

Sept. 25, 1951

F. AUER

2,569,034

HYDRAULIC IMPRESSION GEAR FOR PRINTING PRESSES

Filed May 20, 1948

3 Sheets-Sheet 1

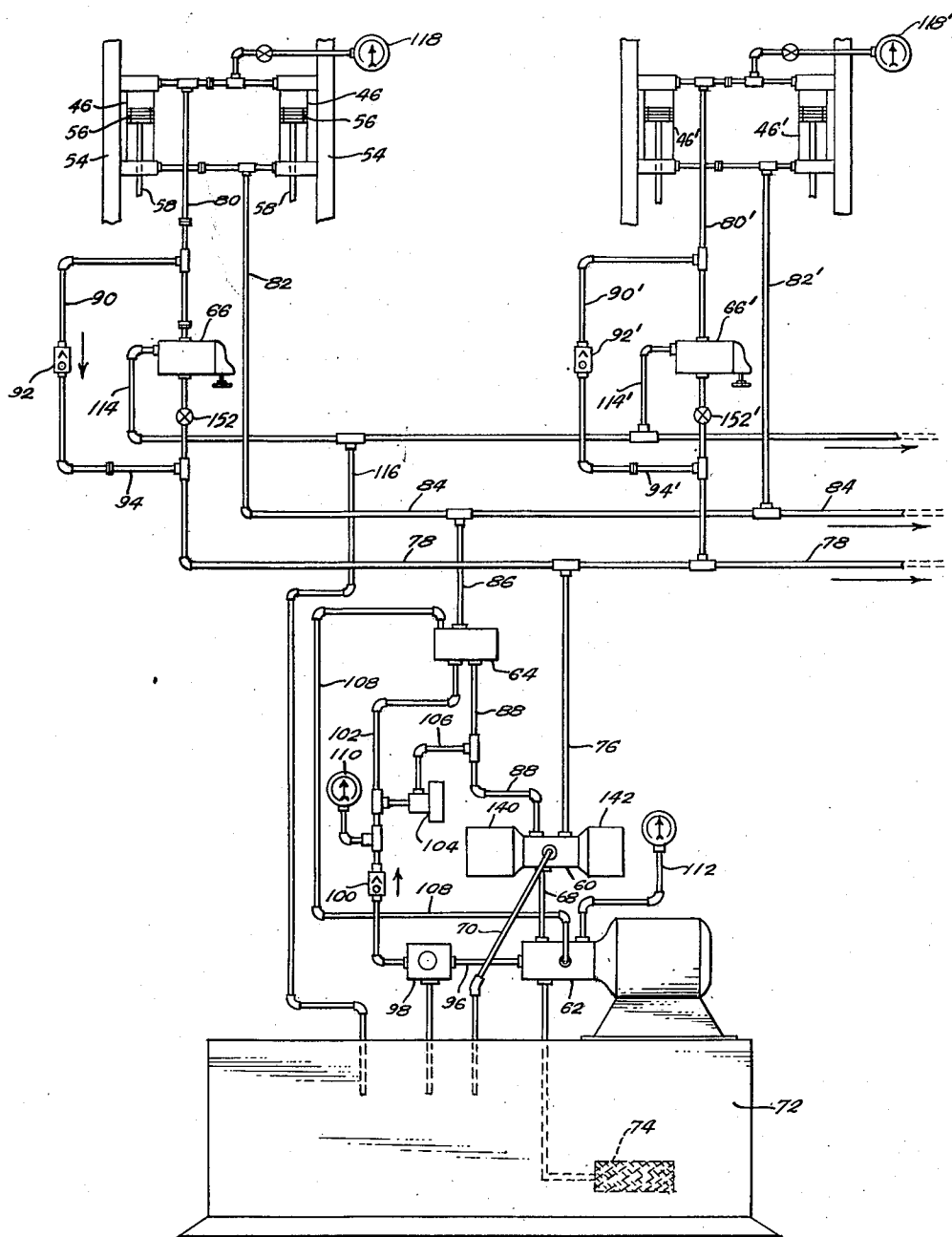


Fig. 1

INVENTOR
FREDERICK AUER
BY *James and Franklin*
ATTORNEYS

Sept. 25, 1951

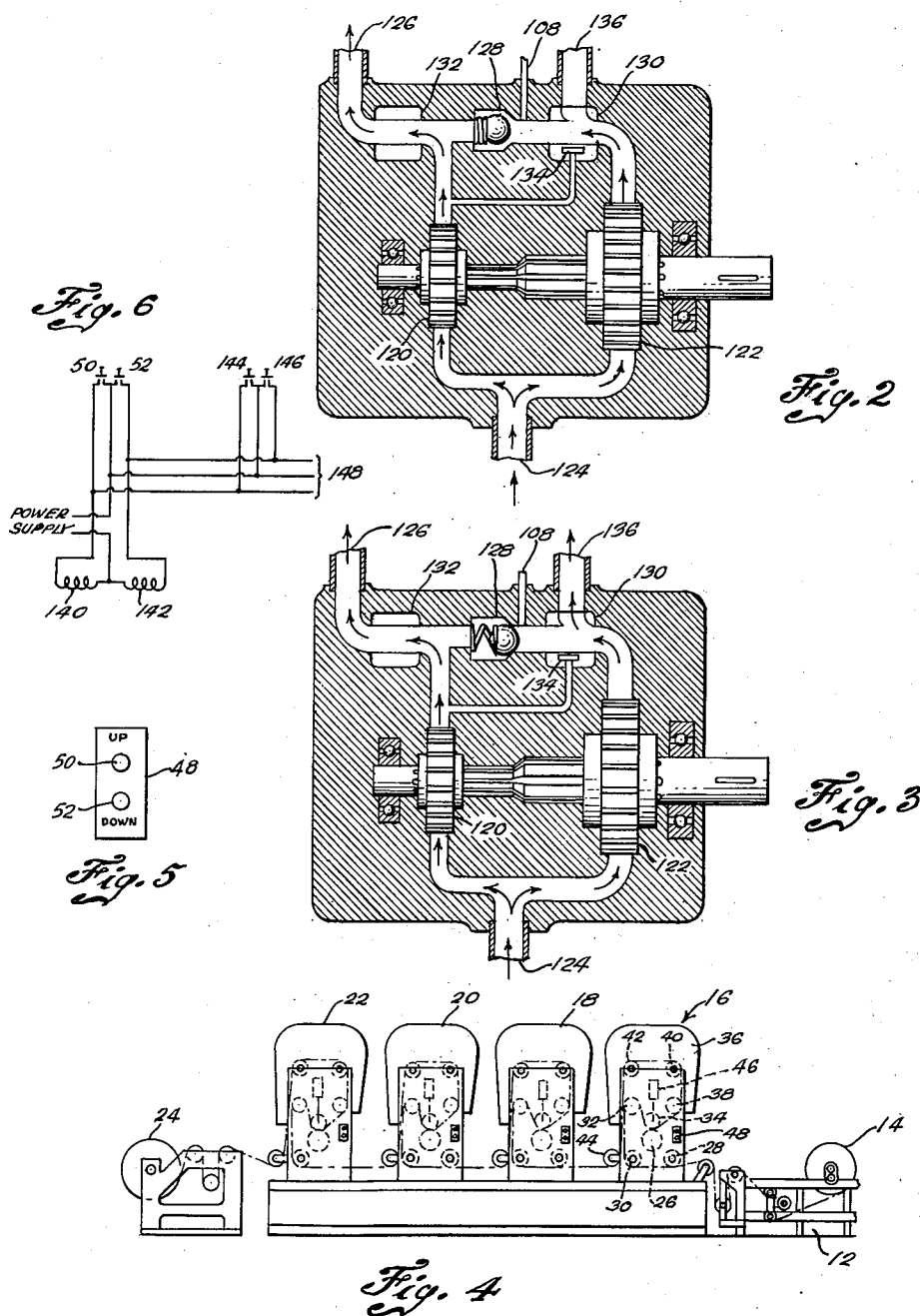
F. AUER

2,569,034

HYDRAULIC IMPRESSION GEAR FOR PRINTING PRESSES

Filed May 20, 1948

3 Sheets-Sheet 2



INVENTOR
 FREDERICK AUER
 BY *James and Franklin*
 ATTORNEYS

Sept. 25, 1951

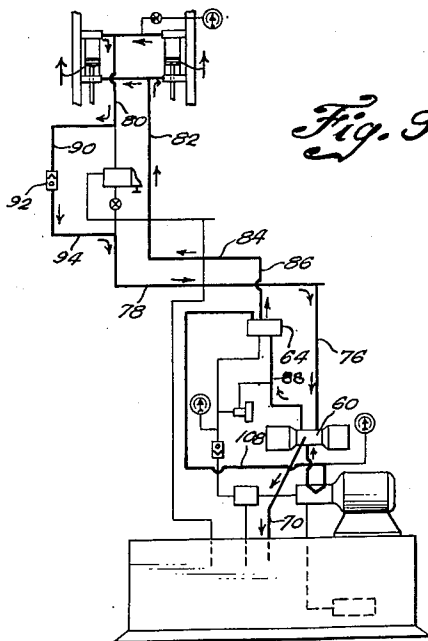
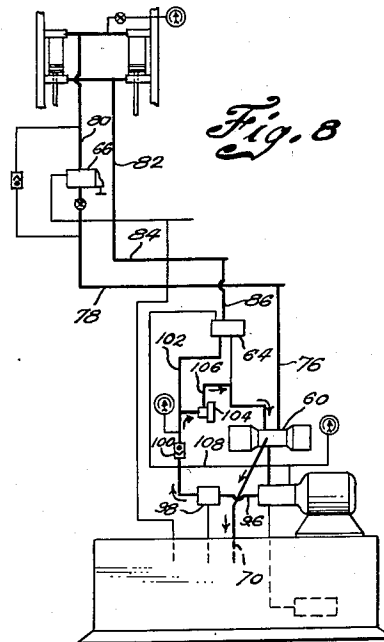
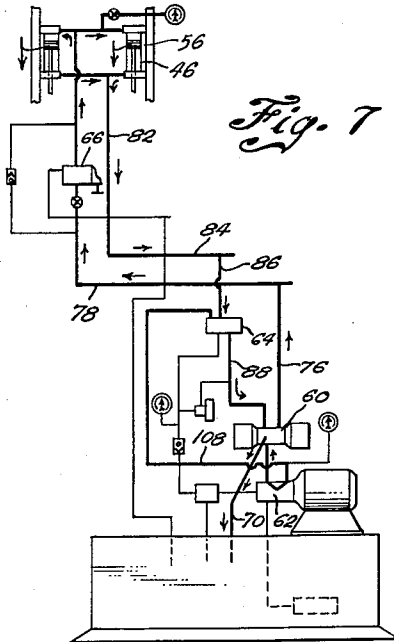
F. AUER

2,569,034

HYDRAULIC IMPRESSION GEAR FOR PRINTING PRESSES

Filed May 20, 1948

3 Sheets-Sheet 3



INVENTOR.
FREDERICK AUER
BY *James and Franklin*
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,569,034

HYDRAULIC IMPRESSION GEAR FOR
PRINTING PRESSESFrederick Auer, Teaneck, N. J., assignor to Cham-
plain Company, Inc., Bloomfield, N. J., a cor-
poration of New York

Application May 20, 1948, Serial No. 28,107

12 Claims. (Cl. 101-247)

1

This invention relates to printing presses, and more particularly to an hydraulic mechanism for controlling the printing pressure in the press, and also for raising and lowering the impression roller.

