April 20, 1965 R. S. ORDWAY 3,179,047

OSCILLATING INK ROLLS

Filed July 29, 1963 2 Sheets-Sheet 1

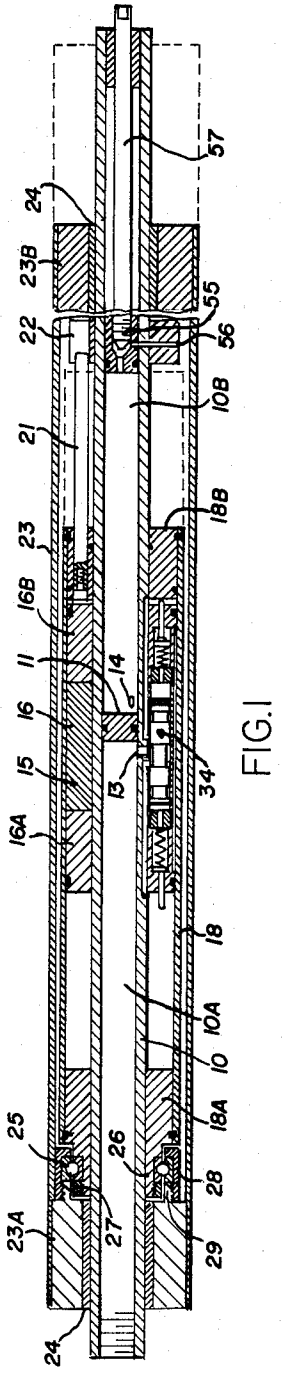


FIG. 1

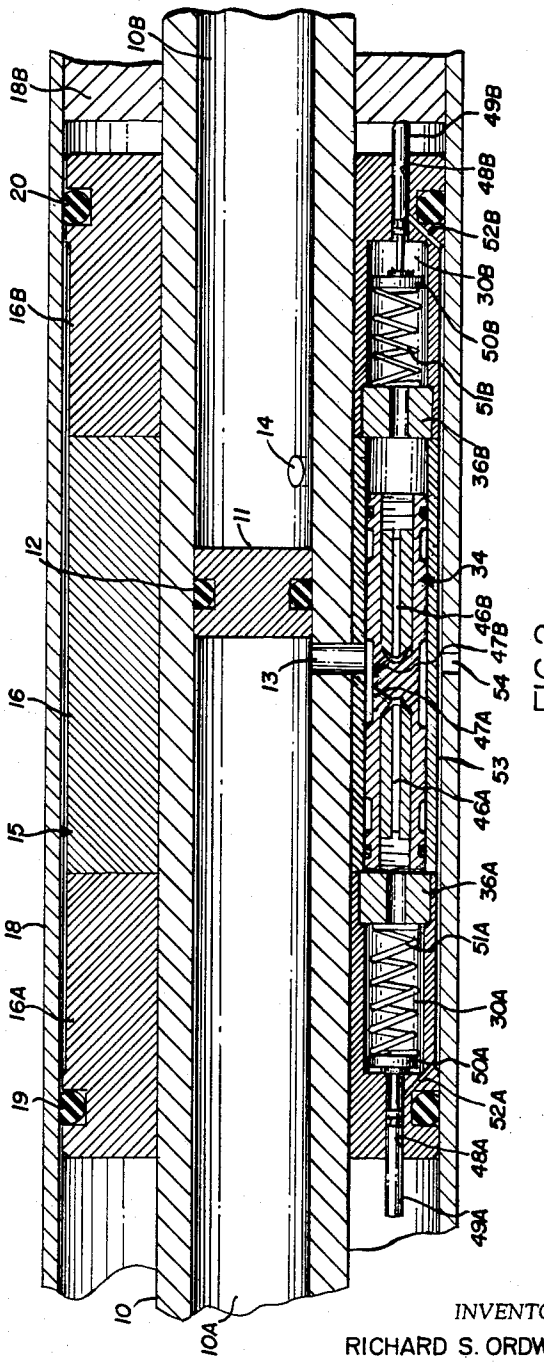


FIG. 2

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FIG. 3

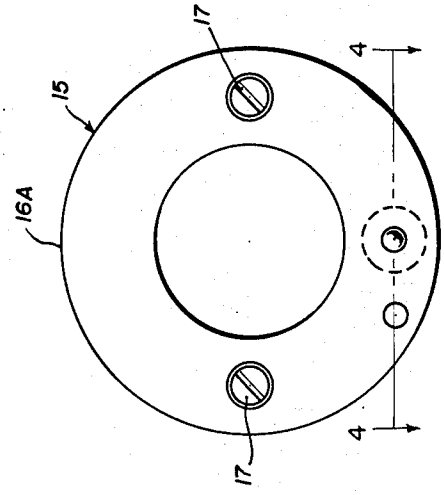
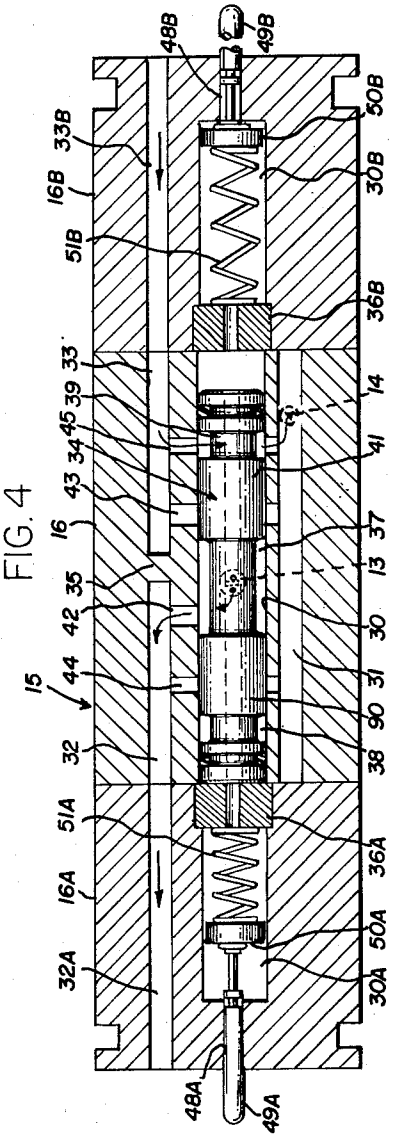


FIG. 4



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OSCILLATING INK ROLLS

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The present invention relates to oscillating ink rolls and particularly to such rolls in which the reciprocable motion is effected by fluid under pressure.

Because of the difficulty of securing a distribution of ink that is sufficiently uniform to ensure satisfactory results, ink rolls oscillated by mechanical means have been provided. These have not been satisfactory because of their cost and because their operation was not sufficiently smooth and flexible to ensure desired results.

A principal objective of the present invention is, accordingly, the provision of such a roll and another objective is to provide for the reciprocation of the roll to be effected by fluid under pressure.

Another objective of the invention is to provide reliable and efficient valve control means for effecting the delivery of the fluid under pressure to cause the reversal of the direction of travel of the roll when in either one of its extreme positions and a particular objective is to have such valve controlled means utilize the fluid under pressure by which roll reciprocation is effected.

