July 24, 1956 J. O. HUNT 2,755,823

WARP LET-OFF FOR LOOMS

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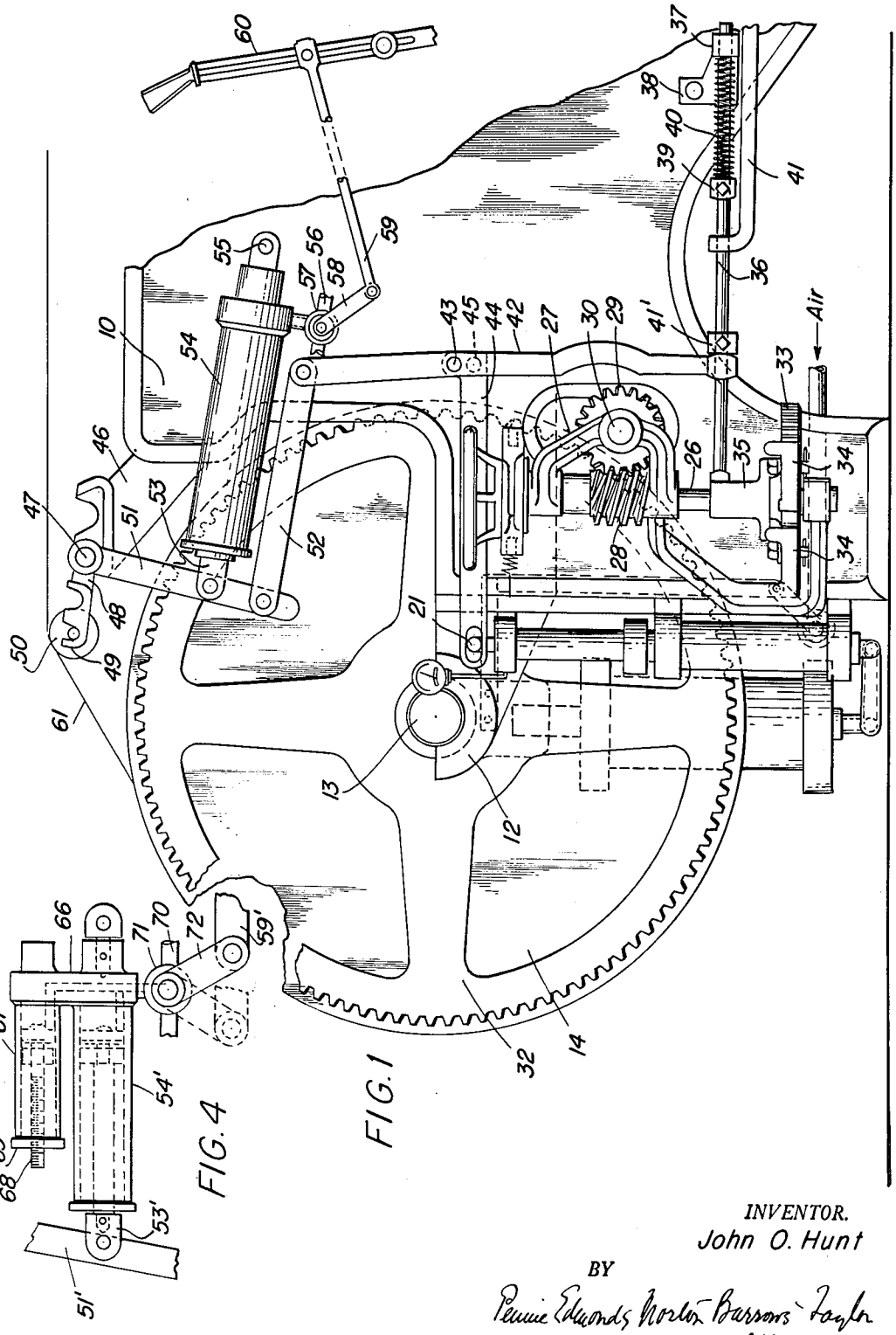


