

April 11, 1944.

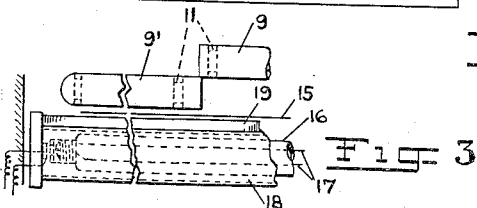
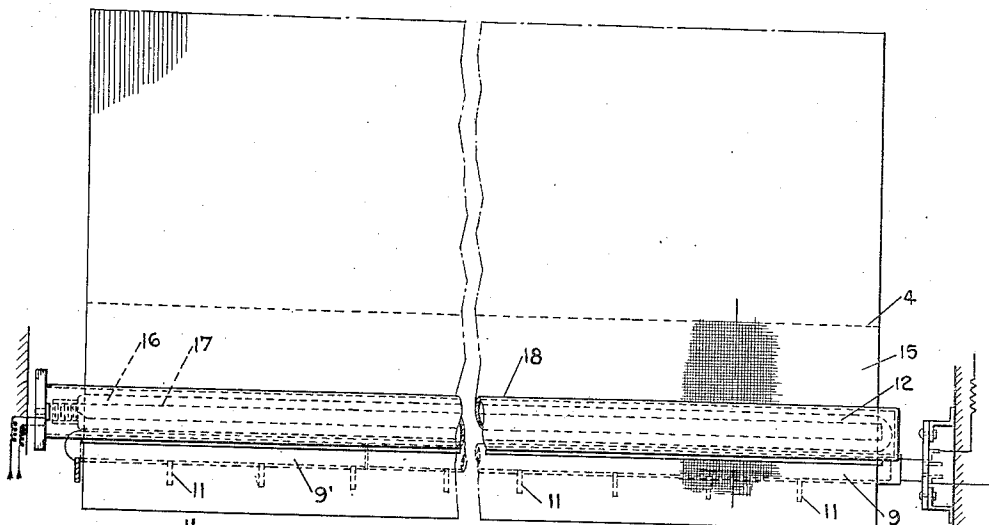
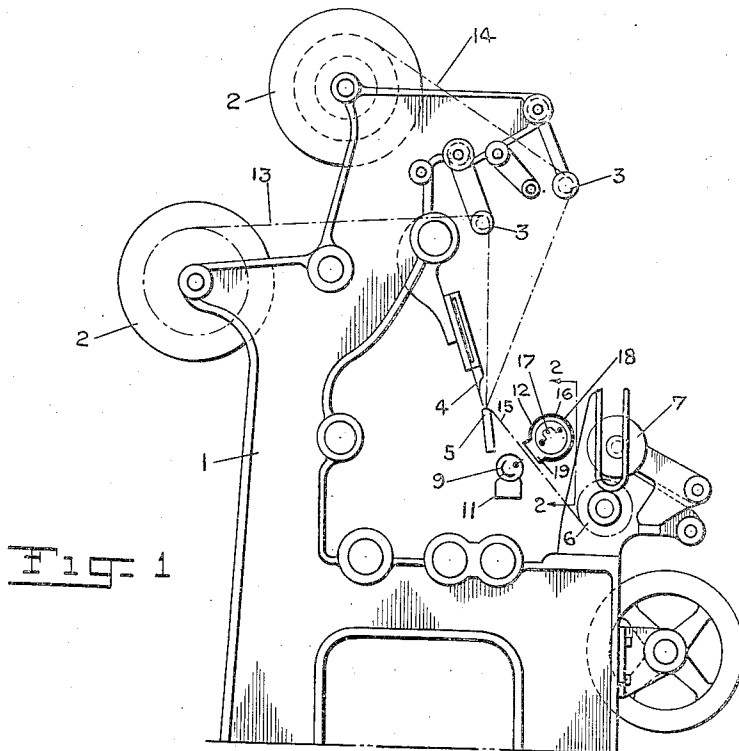
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2,346,240