In accordance with those objectives, an oscillating ink roll includes a shaft, cylinder supported thereby for sliding axial movement between a first position in which one cylinder end wall comes into a predetermined relationship adjacent one end of a fixed, cylindrical piston fixed on the shaft coaxially thereof and a second position in which the other cylinder wall comes into a predetermined relationship adjacent the other end of the piston. A sleeve, functioning as a roller, is connected to the cylinder to move axially therewith and to rotate independently thereof.

Means are provided to deliver fluid to either end of the piston and to exhaust it from the other end thereof and control means for the delivery means are operable, in either position to effect reversal of the motion of the roller. In practice, the control means includes a balanced control valve with valve shifting resulting by upsetting that balance mechanically in either of the above referred to positions.

In the accompanying drawings, there is shown an illustrative embodiment of the invention from which these and other of its objectives, novel features, and advantages will be readily apparent.

In the drawings:

FIGURE 1 is a longitudinally sectioned view of an ink roll in accordance with the invention,

FIGURE 2 is a fragmentary, longitudinal section of the cylinder and the fixed piston on a substantially increased scale,

FIGURE 3 is a view of the fixed piston from end thereof, and

FIGURE 4 is a section taken approximately along the indicated lines 4—4 of FIGURE 3.

The oscillating, ink spreading roll shown in the drawings has a tubular shaft **10** divided by a block **11** having an O-ring **12** to provide an intake passage **10A** and an exhaust or relief passage **10B**. The shaft **10** is to be supported conventionally and has the outer end of the passage **10A** threaded for the attachment of a conduit, not shown, from a source of fluid under pressure, air in the case of the illustrated embodiment of the invention. Adjacent the block **11**, there is a port **13** and the passage **10B** has a port **14**.

