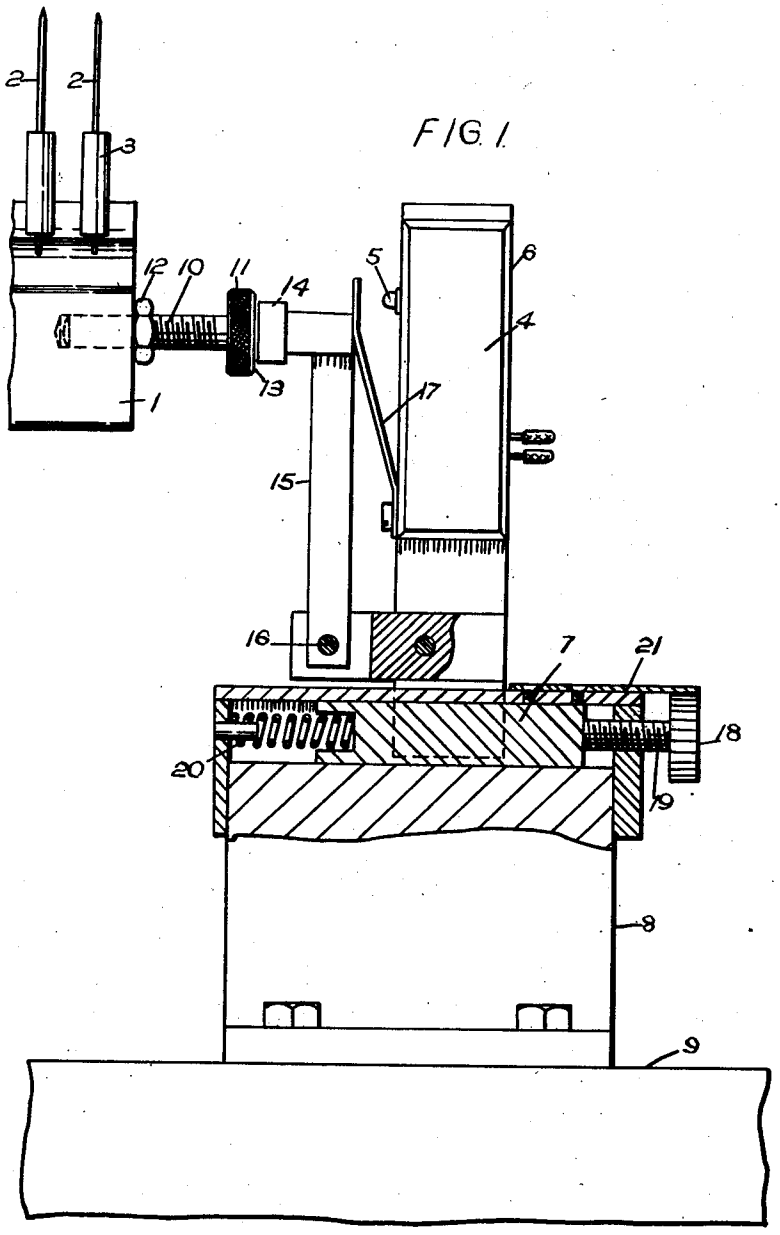
Nov. 18, 1952 R. PEEL ET AL 2,618,138

WARP KNITTING MACHINE AND METHOD OF SETTING THE KNITTING ELEMENTS THEREOF

Filed Nov. 22, 1949 2 SHEETS—SHEET 1

FIG. 1.



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FIG. 2.