The invention is shown applied to rotogravure printing presses, especially of the multiple unit or multi-color type. The web being printed is passed between a printing cylinder or drum which is usually beneath the web and runs in a bath or fountain of ink, and an impression roller which is usually above the web and squeezes the web against the printing cylinder or drum. (In the following specification the term "drum" is preferred for the printing cylinder, in order to distinguish from the hydraulic cylinders hereinafter referred to.)

It is not new to employ hydraulic cylinders and pistons to raise and lower the impression roller. The printing pressure has been controlled by positively arresting downward movement of the impression roller bearings by suitable adjusting means, usually stop screws beneath the bearings. With this arrangement the pressure depends upon the flattening of the bottom part of the periphery of the yieldable impression roller, which is usually made of rubber or equivalent material. Such an adjustment has proved neither convenient nor satisfactory, and has been particularly troublesome when dealing with a web such as glassine or cellophane which should be printed under a very light pressure, for in such case the adjustment of the stop screws is most critical and difficult. Paper may be printed at a pressure of, say, 100 to 400 lbs. per linear inch, and paper board at a pressure of, say, 250 to 450 lbs. per linear inch, but a glossy web, such as cellophane (regenerated cellulose) or glassine is best printed at a very light pressure of, say, 10 to 60 lbs. per linear inch. With positive stop screws it is difficult to adjust the pressure to a value less than 100 lbs. per linear inch. Moreover, there is no convenient way to indicate the pressure being applied to the web, and the adjustment is a painstaking and wasteful matter of trial and error.

The primary object of the present invention is to overcome the foregoing difficulty, and to provide a printing pressure ranging all the way down to zero pressure or so-called "kiss contact," and all the way up to a desired maximum pressure. For this purpose a counterbalance pressure is applied beneath the pistons to counteract or more than counteract the dead weight of the impression roller and its bearings and associated mechanism. The pressure which is applied to

2

the top of the pistons is so adjusted that the differential or net force applied to the impression roller provides the desired printing pressure per linear inch. It is evident that with this arrangement the printing pressure may be reduced to a very low value, and that even such low value, say 10 lbs. per linear inch, may be accurately regulated and maintained.

Moreover, in accordance with a further feature and object of the invention, a pressure gauge is connected to the top of the cylinder, and it is so arranged that it may be set at zero even though under some pressure, the zero setting being used for a kiss contact at the impression roller. The scale on the pressure gauge then may be used by the operator as a guide in quickly adjusting the printing pressure to a change in the nature of the web being printed, and also as a guide during any subsequent trial and error changes of a minor degree for obtaining optimum printing results.

In accordance with further features and objects of the invention, the bottom and top of the cylinder are supplied with pressure fluid from a common source capable of supplying a pressure somewhat greater than that needed as a maximum for the top of the cylinder, and a suitable fixed adjustable means is provided to regulate the counterbalance pressure supplied to the bottom of the cylinder, and another suitable fixed adjustable means is employed to regulate the pressure supplied to the top of the cylinder, independently of the pressure supplied to the bottom of the cylinder.

As so far described, the downward movement of the roller from an elevated position would be rather slow, and a further object of the invention is to provide a rapid movement of the roller from its raised position downward to the printing drum. This is done by releasing all pressure at the bottom of the cylinder during downward movement, and applying the counterbalance pressure at or near the end of the downward movement, and preferably in response to contact between the roller and drum.

A further object is to provide rapid upward movement of the roller, and for this purpose the pressure is released from the top of the piston, and the pressure applied to the bottom of the piston may be supplied directly from the source without passing through the pressure adjusting means previously referred to.

Still another object is to conserve hydraulic power and to further speed up the movement of the impression roller. For this purpose two pres-

3

sure sources may be used, one a low pressure source, and the other a high pressure source, the former being used for raising or lowering the roller, and the latter being used after the roller is in contact with the drum. Such sources may be provided in the form of a combination high and low pressure double pump and valve. Such double pumps have a large volume low pressure impeller, and a low volume high pressure impeller, together with a built-in valve which cuts off the low pressure supply and continues the high pressure supply when a back pressure is built up exceeding the low pressure.

A further object of the invention is to provide for remote control of the raising and lowering of the impression roller, and for this purpose a main four-way valve is connected to the top and bottom of the cylinder, and is preferably of the solenoid type so that at any desired point, preferably including points at each side of the printing unit itself, a pair of pushbuttons may be provided, one for raising and the other for lowering the roller.

Still another object is to apply the invention to multi-color presses having a series of printing units. For economy, and also for the convenience of simultaneous control of all of the units, the pump and nearly all of the valve mechanism is employed in common for all of the printing units. Control buttons are located on each unit, and are connected in common to the solenoid operated four-way valve. Thus an operator at any unit may instantly raise or lower all of the rollers. However, the means for regulating the printing pressure of the unit, typically a pressure reducing valve leading to the top of the cylinder, is preferably provided individually for each of the units, because slight differences in printing pressure may prove desirable for the different colors being printed.

