March 6, 1956 P. W. MEYER 2,737,209

MEANS FOR OPERATING LOOMS

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Fig. 1.

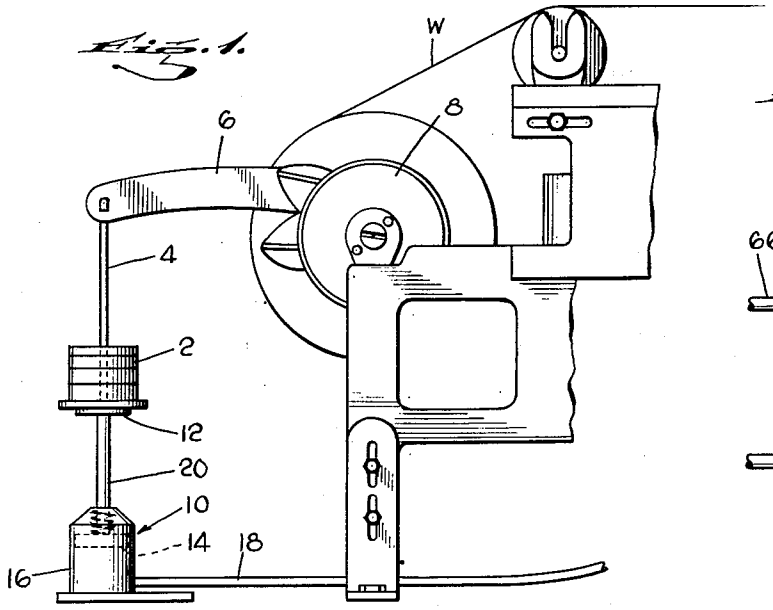


Fig. 1a.

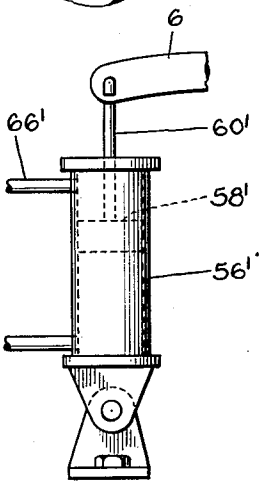
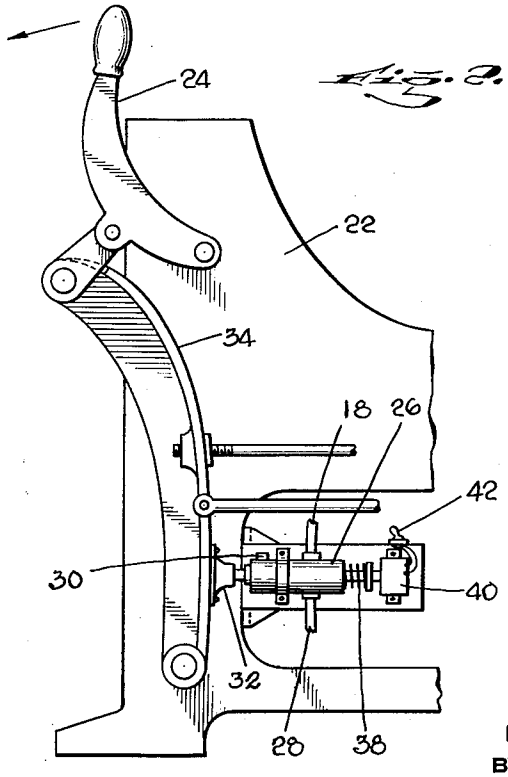


Fig. 2.



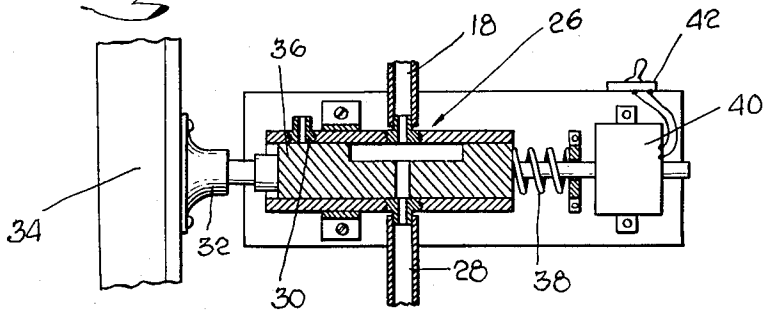
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Fig. 2a.