FIG. 4

FIG. 1

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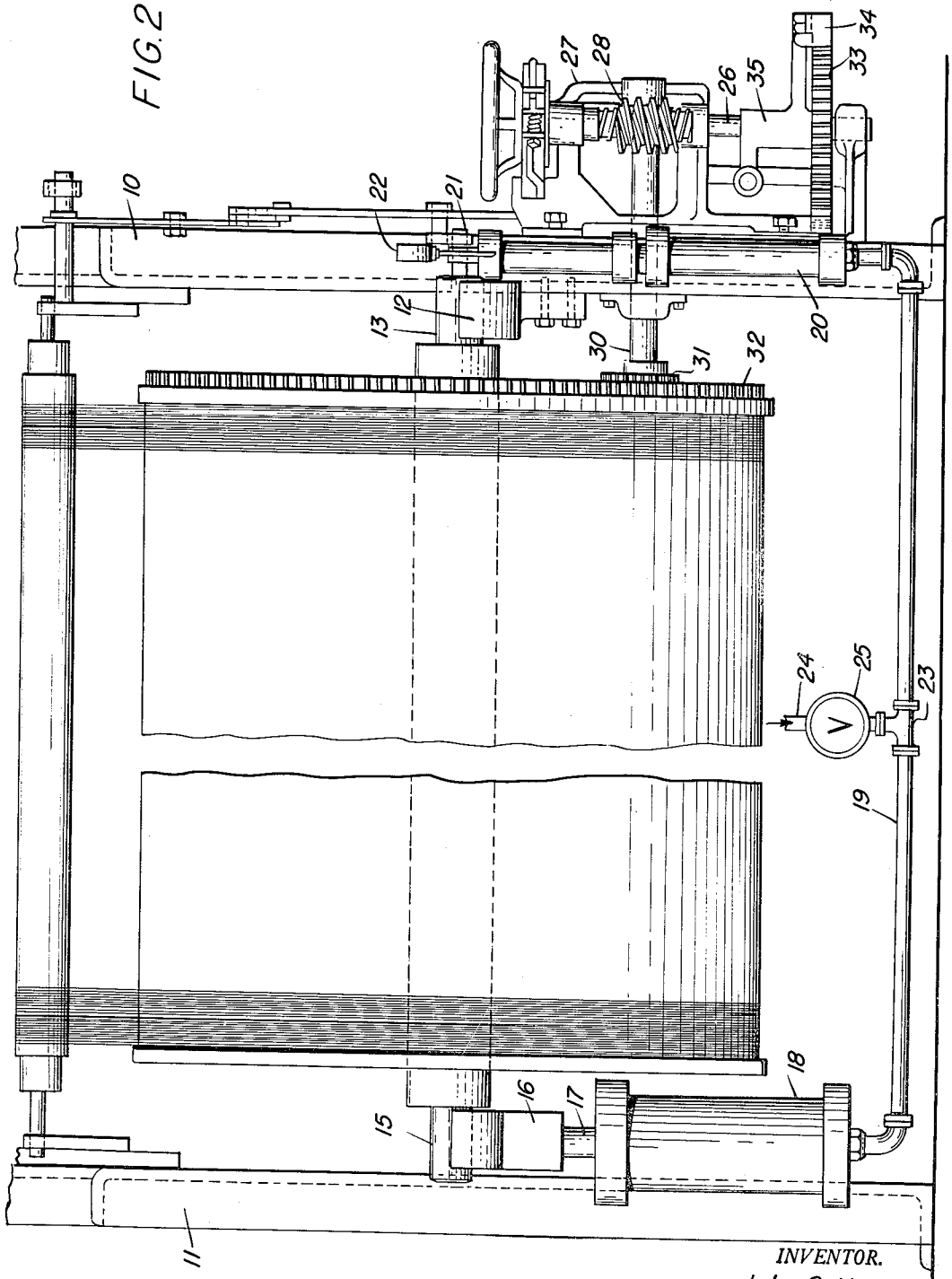
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FIG. 2



