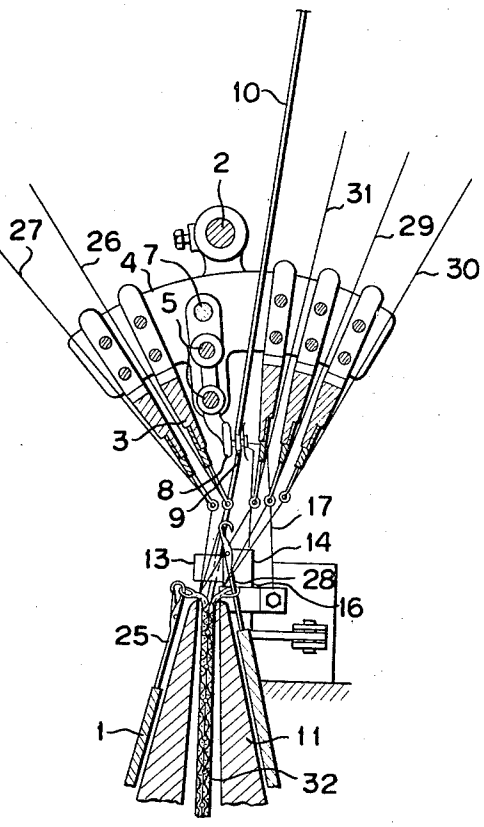


FIG. 3



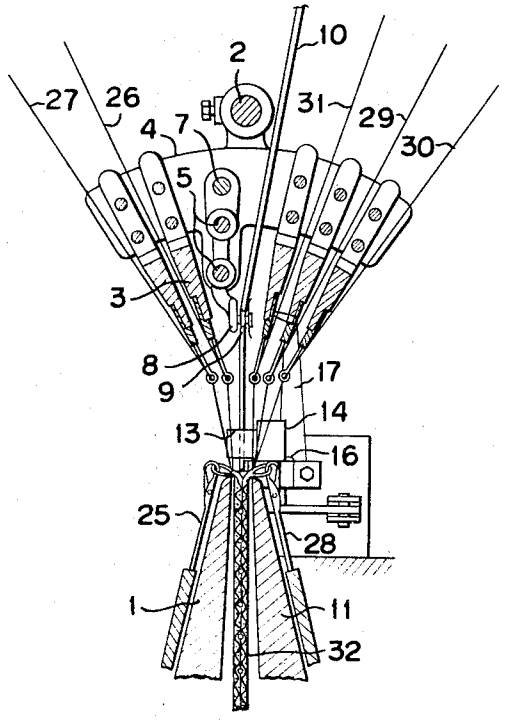


FIG. 4

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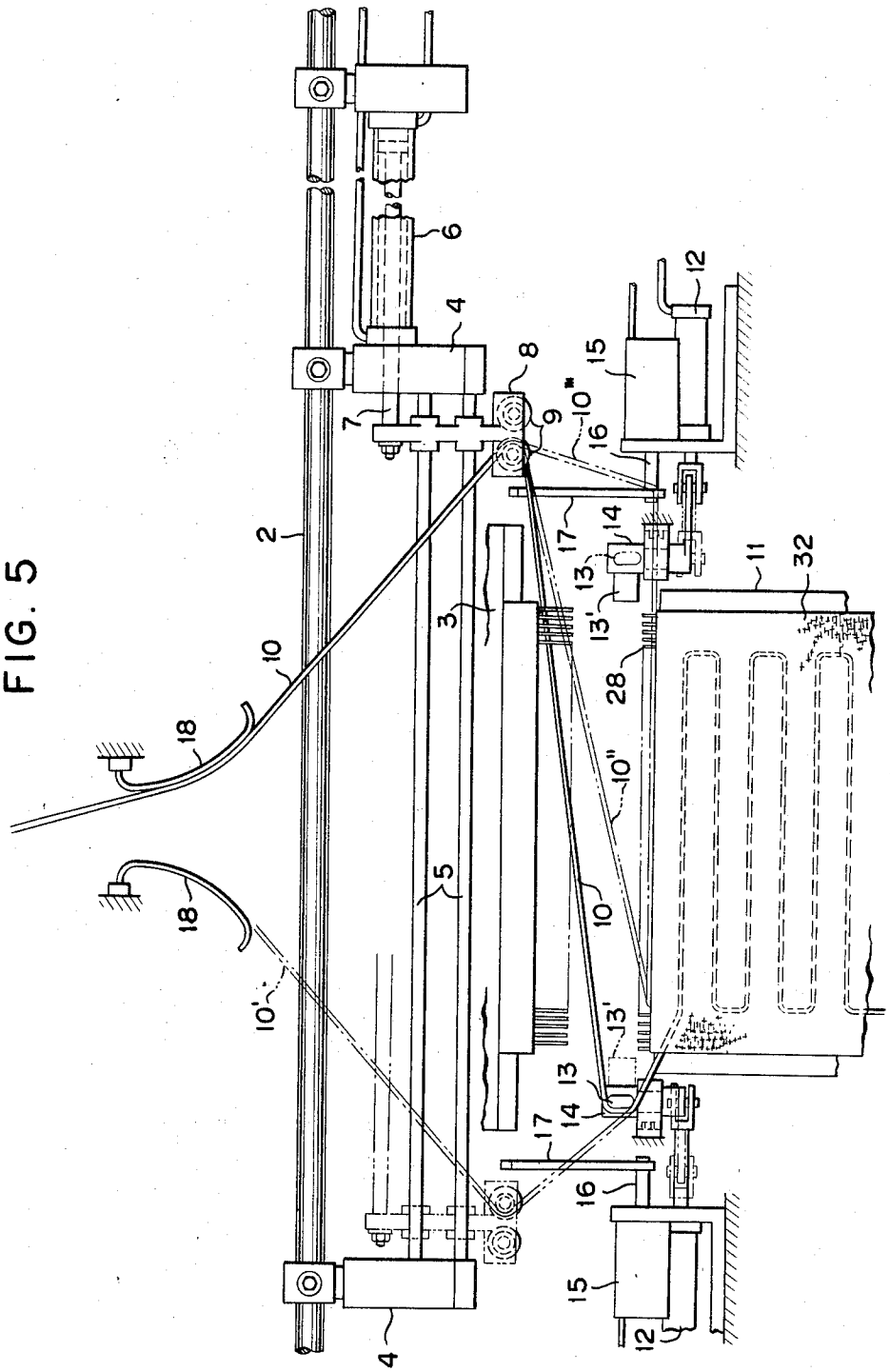
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HEATING WIRE INSERTING APPARATUS

Filed Feb. 7, 1968 4 Sheets-Sheet 3

FIG. 5



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Aug. 11, 1970 TOSHIAKI INUI 3,523,430