To accomplish the foregoing general objects, and other more specific objects which will hereinafter appear, my invention resides in the printing press elements and hydraulic gear elements and their relation one to another as are hereinafter more particularly described in the specification. The specification is accompanied by drawings in which

Fig. 1 is a pipe diagram showing one preferred form of my invention;

Figs. 2 and 3 are schematic sections through a known commercially available form of combination high and low pressure double pump and valve which may be employed as a part of the invention;

Fig. 4 is a side elevation of a multi-color rotogravure printing press embodying features of the invention;

Fig. 5 illustrates the remote pushbutton control for the hydraulic mechanism;

Fig. 6 is a schematic wiring diagram for the remote control wiring; and

Figs. 7, 8 and 9 are pipe diagrams explanatory of the operation of the invention during lowering of the roller, during printing, and during raising of the roller, respectively.

Referring to the drawing, and more particularly to Fig. 4, the invention is shown applied to a multi-color rotogravure printing press comprising a wind-off mechanism 12 supporting a web roll 14 and feeding the paper to printing units 16, 18, 20 and 22 from which the web is wound up on a reel 24. Referring to the printing unit 16 as typical, the printing cylinder or drum is shown at 26, and the web is fed around guide

4

rollers 28, 30 and 32 to an impression roller 34. The web is then fed to a dryer 36 by means of guide rollers 38, 40, 42 and 44, and then goes to the next unit. To avoid changing the length or position of the web, the guide rollers 32 and 38 are preferably raised and lowered in unison with the impression roller 34. The impression roller 34 is raised and lowered by hydraulic mechanism schematically indicated at 46. It will be understood that in the particular printing units here shown, any reference to the hydraulic cylinder 46 raising or lowering the impression roller is to be understood as meaning the raising or lowering of the combination of rollers 32, 34 and 38.

The printing unit has a pushbutton panel 48 (Fig. 4) more clearly shown in Fig. 5, the said panel having two buttons 50 and 52 appropriately marked to indicate raising or lowering of the impression roller. All of the printing units 16, 18, 20 and 22 are preferably alike insofar as the present invention is concerned, and it will be understood that each has a pushbutton panel as described. In fact, one may be provided on each side of the press. However, in the particular arrangement here shown, the pushbutton panel is a remote control for all of the printing units, and pressure on the up button or down button will raise or lower all of the impression rollers which are in use. (It is possible to permanently cut out any desired number of the printing units when fewer colors are to be printed.)

Referring now to Fig. 1 of the drawing, the hydraulic cylinders (there are two, one for each end of the impression roller) are shown at 46, these being secured to the walls 54 of the press. The pistons 56 have piston rods 58 which extend downwardly to the bearings of the impression roller (and its associated guide rollers when, as is here the case, some of the guide rollers are moved in unison with the impression roller). A suitable valve mechanism 60 is provided to apply pressure fluid from a source 62 to either the top or bottom of the cylinder in order to lower or raise the roller. An additional valve means 64 is provided to supply pressure fluid to the bottom of the cylinder through piping independent of the valve means 60, thereby counteracting the dead weight of the impression roller and associated mechanism, such as the hydraulic pistons, rods, bearings and movable guide rollers, etc. There is also a fixed adjustable means, in this case a pressure reducing valve 66, to adjust the pressure supplied to the top of the cylinders 46 in order to obtain a desired net differential force or printing pressure.

From another viewpoint it may be said that the main valve means 60 releases the pressure at the bottom of the cylinder during lowering of the impression roller in order to obtain rapid lowering of the roller, while the additional means 64, which is a counterbalance or sequence valve, applies pressure to the bottom of the cylinder at or near the end of the downward movement of the roller.

The source 62 is in reality two sources, one at low pressure, and the other at high pressure. It is preferably a combination high and low pressure pump or double pump with a built-in valve to cut off the large volume low pressure supply when back pressure builds up against the same. The pump inlet from the tank is shown at 74.

The main valve 60 previously referred to is preferably a solenoid operated four-way valve.

5

6

Its inlet from pump 62 is the pipe 68, and its exhaust or drain outlet is shown by pipe 70 leading back to a tank 72. During lowering of the impression roller, fluid is led by valve 60 to pipes 76, 78 and 80 and so to the top of the cylinder. Fluid is exhausted from the bottom of the cylinder through pipes 82, 84, 86 and 88 to valve 60 and thence through pipe 70 to tank 72. During raising of the roller, pressure fluid is guided by valve 60 to pipes 88, 86, 84 and 82 to the bottom of the cylinder, while the top of the cylinder is released through pipes 80, 80, check valve 92, pipe 94, pipes 78 and 76 to valve 60 and thence through drain pipe 70 to tank 72.

When the impression roller has been lowered into contact with the printing drum, back pressure builds up, and pump 62 changes from low pressure to high pressure. The high pressure is supplied not only to main valve 60 through pipe 68, and so to the top of the cylinder, but also through a pipe 96 to a flow control valve 98 and a check valve 100 and thence through pipe 102, counterbalance and sequence valve 64, pipes 86, 84 and 82, to the bottom of the cylinder. The pressure thus applied to the bottom of the cylinder is limited to a desired amount, and this is preferably done by means of a pressure relief valve 104 which permits some of the fluid passed by the flow control valve 98 to bleed back to the tank through pipes 106, 98, four-way valve 60, drain pipe 70 and thence to tank 72.

The pump 62 has a low pressure outlet connected through pipe 108 to the counterbalance and sequence valve 64. Pipe 108 receives only low pressure, and when the pump changes to high pressure, pipe 108 receives nothing. During downward movement of the impression roller the low pressure through pipe 108 keeps the valve 64 open in such a direction as to connect pipes 86 and 88. However, when back pressure builds up and the pump 62 begins to deliver high pressure, the counterbalance and sequence valve 64 is shifted in such a direction as to connect pipe 102 with pipe 86, the pipe 88 being disconnected from pipe 86 and thereby terminating release or free drainage from the bottom of the cylinder to the tank 72.