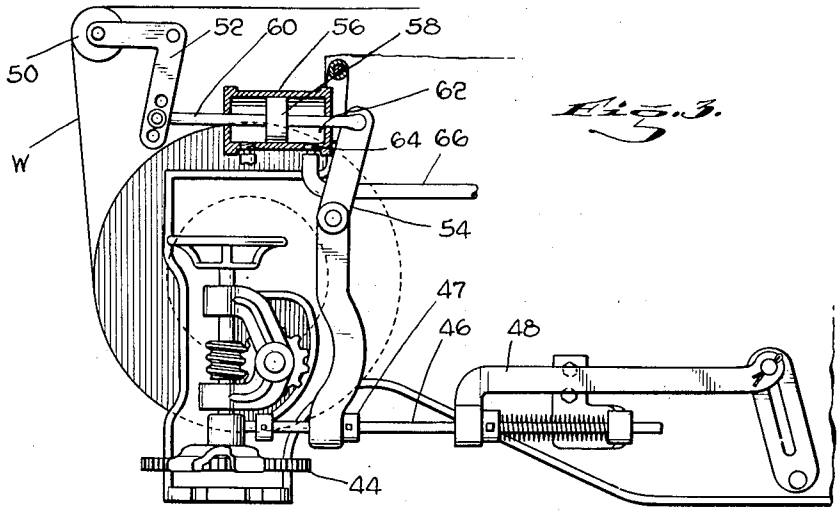


Fig. 3.

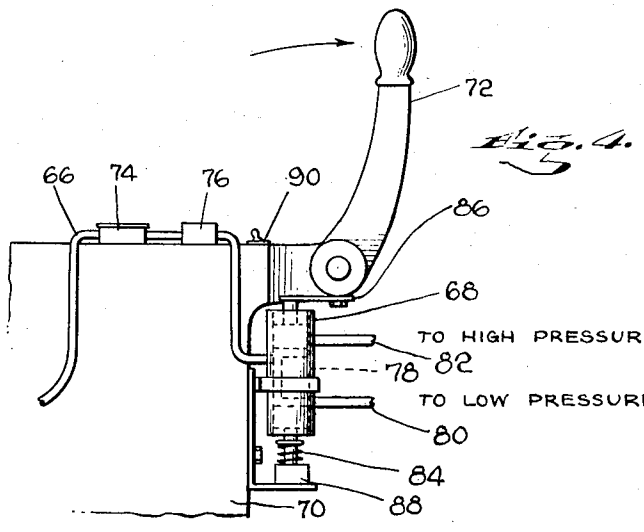


Fig. 4.

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MEANS FOR OPERATING LOOMS

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The present invention relates to looms and comprises a novel method and means for eliminating or reducing the number and severity of "set-marks." "Set-mark" is the name given to irregularities in filling spacing which occur when a loom has been stopped and then later started up again, these irregularities showing up in the woven fabric, particularly after dyeing and finishing, as fillingwise bands. In general, the longer the time during which a loom has stopped, the more severe or pronounced is the set-mark.

Although various attempts have been made in the past to avoid the occurrence of set-marks, none has heretofore proven successful so that the usual practice is to attack the problem from the other end, that is, to devise ways and means to prevent stopping of a loom during the weaving of the desired length of fabric. It is not always feasible economically to operate a loom twenty-four hours a day and seven days a week, and furthermore it is not possible to avoid at least occasional stoppage of a loom, as for example when a warp or filling yarn breaks, or when mechanical failure of a part occurs.

It is an object of the present invention, therefore, to provide a method of so operating a loom that set-marks in the fabric being woven either do not occur upon loom stoppage or are so faint they do not cause the fabric to be classified as seconds.