HEATING WIRE INSERTING APPARATUS

Filed Feb. 7, 1968 4 Sheets-Sheet 4

FIG. 6

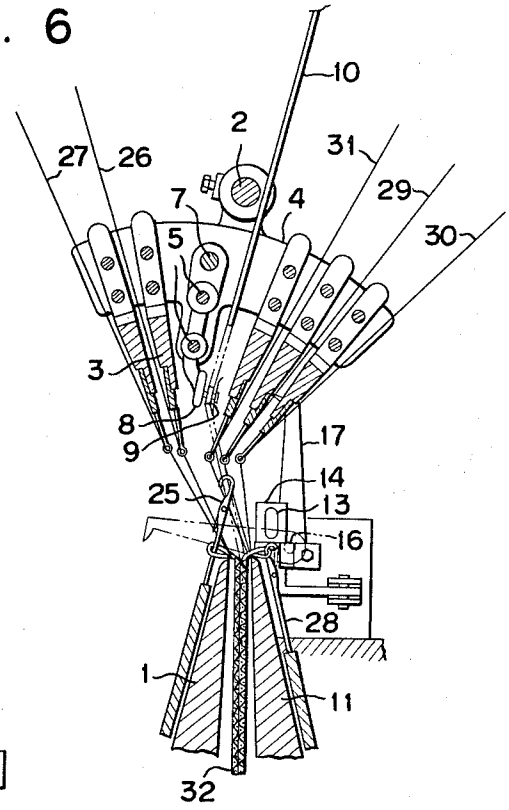


FIG. 7

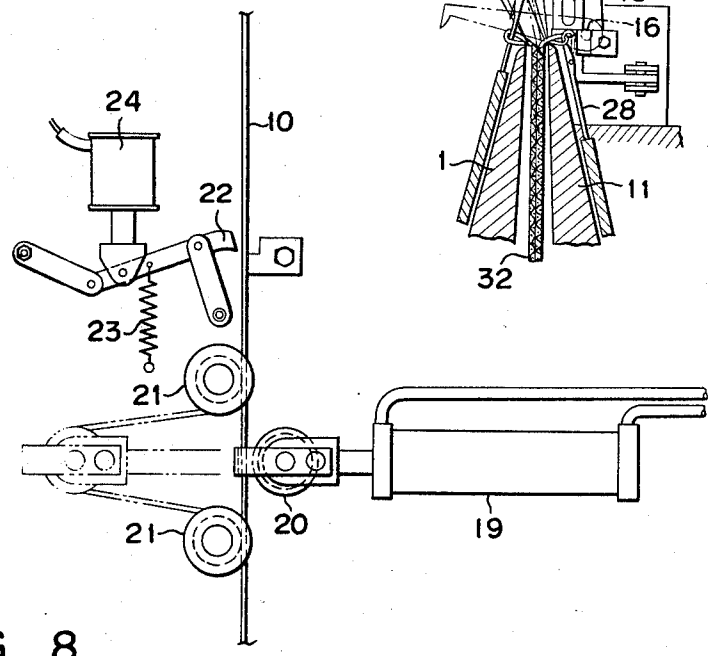
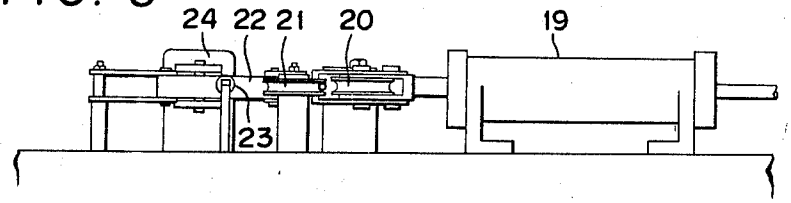


FIG. 8



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United States Patent Office 3,523,430
Patented Aug. 11, 1970

3,523,430

HEATING WIRE INSERTING APPARATUS

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Filed Feb. 7, 1968, Ser. No. 703,736
Int. Cl. D04b 23/12
U.S. Cl. 66—84 3 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for knitting double fabrics with a warp knitting machine together with inserting and knitting bodily the insulatably coated heating wires with one process.

This invention relates to a heating wire inserting apparatus for inserting and integrally knitting insulatively coated heating wires in knitting double fabrics with a warp knitting machine.

A conventional electric blanket is made by arranging and stitching heating wires on a fabric separate from blanket fabrics, inserting the fabric between two blanket fabrics and stitching them on the periphery or by making many lateral pockets between both side fabrics in knitting double fabrics, inserting heating wires longer than the knitted width into said pockets and alternately connecting the ends of the respective heating wires so as to form a heater circuit. Therefore, in the case of the former, the heating wires must be arranged and stitched on a separate fabric and, in the case of the latter, many heating wires must be inserted into the pockets and connected. Therefore, in either case, the operation of forming the heater circuit is complicated, requires much time and further increases the cost of making blankets.

An object of the present invention is to provide an apparatus whereby heating wires can be inserted in knitting at the knitting speed in the warp knitting machine.