The pressure relief valve 104 is so adjusted relative to the flow permitted by the flow control valve 98 as to provide a desired upward or counterbalance pressure at the bottom of the cylinder. The pressure gauge 110 may be added temporarily during servicing of the apparatus to determine the pressure supplied to the bottom of the cylinder. The pressure gauge 112 reads the high pressure from the pump 62, and this too is adjusted to keep it at some value reasonably close to the maximum pressure needed at the top of the cylinder. The actual pressure supplied to the top of the cylinder is adjusted by the pressure reducing valve 66 previously referred to, and any overflow or drainage from the pressure reducing valve is led by means of pipes 114 and 116 to the tank 72. The pressure gauge 118 is left permanently with the apparatus, and may be used as a measure of the printing pressure. To do this the gauge is set at zero when the impression roller just touches the printing drum, or, in other words, at kiss contact, which, as a practical matter, may be determined by placing a strip of cellophane between the roller and drum and regulating the pressure until the cellophane is frictionally restrained yet can be pulled through the rollers.

Multiple printing units are controlled from

the same pump and valve arrangement so far described, this being represented in Fig. 1 by the cylinders 46' connected to the main pipes 78 and 84 previously referred to by means of pressure reducing valve 66', check valve 92' and pipes 82', 80', 90', 94'. The use of individual pressure reducing valves 66 and 66', etc. makes it possible to independently adjust the printing pressure at the different printing units, as indicated by the individual gauges 118, 118', etc.

The particular pump 62 here shown is manufactured by Vickers, Inc., of Detroit, Michigan, and is their unit No. VCH-109-ED-3DB. The operating principle of the double pump and combination valve unit is shown in Figs. 2 and 3 of the drawing. There is a small volume high pressure pump 120 and a large volume low pressure pump 122. These have a common inlet 124. The high pressure pump 120 is continuously connected to an outlet 126. The low pressure pump 122 is connected to the same outlet 126 through a check valve 128. The pump further comprises a pressure actuated unloading valve schematically indicated at 130, an overload relief valve schematically indicated at 132, and a control chamber schematically indicated at 134. In Fig. 2 the pump is operating at low pressure, and the large output of pump 122, say 14 gals. per minute, is joined with the small output, say 1 gal. per minute, from the pump 124, the combined flow being delivered at the outlet 126. The unloading valve 130 may be externally adjusted to open if the back pressure in control chamber 134 rises to a pre-determined value. When the pressure in the control chamber 134 is less than the adjustment, the oil flow is combined in outlet 126; the check valve 128 being opened and the overload relief valve 132 being inoperative. Some low pressure fluid flows through pipe 108.

As the back pressure rises until the pressure in control chamber 134 exceeds the adjustment of the unloading valve 130, the unloading valve opens and permits all of the oil delivered by the large pump 122 to flow freely back to the tank or reservoir without any resistance and without consuming power. The condition is illustrated in Fig. 3 of the drawing. In effect, there is a connection within the pump back to its inlet. The check valve 128 closes and the small volume pump 120 continues to supply fluid under high pressures to the outlet 126. The high pressure may itself be controlled by the overload relief valve 132. No low pressure fluid flows through pipe 108.

The four-way valve 60 might be mechanically operated, but it is convenient to provide remote control, and this in turn is most conveniently done by electrical means. The valve is accordingly a solenoid operated valve, and in the particular case here shown, it is manufactured by Vickers, Inc., of Detroit, Michigan, it being their solenoid operated four-way valve No. CK-2632-NA-220-AC-SC. It is believed unnecessary to explain the internal construction of a four-way valve, and many types are known and available on the market. In Fig. 1 it will be understood that the valve itself is contained in the central portion, the end portions 140 and 142 representing the solenoids which shift the valve toward the right or the left. The electrical control of such a valve is quite simple, it being shown at Fig. 6, in which the circuit to solenoid 140 may be closed by means of a remote pushbutton 50, while the circuit to the solenoid 142 may be closed by means of a companion pushbutton 52. There is a com-

7

mon power supply, as shown. To control the solenoid operated valve at additional remote control points, it is merely necessary to extend wires as shown at 148, running, for example, along the press from printing unit to printing unit, and to connect additional up and down pushbutton panels at desired points, as indicated at 144 and 146 in Fig. 6.

The flow control valve 98 may be of any conventional type. That here shown is a Vickers, Inc., FX-190-D flow control valve. The check valves 92 and 100 may be conventional, one commercially available type being made by Watson-Stillman, and another commercially available type being made by Vickers, Inc., the latter being their No. C-805 check valve. Check valve 92 is faced to permit downward flow, and the check valve 100 is faced to permit upward flow, as viewed in the drawing.

The pressure relief valve 104 may be conventional, that here shown being a Vickers CR-171-B relief valve.

The pressure reducing valve 66 may be conventional, the particular one here shown being a Vickers X-106-DK.

A shut-off valve 152 may be provided beneath the pressure reducing valve 66. This may be closed when it is desired to cut a printing unit out of operation, and also on occasion during servicing and adjusting operations. Release can still take place through check valve 92, hence the roller can be urged upward, but not downward.

The counterbalance and sequence valve 64 is in this case made by Vickers, Inc., it being their series RC-106-Z-4 valve. Other known valves may be used, the important thing being that the valve be able to connect pipe 86 to either the pipe 88 or the pipe 102, and that it be responsive to a change in pressure. In the present case the application of low pressure through the pipe 108 holds the valve in that direction which connects pipe 86 to pipe 88. However, when the valve action of the pump itself bypasses the low pressure supply so that no further low pressure fluid is delivered to pipe 108, and instead the low pressure fluid is released directly back to the tank 72 or to the pump inlet, the valve 64 shifts in such a manner as to connect the pipe 86 to the pipe 102 instead of to the pipe 88, whereupon the bottom of the hydraulic cylinder, instead of draining into the tank, is supplied with pressure fluid, the precise pressure of which has been determined by the adjustment of the pressure relief valve 104.