STOP MOTION FOR KNITTING MACHINES AND THE LIKE

Filed March 23, 1943

2 Sheets-Sheet 1



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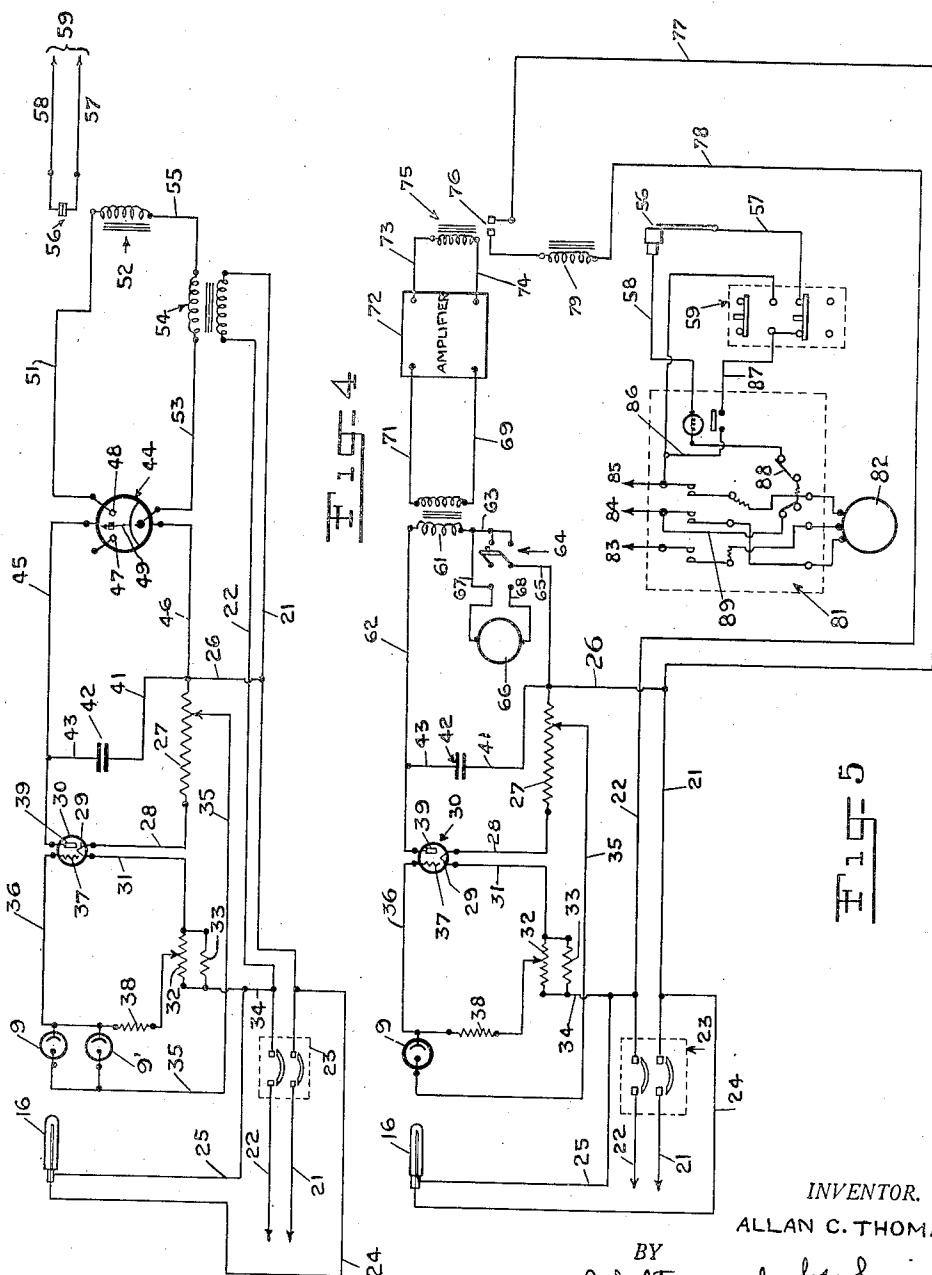
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STOP MOTION FOR KNITTING MACHINES AND THE LIKE

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,346,240

STOP MOTION FOR KNITTING MACHINES
AND THE LIKEAllan Clair Thomas, Cumberland, Md., assignor
to Celanese Corporation of America, a cor-
poration of Delaware

Application March 23, 1943, Serial No. 480,138

10 Claims. (Cl. 66—166)

This invention relates to stop motions for knitting machines and the like, and relates more particularly to stop or detector motions for use on warp knitting machines.

