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ELECTRONICALLY CONTROLLED MOTOR DRIVEN LOOM LETOFF

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FIG. 1

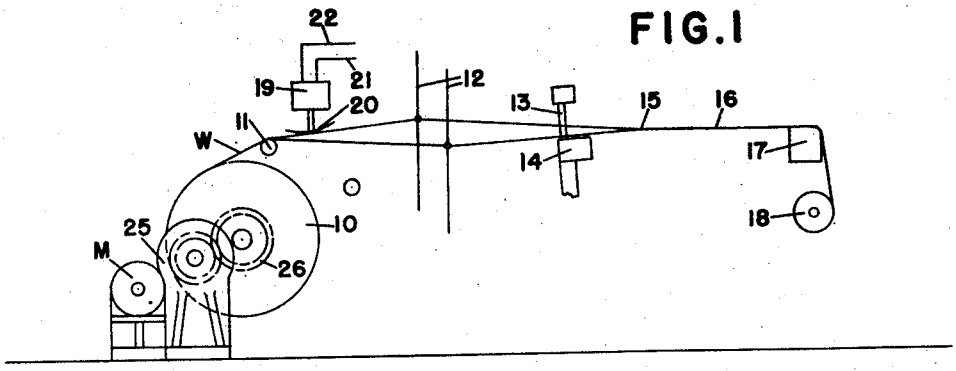
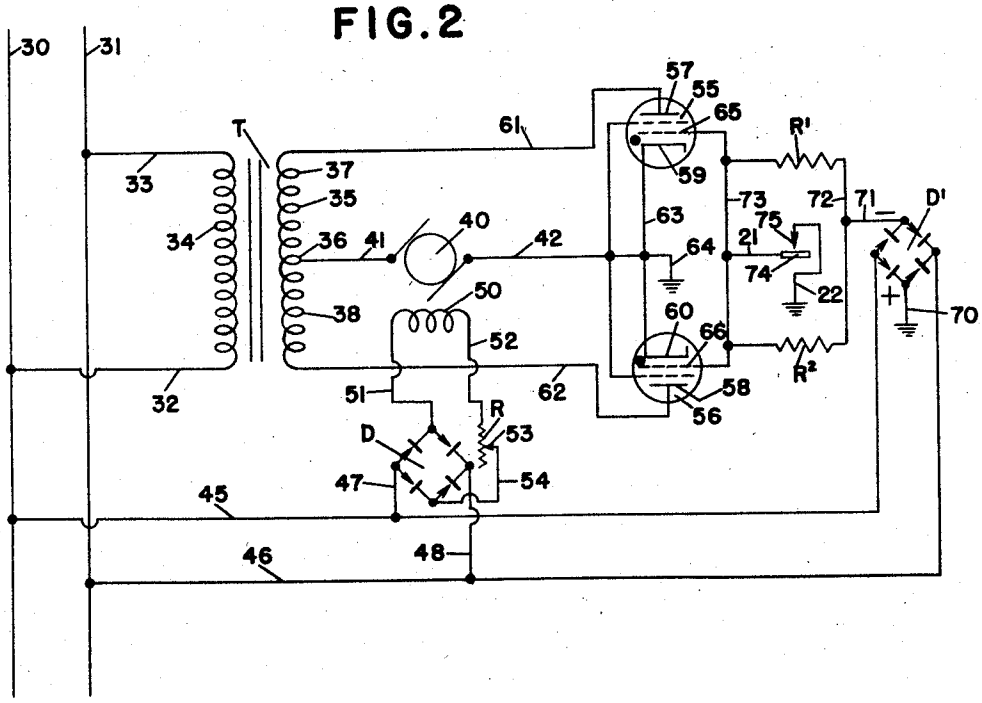


FIG. 2



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ELECTRONICALLY CONTROLLED MOTOR-DRIVEN LOOM LETOFF

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This invention relates to improvements in electronically controlled motor driven letoff mechanisms for looms and it is the general object of the invention to provide simplified control means for the electronic circuits.

