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D. P. MOORE
APPARATUS FOR AND METHODS OF MAKING AN
APPLIQUE KNITTED FABRIC

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2 Sheets-Sheet 1

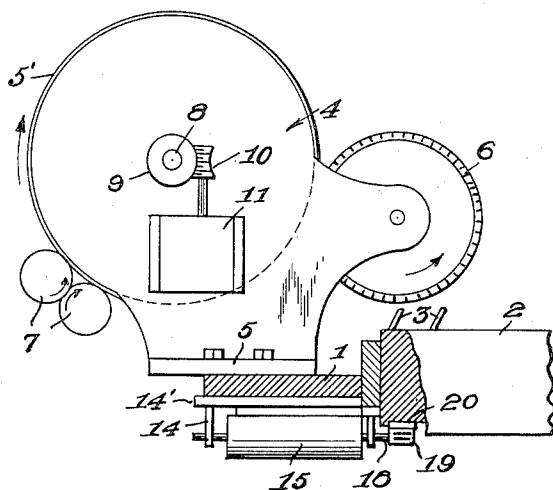


Fig. 1.

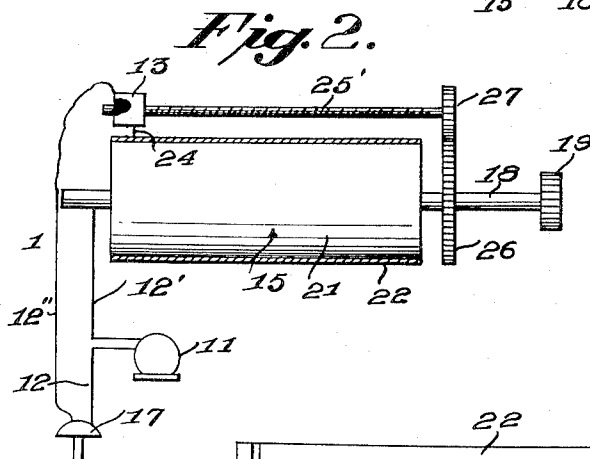


Fig. 2.

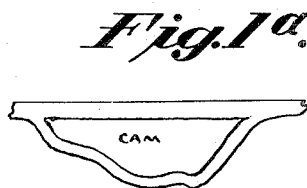
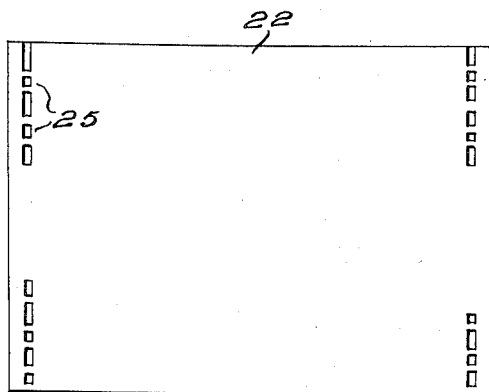


Fig. 1a.

Fig. 3.



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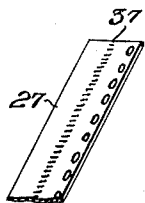
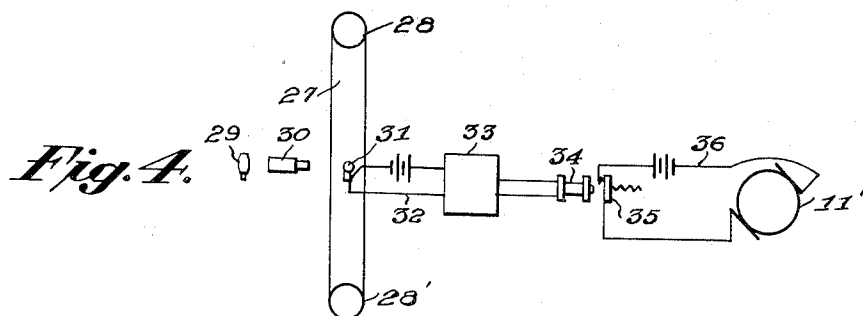


Fig. 5.

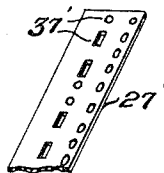


Fig. 6.