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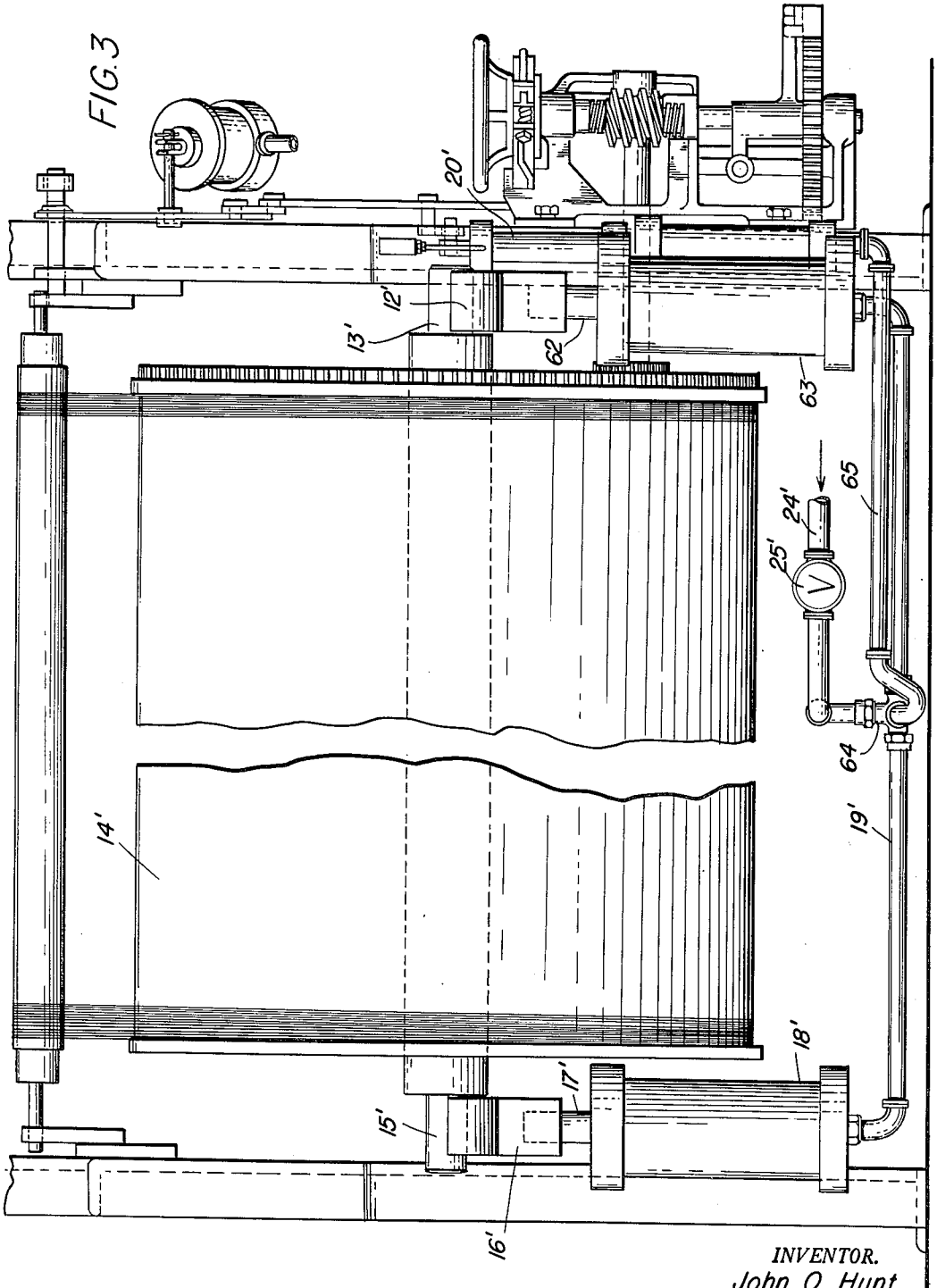
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FIG. 3



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WARP LET-OFF FOR LOOMS

John O. Hunt, Greenville, S. C.