Loom letoff mechanisms operated by electronic circuit means have, so far as I am aware, been controlled by some form of phase displacement for the grid control circuit requiring expensive apparatus and delicate adjustment. It is an important object of my present invention to provide simple grid control circuit means controlled by a grounded contact or the like effective when warp tension attains a given maximum to alter the grid potential in such manner as to permit energization of the motor.

It is another object of my present invention to control the electronic grids by a direct current rectifier which upon closure of the grid circuit by the grounded contact is protected against excessive current by resistances.

It is a further object of my invention to provide means for varying the speed of the motor by means independent of the electronic circuit to enable the letoff to operate satisfactorily when the loom is weaving different grades of fabric, or when needed to permit a change in motor speed as the diameter of the warp beam diminishes.

With these anad other objects in view which will appear as the description proceeds, my invention resides in the combination and arrangement of parts hereinafter described and set forth.

In the accompanying drawings, wherein a convenient embodiment of my invention is set forth,

Fig. 1 is a diagrammatic view illustrating an electric motor operated letoff mechanism, together with other parts of a loom, and

Fig. 2 is a diagrammatic view of the motor controlling electric circuits used with my invention.

Referring to Fig. 1, I have shown a warp beam 10 supplying warp W which is unwound as the beam rotates in a clockwise direction. The warp passes forwardly over a whip roll 11, and through harness frames 12 and a reed 13 on the lay 14. The warp threads lead to the fell 15 of the cloth 16 and the latter passes over a breast beam 17 and then to a takeup roll 18. The warp W is subject to variations in tension during the weaving operation due partly to forward movement of the cloth by the takeup roll. The present invention has as its general purpose to reduce the warp tension variation by means under control of a warp tension contactor 19 having a foot 20 the position of which is determined by the warp tension. As shown in Fig. 1 the foot rises when the

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warp tension is relatively high but falls when the warp tension is decreased. Electric contacts to be described hereinafter are located within the contactor 19 and operate in such manner that whenever the warp tension is high or has attained a given maximum two wires 21 and 22 will be electrically connected, but when the warp tension falls these wires will be electrically disconnected.

A motor M is operatively connected to speed reducing mechanisms 25 which in turn is connected to a driving gear 26 secured to the warp beam 10. The motor and speed reducer act when the motor is stationary to prevent turning of the beam, but when the motor turns due to closure of its operating circuit the beam is turned to supply warp for the weaving process and also to relieve warp tension.

The motor is connected electrically as indicated in Fig. 2 and may be of the direct current shunt wound type. Two alternating current power lines 30 and 31 are connected by wires 32 and 33, respectively, to the primary 34 of a transformer T. The latter has a secondary 35 provided with a center tap 36 which divides the secondary into upper and lower windings 37 and 38, respectively. The motor has a rotor or armature 40 connected on one side thereof to the center tap by a wire 41 and connected on its other side to a second wire 42.

Wires 45 and 46 lead from the power lines 30 and 31, respectively, and are connected by wires 47 and 48 to a rectifier unit D which furnishes direct current. One end of the field coil 50 of the motor is connected to one side of the rectifier by wire 51, and the other end of the field is connected by wire 52, resistance R and its adjustable contact 53, and wire 54 to the other side of the rectifier. Whenever the power lines 30 and 31 are alive the field will be excited by direct current the strength of which can be altered by contact 53 to vary the speed of the motor.

Gas filled electronic tubes 55 and 56 have plates 57 and 58, respectively, and also cathodes 59 and 60, respectively. The plate 57 is connected to the upper part of winding 37 by wire 61, while the other plate 58 is connected to the lower part of winding 38 by wire 62. The cathodes 59 and 60 are connected by a wire 63 which is connected also to wire 42 and grounded by wire 64.