The three main stages of operation of the apparatus shown will be clear from inspection and comparison of Figs. 7, 8 and 9 of the drawing. In these figures the active pipes have been shown in heavier lines in order to simplify the drawings and the explanation. Referring to Fig. 7, it will be seen that the piston 56 is being forced downwardly by low pressure fluid supplied from pump 62 through valve 60, pipes 76 and 78, pressure reducing valve 66, and pipe 80, to the top of the cylinder 46. The bottom of the cylinder drains freely through pipes 82, 84, 86 and 88, valve 60, and pipe 70. Low pressure fluid also presses through pipe 108 to the counterbalance and sequence valve 64, thus holding pipe 86 connected to pipe 88.

When the piston has come to the bottom of its stroke, or, in other words, when the roller contacts the printing drum, the situation becomes that illustrated in Fig. 8. Back pressure builds up and the low pressure pump is cut out of operation. The high pressure pump supplies high

8

pressure fluid through valve 60, pipes 76 and 78, pressure reducing valve 66 and pipe 80 to the top of the cylinder. At the same time the cut-off of low pressure through pipe 108 to the counterbalance and sequence valve 64 causes that valve to shift and to connect pipe 86 with pipe 102. At this time, therefore, some of the high pressure fluid flows through pipe 96, flow control valve 98, check valve 100, and thence upward through pipe 102, valve 64, pipes 86, 84 and 82, to the bottom of the cylinder. This opposes and counteracts or more than counteracts the dead weight of the impression roller and its associated mechanism. The amount of counterbalance pressure is determined and limited by the pressure relief valve 104, which permits some of the fluid to flow back through the pipe 106 and pipe 88 to valve 60 and drain pipe 70. The pressure provided through the pressure reducing valve 66 is so adjusted, relative to the counterbalance pressure, as to result in a net downward force which gives the desired printing pressure, ranging anywhere from zero or kiss contact upward to, say, 500 lbs. per linear inch.

The conditions which prevail when the impression roller is being raised are shown in Fig. 9, in which it will be seen that the top end of the cylinder is released through pipes 80 and 90, check valve 92, pipes 94, 78, and 76, to the four-way valve 60, and thence to the drain pipe 70. At the same time low pressure fluid, ordinarily the combined output of the low pressure and high pressure pumps, is supplied from valve 60 through pipe 88, valve 64, pipe 86, pipe 84, and pipe 82 to the bottom of the cylinder. The resumption of low pressure supply is, of course, applied through pipe 108 to the valve 64, thus shifting it to a position which connects the pipes 86 and 88.

In setting up the apparatus, a theoretical procedure would be to first cut off pressure to the top of the cylinder and to the bottom, permitting the impression roller to come down of its own weight, and to then open up the adjustment of the pressure relief valve 104 until the impression roller begins to creep upwardly. A piece of cellophane may then be placed between the roller and the drum, and the supply of pressure to the top of the cylinder may be resumed, the pressure reducing valve 66 then being adjusted until the cellophane is frictionally restrained yet can be pulled between the rollers. At this time the printing pressure gauge 118 is preferably set to zero. The desired printing pressure is then obtained by opening up the pressure reducing valve 60 further to increase the pressure at the top of the cylinder.

In practice this procedure is modified to specify an actual pressure for the bottom of the cylinder, as learned by experience for a particular type of press. This figure is supplied to the serviceman as a part of his instructions, and is usually somewhat more than is needed to just counterbalance the dead weight of the impression roller and its associated mechanism. In the particular case here illustrated, the pressure is 140 lbs. per square inch, as determined by a pressure gauge 110 (Fig. 1) temporarily connected to the piping. The top pressure is then applied until the roller and drum just hold a piece of cellophane, as above described, whereupon the printing pressure gauge 118 is set to zero. The pressure reducing valve 66 is then opened up to obtain a desired printing pressure.

In theory the bottom pressure may be made

excessive, and the top pressure may be adjusted to overcome the excess. However, this is preferably done to only a slight extent because it is wasteful of power to use high pressures bucking each other on opposite sides of the pistons.

It is believed that the construction and operation of my improved hydraulic system for controlling the impression roller of a printing press, as well as the advantages thereof, will be apparent from the foregoing detailed description.

The main advantage is that the printing pressure may be adjusted with gradual control all the way from zero or kiss contact upward to any desired maximum pressure. This is particularly important when printing webs which require a very light printing pressure as, for example, cellophane or glassine. The dead weight alone of the impression roller and associated mechanism may result in a printing pressure of several hundred pounds per linear inch, and may be vastly in excess of the desired printing pressure. Despite that fact, the present arrangement permits a printing pressure of, say, 10 lbs. per linear inch to be readily obtained and maintained throughout the printing operation.

Other advantages are that the impression roller may be lowered rapidly and raised rapidly, and this movement may be obtained with low pressure fluid, and consequent economy.

The arrangement provides for remote control of the impression roller, and for control at any station along the press. It also affords simultaneous operation of all of the impression rollers. This is some times important, because in an emergency it may be desired to quickly relieve the pressure of all of the impression rollers. Although all of the units are operated simultaneously, this does not mean that all of the units must be kept in operation, and any one or more of the printing units may be cut out of operation by closing appropriate valves.

The invention has been shown applied to rotogravure printing presses, but it is applicable to other printing presses which may be considered to be of the planographic type, that is, printing presses in which the printing surface is continuous rather than intermittent, an example being photooffset printing.