Application May 22, 1953, Serial No. 356,834

1 Claim. (Cl. 139—110)

This invention relates to warp left-off mechanisms for use in looms and is concerned more particularly with a novel let-off of the positive type, which maintains more nearly uniform tension on the warp sheet than has heretofore been attained and functions in such a way as to avoid the creation of set marks in the fabric as a result of damage to the warp yarns.

Positive let-offs are now in common use and one form of such mechanism comprises a let-off shaft connected through gearing to the warp beam and driven through worm gearing by a worm shaft. The worm shaft is rotated stepwise by pawl and ratchet means, including a pawl carrier actuated by a rod acted on by a reciprocating link. The rate of let-off is determined by the throw of the rod and is controlled by mechanism actuated by the whip roll, as it moves in response to variations in the tension on the warp threads, and other mechanism responding to the decreasing size of the warp supply on the beam. The whip roll mechanism includes a spring resisting the movement of the roll by the warp sheet as the shed is opened and, since such a spring offers increasing resistance as it is compressed, it will be apparent that the spring-pressed whip roll applies a tension to the warp, which varies with the position of the roll. The mechanism for controlling the let-off, which responds to the size of the warp supply on the beam, includes a roller pressed by a spring against the warp. The pressure of such a roller on the warp yarns is likely to do damage to yarns of certain kinds, such as those of filamentary synthetic fibers, and the use of the roller is objectionable for that reason. Another disadvantage of the let-off described is that, when the loom is stopped for any reason, the pressure of the whip roll on the warp is maintained and, in the case of filamentary synthetic fiber yarns, the roll produces effects on the yarns, which appear in the fabric as set marks.

The let-off of the invention operates to vary the rate at which the yarn is let off the warp beam in response both to the tension on the warp threads and to the size of the warp supply on the beam, but it achieves the desired results without the disadvantages above set forth, to which conventional let-offs are subject. Thus, in the new let-off, the whip roll is held against the warp sheet under constant pressure, and, for this purpose, pneumatic means are employed including a cylinder containing a piston subjected to air pressure supplied from a source, such as a tank of substantial size. With this arrangement, the pressure applied through the piston to the whip roll does not vary, as the roll changes its position and, as a result, movement of the roll by the warp threads does not subject the threads to a rapidly increasing tension as in the case of a roll acted on by a spring. The control of the rate of let-off in response to the size of the warp supply on the beam is effected by supporting the beam journal on at least one bearing, which is held in place pneumatically and assumes different positions according to the weight of the beam. The pneumatic pressure developed by the weight of the beam actuates mechanism, which

increases the rate of let-off as the weight of the beam decreases.

A further feature of the new let-off is the provision of means, by which stopping of the loom is accompanied by a release of the pressure of the whip roll against the warp sheet. For this purpose, the control element, such as a shipper handle, by which the loom is started and stopped, operates to release the pneumatic pressure from the whip roll, when the loom is stopped. This prevents distortion of the warp threads as a result of prolonged pressure exerted thereon by the whip roll and avoids the formation of set marks in the fabric.

For a better understanding of the invention, reference may be made to the accompanying drawings, in which

Fig. 1 is a view in side elevation with parts removed of a loom equipped with the new let-off;

Fig. 2 is a rear elevational view with parts cut away of the loom shown in Fig. 1;

Fig. 3 is a view similar to Fig. 2 showing a modified construction; and

Fig. 4 is a fragmentary elevational view of a modified feature of the new let-off.

