

PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) IMPROVEMENTS IN AND RELATING TO PRINTING APPARATUS

(71) We, COLORFLO LIMITED, a British company of Bessemer Works, Whinbush Road, Hitchin, Hertfordshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to printing apparatus of the type in which printing ink is fed into the recessed design or engraving of an intaglio printing plate through the thickness of the plate.

A printing apparatus of this type in accordance with the invention has a printing liquid feed mechanism comprising at least one pump chamber adapted to be contracted by a main piston on application of pressure on the printing plate during printing and to expand when the printing pressure is released, the or each chamber having an outlet which communicates when printing is taking place with one or more ink passages extending through the printing plate and an inlet which communicates when printing is taking place with an ink supply, the piston carrying at least one yieldable member which is exposed to pressure generated in the liquid during use by contraction of the chamber by the piston, and which yields, to effect pressure relief, when the pressure reaches a predetermined value.

The yielding of the yieldable member prevents excess pressure build up which could cause smudging or the like. The yieldable member may comprise a relief or auxiliary piston working in the main piston and/or a relief valve biased to a position closing communication between a relief passage passing through the main piston and the pump chamber.

When sufficient ink has been supplied to service the intaglio printing plate excess ink is prevented from leaking and is preferably returned to the supply by the opening of the relief valve.

[Price 25p]

Each inlet opening for the supply of the ink preferably communicates with its pump chamber through a port formed in the auxiliary or "relief" piston which works in a cylindrical bore in the main piston, the relative movement of the auxiliary and main pistons acting to open or close the ports and they then act as a valve device. One end of this auxiliary piston may carry at least one valve element which controls the outlet leading from the pump chamber to the recesses of the printing plate. The auxiliary piston is biased by a spring which constantly tends to press the auxiliary piston in a direction to close the outlet.

The operation of the various parts of the unit are described and claimed in the complete specification of our co-pending application No. 33735/67. (Serial No. 1241793)

An embodiment of one part of the ink feed mechanism of a printing machine in accordance with the invention will now be described by way of example with reference to the accompanying drawing which is a cross-section through the mechanism.

The mechanism comprises a member 2 the interior chamber 4 of which constitutes a "pump" chamber and is intended to communicate with a recessed design or engraving on the printing surface of an intaglio printing plate (not shown) through an outlet passage 6. A piston 8 works in the chamber 4 and is provided with a sliding seal member 10 to provide a seal between the piston and the chamber. The upper portion of the piston rod 12 is secured to a support member 14 having a head 15 which is arranged for limited sliding movement in a cylinder 16 which rests on the top of the walls of the member 2. As pressure is applied to the piston rod during printing for example by means of a member secured at 18 to the piston rod, the member 14 moves down within the cylinder 16 compressing a spring 20 which is located between the head 15 of the member 14 and bottom wall 22 of the cylinder so as to apply pressure to the member 2 through the spring and consequently

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to press the printing plate attached to the member 2 against the surface to be printed.

The piston 8 and its rod 12 are formed with an internal passage 24 communicating at the upper end with an opening 25 through the member 14 for connection to a supply of printing ink. The lower portion of the passage 24 is of larger diameter to provide a cylinder 26 carrying a yieldable member in the form of a relief or auxiliary piston 28 which is hollow and which communicates with the cylinder 26 through an opening 30 and with the chamber 4 through chamber inlet openings 32.

The piston 28 which is a sliding fit in the cylinder 26 carries a ball valve 34 at its lower end which is normally biased by means of a spring 36 within the piston to a position in which it closes a relief passage 38 from the piston to the chamber 4. The piston itself is biased by means of a spring 40, located within the cylinder 26 to a position in which the ball valve 34 closes communication between the chamber 4 and its outlet passage 6.