It is a further object of the invention to provide for looms of standard manufacture an attachment which will not interfere with the weaving operation and which will tend to prevent the occurrence of a set-mark in the fabric when the loom is started up after it has been stopped.

Extensive experimentation leading to the development of the present invention revealed that the marks have their origin in a backwards movement of the fell, unless the loom is stopped with the reed in the front dead center position, and that this movement is caused by relaxation of the section of cloth between the guide rod or bar on the breast beam and the fell. By reducing the tension on the warp from 40 to 60% while the loom is stopped, and then returning it to its former value when the loom is started up again or shortly thereafter, depending upon the duration of the stopping period, backwards movement of the fell is prevented and stop, start and set-marks are minimized or entirely eliminated. The present invention comprises this novel method of reducing or eliminating set-marks and novel means for practicing the same, of which three embodiments are diagrammatically illustrated in the drawings.

Figs. 1 and 2 illustrate the invention as applied to a loom of the type wherein tension is applied to the warp by weights opposing rotation of the warp beam, Fig. 1 being a side view of the let-off end of the loom and Fig. 2 being a side view of the right hand loomside; Fig. 1*a* is a fragmentary view illustrating an alternative tension relief device for the loom of Figs. 1 and 2; Fig. 2*a* is a diagrammatic sectional view of an enlarged scale of the control valve of Fig. 2; Figs. 3 and 4 illustrate the

invention as applied to a loom of the type having a ratchet driven let-off, Fig. 3 being a side view of the let off end of the loom and Fig. 4 being a side view of the left hand loomside of the loom at the breast beam.

In Figs. 1 and 2 the invention is illustrated as applied to a Crompton and Knowles loom of the S type and as these looms are well known only so much of the operating mechanism of the loom is illustrated as is necessary for an understanding of the invention. In the type of loom illustrated, tension is applied to the warp W by means of weights **2** which are cerried by a weight spindle **4** depending from the free end of a weight support arm **6**. The other end of weight support arm **6** is connected to a casing **8** of the let-off mechanism for the warp beam. For a detailed description of the operating elements of the let-off mechanism reference may be had to U. S. Patent No. 1,803,143 to O. V. Payne dated April 28, 1931. In general, however, the weights **2** exert a torque on the warp beam to tension the warp yarns. In accordance with the invention, a pneumatic jack **10** is located directly beneath the lower end of the weight spindle rod **4**. The platform **12** of the jack is attached to the piston **14** disposed within the cylinder **16** of the jack. Application of compressed air to the cylinder **16** through an air line **18** raises the piston and platform against the action of a suitable compression spring. The stroke of the piston rod **20** upon which the platform **12** is mounted is so adjusted that the platform engages the lower end of the spindle rod **4** when near the completion of its upstroke and relieves the force exerted by the weights upon the arm **6** to a predetermined extent. Thus when the jack **10** is actuated, it serves to exert a countertorque on the warp beam to relieve by a predetermined amount, the tension in the warp yarns.

Attached to the frame **22** of the loom adjacent the shipper handle **24** is a three way air plunger type valve **26** which in one position, that illustrated in Figs. 2 and 2*a*, connects line **18** to a compressed air line **28** and in the other position, to the left as viewed in Figs. 2 and 2*a*, connects line **18** to an exhaust port **30**. A resilient bumper **32** of rubber, or the like, is secured to the lever **34** operated by the shipper handle **24** and the valve **26** is so mounted as to present the end of the plunger **36** thereof to the bumper **32** to be moved thereby into the first mentionad position when the shipper handle is rocked to the "loom stopped" position illustrated in Fig. 2. A compression spring **38**, acting on the other end of the plunger **36**, moves the plunger into position to connect line **18** with the exhaust port **30** when the shipper handle is moved to "loom running" position. In order that the valve may be prevented, if desired, from moving to this latter position when the loom is started up, a solenoid **40**, energization of which is controlled by a manually operable switch **42**, is positioned adjacent the end of the plunger **36** remote from the bumper **32** and the movable core thereof is secured to the plunger so as to move the plunger against the action of spring **38** when the solenoid is energized.