The loom illustrated in Figs. 1 and 2 is provided with sides **10**, **11**, and the side **10** has a bracket **12** providing a bearing for the journal **13** at one end of the beam **14**. The journal **15** at the other end of the beam is supported in a bearing **16** attached to a rod connected to a piston within a cylinder **18** mounted on the loom side **11**. The lower end of the cylinder is connected by a line **19** to the bottom of a control cylinder **20** of substantially smaller diameter than the cylinder **18** and mounted on the loom side **10**. Cylinder **20** contains a piston and a piston rod extending out of the top of the cylinder and having a pin **21** projecting laterally therefrom. The cylinder contains a quantity of air trapped above the piston and a pressure gauge **22** is connected to the cylinder above the piston to indicate the pressure of the trapped air. The line **20** includes a T **23**, to one branch of which is connected an air supply line **24** containing a control valve **25**.

A vertical worm shaft **26** is mounted in vertically spaced bearings in a bracket **27** attached to the loom side **10** and the shaft is provided with a worm **28** meshing with a worm wheel **29** on a shaft **30**, which carries a pinion **31** meshing with a gear **32** attached to the warp beam. A ratchet wheel **33** is fast on the worm shaft and operable by pawls **34** on a pawl carrier **35** loosely mounted on shaft **26**. A rod **36** is pivotally attached to the pawl carrier and has one end extending through a sleeve **37** forming part of a bracket **38** attached to the loom side **10**. The rod **36** carries a collar **39** and is encircled by a spring **40** acting on the collar and seated against the end of sleeve **37**, the spring tending to urge the rod **36** to the left, as seen in Fig. 1. The collar **39** on rod **36** is engageable by the end of a link **41** reciprocated by a suitable part of the loom, and, when rod **36** is pulled by link **41**, the pawl carrier **35** is given a rotary movement effecting a movement of the ratchet wheel, which in turn causes let-off of yarn from the beam. The amount of yarn let off by a rotary movement of the pawl carrier depends upon the length of the stroke of rod **36** and this in turn depends on the position of the rod and the point during the stroke of link **41**, at which the link engages the collar **39** on the rod. The position of rod **36** thus determines the length of the steps in the movement of the warp beam.

The rod **36** is provided with a collar **41**, which is engageable by the lower end of a lever **42**. The lever has a fulcrum on a pin **43** carried by one arm of lever **44** pivotally mounted on a pin **45** carried by the loom side **10**. The other arm of lever **44** is engageable by the pin **21** connected to the piston rod of the piston within the control cylinder **20**. The fulcrum **43** for lever **42** is up-

wardly offset from the pivot pin 45 of lever 44 and, when the lever 44 moves counterclockwise, as seen in Fig. 1, the fulcrum 43 is shifted to move the lower end of lever 42 in a direction away from collar 41. However, the spring 40 acts to move rod 36 to maintain collar 41' in contact with the lower end of lever 42 at all times and the shifting of lever 42, as described, causes an increase in the stroke of rod 36 by link 41 and a corresponding increase in the amount of yarn let off for each stroke of rod 36.

The loom sides 10 and 11 are provided with brackets 46, which serve as bearings for a shaft 47, to which is rigidly attached a pair of arms 48 providing bearings 49 for a whip roll 50. An arm 51 is rigidly attached to shaft 47 and the lower end of the arm is connected by a link 52 to the upper end of lever 42. Arm 51 is also connected to a rod 53 attached to a piston within a cylinder 54 pivotally mounted at 55 on the loom side 10. Air under pressure can be supplied to cylinder 54 at the end adjacent pivot 55 through a line 56 containing a valve 57 having an operating handle 58. The handle is connected by a link 59 to the shipper handle 60, by which the loom can be started and stopped. The whip roll engages the warp sheet formed of the warp yarns 61 leaving the warp supply on beam 14 and is caused to move up and down about the axis of shaft 47, as the tension on the warp yarns varies.