During use of the mechanism, pressure is applied by a standard printing apparatus (not shown) to the piston rod 12 and support member 14 causing, through the spring 20, the member 2 and the printing plate carried thereby to be pressed against the surface to be printed. Further, when the spring pressure is overcome further pressure causes the piston 8 to move to contract the chamber 4 and hence apply pressure to the printing ink in the chamber. During the initial movement of the piston in the chamber the outlet 6 remains closed by the outlet valve 34 and the inlet valve 32 is open so that ink within the chamber 4 can flow back through the relief piston 28 and up through the passage 24 in the main piston to the ink supply. However, as the pressure increases and the piston 8 moves downwards in the chamber 4 over the relief piston 28 overcoming the pressure of spring 40, the head of the piston 8 acts as a valve device to close the ports 32 so that communication between the chamber 4 and the ink supply is cut off. By this time the printing plate is pressed firmly down on the surface to be printed and when the pressure in the chamber 4 has built up sufficiently the pressure acting on the tapered nose 42 of the relief piston 28 causes this piston to yield and to move up into the cylinder 26 against the pressure of the spring 40 which movement opens the passage 6 through the printing plate to the chamber 4 allowing printing ink to reach the intaglio surface of the plate.

When sufficient ink has been supplied to service the intaglio plate the pressure in the chamber 4 increases and the ball valve 34 yields and is lifted from its seat, excess ink is then returned to the supply via the relief passage 38.

As the printing pressure is relaxed the pressure on the relief piston 28 within the chamber 4 is also relaxed allowing the spring 40 to move the piston 28 back to the position in which the passage 6 is closed by the ball valve 34. In this position ink is no longer fed to the intaglio recess thus avoiding the possibility of excess ink being supplied as the plate is lifted from the surface which has just been printed.

As the pressure is further relaxed the spring 20 moves the main piston 8 upwardly within the chamber 4 to the position shown in the drawings in which it abuts against the stop 44 and as the chamber 4 is expanded and as the ports 32 are now open ink is drawn through the supply opening 25 the passage 24 the cylinder 26 and the opening 30 into the chamber 4 ready for the next printing operation.

Thus the ink required for printing is controlled automatically.

It will be appreciated that a plurality of chambers and pistons such as that described and illustrated in the drawings would normally be provided for a single printing plate.

The spring 20 which is used to apply pressure to the printing plate could of course be replaced by subsidiary pistons and cylinders coupled to a hydraulic accumulator.

The mechanism can be used for example to feed coloured paint or like liquid to be printed rather than coloured ink into different parts of an intaglio surface each chamber being supplied with paint of one particular colour so that coloured patterns can be printed. Alternatively two or more pump units such as that described can be connected to a common outlet into an intaglio relief so that by using different colours of ink or paint one for each pump unit, marbled effects can be obtained.

Equally adhesives could be used for the printing liquid instead of paint or coloured printing inks, as could thermoplastic material.

If a plate is supplied with more than one pump unit then the outlets from the chambers of each unit can be made of different cross section so that the quantity of each coloured ink or paint can be regulated.

WHAT WE CLAIM IS:—

1. A printing apparatus of the type in which printing ink or like liquid to be printed is fed into the recessed design or engraving of an intaglio printing plate through the thickness of the plate, comprising a printing liquid feed mechanism having at least one pump chamber adapted to be contacted by a main piston on application of pressure on the printing plate during printing and to expand when the printing pressure is released, the or each chamber having an outlet which communicates when printing is taking place, with one or more ink passages extending through the plate when printing is taking place with an printing plate, an inlet which communi-

to press the printing plate attached to the member 2 against the surface to be printed.

The piston 8 and its rod 12 are formed with an internal passage 24 communicating at the upper end with an opening 25 through the member 14 for connection to a supply of printing ink. The lower portion of the passage 24 is of larger diameter to provide a cylinder 26 carrying a yieldable member in the form of a relief or auxiliary piston 28 which is hollow and which communicates with the cylinder 26 through an opening 30 and with the chamber 4 through chamber inlet openings 32.

The piston 28 which is a sliding fit in the cylinder 26 carries a ball valve 34 at its lower end which is normally biased by means of a spring 36 within the piston to a position in which it closes a relief passage 38 from the piston to the chamber 4. The piston itself is biased by means of a spring 40, located within the cylinder 26 to a position in which the ball valve 34 closes communication between the chamber 4 and its outlet passage 6.