The operation of the above described apparatus is as follows: Whenever the loom is stopped, either by the operator or by the automatic stop mechanism of the loom, the shipper handle **24** moves through a fixed arc of rotation, so that the bumper on lever **34** engages the piston plunger **36** and moves it into the position connecting lines **18** and **28**. Compressed air from line **28** flows through the line **18** into the cylinder **16** of the jack **10**, thus elevating the platform **12** and bringing it into contact with the lower end of the weight spindle rod **4**. The effective weight on the arm **6** is thus reduced, lessening the tension upon the warp yarns. Preferably the air pressure is so

adjusted that the tension upon the warp is reduced from 40 to 60%.

In order to start up the loom again, the operator simply moves the shipper handle 24 to the "on" position. This releases the piston plunger 36, thus permitting air to exhaust from the cylinder 16 through the line 18 and exhaust port 30. The platform 12 is thus lowered, and the tension applied to the warp W is returned to its original value under the force of the weights 2.

If the loom has been stopped for long periods of time the operator first turns the switch 42 to the "on" position to energize the solenoid 40, and then he starts the loom in the customary manner, permitting it to make several picks. During this time, the piston plunger 36 is held by the solenoid 40 and does not return to its original position, so that the tension upon the warp remains reduced. After a few picks have been completed, the operator then turns the switch 42 to the "off" position deenergizing solenoid 40 and permiting plunger 36 to return to the position wherein air exhausts through the line 18 and exhaust port 30 and the original tension is again applied to the warp. This delayed application of tension to the warp is advisable in order to prevent occurrence of set-marks when the loom has been stopped for long periods of time such as over 24 hours or a week end.

Figs. 3 and 4 show portions of a Draper loom equipped with tension relief means embodying the invention. In this type of a loom a ratchet wheel controlling rotation of the warp beam is intermittently rotated through a few degrees by means coupled to the reciprocating parts of the loom. These coupling means are operatively connected with the whip roll to permit the tension in the warp acting through the whip roll to control the amount of rotation of the ratchet wheel. In Fig. 3 the ratchet wheel is indicated at 44, the connecting rod for operating the driving pallet for the wheel 44 at 46, the connecting rod collar at 47, the driving rod for reciprocating the connecting rod at 48, the whip roll at 50, whip roll lever at 52 and the upright lever, normally coupling the connecting rod 46 to the whip roll lever 52 through a vibrating rod assembly, at 54. In accordance with the invention an air cylinder 56 having a piston 58 and tie rod 60 is interposed between the whip roll lever 52 and the upright lever 54 with its tie rod 60 pivotally connected at one end to the lower end of the whip roll lever 52 and at its other end to the upright lever 54. The pressure chamber 62 of the cylinder is connected through a nipple 64 to a hose 66 the other end of which (see Fig. 4) is connected to a plunger type three way valve 68 mounted on the frame 70 of the loom adjacent the shipper handle 72, a gauge 74 and pressure relief valve 76 being interposed in the line 66 between the cylinder and the valve. The valve 68 has a piston plunger 78 therein provided with passages which in one position, that shown in Fig. 4, connect line 66 with a low pressure line 80 and in a second position connect line 66 with a high pressure line 82. Lines 80 and 82 can be supplied with compressed air from different sources, or, as will be readily apparent to those skilled in the art, a single high pressure source may be provided. When a single source is employed, suitable pressure reducing valves (not shown) would be provided in the lines and a suitable pressure relief valve would be included in line 80 to insure reduction of the pressure in chamber 62 of the air cylinder 56 when the plunger of valve 68 is moved into position to connect lines 66 and 80. A spring 84 biases the plunger to the position wherein line 66 is connected to the high pressure line 82 which position is assumed by the valve while the loom is operating. A flat spring 86 secured to the shaft of the shipper handle 72 engages the end of the plunger 78 remote from spring 84 when the shipper handle is in loom stopping position and holds the plunger in the first mentioned position wherein air under reduced pressure is supplied by air cylinder 56.