In the operation of the let-off described, air under pressure is introduced from the supply line 24 into the line 19 connecting the cylinders 18 and 20, until the cylinders contain air at a suitable pressure, after which valve 25 is closed. When a full warp beam is put into position with one journal received in the bearing in bracket 12 and the other in bearing 16 are connected to the piston within cylinder 18, the weight of the beam causes the piston within cylinder 18 to move down and the piston within the control cylinder 20 to move up. The air confined in cylinder 20 above the piston is then subjected to increased compression and the pressure is shown on the gauge 22. The upward movement of the piston in the control cylinder by the weight of the beam causes the lever 44 to swing clockwise, as seen in Fig. 3 and the fulcrum 43 of lever 42 is swung clockwise about the pivot 45 of lever 44. The shifting of the fulcrum 43 of lever 42 causes the lower end of lever to engage the collar 41' on rod 36 and to move the rod against the compression of spring 40 and in a direction to decrease the let-off. The control cylinder 20 is of much less diameter than cylinder 18, as, for example, cylinder 18 may have a diameter five times that of cylinder 20. As a result, a small movement of the piston in cylinder 18 produces a large movement in cylinder 20 and a corresponding movement of lever 44.

During the operation of the loom, the tension on the warp threads 61 is increased, whenever the shed is opened, and this causes the whip roll 50 to move shaft 47 counterclockwise, as seen in Fig. 1. The movement of the whip roll causes arm 51 to swing with shaft 47 and the movement of the arm is resisted by the air pressure within cylinder 54. The interior of the cylinder is connected through valve 57 to the supply line 56 and the pressure behind the piston in cylinder 54 maintains a continuous force upon arm 51 resisting the movement of the whip roll. As the whip roll is moved by the pull of the warp threads and swings arm 51, the arm operates through link 52 to rock lever 42 to move its lower end in a direction away from collar 41' and thus increase the let-off. As the weight of the warp supply on the beam decreases, the pressure within the control cylinder 20 above the piston therein decreases and, as the piston within cylinder 20 moves down, lever 44 is rocked on its pivot 45 to shift the fulcrum 43 of lever 42 and move the lower end of that lever in a direction away from collar 41' on rod 36 to increase the let-off.

During the operation of the loom, the interior of cylinder 54 is connected through line 56 to a source of air under pressure, such as a tank supplied by a pump under automatic control. As a result, a constant force is applied to the whip roll through arm 51 on shaft 47 and the warp yarns move the whip roll against constant resistance offered by the pressure behind the piston in cylinder 54. In prior let-offs, in which the movement of the whip roll is resisted by a spring, the force exerted by the spring increases as the spring is compressed, so that the movement of the whip roll is against an increasing force, which imposes an increasing tension on the warp yarns. Also, in former let-offs, the rate of let-off is controlled in part by a roller bearing against the warp supply on the beam and the rubbing of the roller on the yarn is likely to do damage thereto. In the present apparatus, the rate of let-off is controlled in part by the weight of the yarn on the beam, so that the let-off can be increased as the supply of warp on the beam diminishes, and the desired control is exercised without the use of a member contacting with the yarn and liable to do damage thereto.

The valve 57 in the new let-off is of the three-way type and, when the shipper handle 60 is moved to stop the loom, the handle operates the valve to shut off the line 56 and open the interior of cylinder 54 to the atmosphere. As a result, the whip roll no longer applies tension to the warp threads and the light contact of the whip roll with the threads avoids the distortion of the threads, which result in set marks in the fabric. When the loom is again started by operation of the shipper handle, valve 57 is rotated to shut off cylinder 54 from the atmosphere and connect the cylinder to the supply line 56, so that the whip roll is forced against the warp threads by pressure applied to the piston within cylinder 54.