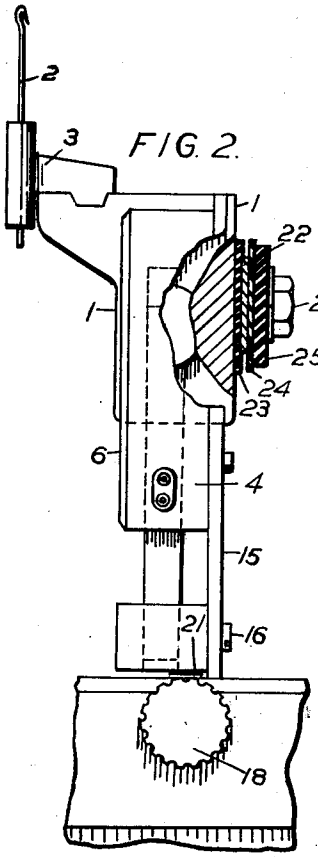
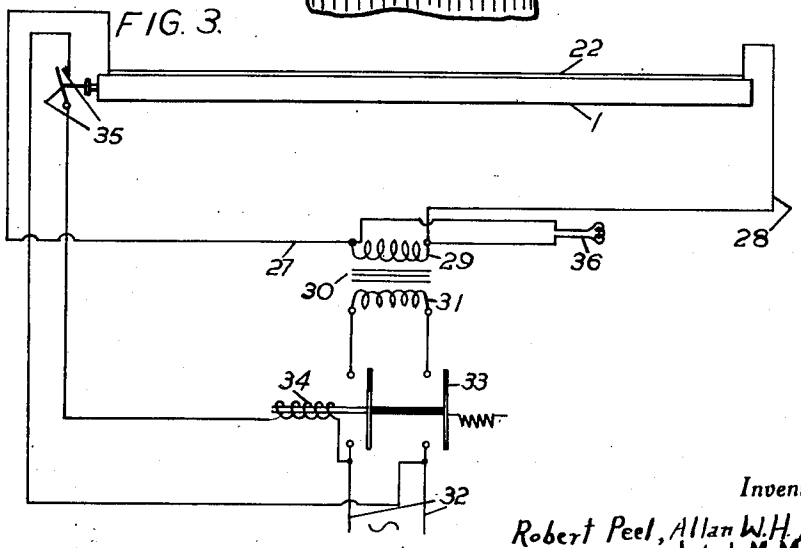


FIG. 3.



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WARP KNITTING MACHINE AND METHOD OF SETTING THE KNITTING ELEMENTS THEREOF

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This invention relates to knitting machines and particularly to the mounting and setting up of the knitting elements such as the needles, the warp guides, the sinkers and similar elements of warp knitting machines.

The main object of the invention is to enable great accuracy to be obtained in the setting of such elements and the accuracy of setting to be maintained during the running of the machine.

It is found that considerable problems arise in knitting machines in which long straight needle bars, sinker and guide bars and the like are employed, due to the differences in the thermal expansion of these bars upon rapid changes in the ambient temperature and also upon the transfer of heat to one or more of such bars from high speed mechanisms in the machine which are provided to operate the bars. Thus, it has been found that in a high speed warping knitting machine in accordance with Patent No. 2,292,287 of R. Peel and J. L. M. Morrison issued August 4, 1942, having bars 84 inches long carrying the knitting elements, after the machine has been running continuously for several hours, the needle bar acquires a temperature approximately 5° C. above that of the other bars of the machine with which it has to co-operate. In general terms, the difference in temperature remains of this order irrespectively of the temperature of the room in which the machine is running. In such an 84 inch machine, it is found that if the plliering and other adjustments of the knitting elements are carried out with all the bars at the same temperature, inaccuracies in the relative settings of the different kinds of knitting elements become apparent when the machine is thoroughly warmed up.

The drawback already explained is overcome in accordance with the present invention, by employing needle bars in which the pliering and other manipulations of the needles have been carried out with the needle bar maintained at a temperature, for example, higher by about 5° C. than that of the other bars during the setting of their knitting elements, these other bars being ordinarily at room temperature during this setting. One result of maintaining the needle bar at such a temperature is that when the bars are fitted in the knitting machine when the machine is cold and the needle bar has settled down to the room temperature, the last mentioned bar is shorter than the remaining bars. However, this is not found to be a serious drawback since after the machine has been running for say half an hour, it becomes warmed up sufficiently to restore the accuracy of gauging sufficiently for the machine to be operable and the parts acquire their steady stable temperature after a further running period of 1½ to 2 hours. In such a case any difficulty due to inaccurate gauging only occurs during running up of the machine from cold, which is only a very small part of its running life. If, however, the invention is not employed and all the bars are pliered at the same temperature, the inaccuracy would exist during most of the life of the machine and, therefore, any benefits which could be derived from the necessarily fine setting of the knitting elements would be lost.

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However, knitting machines having considerably longer bars, for example 168 inches in length, are also used in particular in the United States of America, and then the difficulties due to thermal expansion referred to above become much more serious. This may be realised if it is borne in mind that the length of an 84 inch needle bar only changes by about 0.01 inch upon a change in temperature of 5° C. but, under the same conditions, a needle bar having a length of 168 inches would change in length by nearly 0.02 inch.

These difficulties are overcome by a further feature of the invention which consists in equipping the needle bars so that they can be heated throughout the life of the machine. Heating means applied to the needle bar is arranged to keep the latter at a higher temperature as necessary, for example, 5° C. higher, than the remaining bars such as the warp guide bars, sinker bars and so forth. The needle bar is kept at the higher temperature during the setting up of the needles, during running up of the machine from cold, and during normal running of the machine.