As in the embodiment of the invention illustrated in Figs. 1 and 2 a solenoid 88, energization of which is controlled by a manually operated switch 90, is positioned adjacent the end of the plunger 78 and the movable core thereof is secured to the plunger so as to hold the plunger against the action of spring 84 when the solenoid is energized.

The operation of this device is as follows: When the shipper handle 72 is turned to the "loom stopped" position, plunger 78 is forced against spring 84 and the line 66 is connected to the compressed air line 80 of reduced pressure, reducing the pressure in the chamber 62 of the cylinder 56. The piston 58 and tie rod 60 are therefore moved to the right, as viewed in Fig. 3, under the tension of the warp exerted on the whip roll. The stroke of the piston is so adjusted by regulation of the air pressure that the tension on the warp is thus reduced from 40 to 60%. When the shipper handle 72 is moved in the direction of the arrow into loom operating position, compressed air under high pressure is supplied to line 66 and piston 58 moves rearwardly rocking the whip roll lever and returning the tension of the warp to its former value. As in the embodiment of the invention illustrated in Figs. 1 and 2, the operator by manipulation of switch 90 may delay the application of warp tension.

The above described tension relief means of Figs. 3 and 4 does not interfere with the normal operation of the let-off mechanism of the loom. Excess tension in the warp acts through the whip roll, whip roll lever and tie rod to rock the upright lever 54 which shifts the connecting collar 47 thus allowing the ratchet wheel 44 to be operated in the direction to let off warp and thereby reduce tension therein. It is only when the loom is stopped that the tension relief means of the invention comes into operation as heretofore described.

In Fig. 1*a* is indicated an alternative means for relieving warp tension in a Crompton and Knowles S type loom. In this embodiment of the invention the weights are replaced by an air cylinder controlled similarly to cylinder 56 in Figs. 3 and 4. The arm 6 of the let-off mechanism is connected directly to the piston rod 60′ of an air cylinder 56′. The cylinder 56′, above the piston 58′, is supplied with compressed air through a line 66′ from any suitable source (not shown). The cylinder below the piston 58′ is connected to atmosphere, or if desired, to a source of compressed air under reduced pressure. It will be understood that the pressure in line 66′ can be controlled in response to the position of the shipper handle in the same manner as that described for line 66 of Figs. 3 and 4, the pressure being high during operation of the loom and being reduced during loom stoppage. If desired a four way control valve may be employed and the cylinder 56′ below the piston 58′ connected thereto so that, by proper adjustment of air pressure applied to opposite sides of the piston, its position, and thus the tension applied to the warp, can be accurately regulated.

The invention has now been described with particular reference to two different types of looms. Although in each embodiment of the invention pneumatically operated means for reducing warp tension during loom stoppage have been illustrated, obviously hydraulic or electrically operated means could be substituted therefor and various other changes in the particular constructions illustrated and described could be made without departing from the spirit of the invention or the scope of the accompanying claims.

The following is offered as a possible explanation for the function of the apparatus of the invention in preventing set-marks, but is given for information only and the scope of the invention is not to be limited thereby: It is believed that when the loom is not operating and the cloth is subjected to the tension applied to the warp necessary for proper weaving, the cloth tends to stretch, thus moving the fell back towards the warp beam unless prevented from doing so by the front center position of the reed. Apparently, little or no stretch takes place in the

warp itself, all of the dimensional changes occurring in the cloth. Because the fell has moved backwards, for the first few picks after the loom is started up again, the newly-placed filling yarns are beat up relatively close to each other thus creating a set-mark. After a few picks, however, the fell returns to its original equilibrium position, and thereafter picks are the proper distance apart in the newly woven cloth. The apparatus of the present invention overcomes this problem by relieving the tension applied to the cloth, while the loom is stationary so that the fell does not change its position, and yet permits reapplication of tension to the degree originally obtained upon starting up the loom or shortly thereafter, as desired.