The let-off of modified construction shown in Fig. 3 is similar in many respects to that above described and corresponding parts are designated by the same reference characters with prime marks added. In the Fig. 3 construction, the bearing 12' for the journal 13' at one end of the warp beam 14' is mounted on a rod 62 connected to a piston within a cylinder 63. The journal 15' at the other end of the beam is supported, as in the Fig. 1 construction, in a bearing 16' mounted on the rod 17' connected to a piston within a cylinder 18'. The lower ends of cylinders 18' and 63 are connected by a line 19' containing a four-way fitting 64 having a branch, to which an air supply line 24' containing a valve 25' is connected. Another branch of the fitting is connected by a line 65 to the lower end of a control cylinder 20'. In all other respects, the let-offs of Figs. 1 and 3 are the same and their operation is the same.

In some cases, it may be desirable to construct the device, so that increasing resistance is offered to the movement of the whip roll by the warp threads and, for this purpose, the construction shown in Fig. 4 can be employed. As illustrated, the arm 51', which corresponds to arm 51 and is connected to the whip roll so as to be moved thereby, is also connected by a rod 53' to a piston within a cylinder 54'. The cylinder has a head 66, on which is mounted a second cylinder 67, which is preferably of somewhat smaller capacity than cylinder 54'. Cylinder 67 contains a piston mounted on a rod 68 threaded through the end plate 69 of cylinder 67. The interiors of cylinders 54' and 67 at the same side of the piston are connected by a passage through the head 66 and an air supply line 70 is connected to the inlet of the passage. The line contains a valve 71 having an operating arm 72, which is connected by a link 59' to a shipper handle, not shown.

In the operation of the apparatus shown in Fig. 4, starting of the loom by the operation of the shipper handle causes a movement of the handle 72 of valve 71, so that the valve momentarily connects the air supply line 70 to the passage in the head 66 of the cylinders 54' and 67

and then shuts off the line from the passage. There is, accordingly, a volume of trapped air in the two cylinders between their pistons and head **66** and the size of the volume of air trapped depends on the setting of the piston within cylinder **67**. When the whip roll is moved by the tension on the warp yarns and swings arm **51'**, the piston within cylinder **54'** is moved to reduce the volume of the trapped air and the pressure of such air increases, so that the movement of the whip roll is against increasing resistance. The rate, at which such resistance increases, depends on the setting of the piston within cylinder **67** and this setting can be adjusted by the threaded rod **68**. Whenever the loom is stopped by the shipper handle, the valve **71** is operated by its handle **72** to connect the passage within head **66** to the atmosphere, so that the trapped air within the two cylinders can escape. The whip roll then engages the warp threads so lightly that, if the loom stands at rest for any length of time, the warp yarns are not distorted by whip roll pressure and set marks in the fabric are avoided.

In both forms of the new let-off, the warp beam is rotated step by step and the length of the steps is varied in accordance with the tension on the warp yarns and the size of the available warp supply. The whip roll is held against the warp sheet under constant pressure or under a pressure increasing at a controlled rate as the roll is moved and the pressure exerted by the whip roll on the warp sheet is cut off whenever the loom is stopped. By controlling the let-off by means responsive to the weight of the warp beam, rather than by a roller engaging the warp supply, damage to the yarns is avoided. The reading of the gauge **22** on the control cylinder is an indication of the size of the warp supply present on the beam, so that an inventory of the amount of the warp supplies on a number of looms equipped with the new let-offs can be easily taken.

I claim:

A warp let-off for use in looms, which comprises a warp beam supplying warp yarns in the form of a sheet, means for positively rotating the beam stepwise, said means being regulable to vary the length of the steps in the beam movement, a whip roll in contact with the warp sheet being let off, the roll being movable by the warp sheet as the tension thereon varies, means holding the whip roll against the warp sheet under pressure, means controlled by the whip roll for regulating the beam rotating means, and means responsive to the weight of the warp beam for regulating the beam rotating means and including at least one bearing for the beam, a pair of cylinders connected together and containing a fluid under pressure, a piston in each cylinder, a connection between one piston and the bearing, and a connection between the other piston and the beam rotating means.

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