An important object of this invention is the provision of improved means for automatically detecting broken threads or similar defects in the fabric being formed on knitting machines and which causes stoppage of the machine or gives warning of the defect.

Another object of this invention is to provide a stop or detector motion which operates immediately upon the occurrence of a broken thread or other flaw in the fabric being formed.

A further object of this invention is to provide a photo-electric cell structure, in a stop or detector motion for a knitting machine, which is stationary with respect to the frame of said machine.

Other objects of this invention, together with certain details of construction and combinations of parts, will appear from the following detailed description and claims.

Stop or detector motions for knitting and weaving machines are known and universally employed. These usually consist of electrical contacts made by metallic droppers or other elements that normally are supported by the thread. In Patent No. 2,290,257 to Stanley and Edwards, there is described a stop or detector motion which employs a photo-electric cell and light source that travels back and forth across the fabric and which examines a single spot of fabric at a time. While this device was an improvement over prior stop motions, it suffered from the same difficulty in that in both types a number of stitches could be knitted or a number of weft yarns laid before the break was detected and the signal given or machine stopped, resulting in several inches of imperfect fabric. Moreover, a transverse moving photo-electric cell stop motion cannot be employed in forming a fabric having several warps of heavy yarn alternating with several warps of fine yarn since the photo-electric cell could not detect the difference between an open stitch and mere passage from the heavy warp to the fine warp. The present invention scans the entire width or a substantial width of fabric at one time and is responsive to an over-all change of transmitted light over the entire width of the fabric. This permits of the use of the device with warps having alternate types of warp yarns such as heavy and fine denier, bright and pigmented yarns,

colorless and colored yarns or combinations of these.

In accordance with my invention, I construct a stop or detector motion, for warp knitting machines, looms, fabric inspection tables, etc., having substantial width and including a source of light adapted to act on a photo-electric cell in such a manner that the increase or decrease of light, transmitted to the photo-electric cell by a missing yarn or a double yarn in the fabric, is amplified in one modification and moves a contact microammeter in another modification to operate a switch controlling the main drive or to operate a visible or audible signal to the machine operator. The device of my invention does not, of course, prevent breaks in the fabric but it will keep the breaks to small size and confine the defect to a small area. The dropped stitches can be worked in by hand, preventing a degrading of the fabric. The device also offers a considerable economy due to the larger number of machines that can be handled by a single operator.

An important advantage of this device is that it can be used on any type of fabric, including mesh fabrics, drop stitch fabrics, figured fabrics, ribbed fabrics, etc. The photo-electric cell of the stop motion has merely to be set to the amount of light coming through the particular fabric being manufactured or inspected, so that a slight additional amount of light, such as would be caused by a broken end in the fabric, will cause the stop motion to become operative.

Referring now to the drawings for a detailed description of this invention.

Fig. 1 is a somewhat diagrammatic view, in side elevation, of a warp knitting machine showing the relation thereto of the light and photo-electric cell,

Fig. 2 is an enlarged detail view taken on the line 2—2 of Fig. 1,

Fig. 3 is a detailed view of a modified form of photo-electric cell structure,

Fig. 4 is a wiring diagram of the electric circuit employing a combined microammeter and switch contact, and

Fig. 5 is a wiring diagram of the electric circuit employing amplifier tubes and milliammeter relay.

Like reference numerals indicate like parts throughout the several views of the drawings.