A generally indicated cylindrical piston **15** is fixed on the shaft **10** coaxially thereof and is shown as consisting

of a central section **16** and end sections **16A** and **16B** joined thereto as by bolts **17**, see FIGURE 3. The piston **15** is within a cylinder **18** with the end sections **16A** and **16B** carrying O-ring seals **19** and **20** in engagement therewith. The cylinder **18** has end walls **18A** and **18B** slidably receiving the shaft **10** so that the cylinder **18** may be slid axially from one position in which the cylinder end wall **18A** engages or closely approaches the end of the piston section **16A** into another position in which the end wall **18B** engages or closely approaches the end of the piston section **16B**.

The end wall **18B** carries a rod **21** slidable in a collar **22** fast on the shaft **10** thereby to hold the cylinder **18** against rotation while permitting it to slide back and forth between the two above referred to positions.

A roller in the form of a sleeve **23**, considerably larger than the cylinder **18**, and having its inside diameter greater than the outside diameter of the cylinder **18**, has annular ends **23A** and **23B** each having a bushing **24** providing a slidable bearing contact with the shaft **10**. A thrust ball bearing unit **25** connects the sleeve **23** to the cylinder **18**, a result attained by providing the cylinder end **18A** with a shoulder **26** on which the bearing unit **25** is anchored as by a threaded ring **27** and by providing the bearing unit **25** with a projecting annular sleeve **28** into which the annular flange **29** of the sleeve end **23A** is threaded.

The piston section **16** has, see FIGURES 3 and 4, parallel bores **30**, **31**, **32**, and **33** with the port **13** opening into the bore **30** which slidably receives the generally indicated valve **34** and with the port **14** opening into the bore **31**. The bores **32** and **33** have their proximate ends axially alined but spaced from each other by a web **35**. As may be seen in FIGURE 4, the ends of the bore **31** are closed by the piston ends **16A** and **16B** which have bores **30A** and **30B**, respectively, alined with and in communication with the bore **30** and also have bores **32A** and **32B**, respectively. The bore **32A** is in communication with the bore **32** and the bore **33B** is in communication with the bore **33**.

Within the proximate ends of the bores **30A** and **30B**, there are annular stops **36A** and **36B**, respectively, which confine the valve **34** but permit the passage of air into the bores **30A** and **30B**. The valve **34** has a central, relatively wide annular channel **37** which at all times is in communication with the intake port **13** and which is spaced from end channels **38** and **39** to provide intermediate portions **40** and **41**.

Ports **42** and **43** are proximate to each other with the port **42** effecting communication between the bore **30** and the bore **32** and with the port **43** effecting communication between the bore **30** and the bore **33**. Remote transverse ports **44** and **45** are provided, the port **44** to effect communication between the bore **30** and the bores **31** and **32** and the port **45** to effect communication between the bores **31** and **33**.

The various ports are spaced and arranged relative to each other and to the annular valve channels so that in one position of the valve **34**, see FIGURE 4, the port **13** and the port **42** are placed in communication by the valve channel **37**, the port **44** is blocked by the intermediate valve portion **40**, the port **43** is blocked by the intermediate portion **41**, and the port **45** is open via the annular channel **39**. Air is thus delivered into one end of the cylinder via the bore **32** and **32A** and is vented from the other end thereof via the bore **33B** and **33**. The cylinder **18** and, accordingly, the roller **23** are moved to the left. With the cylinder end **18B** seated against the end section **16B** of the fixed piston **15**, reversed flows result and the cylinder **18** and, accordingly, the roller **23** are moved axially in the opposite direction.

The shifting of the valve **34** from one seated position

into the other is also effected by fluid pressure. This result is attained by providing the valve 34 with axial passages 46A and 46B, see FIGURE 2, with radial bleeder lines 47A and 47B in communication therewith so that at all times there is a flow of air into the bores 30A and 30B. The bores 30A and 30B do not extend through the end sections 16A and 16B, respectively, but these have bores 48A and 48B, respectively, slidably receiving the stems 49A and 49B, respectively, of valves 50A and 50B. The valves 50A and 50B are held seated by springs 51A and 51B, respectively, thus to normally close the relief ports 52A and 52B.

In practice, the piston 15 is relieved as at 53 between its seals and the relief ports 52A and 52B open into the relieved area with the relief ports 52A and 52B being substantially larger, as to cross sectional areas, than the bleeder ports 47A and 47B, respectively. The cylinder 18 has an outlet 54 in communication with the relieved zone 53.