Another object of the present invention is to provide an apparatus whereby the knitting of fabrics and the insertion of heating wires can be made in one step.

The present invention is a heating wire inserting apparatus wherein a heating wire fitting device in which guide shaft bars supported at both ends with a rocking rod supporting many guide bars feeding warps and wefts above needle beds of a warp knitting machine are provided with a guide laterally moving as connected with a piston rod of an air cylinder is provided so as to be rockable together with a guide bar group, engaging rods to engage heating wires at the time of the lateral movement of the above mentioned guide outside both ends of a needle bed and to help their fitting are provided rotatably in two directions parallel and perpendicularly to the needle bed by piston rods of air cylinders and a push-in rod to insert heating wires into the knitted parts of the fabrics is fixed to a rotary shaft of a rotary solenoid provided with the axis in parallel with the needle bed so that one long heating wire may be knitted while being inserted at the time of knitting double fabrics.

In the accompanying drawings:

FIG. 1 is an elevation showing an essential part of an embodiment of the present invention;

FIG. 2 is a vertically sectional side view on line A—A in FIG. 1;

FIG. 3 is a vertically sectional side view showing a knitting operation;

FIG. 4 is a vertically sectional side view showing another knitting operation;

FIG. 5 is an elevation of an essential part in the operating state shown in FIG. 4;

FIG. 6 is a vertically sectional side view showing the state just after an electric heating wire is inserted into a knitted part;

FIG. 7 is an elevation of a tension adjusting device and cutting device for heating wires;

FIG. 8 is a plan view of the device shown in FIG. 7.

An embodiment of the present invention shall now be explained with reference to the drawings. A heating wire fitting device is provided in a guide bar group **3** of a rocking rod **2** provided above needle beds **1** and **11** consisting of a pair of front and rear beds of a warp knitting machine and having many guide bars fixed. That is to say, a guide **8** supported with guide shaft bars **5** fixed at both ends with a pair of arms **4** provided on the rocking rod **2** and laterally movable as connected with a driving rod **7** moved by a piston of an air cylinder **6** is supported. A pair of rollers **9** are provided in the lower part of the guide **8** so that a heating wire **10** may be fitted as engaged with said rollers **9**. A heating wire engaging rod **13** driven by an air cylinder **12** is provided opposite the outside of each end of the needle beds **1** and **11**. Said engaging rod **13** is provided to project horizontally on a vertical supporting shaft **14** rotated through 90 degrees by the air cylinder **12** and is provided so as to be perpendicular to the needle bed as shown on the left side of FIG. 1 and to be reversely directed parallel with the needle bed as shown on the right side in FIG. 1. A push-in rod **17** is secured to a shaft **16** rotated through 90 degrees with a rotary solenoid **15** so that the heating wire **10** may be inserted into the knitted part of the fabric. A pair of spring plates **18** provided above the apparatus are to eliminate the relaxation of the heating wire **10**. Further, as shown in FIG. 7, a tension or slack adjusting device for the heating wire is made by providing a tensioning roller **20** moved forward and rearward by an air cylinder **19** oppositely between a pair of guide rollers **21, 21** so that the roller **20** may retreat (to be in the position shown by the solid lines) in case said guide **8** moves laterally and the heating wire **10** is to be fitted but may advance to be in the position shown by the broken lines and to tension the heating wire when the guide **8** stops. The cutting device is to cut the heating wire when it has been knitted in by a required length. A blade rod **22** is of a link mechanism and is provided as pulled by a spring **23** so as to carry out a cutting operation by the operation of a solenoid **24**. The above mentioned tension adjusting device and cutting device can be either directly fitted to the warp knitting machine or separately provided.