In Fig. 1 there is shown the frame 1 of a warp knitting machine on which may be supported one or a plurality of warp beams 2, guide rollers 3 for bringing the warps to the needles 4 and

sinkers 5 and rollers 6 and 7 for taking up the finished fabric. Many parts of the machine have been eliminated from the drawings for the sake of clarity, and it is to be understood that the device of my invention may be applied to apparatus other than warp knitting machines. Fig. 1 shows the relation of the photo-electric cell 9, its supports or brackets 11 and source of light 12 to the fabric being formed. Thus, warps 13 and 14 are brought from warp beams 2 over guides 3 to the needles 4 where they are knitting into a fabric 15 that immediately passes between the source of light 12 and the photo-electric cell 9 to the fabric take-up rolls 6 and 7. The photo-electric cell 9 may be connected with the amplification and operating circuits, described below, by suitable connecting wires and these circuits may be conveniently located in a cabinet at one end of the machine, however, single stage amplifiers may be inserted in the circuit at various points across the width of the machine to compensate for current losses or line drop.

Fig. 2 shows, on an enlarged scale, the position of the stop-motion with respect to the fabric. In this view the warp yarns 14 pass to the needles 4 where they are formed into a fabric 15 which passes between the source of light 12 and the photo-electric cell 9 supported by brackets 11. The source of light may be a fluorescent bulb 16 or other type of bulb containing filaments 17. The bulb is covered by a reflector 18 having a slotted opening 19 directed toward the fabric. Where the fabric is not too wide a single photo-electric cell 9 may be employed. However, on wider fabrics a number of cells 9 and 9' placed end-to-end, or placed in a staggered relation as shown in Fig. 3, may be employed. Whether the cells are placed end-to-end or staggered depends somewhat on the fineness of the yarns being knitted and on the particular type of electric connections employed on the cells. It is immaterial if the cells overlap as the whole bank of cells is set as one unit, as will appear from a description of Figs. 4 and 5.

Figs. 4 and 5 show alternative circuits for supplying current to the bulb and photo-electric cell in conjunction with means for intensifying the small variation of current occurring when the resistance of the photo-electric cell varies in response to a change in light intensity, so that it may be employed for stopping the machine or give the required signal. Referring particularly to Fig. 4, wherein a combined micro-ammeter and switch is employed, reference numerals 21 and 22 indicate alternating current supply lines, say, from a 115-volt city line which lead into a regular 25-ampere circuit breaker or fuse box generally indicated by reference numeral 23. Bulb 16 is connected to the output side of circuit breaker 23 by conductors 24 and 25.

A conductor 26 connects supply line 21 to one end of a variable resistance coil 27 and a conductor 28 connects the other end of coil 27 to the filament 29 of an amplifier tube 30. The other end of filament 29 is connected by means of conductor 31 to a variable resistor 32 and a constant resistor 33, which are connected in parallel to a conductor 34 leading back to the supply line 22. A conductor 35 joins the variable resistance coil 27 to the variable side of photo-electric cell 9. In this modification a plurality of photo-electric cells 9 and 9', which are con-

nected in parallel between conductors 35 and 36, are shown. One end of the conductor 36 is connected to the grid 37 of the amplifier tube 30, and the other end thereof is connected to high resistance resistor 38 which in turn is connected to the variable side of the variable resistor 32. Plate 39 of the amplifier tube 30 is charged through a circuit comprising a conductor 41 leading to a condenser 42 which is connected to the plate by conductor 43.

A combined micro-ammeter and switch 44 is located in a circuit shunted by leads 45 and 46, around condenser 42. The micro-ammeter 44 is provided with movable contacts 47 and 48 which with needle 49 act as a switch. Either one, or both, of the contacts 47 and 48 may be connected to a conductor leading to power relay or solenoid 52. The needle 49 is connected to a conductor 53 that leads to a secondary terminal of a transformer 54, the other secondary terminal being connected by a conductor 55 to the power relay 52, thus completing the secondary circuit of transformer 54. The transformer 54 has a primary circuit directly connected to supply lines 21 and 22. When the needle 49 closes the secondary circuit of the transformer, it operates the power relay 52 to open contacts 56 connected by conductors 57 and 58 to a signal or to a holding coil circuit of a magnetic switch generally indicated at 59 in Fig. 5.