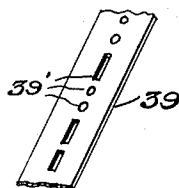
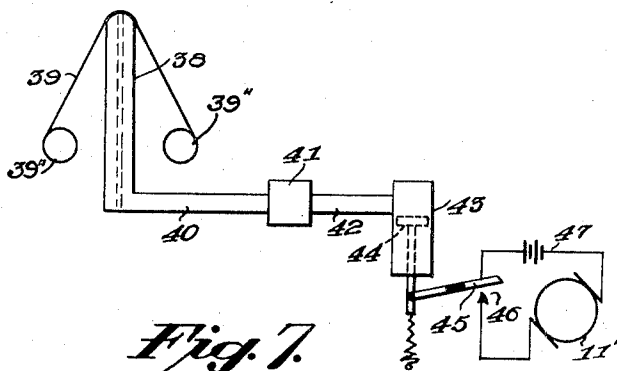


Fig. 8.



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APPARATUS FOR AND METHODS OF MAKING AN APPLIQUE KNITTED FABRIC

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11 Claims. (Cl. 66—9)

The present invention relates to improvements in apparatus for and methods of making an applique knitted fabric, one object of the invention being provision of an apparatus utilizing latch or spring needle rotating cylinder knitting machines, in combination with a fiber feeding machine under jacquard control, so that fibers are fed only to selected needles to produce applique designs upon the knitted base fabric, during the knitting operation.

Another object of the invention is the provision of a method for producing applique knitted fabrics, in which the steps for making the same produce novel effects.

In order that one application of the present invention may be fully understood, and its numerous advantages appreciated, attention is invited to the accompanying drawings, in which:

Figure 1 is a diagrammatic view in side elevation and section of a portion of a rotating cylinder latch needle knitting machine with the fiber feeder and jacquard control.

Figure 1a is a view showing the knitting cam.

Figure 2 is a sectional view through the jacquard cylinder and circuit diagram for the control of the fiber feeder's motor.

Figure 3 is a view of the insulation blank showing the perforations in parts thereof, that constitute the make-and-break that starts and stops the motor and consequently the fiber feeder.

Figure 4 is a diagrammatic view of a continuously operated endless film mechanism for operating the motor of the fiber feeder.

Figure 5 is a view of a portion of the photographic variable density film used with the machine in Fig. 4.

Figure 6 is a similar view of a perforated film used with the machine in Fig. 4.

Figure 7 is a diagrammatic view of a pneumatic machine such as a piano player for actuating a circuit to the motor of the fiber feeder.

Figure 8 is a view of a portion of the perforated strip used in the machine as shown in Fig. 7.

Referring to the drawings, the numeral 1 designates the bed plate of a rotary cylinder latch needle knitting machine, although it is to be understood that spring needle machines may be used.

A rotating needle cylinder 2 carries a fiber feeder 4, having a frame 5 attached to the base plate of the knitting machine, and provided with a main drum 5' and a fiber feeding brush 6, directly adjacent the needles 3, to feed fibers to such needles. The roving or sliver is fed by the two feed rolls 7 to the main drum, and the parts move in the direction of the arrows. Where necessary workers and strippers, not shown, may be used.

A main shaft 8 of the drum, is provided with a gear 9, while a worm 10 driven by a motor 11 that is attached to the frame, is bodily carried by the fiber feeder 4. In this manner, the fiber feeder may be selectively driven, as will presently appear.

One type of apparatus for operating the motor 11 selec-

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tively, and by a novel jacquard means, or pattern device, consists of a device 14, somewhat in the nature of a cylinder sound recording or reproducing device or phonograph. In this instance, its base 14' is secured to the underside of the bed plate 1, so that the device 14 can be operated from the drive gear 20 of the needle cylinder of the knitting machine. In Fig. 2, is shown one type of the electrical circuit to be used, and whereby the pattern controller device 14 is operated. This device consists of a main metal cylinder 21, which is rotated by a shaft 18, as in phonographs, and so that the gear 19 driven from the needle cylinder is rotated thereby. Removably mounted, as a cylindrical sound record of a phonograph, is a sheet 22, which in turn is provided with spirally arranged stylus receiving perforations 25, which at selected places, exposes the surface of the metal cylinder 21. By this means, as the shaft 18 is rotated, a gear 24 transmits motion to a feed screw 25', through a gear 27, as in a phonograph. As a carriage 13 is mounted upon the feed screw to be moved to the right, as shown, a stylus 24, which as it rides upon the surface of the insulation sheet 22, acts as a circuit closer and opener, that is when it contacts through a perforation of the sheet the metal cylinder 21, a circuit is closed to the motor 11, for a period in accordance with the length of the respective perforation.

The circuit here shown, for operating the motor 11, consists of a plug 17, from which a conductor 12 is led to one side of the motor 11. A conductor 12' leads from the motor to the metal cylinder 21, so that as and when a perforation is entered by the stylus, the circuit continues from such stylus and its supporting shell of the carriage 13, and back to the plug by conductor 12'', which latter is inserted in an electric outlet in the usual manner.