Warps **26** and wefts **27** are fed to needles **25** (see FIG. 2) in the front row and warps **29** and wefts **30** are fed to needles **28** in the rear row so as to knit two front and rear fabrics. At the same time, connecting threads **31** for connecting both fabrics are hung alternately on the front row needles **25** and rear row needles **28** (see FIGS. 6 and 3, respectively) so as to knit double fabrics. When a fabric of a required length has been knitted (FIG. 4), while the guide **8** is at the left end and the heating wire is in the position shown in broken lines **10'** as shown in FIG. 5, the air cylinder **6** will be opearted to move the guide **8** rightward. In such case, as the engaging rod **13** on the left side is directed to be perpendicular to the needle bed, the heating wire **10** will be engaged with this engaging rod **13** and, when the guide **8** has reached the right end and has stopped there, the heating wire be fitted diagonally as shown by the solid lines **10**. When the needles **25** or **28** on one side have risen (FIGS. 2, 3) the rotary solenoid **15** on the right side will be energized electrically to bring down the push-in rod **17** on the right side and at the same time the air cylinder **12** will be operated to rotate the engaging rod **13** on the left side as shown by **13'**. Then the heating wire **10** will change to be in the position as shown by **10''**, will be pushed down by the rod **17**, as shown in FIG. 6, into the knitted part (in such case, the engaging rod on the right side will be

in the state shown by 13' and the thread will not hang on it) and will be inserted between the fabrics on both sides. After it is inserted, the fabrics on both sides will be connected together with the connecting thread **31**. Therefore, the heating wire will be laterally fixed in the fabric.

The knitting of the fabric is continued in such state. When the time for inserting the heating wire comes, if the air cylinder **12** is operated to rotate the engaging rod **13'** on the right side so as to be in the state shown by **13** and then the guide **8** is moved leftward, the heating wire **10** will be fitted in the same manner as is mentioned above. Then the rotary solenoid **15** will be operated to rotate the push-in rod **17** on the left side and the heating wire **10** will be pushed down. (In such case the left engaging rod will be in the state shown by **13'** and the thread will not hang on it.)

When the above mentioned operation is repeated and the guide **8** is moved alternately rightward and leftward for each required knitted length so as to insert the heating wire **10**, the wire will be integrally inserted in the fabric in an arrangement of many parallel lines. When the knitting for one blanket ends, the solenoid **24** will be operated to move the blade rod **22** so as to cut the heating wire **10**.

In the apparatus of the present invention, as mentioned above, as the heating wire fitting device operates integrally with the rocking rod supporting the guide bars and the inserting devices to push down the fitted heating wire into the knitted part of the fabric are outside both ends of the needle bed so as not to interfere with the knitting operation, the heating wire can be inserted at the time of the knitting at the knitting speed in an ordinary warp knitting machine. Therefore, as the heating wire is inserted in one step without requiring such separate step as in a conventional machine, the mass-production is possible at a low cost.

What is claimed is:

1. An apparatus, for use in inserting heating wire between two interconnected fabrics as the fabrics are knitted on a warp knitting machine having a support and two needle beds comprising guide shaft bar means supported by said support, a guide for the heating wire supported by said guide shaft bar means, actuating means operable for moving said guide in opposite directions laterally of said fabrics, two opposite engaging rods, each engaging rod being disposed near one side of said needle beds and being rotatable between a first position wherein it is disposed at an angle to said needle beds and engages said heating wire when said guide is moved in opposite directions and, respectively, a second position at an angle to the first position wherein it releases said heating wire, and a push-in rod tiltable between an inactive upright station and an active station at an angle to the inactive station and wherein it emplaces a portion of the heating wire between the fabrics when the heating wire is released by both said engaging rods.

2. An apparatus, as claimed in claim **1**, and a tension device for said heating wire comprising two guide rollers and a tension roller, all of said rollers engaging said heating wire, said tensioning roller being movable, in relation to the movement of said guide, in opposite directions in a path extending between said guide rollers thereby to adjust the slack of the heating wires.

3. An apparatus, as claimed in claim **1**, and a blade rod disposed in the path of said heating wire and being operable to cut the heating wire.

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U.S. Cl. X.R.

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