The embodiment of the invention shown in Fig. 5 employs a one, two or more stages of amplification in place of the micro-ammeter switch 44. Just as in the modification shown in Fig. 4 supply lines 21 and 22 pass through a circuit breaker 23, to which conductors 24 and 25 are led to form a circuit for the light bulb 16. Conductor 26 connects variable resistance coil 27 with the supply line 21, while conductor 28 is led from the constant pole of the coil 27 to the filament 29 of an amplifier tube 30, the other contact of the filament 29 being connected to conductor 31 which, in turn, is connected to the variable resistor 32 and the constant resistor 33 connected in parallel between the conductors 31 and 34 leading back to the supply line 22, thus forming the filament circuit of the amplifier tube. Conductor 35 attached to the variable pole of the variable condenser 27 leads to the photo-electric cell 9 with the other contact of cell 9 attached to conductor 36 that leads to the grid 37 of the amplifier tube 30. Connected in parallel with the photo-electric cell 9 is high resistance resistor 38 which ties into the circuit at the variable pole of the variable resistor 32. Plate 39 of amplifier tube 30 is connected to supply line 21 to be charged thereby by means of conductor 41 leading to condenser 42 to which is joined conductor 43 leading to plate 39. Conductors 31 and 34 lead back to supply line 22 thus completing the plate circuit.

The modification shown in Fig. 5 differs from that shown in Fig. 4 in the following features. Connected in parallel with the condenser 42 is a primary circuit of an inductance coil 61, which circuit is formed by a conductor 62 connecting conductor 43 with coil 61 and conductor 63 passing through a double-action switch 64 to a conductor 64 leading back to conductor 41. An ammeter 66 is connected by conductors 67 and 68 to switch 64, so that in setting the circuits for a particular fabric the amperage in the primary circuit of the coil 61 may be measured. The secondary circuit of coil 61 comprises conductors

69 and 71 leading to the input side of a single or multiple stage amplifier 72. The amplified circuit is carried by conductors 73 and 74 to a sensitive relay 75 that may be of any suitable type, such as a closed iron coil or solenoid, capable of operating a contact switch 76, in a circuit comprising conductors 77 and 78 that are continuations of supply lines 21 and 22, and a power relay 79 that opens contacts 56 of the magnetic switch 59.

As shown in the embodiment diagrammed in Fig. 5, the contacts 56 through conductors 57 and 58 control a magnetic starter generally indicated by reference numeral 81 of a three-phase motor 82 that may be the source of power for a warp knitting machine, loom, fabric inspection table, etc. This starter 81 may be of any conventional type adapted to function with the power supplied by lines 82, 84 and 85. In the type shown, it has a starter circuit comprising conductors 86 and 87, a magnetic switch 59, conductors 57 and 58, an overhead bar 88 and conductor 89. When contacts 56 are closed the motor 82 can be started, or continues to operate if already started, but when the power relay (79 in Fig. 5 and 52 in Fig. 4) is energized by the transformed impulse of the light from tube 16 on photo-electric cell 9 the contacts 56 are opened and the power to the motor is disconnected.

Obviously, any suitable voltage supply may be employed and the various resistors set at a variety of points to balance the set. To "tune" the set the light is passed through a most dense and then the most open part of a perfect fabric to get the limits of variation in the intensity of light acting upon the photo-electric cell and then adjusting the contacts 47 and 48 in Fig. 4 and the resistance 27 in Fig. 5 so that any greater or lesser surge of current beyond the ascertained limits will cause the operation of the power relays controlling the contacts 56.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of my invention.

Having described my invention what I desire to secure by Letters Patent is:

1. A stop or detector motion for a knitting machine and the like for detecting faults in a fabric, comprising a photo-electric cell positioned on one side of said fabric and extending substantially the full width of said fabric, a source of light coextensive with said photo-electric cell and positioned on the opposite side of said fabric so as to direct light on to said fabric, and operative means controlled by said photo-electric cell and adapted to stop the machine or give a warning indication on undue variation of the amount of light entering said photo-electric cell by reason of faulty fabric.

2. A stop or detector motion for a knitting machine and the like for detecting faults in a fabric, comprising a photo-electric cell positioned on one side of said fabric and extending substantially the full width of said fabric, a source of light coextensive with said photo-electric cell and positioned on the opposite side of said fabric, means for directing a beam of light from said light source on to said fabric, and operative means controlled by said photo-electric cell and adapted to stop the machine or give a warning indication on undue variation of the amount of light entering said photo-electric cell by reason of faulty fabric.