It will be apparent that while I have shown and described my invention in a preferred form, changes may be made in the structure shown without departing from the spirit of the invention as sought to be defined in the following claims. In the claims, for convenience, reference is made to supplying pressure to the top of the cylinder or the bottom of the cylinder, and it will be understood that top of the cylinder means that end which moves the impression roller against the printing drum, and bottom of the cylinder means that end which separates the impression roller from the printing drum. Also the impression roller is said to be moved by the pistons, but this is not intended to exclude an obvious reversal of parts in which the pistons might be stationary and the cylinder movable and connected to the impression roller. The printing cylinder is referred to as a "drum," and the impression cylinder is referred to as a "roller," in order to help distinguish from the term "cylinder" as applied to the hydraulic cylinder. Reference to raising or lowering the impression roller is intended to include raising and lowering guide rollers associated with it when the press is of that type.

I claim:

1. In combination, a printing press having a printing drum, an hydraulic cylinder and piston, and an impression roller raised and lowered by said piston, a source of pressure fluid, a valve mechanism between said source and said hydraulic cylinder to raise or lower the impression roller, means responsive to the building up of back pressure in the supply to the top of the cylinder to automatically connect the source to the bottom of the hydraulic cylinder when the roller contacts the printing drum in order to counteract the dead weight of the impression roller and associated mechanism carrying the same, and means to adjust the pressure supplied to the top of the cylinder to obtain a net printing pressure depending upon the nature of the web being printed.

2. In combination, a printing press having a printing drum, an hydraulic cylinder and piston, and an impression roller raised and lowered by said piston, a source of pressure fluid, a four-way valve mechanism between said source and said hydraulic cylinder to raise or lower the impression roller, means responsive to the building up of back pressure in the supply to the top of the cylinder to automatically connect the source to the bottom of the hydraulic cylinder when the roller contacts the printing drum, a fixed adjustable means to adjust the counterbalance pressure supplied to the bottom of the cylinder in order to counteract the dead weight of the impression roller and associated mechanism carrying the same, and a fixed adjustable means to adjust the pressure supplied to the top of the cylinder to obtain a net printing pressure ranging anywhere from zero or kiss contact upward to a desired maximum pressure depending upon the nature of the web being printed.

3. In combination, a printing press having a printing drum, an hydraulic cylinder and piston, and an impression roller raised and lowered by said piston, a source of pressure fluid, a solenoid operated four-way valve between said source and said hydraulic cylinder to raise or lower the impression roller, means responsive to the building up of back pressure in the supply to the top of the cylinder to automatically connect the source to the bottom of the hydraulic cylinder when the roller contacts the printing drum, a fixed adjustable pressure relief valve to adjust the counterbalance pressure supplied to the bottom of the cylinder in order to counteract the dead weight of the impression roller and associated mechanism carrying the same, and a fixed adjustable pressure reducing valve between the four-way valve and the top of the hydraulic cylinder to adjust the pressure supplied to the top of the cylinder to obtain a net printing pressure ranging anywhere from zero or kiss contact upward to a desired maximum pressure depending upon the nature of the web being printed.

4. In combination, a printing press having a printing drum, an hydraulic cylinder and piston, and an impression roller raised and lowered by said piston, a source of high pressure fluid, a source of low pressure fluid, a valve to change from the low to the high pressure source when increased resistance is encountered, valve mechanism between said sources and said hydraulic cylinder to raise or lower the impression roller, means responsive to a change from low to high pressure to apply counterbalance pressure to the bottom of the hydraulic cylinder when the roller

contacts the printing drum, means to adjust the counterbalance pressure supplied to the bottom of the cylinder to counteract the dead weight of the impression roller and associated mechanism carrying the same, and means to adjust the pressure supplied to the top of the cylinder to obtain a net printing pressure depending upon the nature of the web being printed.

5. In combination, a printing press having a printing drum, an hydraulic cylinder and piston, and an impression roller raised and lowered by said piston, a combination high and low pressure double pump and valve including means to deliver high instead of low pressure when the back pressure on the pump builds up, a four-way valve between said pump and said hydraulic cylinder to raise or lower the impression roller, means responsive to a change of pump action from low to high pressure to apply a counterbalance pressure to the bottom of the hydraulic cylinder when the roller contacts the printing drum, means to adjust the counterbalance pressure supplied to the bottom of the cylinder to counteract the dead weight of the impression roller and associated mechanism carrying the same, and means to adjust the pressure supplied to the top of the cylinder to obtain a net printing pressure ranging anywhere from zero or kiss contact upward to a desired maximum pressure depending upon the nature of the web being printed.

6. In combination, a rotogravure printing press having a printing drum, an hydraulic cylinder and piston, and an impression roller raised and lowered by said piston, a combination high and low pressure double pump and valve including means to deliver high instead of low pressure when the back pressure on the pump builds up, a solenoid operated four-way valve between said pump and said hydraulic cylinder to raise or lower the impression roller, a counterbalance sequence valve responsive to a change of pump action from high to low pressure to apply a counterbalance pressure to the bottom of the hydraulic cylinder when the roller contacts the printing drum, a fixed adjustable pressure relief valve to adjust the counterbalance pressure supplied to the bottom of the cylinder to counteract the dead weight of the impression roller and associated mechanism carrying the same, and a fixed adjustable pressure reducing valve between the four-way valve and the top of the hydraulic cylinder to adjust the pressure supplied to the top of the cylinder to obtain a net printing pressure ranging anywhere from zero or kiss contact upward to a desired maximum pressure depending upon the nature of the web being printed.