The secondary of transformer T makes the plates 57 and 58 alternately positive and the windings 37 and 38 constantly tend to cause electric current to flow through their corresponding tubes.

The tubes 55 and 56 have control grids 65 and

66, respectively, which determine whether or not current can flow through them. The electric condition of the grids is controlled in such manner that they will prevent current from flowing through the tubes when the warp tension is below a given maximum but will enable the tubes to pass current for energization of armature 40 whenever the warp tension has reached a given maximum. To accomplish this result I provide a second rectifier D' connected to the wires 45 and 46 and having the positive side thereof grounded by wire 70. The negative side of rectifier D' is connected by wire 71 to a wire 72 the upper end of which is connected by resistance R' to a wire 73 and the lower end of which is similarly connected to wire 73 by resistance R2. The wire 73 connects the grids 65 and 66 and is also connected to the previously mentioned wire 21 leading to movable contact 74 of the contactor mechanism 19. Wire 22 connects the stationary contact 75 of the contactor mechanism to the ground. Contact 74 has its position determined by the foot 20 and will be out of engagement with contact 75 when the warp tension is below a given maximum, but will engage said contact when the warp tension has attained a given maximum.

When contacts 74 and 75 are separated the grids 65 and 66 are negative with respect to the grounded cathodes 59 and 60 and prevent flow of current through the tubes and armature, and the motor will be idle. When the contacts 74 and 75 engage each other, however, the grids are grounded and are at the same potential as the cathodes. Under this condition current can flow through the tubes and armature 40 will be energized to cause turning or running of the motor.

It will be noted that when contacts 74 and 75 are closed shortcircuiting of the rectifier D' is prevented by the resistances R' and R2, and the latter also serve to protect the grids 65 and 66. When the rotor 40 turns the beam 10 in a clockwise direction as viewed in Fig. 1 the warp tension is reduced the result of which is to separate contacts 74 and 75, whereupon the grids again become negative and prevent further flow of electric current through the tubes, thereby stopping the motor.

The letoff mechanism may be called upon to rotate the warp beam throughout a rather wide range of angular movement per pick. Thus, when the warp diameter is large the angular movement of the beam per pick is considerably less than when the warp diameter is at a minimum, and when the loom is weaving a fabric having a fine weft the forward movement of the cloth per pick is very much less than it is when coarse weft is being woven. Adjustment of the field resistance contact 53 enables the weaver to adapt the letoff mechanism to these varying conditions. The contact 53 is not automatically controlled as set forth herein but can be changed by the weaver either during the weaving of warp from a beam as the diameter of the latter is reduced, or in accordance with the size of the weft being used. For any given setting of the contact 53 the motor will tend to operate at a given speed when called into action after a period of idleness, and the length of the running period of the motor will vary slightly, being relatively long if the warp tension should happen to exceed the aforesaid given maximum, but being shorter when the warp tension does not rise above said given maximum. Compensation for the varying demands of warp is therefore attained by the length of time during which the motor is in operation for any particular setting of contact 53, but when the contact is altered the speed of the motor during its period of action can either be increased or diminished as conditions require.

From the foregoing it will be seen that I have provided simple means for controlling the flow of electric current through the tubes 55 and 56 by means of a grid control circuit connected to the rectifier D'. The grids are negative with respect to the ground at all times except when the contacts 74 and 75 engage each other, at which time the grids have the same potential as the cathodes and permit flow of current through the tube and armature. It will also be seen that resistances R' and R2 prevent a dead shortcircuit across the rectifier D' when contact 74 engages contact 75. By the use of the electric circuit shown in Fig. 2 the motor is either idle, or attempts to run at a given speed, depending upon whether the contacts 74 and 75 are open or closed. When a relatively large angular movement of warp beam 10 is needed the motor will run for a relatively longer time than when less angular movement of the beam is needed. The amount of warp letoff therefore depends upon the total running time of the motor, but the amount of warp delivered by the beam during this time can be varied by adjustment of the resistance R. The rectifier D' is a convenient source of grid control direct current, but I am not necessarily limited to it in the practice of the invention.