As the valves 50A and 50B are normally closed and as the springs 51A and 51B are balanced, and as the air pressure between them and the piston is equal, the valve 34 does not move. When, however, a valve stem 49A, 49B is engaged by a cylinder end wall 18A, 18B, it is pushed inwardly as the cylinder 18 moves. The appropriate one of the valves 50A, 50B is thus opened to vent air from that side of the valve 34 thus to so unbalance it as to cause its movement in a direction towards the reduced pressure side. The valve 34 is, accordingly, moved by the pressure on the high pressure side and its position is maintained until the opposite limit of cylinder travel relative to the piston 15 is reached to again shift it. By these means, the valve 34 is shifted to so control the flow of fluid under pressure as to cause the axial reciprocation of the roller 23. In practice, the pressure of the delivered fluid is not varied but the speed of roll reciprocation is controlled by the needle valve 55 in control of a relief port 56, the needle valve having a stem 57 exposed through the end of the shaft passage 10B.

I claim:

1. In an oscillating ink roll, a shaft, a cylinder slidably supported by said shaft, a cylindrical piston within said cylinder and fixed on said shaft coaxially thereof, said cylinder being slidable between a first position in which one end of the cylinder is adjacent one end of the piston and a second position in which the other cylinder end is adjacent the other piston end, a roller in the form of a cylindrical sleeve connected to said cylinder to move axially therewith and supported by said shaft to rotate with respect thereto, both ends of said shaft having a passage, one passage for the delivery of fluid under pressure and the other for the relief thereof, said piston having a port in each end, valve means simultaneously to connect one piston port to one shaft passage and the other of the piston ports to the other shaft passage thereby to move said cylinder and roller axially in one direction relative to said shaft, and means to shift said valve means when said cylinder is in either of said positions thereby to reverse the direction of axial movement of said cylinder and roller.

2. In an oscillating ink roll, a shaft, a cylinder slidably supported by said shaft, a cylindrical piston within said cylinder and fixed on said shaft coaxially thereof, said cylinder being slidable between a first position in which one end of the cylinder is adjacent one end of the piston and a second position in which the other cylinder end is adjacent the other piston end, a roller in the form of a cylindrical sleeve including ends slidably and rotatably connected to said shaft to move axially therewith, a connection between one roller end and said cylinder including a thrust ball bearing unit, both ends of said shaft having a passage, one passage for the delivery of fluid under pressure and the other for the relief thereof, said piston having a port in each end, valve means simultaneously to connect one piston port to one shaft passage and

the other of the piston ports to the other shaft passage thereby to move said cylinder and roller axially in one direction relative to said shaft, and means to shift said valve means when said cylinder is in either of said positions thereby to reverse the direction of axial movement of said cylinder and roller.

3. In an oscillating ink roll, a shaft, a cylinder slidably supported by said shaft, a cylindrical piston within said cylinder and fixed on said shaft coaxially thereof, said cylinder being slidable between a first position in which one end of the cylinder is adjacent one end of the piston and a second position in which the other cylinder end is adjacent the other piston end, a roller in the form of a cylindrical sleeve including ends slidably and rotatably connected to said shaft to move axially therewith but to rotate with respect thereto, means slidably connecting said cylinder to said shaft, both ends of said shaft having a passage, one passage for the delivery of fluid under pressure and the other for the relief thereof, said piston having a port in each end, valve means simultaneously to connect one piston port to one shaft passage and the other of the piston ports to the other shaft passage thereby to move said cylinder and roller axially in one direction relative to said shaft, and means to shift said valve means when said cylinder is in either of said positions thereby to reverse the direction of axial movement of said cylinder and roller.

4. The ink roll of claim 3 in which the roller is longer than the cylinder and the means connecting the cylinder to the shaft comprise a collar on the shaft within the roll and spaced from the cylinder in any position thereof and a member protruding from one cylinder end and slidably connected to the collar.

5. In an oscillating ink roll, a shaft, a cylinder slidably supported by said shaft, a cylindrical piston within said cylinder and fixed on said shaft coaxially thereof, said cylinder being slidable between a first position in which one end of the cylinder is adjacent one end of the piston and a second position in which the other cylinder end is adjacent the other piston end, a roller in the form of a cylindrical sleeve connected to said cylinder and supported by said shaft to move axially therewith but to rotate with respect thereto, both ends of said shaft having a passage, one passage for the delivery of fluid under pressure and the other for the relief thereof, valve means in control of said relief passage, said piston having a port in each end, valve means simultaneously to connect one piston port to one shaft passage and the other of the piston ports to the other shaft passage thereby to move said cylinder and roller axially in one direction relative to said shaft, and means to shift said valve means when said cylinder is in either of said positions thereby to reverse the direction of axial movement of said cylinder and roller.