7. The combination with a printing press having a printing drum, an impression roller, an hydraulic cylinder and piston for raising or lowering the impression roller, and a source of pressure fluid, of valve means to supply pressure fluid to the bottom of the cylinder, valve means to supply pressure fluid to the top of the cylinder, fixed adjustable means to adjust the pressure supplied to the top of the cylinder to obtain a desired net differential force or printing pressure depending upon the nature of the web being printed, additional means to release the pressure at the bottom of the cylinder during lowering of the roller for rapid lowering of the roller, and additional means responsive to the building up of back pressure in the supply to the top of the cylinder to automatically apply pressure to the bottom of the cylinder at or near the end of the downward movement of the roller.

8. The combination with a printing press having a printing drum, an impression roller, an hydraulic cylinder and piston for raising or lowering the impression roller, and a source of pressure fluid, of valve means to supply pressure fluid to the bottom of the cylinder, valve means to supply pressure fluid to the top of the cylinder, fixed adjustable means to adjust the pressure supplied to the top of the cylinder to obtain a desired net differential force or printing pressure depending upon the nature of the web being printed, two sources of pressure fluid, one at low pressure and the other at high pressure, means to connect the low pressure source to the top of the cylinder during lowering of the roller, and means responsive to the building up of back pressure in the supply to the top of the cylinder to automatically connect the high pressure source to the top of the cylinder at or near the end of the downward movement of the roller.

9. The combination with a printing press having a printing drum, an impression roller, an hydraulic cylinder and piston for raising or lowering the impression roller, and a source of pressure fluid, of valve means to supply pressure fluid to the bottom of the cylinder, valve means to supply pressure fluid to the top of the cylinder, fixed adjustable means to adjust the pressure supplied to the top of the cylinder to obtain a desired net differential force or printing pressure depending upon the nature of the web being printed, two sources of pressure fluid, one at low pressure, the other at high pressure, means to connect the low pressure source to the top of the cylinder during lowering of the roller, means to release the pressure at the bottom of the cylinder during lowering of the roller, means responsive to the building up of back pressure in the supply to the top of the cylinder to automatically connect the high pressure source to the top of the cylinder at or near the end of the downward movement of the roller, and means responsive to the change to the high pressure source to automatically apply pressure to the bottom of the cylinder at or near the end of the downward movement of the roller.

10. The combination with a rotogravure printing press having a printing drum, an impression roller, an hydraulic cylinder and piston for raising or lowering the impression roller, and a source of pressure fluid, a valve means to supply pressure fluid to the bottom of the cylinder in order to counteract the dead weight of the impression roller and associated mechanism carrying the same, fixed adjustable means to adjust the counterbalance pressure supplied to the bottom of the cylinder, valve means to supply pressure fluid to the top of the cylinder, fixed adjustable means to adjust the pressure supplied to the top of the cylinder to obtain a printing pressure ranging anywhere from zero or kiss contact upward to a desired maximum pressure depending upon the nature of the web being printed, means to release the pressure at the bottom of the cylinder during lowering of the roller for rapid lowering of the roller, and additional means responsive to the building up of back pressure in the supply to the top of the cylinder to automatically apply the aforesaid counterbalance pressure to the bottom of the cylinder when the roller contacts the printing drum.

11. The combination with a rotogravure printing press having a printing drum, an impression roller, an hydraulic cylinder and piston for raising or lowering the impression roller, and a source

13

of pressure fluid, of valve means to supply pressure fluid to the bottom of the cylinder in order to counteract the dead weight of the impression roller and associated mechanism carrying the same, fixed adjustable means to adjust the counterbalance pressure supplied to the bottom of the cylinder, valve means to supply pressure fluid to the top of the cylinder, fixed adjustable means to adjust the pressure supplied to the top of the cylinder to obtain a printing pressure ranging anywhere from zero or kiss contact upward to a desired maximum pressure depending upon the nature of the web being printed, two sources of pressure fluid, one at low pressure, and the other at high pressure, means to connect the low pressure source to the top of the cylinder during lowering of the roller, and means responsive to the building up of back pressure in the supply to the top of the cylinder to automatically connect the high pressure source to the top of the cylinder when the roller contacts the printing drum.

12. The combination with a rotogravure printing press having a printing drum, an impression roller, an hydraulic cylinder and piston for raising or lowering the impression roller, and a source of pressure fluid, of valve means to supply pressure fluid to the bottom of the cylinder in order to counteract the dead weight of the impression roller and associated mechanism carrying the same, fixed adjustable means to adjust the counterbalance pressure supplied to the bottom of the cylinder, valve means to supply pressure fluid to the top of the cylinder, fixed adjustable means to adjust the pressure supplied to the top of the cylinder to obtain a printing pressure

14

ranging anywhere from zero or kiss contact upward to a desired maximum pressure depending upon the nature of the web being printed, two sources of pressure fluid, one at low pressure, the other at high pressure, means to connect the low pressure source to the top of the cylinder during lowering of the roller, means to release the pressure at the bottom of the cylinder during lowering of the roller, means responsive to the building up of back pressure in the supply to the top of the cylinder to automatically connect the high pressure source to the top of the cylinder when the roller contacts the printing drum at the end of the downward movement of the roller, and means responsive to the change to the high pressure source to automatically apply the aforesaid counterbalance pressure to the bottom of the cylinder when the roller contacts the printing drum at the end of the downward movement of the roller.

FREDERICK AUER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,771,750	Ellis	July 29, 1930
2,111,134	Allin	Mar. 15, 1938
2,194,078	Simonds	Mar. 19, 1940
2,205,720	Goebel et al.	June 25, 1940
2,206,620	Schwartz	July 2, 1940
2,216,565	Eckhard	Oct. 1, 1940
2,267,380	Tyler	Dec. 23, 1941
2,281,900	Weiking	May 5, 1942