There are, of course, many ways in which such heating may be effected but two convenient ways may be mentioned. Thus, in one embodiment, a heating element in the form of a soft iron strip is supported along the whole length of the needle bar but separated from it by very thin electrical insulating material so that the transfer of the heat from the heating element into the needle bar is facilitated as much as possible. In order to avoid the risk of shocks, a low voltage electrical source is preferably employed such as a transformer capable of giving an output of 50 amperes at 4 volts. In a second method, the needle bar itself may be arranged to serve as a heating element by passing through it a considerably heavier current at a low voltage. Then, of

course, it is necessary to insulate the needle bar from the other parts of the machine in order to avoid short-circuiting of the source of electrical supply.

It will be appreciated that a greater transfer of heat to the needle bar from the heating element is required during the running up of the machine from cold since under steady running conditions, the needle bar will practically maintain its temperature without the aid of the heating element. Thus, automatic regulation is desirable and this may be arranged by employing the needle bar itself as a thermo-element arranged to open electrical contacts when it attains a predetermined length. In fact, the end of the needle bar adjacent the wheels of the pattern motion may be immovably fixed and the opposite end allowed to move freely and its movement employed to control the supply of electrical heating current.

In one method, the free end of the bar may bear a plate with a slit which moves relatively to a slit in another plate secured to the stationary part of the machine. The slits may move into or out of register as the bar expands. The slits are arranged to control a beam of light to a photo-electric cell, the output of which actuates a relay switch controlling the heating current. Such an arrangement is not subject to wear but a simple mechanical arrangement attaining the same end consists in providing a small precision switch which opens its contacts with a snap action due to a dead-centre flat spring having tension and compression elements. Such switches are readily procurable on the market and can open and close their contacts upon a movement of 0.00075 inch. Such a switch is then used to control an electro-magnetic switch in the primary circuit of the transformer which supplies the heating current. Such a switch may be arranged to control only a part of the heating current in order to prevent unduly rapid fluctuations or surges in the length of the needle bar and over-correction. By this means it is entirely practicable to maintain a machine in running order over long periods.

The conditions set out above have been found to apply to warp knitting machines fitted with hooked needles and sliding tongues, but the invention may equally be applied to machines equipped with any other form of needles.

The invention will now be more fully explained by describing one embodiment thereof by way of example with reference to the annexed drawings, in which:

Figure 1 is a diagrammatic side elevation showing the mechanism applied to the free end of a needle bar in accordance with the invention and showing the adjusting slide for the precision switch in section;

Figure 2 is an end elevation seen from the right of Figure 1 with the heating element shown in section; and

Figure 3 is a circuit diagram.

Referring to Figures 1 and 2, the free end of the needle bar 1 is shown, that is to say, the end remote from the wheels of the pattern motion. The bar is immovably fixed at the end adjacent to the pattern motion so that the end seen in the drawing is free to move to the right in Figure 1 as the temperature of the bar is increased. In the embodiment illustrated as an example, the needles 2 are hooked needles with tongues to close the hooks slidably mounted in the shanks of the needles; the needles are embedded in the needle leads 3. The precision switch 4 which is employed is of conventional form, the actuator member 5 protruding from the switch housing 6. The switch is mounted on a slide block 7 itself slidably mounted in a block 8 rigidly bolted to the bed 9 of the machine.

A threaded stem 10 is threaded into the end of the needle bar 1 and its exact position is set by an adjusting knob 11 and then the stem 10 is locked by a lock nut 12. The face 13 of the adjusting knob 11 is hardened and ground perfectly flat in a plane at right angles to the axis of the threaded stem 10. It is important that the stem 10 is secured in the needle bar 1 so that the face 13 remains at right angles to the direction of movement of the needle bar 1. A hardened block 14 is carried at the upper end of an arm 15 pivoted at 16 on the support of the precision switch 4. The block 14 is pressed against the face 13 of the adjusting knob 11 by means of a leaf spring 17 so as to provide a good area of contact between the knob 11 and the block 14 in order to reduce wear to a minimum since this has to withstand the continuous reciprocation of the needle bar 1 which in a high speed machine occurs at 1000 times a minute.