3. A stop or detector motion for a knitting machine and the like for detecting faults in a fabric, comprising a photo-electric cell positioned on one side of said fabric and extending substantially the full width of said fabric, a source of light coextensive with said photo-electric cell and positioned on the opposite side of said fabric, means, including a reflector having a slotted opening therein, for directing a beam of light from said light source on to said fabric, and operative means controlled by said photo-electric cell and adapted to stop the machine or give a warning indication on undue variation of the amount of light entering said photo-electric cell by reason of faulty fabric.

4. A stop or detector motion for a knitting machine and the like for detecting faults in a fabric, comprising a plurality of photo-electric cells positioned substantially end-to-end on one side of said fabric so as to extend substantially the full width of said fabric, a source of light coextensive with said photo-electric cell and positioned on the opposite side of said fabric so as to direct light on to said fabric, and operative means controlled by said photo-electric cell and adapted to stop the machine or give a warning indication on undue variation of the amount of light entering said photo-electric cell by reason of faulty fabric.

5. A stop or detector motion for a knitting machine and the like for detecting faults in a fabric, comprising a plurality of photo-electric cells positioned substantially end-to-end on one side of said fabric so as to extend substantially the full width of said fabric, a source of light coextensive with said photo-electric cell and positioned on the opposite side of said fabric, means for directing a beam of light from said light source to said fabric, and operative means controlled by said photo-electric cell and adapted to stop the machine or give a warning indication on undue variation of the amount of light entering said photo-electric cell by reason of faulty fabric.

6. A stop or detector motion for a knitting machine and the like for detecting faults in a fabric, comprising a plurality of photo-electric cells positioned substantially end-to-end on one side of said fabric so as to extend substantially the full width of said fabric, a source of light coextensive with said photo-electric cell and positioned on the opposite side of said fabric, means, including a reflector having a slotted opening therein, for directing a beam of light from said light source on to said fabric, and operative means controlled by said photo-electric cell and adapted to stop the machine or give a warning indication on undue variation of the amount of light entering said photo-electric cell by reason of faulty fabric.

7. A stop or detector motion for a knitting machine and the like for detecting faults in a fabric, comprising a photo-electric cell positioned on one side of said fabric and extending substantially the full width of said fabric, a source of light coextensive with said photo-electric cell and positioned on the opposite side of said fabric so as to direct light on to said fabric, and operative means, including a combined microammeter and switch, controlled by said photo-electric cell and adapted to stop the machine or give a warning indication on undue variation of the amount of light entering said photo-electric cell by reason of faulty fabric.

8. A stop or detector motion for a knitting machine and the like for detecting faults in a

fabric, comprising a plurality of photo-electric cells positioned substantially end-to-end on one side of said fabric so as to extend substantially the full width of said fabric, a source of light co-extensive with said photo-electric cell and positioned on the opposite side of said fabric so as to direct light on to said fabric, and operative means, including a combined microammeter and switch, controlled by said photo-electric cell and adapted to stop the machine or give a warning indication on undue variation of the amount of light entering said photo-electric cell by reason of faulty fabric.

9. A stop or detector motion for a knitting machine and the like for detecting faults in a fabric, comprising a photo-electric cell positioned on one side of said fabric and extending substantially the full width of said fabric, a source of light co-extensive with said photo-electric cell and positioned on the opposite side of said fabric so as to direct light on to said fabric, and operative means controlled by said photo-electric cell, including a

plurality of stages of amplification, and adapted to stop the machine or give a warning indication on undue variation of the amount of light entering said photo-electric cell by reason of faulty fabric.

10. A stop or detector motion for a knitting machine and the like for detecting faults in a fabric, comprising a plurality of photo-electric cells positioned substantially end-to-end on one side of said fabric so as to extend substantially the full width of said fabric, a source of light coextensive with said photo-electric cell and positioned on the opposite side of said fabric so as to direct light on to said fabric, and operative means controlled by said photo-electric cell, including a plurality of stages of amplification, and adapted to stop the machine or give a warning indication on undue variation of the amount of light entering said photo-electric cell by reason of faulty fabric.

ALLAN CLAIR THOMAS.