During use of the mechanism, pressure is applied by a standard printing apparatus (not shown) to the piston rod 12 and support member 14 causing, through the spring 20, the member 2 and the printing plate carried thereby to be pressed against the surface to be printed. Further, when the spring pressure is overcome further pressure causes the piston 8 to move to contract the chamber 4 and hence apply pressure to the printing ink in the chamber. During the initial movement of the piston in the chamber the outlet 6 remains closed by the outlet valve 34 and the inlet valve 32 is open so that ink within the chamber 4 can flow back through the relief piston 28 and up through the passage 24 in the main piston to the ink supply. However, as the pressure increases and the piston 8 moves downwards in the chamber 4 over the relief piston 28 overcoming the pressure of spring 40, the head of the piston 8 acts as a valve device to close the ports 32 so that communication between the chamber 4 and the ink supply is cut off. By this time the printing plate is pressed firmly down on the surface to be printed and when the pressure in the chamber 4 has built up sufficiently the pressure acting on the tapered nose 42 of the relief piston 28 causes this piston to yield and to move up into the cylinder 26 against the pressure of the spring 40 which movement opens the passage 6 through the printing plate to the chamber 4 allowing printing ink to reach the intaglio surface of the plate.

When sufficient ink has been supplied to service the intaglio plate the pressure in the chamber 4 increases and the ball valve 34 yields and is lifted from its seat, excess ink is then returned to the supply via the relief passage 38.

As the printing pressure is relaxed the pressure on the relief piston 28 within the chamber 4 is also relaxed allowing the spring 40 to move the piston 28 back to the position in which the passage 6 is closed by the ball valve 34. In this position ink is no longer fed to the intaglio recess thus avoiding the possibility of excess ink being supplied as the plate is lifted from the surface which has just been printed.

As the pressure is further relaxed the spring 20 moves the main piston 8 upwardly within the chamber 4 to the position shown in the drawings in which it abuts against the stop 44 and as the chamber 4 is expanded and as the ports 32 are now open ink is drawn through the supply opening 25 the passage 24 the cylinder 26 and the opening 30 into the chamber 4 ready for the next printing operation.

Thus the ink required for printing is controlled automatically.

It will be appreciated that a plurality of chambers and pistons such as that described and illustrated in the drawings would normally be provided for a single printing plate.

The spring 20 which is used to apply pressure to the printing plate could of course be replaced by subsidiary pistons and cylinders coupled to a hydraulic accumulator.

The mechanism can be used for example to feed coloured paint or like liquid to be printed rather than coloured ink into different parts of an intaglio surface each chamber being supplied with paint of one particular colour so that coloured patterns can be printed. Alternatively two or more pump units such as that described can be connected to a common outlet into an intaglio relief so that by using different colours of ink or paint one for each pump unit, marbled effects can be obtained.

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If a plate is supplied with more than one pump unit then the outlets from the chambers of each unit can be made of different cross section so that the quantity of each coloured ink or paint can be regulated.

WHAT WE CLAIM IS:—

1. A printing apparatus of the type in which printing ink or like liquid to be printed is fed into the recessed design or engraving of an intaglio printing plate through the thickness of the plate, comprising a printing liquid feed mechanism having at least one pump chamber adapted to be contacted by a main piston on application of pressure on the printing plate during printing and to expand when the printing pressure is released, the or each chamber having an outlet which communicates when printing is taking place, with one or more ink passages extending through the printing plate, and an inlet which communi-



- ink supply the piston carrying at least one yieldable member which is exposed to pressure generated in the liquid during use by contraction of the chamber by the piston and which yields, to effect pressure relief, when the pressure reaches a predetermined value. 20
- 5 2. An apparatus as claimed in Claim 1 having an valve, biased to close communication between the pump chamber and a relief passage passing through the main piston and constituting a yieldable member. 25
- 10 3. An apparatus as claimed in Claim 2 in which the relief passage communicates with a connection for the ink supply.
- 15 4. An apparatus as claimed in any of the preceding claims having an auxilliary piston working in a bore in the main piston and constituting a yieldable member which has a surface open to the pump chamber below the main piston.
5. A printing apparatus as claimed in any of the preceding claims the various pump chambers being provided for a single printing plate, each chamber connecting with a different part of the intaglio design so as to produce multi-coloured prints.

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