Thus this device 15 is in the nature of a modified jacquard device, and therefor by this arrangement, the basic yarn in the knitting machine is made into a jersey web, and will be interspersed upon its body with such selected designs, that originate with and from the perforated sheet 22.

It will thus be evident that with this novel arrangement of cylinder controlling device or machine, that the design to be imparted to the knitted fabric as it is being knitted by the knitting machine, is first cut in the plastic tubular sheet 22, and then attached to the cylinder 15, so that the main cylinder and this arrangement constitutes a modified jacquard, which in itself may be usable with looms, in lieu of the heavy cards now employed, as the respective heddles of a loom can be controlled from electric circuits established by this device.

Where this jacquard is employed with stationary knitting machines, the fiber feeder is located at a point where the design is to be formed, and just prior to the yarn being placed in the needle, the fiber feeder being operated to insert the fibers in the quantity and the number of needles desired in accordance to the applique design desired.

What is broadly the idea of this invention, is the use of a new type of jacquard mechanism, a type of pattern device, that will control the selective operation of a fiber feeder, so that the fiber feeder feeds fibers only to predetermined selected needles, to produce plush-like applique designs to be formed on a knitted web and to be bodily carried by the fabric, all being accomplished during the knitting operation.

In Figs. 4, 5 and 6, a continuously operated endless film 27, is operated through the rollers 28—28', one of which is motor driven or driven from the knitting machine cylinder. This film, as shown in Fig. 5, is a photographic film, having thereon the developed variable density track 37, which when passed between an exciter lamp 29, and its optical system 30, causes the light rays to act upon

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a photo-electric cell 31, which in turns controls a circuit to operate the motor 11'. This cell 31 is in a circuit 32, including a photo-electric cell amplifier 33, whose output varies the operation of the electro-magnet 34, which in turn causes a spring returned switch 35 to open and close a circuit 36 to the motor 11', similar to the motor 11 of Fig. 1. In this manner, the sound track formed, in accordance with the design to be applied, is transferred through the fiber feeder 4 to the knitting needles.

As shown in Fig. 6, the film 27' is provided with perforations 37', which when the film is passed continuously between the exciter lamp and its optical system and the cell 31, operates in a similar manner to the variable density film with sound reproducing equipment, but when perforations 37' are used, needs no photographing development.

As shown in Figs. 7 and 8, a standard 38, similar to the suction head used in piano players, is provided, and over this standard is passed a strip 39 having perforations 39', which act as suction openings, as in a piano player, so that air drawn by a vacuum device 41, will draw air through the perforations 39', which may be dots and dashes or either, one at a time, from and through the standard 38 and the tube 40, suction means 41 and the tube 42, to depress the spring returned plunger 44, in a cylinder 43, to throw a switch 45, normally held open by the spring returned plunger. This switch will then contact a point 46, and close a circuit 47 to a motor 11'', which motor is similar to the motor 11 of the fiber feeder 4. Thus the fiber feeder will be operated to feed fibers from its drum to the needles of the knitting machine, the actuator rollers 39'', being operated by or from the knitting cylinder.

It will therefore be seen that the cylinder device of Figs. 1-3, the photo-electric cell or "electric eye," as in Figs. 4-6, and the pneumatic device in Figs. 7 and 8, the main mechanisms of which are driven in synchrony with the knitting machine, will so actuate the fiber feeder 4 as to reproduce patterns or designs, as in applique, upon a jersey type knitted fabric.

Although one fiber feeder has been shown and described, it is possible with this arrangement to simultaneously operate a plurality of these fiber feeders, one to each knitting station or cam, that is where from four to six are used on a single knitting machine. Also, by driving the selector jacquard cylinder 21 at a distant point in synchrony with a number of knitting machines, many fiber feeders producing the same design can be employed. That is, the cylinder 15 and the stylus operator, or the endless tape or film carrying the design indications can be operated by a single motor that is in synchrony with the speed of the several knitting cylinders, or the heddle actuators of looms, and through its switch control, set in motion, or stop, the various motors of the fiber feeders or heddles, just so long as the knitting machines or looms are in operation. Should one machine or loom stop for some abnormal condition, all would stop, and when such abnormal condition was brought back to normal, all can then be started.

What is claimed is:

1. A method of making an applique knitted fabric, which consists in feeding basic yarn into the needles of a knitting machine during the knitting operation to make a jersey type fabric, and while so knitting jacquard-control feeding of short loose fibers to selected needles during the knitting operation to knit in with the basic yarn scattered plush designs.