The following is claimed:

1. In a let-off mechanism for a loom having a warp beam delivering warp and means to retain said warp under tension during loom operation comprising a whip-roll associated with said warp beam, means cooperating with said tension applying means for relieving the tension applied thereby while said loom is stopped, said tension-relieving means comprising a cylinder, a fluid pressure-actuated piston disposed therein, a piston rod affixed to said piston and operatively associated with said whip-roll, and means for applying fluid pressure to said piston to actuate said piston rod and thereby adjust the tension applied to the warp by the whip-roll.

2. An apparatus for preventing the occurrence of set-marks in a loom-woven fabric, which comprises, in a loom having a warp beam delivering warp, means for starting and stopping said loom, means for applying tension to a warp, and, associated with said tension-applying means, means for cooperating therewith to reduce the tension applied thereby, comprising a cylinder, a fluid pressure-actuated piston disposed therein, means for applying fluid pressure to said piston, means associated with said loom stopping and starting means for actuating said fluid pressure-applying means simultaneously with stopping the loom, and means associated with said last-mentioned means for preventing deactuation thereof when the loom is next started up.

3. An apparatus for preventing the occurrence of set-marks in a loom-woven fabric, which comprises, in a loom having a warp beam delivering warp, means for starting and stopping said loom, means for applying tension to a warp, and, associated with said tension-applying means, means cooperating therewith to reduce the tension applied thereby, comprising a cylinder, a fluid-pressure-actuated piston disposed therein, and means for applying fluid pressure to said piston, means associated with said loom starting and stopping means for actuating said fluid pressure-applying means, comprising a three-way valve, a spring-loaded reciprocable piston plunger disposed therein for connecting two of three passages therein at one time, one end of said piston plunger being engaged and reciprocated by said loom-control means against the thrust of said spring, an electric solenoid disposed adjacent said valve for receiving the other end of said plunger, and preventing reciprocation thereof when electrically actuated, and switch means for controlling actuation of said solenoid.

4. In a loom having a warp beam delivering warp, means for applying a torque to the beam to place the warp under tension, and means including a shipper handle movable to operative and inoperative positions for starting and stopping the loom, said torque applying means including a lever associated with said beam, means dependent from said lever for supporting weights to control the tension applied by said lever and having weights disposed thereon, and tension relieving means comprising a cylinder having a reciprocable fluid pressure actuated piston disposed therein, a piston rod affixed to said piston, said piston rod on actuation of said piston being engageable with said weight-supporting means to relieve the force exerted upon said lever by said weights, and means operable in response to movement of said shipper lever to inoperative position for applying fluid pressure to said piston to actuate the same.

5. The improvement in accordance with claim 4 including means for maintaining the fluid pressure on said piston for a selected time period following movement of said shipper handle to the operative position whereby the restoration of normal tension on said warp is delayed during said time period.

6. In a loom having a warp beam delivering warp, means for applying a torque to the beams to place the warp under tension, and means movable to operative and inoperative positions for starting and stopping the loom, the improvement comprising means operative in response to movement of said movable means to inoperative position for applying a countertorque to said beam to reduce the tension in said warp when the loom is stopped.

7. The improvement according to claim 6 including means for maintaining said third mentioned means in its countertorque applying position.

8. The improvement according to claim 6 wherein the means for applying a countertorque to the beam comprises a fluid actuated motor to which fluid under pressure is controlled by a valve actuated in accordance with movement of said movable means for starting and stopping the loom.

9. The improvement according to claim 8 including means for selective controlling said valve to maintain fluid under pressure at said motor independently of the movement of the movable means to a loom starting position.

10. The improvement according to claim 9 wherein said valve has a movable control member adapted to be actuated to open position by said movable means on movement to loom stopping position, means for biasing said movable control member to closed position, an electric solenoid operatively coupled to said movable control member, and switch means for controlling the energization of the solenoid whereby said valve may be held open at will against the action of said biasing means following movement of said movable means to loom starting position.

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