6. The ink roll of claim 5 in which the valve means includes a seat in the relief passage, a needle valve adjustable relative thereto and including a stem exposed at one end of the shaft.

7. In an oscillating ink roll, a shaft, a cylinder slidably supported by said shaft, a cylindrical piston within said cylinder and fixed on said shaft coaxially thereof, said cylinder being slidable between a first position in which one end of the cylinder is adjacent one end of the piston and a second position in which the other cylinder end is adjacent the other piston end, a roller in the form of a cylindrical sleeve connected to said cylinder and supported by said shaft to move axially therewith but to rotate with respect thereto, both ends of said shaft having a passage, one passage for the delivery of fluid under pressure and the other for the relief thereof, said piston having a port in each end, balanced valve means simultaneously to connect one piston port to one shaft passage and the other of the piston ports to the other shaft passage thereby to move said cylinder and roller axially in one direction relative to said shaft, and means to un-

balance said valve means to shift said valve means when said cylinder is in either of said positions thereby to reverse the direction of axial movement of said cylinder and roller.

8. The ink roll of claim 7 in which the valve means include at each end a spring, a pressure chamber in communication with the delivery passage, and a relief valve, each relief valve including a stem projecting from an appropriate end of the piston to be engaged by the cylinder in one position thereof.

9. In an oscillating ink roll, a shaft, a cylinder slidably supported by said shaft, a cylindrical piston within said cylinder and fixed on said shaft coaxially thereof, said cylinder being slidable between a first position in which one end of the cylinder is adjacent one end of the piston and a second position in which the other cylinder end is adjacent the other piston end, a roller in the form of a cylindrical sleeve connected to said cylinder and supported by said shaft to move axially therewith but to rotate with respect thereto, said roller having a vent, both ends of said shaft having a passage, one passage for the delivery of air under pressure and the other for the relief thereof and opening into said roller, said piston having a port in each end, balanced valve means simultaneously to connect one piston port to one shaft passage and the other of the piston ports to the other shaft passage thereby to move said cylinder and roller axially in one direction relative to said shaft, and means to unbalance said valve means to shift said valve means when said cylinder is in either of said positions thereby to reverse the direction of axial movement of said cylinder and roller.

10. In an oscillating ink roll, a shaft, a cylinder slidably supported by said shaft, a cylindrical piston within said cylinder and fixed on said shaft coaxially thereof, said cylinder being slidable between a first position in which one end of the cylinder is adjacent one end of the piston and a second position in which the other cylinder end is adjacent the other piston end, a roller in the form of a cylinder sleeve connected to said cylinder and supported by said shaft to move axially therewith but to rotate with respect thereto, said roller having a vent, both ends of said shaft having a passage, one passage for the delivery of air under pressure and the other for the relief thereof, and opening into said roller, said piston having a port in each end, balanced valve means simultaneously to connect one piston port to one shaft passage and the other of the piston ports to the other shaft passage thereby to move said cylinder and roller axially in one direction relative to said shaft, and means to unbalance said valve means to shift said valve means when said cylinder is in either of said positions thereby to reverse the direction of axial movement of said cylinder and roller, and each relief valve including a port opening through the cylinder wall.

11. In an oscillating ink roll, a shaft, a cylinder slidably supported by said shaft, a cylindrical piston within said cylinder and fixed on said shaft coaxially thereof, said cylinder being slidable between a first position in which one end of the cylinder is adjacent one end of the piston and a second position in which the other cylinder end is adjacent the other piston end, a roller in the form of a cylindrical sleeve connected to said cylinder and supported by said shaft to move axially therewith but to rotate with respect thereto, both ends of said shaft having a passage, one passage for the delivery of fluid under pressure and the other for the relief thereof, said piston having an outlet passage opening through each end, an exhaust passage whose ends are closed and which is in communication with said relief passage, and an intermediate bore in communication with said delivery passage, said piston having four transverse ports, each of the two proximate ports connecting said bore to an appropriate one of said outlet passages and each of the two remote ports connecting said exhaust passage to an appropriate one of said delivery passages through said bore, and a valve slidable in said bore between two positions, in each position the proximate port for one delivery passage being open and the remote port of the other delivery passage being open, thereby to move said cylinder and roller axially, and means to shift said valve from one position to the other when said cylinder is in either of said positions thereby to reverse the direction of axial movement of said cylinder and said roller.

12. The ink roll of claim 11 in which the piston passage and bore are in the same plane.

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