2. A knitting apparatus for making applique knitted fabrics, including in combination, a knitting machine having a rotatable needle cylinder, needles carried thereby, a fiber feeder for feeding short loose fibers into the needles during the knitting operation, a motor for operating the fiber feeder, an electrical circuit including said motor, and a jacquard circuit controller in said circuit and operated

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in a synchrony with the knitting machine for selectively cutting in and out the motor of the fiber feeder.

3. A knitting apparatus for making applique knitted fabrics, as claimed in claim 2, wherein the jacquard circuit controller is a device having a screw-fed stylus and a grooved rotatable member in which the screw-fed stylus forms the circuit closer and a perforated sheet of insulation forms the opener for the circuit.

4. A knitting apparatus for making applique knitted fabrics, as claimed in claim 2, wherein the knitting machine is a rotatable cylinder latch needle machine.

5. A knitting apparatus for making applique knitted fabrics, as claimed in claim 2, wherein the knitting machine is a rotatable cylinder latch needle machine, and the jacquard circuit controller is operated from the cylinder thereof.

6. A knitting apparatus for making applique knitted fabrics, as claimed in claim 2, wherein the jacquard circuit controller comprises a base, a main metal cylinder journaled thereto, a sheet of insulation covering the cylinder and provided with selected apertures therethrough to expose the surface of the cylinder thereat, a stylus operatably associated with the cylinder and riding upon the sheet of insulation and acting with the cylinder as a circuit closer to the motor of the fiber feeder, and means for driving the jacquard circuit controller from the knitting machine.

7. A knitting apparatus for making applique knitted fabrics, including in combination, a rotatable cylinder knitting machine, a needle cylinder having a gear, a fiber feeder associated with the knitting machine for feeding short loose fibers to the needles of the knitting machine, an electric motor for driving the fiber feeder, a selectively operated switch for selectively operating the motor of the fiber feeder, and means for controlling the operation of the switch in synchrony with the rotatable cylinder of the knitting machine.

8. A knitting apparatus for making applique knitted fabrics, as claimed in claim 7, wherein the selectively operated switch includes a base, a screw fed shaft and main metal cylinder operated in synchrony with the rotatable cylinder of the knitting machine, a sheet of insulation provided with jacquard perforations mounted upon the metal cylinder, and the surface of such cylinder being exposed through the perforations, a carriage mounted upon the feed-screw shaft for movement longitudinally of the metal cylinder and the perforated sheet, a stylus carried by the carriage and having its free end engaging the sheet and through the perforations the metal cylinder and thereby acting as a selective circuit closer, a source of electrical energy, and a circuit including said source, the motor of the fiber feeder, said stylus and the metal cylinder.

9. A knitting apparatus for making applique knitted fabrics, including in combination, a knitting machine, a needle cylinder carried thereby, needles carried by said cylinder to form stitches, a fiber feeding machine for feeding fibers into the hooks of the needles, an electric motor for operating the fiber feeding machine, a switch for controlling the motor, and mechanism for actuating such switch in accordance to a design pattern, such design pattern being in the form of an endless tape carrying switch control means, whereby the switch to the motor is opened and closed to cause the fiber feeding machine to feed fibers in selected quantities to selected needles.

10. A knitting apparatus for making applique knitted fabrics, including in combination, a knitting machine having a rotatable needle cylinder, needles carried thereby, a fiber feeder for feeding short loose fibers into the needles during the knitting operation, a motor for operating the fiber feeder, an electrical circuit including said motor, and a jacquard circuit controller in said circuit and operated in synchrony with the knitting machine for selectively cutting in and out the motor of the fiber feeder, said jacquard circuit controller including a photo-electric cell, and a photo-electric cell circuit including such cell, an

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exciter lamp, a source of electrical energy, an amplifier, and circuit controller means for the motor, and an endless photographic film carrying variable density portions caused by the design effect to be transmitted to the fabric, and means for moving said film between the exciter lamp and the photo electric cell, whereby variations in the density of the film actuate the motor to cause the selective operation of the fiber feeder.

11. A knitting apparatus for making an applique knitted fabric, including in combination, a rotary cylinder knitting machine, needles carried by the cylinder thereof, a fiber feeder mounted to feed fibers to the needles during the knitting operation, a motor to drive the fiber feeder, and a fiber feeder motor control means actuated by the cylinder of the knitting machine, and including a standard having a single passage therethrough, means for passing air through said passage, means for controlling the air

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passage including a perforated tape that is moved over the mouth of the passage of the standard, means controlled by the intermittently affected air, a switch controlled by the last means to be opened and closed, and a circuit including a source of electrical energy, said switch and the motor of the fiber feeder, whereby the fiber feeder is halted or operated in accordance with the perforations of the tape.

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