Having thus described my invention it will be seen that changes and modifications may be made therein by those skilled in the art without departing from the spirit and scope of the invention and I do not wish to be limited to the details herein disclosed, but what I claim is:

1. In letoff mechanism for a loom having a warp beam operatively connected to a motor which when running causes the beam to turn to deliver warp for the weaving process, said motor having an armature and a field coil, the latter being energized during loom operation, electronic circuit means for the armature including two electronic tubes each having a plate, a grid, and a grounded cathode, a transformer winding excited by alternating current and having a center tap connected to one side of the armature and having one side of the winding connected to one of said plates and the other side of the winding connected to the other of said plates, said electronic circuit means including a common connection between the cathodes and the other side of the armature and tending normally to cause electric current to flow through said tubes and armature, a source of direct current the positive side of which is grounded, a contact which is closed and grounded when the warp tension attains a given maximum and is open when the warp tension is less than said given maximum, and grid control circuit means including said source of direct current and contact normally effective when the latter is open to enable the grids to prevent flow of electric current through the tubes to prevent operation of the armature and effective when said contact is closed to alter the grids in such manner that current derived from said winding can flow through said tubes and armature to energize the latter.

2. In letoff mechanism for a loom having a warp beam operatively connected to the armature of a motor which when turning causes the warp beam to deliver warp for the weaving process, electronic armature circuit means including an electronic tube and tending normally to cause

current to flow through the tube and armature, a control grid in the tube, a source of direct current, two contact members which engage each other when the tension of the warp attains a given maximum but which are separated when the warp tension is less than said given maximum, said tube having a cathode, said cathode, one of said contact members, and the positive side of said source being grounded, and grid control circuit means connecting the negative side of said source to said grids and one of said contact elements and normally effective when said elements are separated to enable the grid to prevent flow of current through the tube to prevent energization of the armature but effective when said contact elements engage each other to connect the grid to the ground and thereby enable current to flow in said electronic armature circuit means through said tube and armature to cause energization of the latter.

3. In warp letoff mechanism for a loom having a warp beam operatively connected to a motor armature which when turning causes the beam to turn to deliver warp, electric circuit means including an electronic tube and the armature tending normally to energize the latter and enabled to do so when current can flow through the tube but prevented from doing so when current is unable to pass through the tube, said tube having a grounded cathode and a control grid, two contact elements which engage each other when the warp tension attains a given maximum but are separated from each other when the tension is less than said given maximum, a source of direct current the positive side of which is grounded, one of said contact elements being grounded, resistance means, and grid control electric circuit means including said source, electric resistance means, and contact elements connected to the grid and effective when the contact elements are separated to enable the grid to prevent flow of current through the tube and effective when said contact elements engage each other to ground the grid and cause current to flow from said source through said resistance means and said contact elements and thereby enable current to flow through said tube.

4. In letoff mechanism for a loom having a warp beam rotatable to deliver warp for the weaving operation, a source of alternating current electric power, an electric motor having a field coil and having an armature operatively connected to the beam to cause turning of the latter when the armature turns, electronic circuit means energized by electric power derived from said source and tending normally to cause current to flow through the armature to effect turning thereof, grid control circuit means responsive to variations in warp tension and effective when the tension is less than a given maximum to prevent said electronic circuit means from causing current to flow through the armature but effective when the warp tension attains said given maximum to enable said electronic circuit means to cause current to flow through the armature, a rectifier connected to said source of alternating current and delivering direct current, a variable resistance, and field circuit means including said rectifier, field coil and variable resistance effective to maintain the field energized independently of the condition of the grid control circuit means, said resistance permitting a variation in the strength of the field and said electronic circuit means always tending to cause the same strength of current to pass through said armature.

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