As the needle bar 1 is heated and expands, it presses the block 14 and leaf spring 17 to the right in Figure 1 until the desired amount of expansion has occurred in order to bring the needles 2 into their operating positions. Then the spring 17 engages the switch actuator 5 and opens the switch contacts. In order to enable the switch 4 and its support 7 and, consequently, the block 14 to be accurately adjusted in a direction parallel to the axis of the stem 10, the slide 7 is adjusted by an adjusting wheel 18 with a notched periphery as seen in Figure 2. The slide 7 is held in contact with the threaded stem 19 of the wheel 18 by a compression spring 20 mounted in the slide housing. When the position of the switch 4 and the block 14 has been adjusted by manipulation of the wheel 18, the parts are retained in the adjusted position by a spring plate 21 which bears on the periphery of the wheel 18. The stem 19 may be threaded to a pitch of 40 to the inch to allow a fine adjustment of the clearance between the face 13 and the block 14 when the needle bar is cold.

In this embodiment, the needle bar 1 is heated by an element consisting of a flat iron strip 22 about ½" wide and 0.03" thick insulated from the needle bar 1 by a thin mica strip 23 and covered by another strip 24. Outside the strip 24 are wooden strips 25 serving to hold the element 22 in place and to lag it, and the whole is secured to the needle bar 1 by bolts 26 passing through clearance holes in the element 22 so that the latter is entirely insulated from the needle bar 1.

In the circuit illustrated in Figure 3 the heating element 22 is supplied with alternating current by conductors 27, 28, connected to the secondary winding 29 of a transformer 30. The primary winding 31 of the transformer is fed from alternating current mains 32 through an electro-magnetic switch 33. The winding 34 of the switch 33 is energised through contacts 35 of the precision switch 4 and when the needle bar 1 has expanded to the predetermined amount and the contacts 35 opened, the switch winding 34 which is energised from the alternating current mains 32 has its circuit interrupted and the switch 33 is tripped and cuts off the heating supply to the element 22. An indicating lamp

36 is provided connected across the secondary winding 29 to indicate when heating current is flowing.

We claim:

1. A method of setting the knitting elements of the needle and other element bars of a warp knitting machine which comprises effecting the setting operations of the knitting elements other than the knitting needles at a predetermined temperature, heating the needle bar to a temperature higher than that of said other bars and effecting the setting operations of said needles while maintaining said temperature of said needle bar.

2. In a warp knitting machine, the combination of a needle bar, an electrical heating element mounted in thermal-transfer relationship with said needle bar, a source of electrical supply, switching means for connecting said source of supply to said heating element, and means controlled by the expansion of said needle bar for actuating said switching means.

3. In a warp knitting machine, the combination of a needle bar, an electrical heating element mounted in thermal-transfer relationship with said needle bar, a source of electrical supply, a mechanically-actuated switch mounted for operation by said needle bar upon thermal expansion of same and arranged to control the connection of said source of electrical supply to said heating element.

4. In a warp knitting machine, the combination of a needle bar fixedly secured at one end and free to expand at the other, an electrical heating element mounted in thermal-transfer relationship with said needle bar, a switch actuator adjustably supported on the free end of said needle bar, a precision switch mounted to be engaged by said switch actuator upon expansion of said needle bar, a source of electrical supply and conductors controlled by said precision switch for connecting said source of electrical supply to said heating element.

5. A warp knitting machine, comprising in combination, a needle bar fixedly secured at one end and free to expand at the other, an electrical heating element mounted in thermal-transfer relationship with said needle bar, a switch actuator adjustably supported on the free end of said needle bar, a precision switch mounted on the frame of said machine, an arm pivoted on the frame of said machine, a thrust block carried on said arm and interposed between said switch actuator and said precision switch to be engaged by said switch actuator upon expansion of said needle bar to operate said precision switch, a source of electrical supply and conductors controlled by said precision switch for connecting said source of electrical supply to said heating element.

6. A warp knitting machine according to claim 5, also including a slide carrying said precision switch, said pivoted arm and said thrust block and slidably mounted in the framework of said machine and means for adjusting said slide to move said thrust block, said pivoted arm and said precision switch relatively to said switch actuator.

7. In a warp knitting machine having a needle bar and other cooperating bars, the combination with said needle bar of an electrical heating element mounted in thermo-transfer relationship with said needle bar, means for supplying electrical heating current to said heating element and control means regulating the flow of current to said heating element and thereby maintaining the temperature of said needle bar at a predetermined level above that of said other cooperating bars.

8. A machine as claimed in claim 7 in which said electrical heating element extends along the length of said bar and is electrically insulated therefrom.

9. In a warp knitting machine having a needle bar and other cooperating bars the combination of a needle bar, means for heating said needle bar substantially exclusively to maintain said bar at a predetermined temperature above that of the cooperating bars, and a controller for regulating said heating means.

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JOHN LAMB MURRAY MORRISON.

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