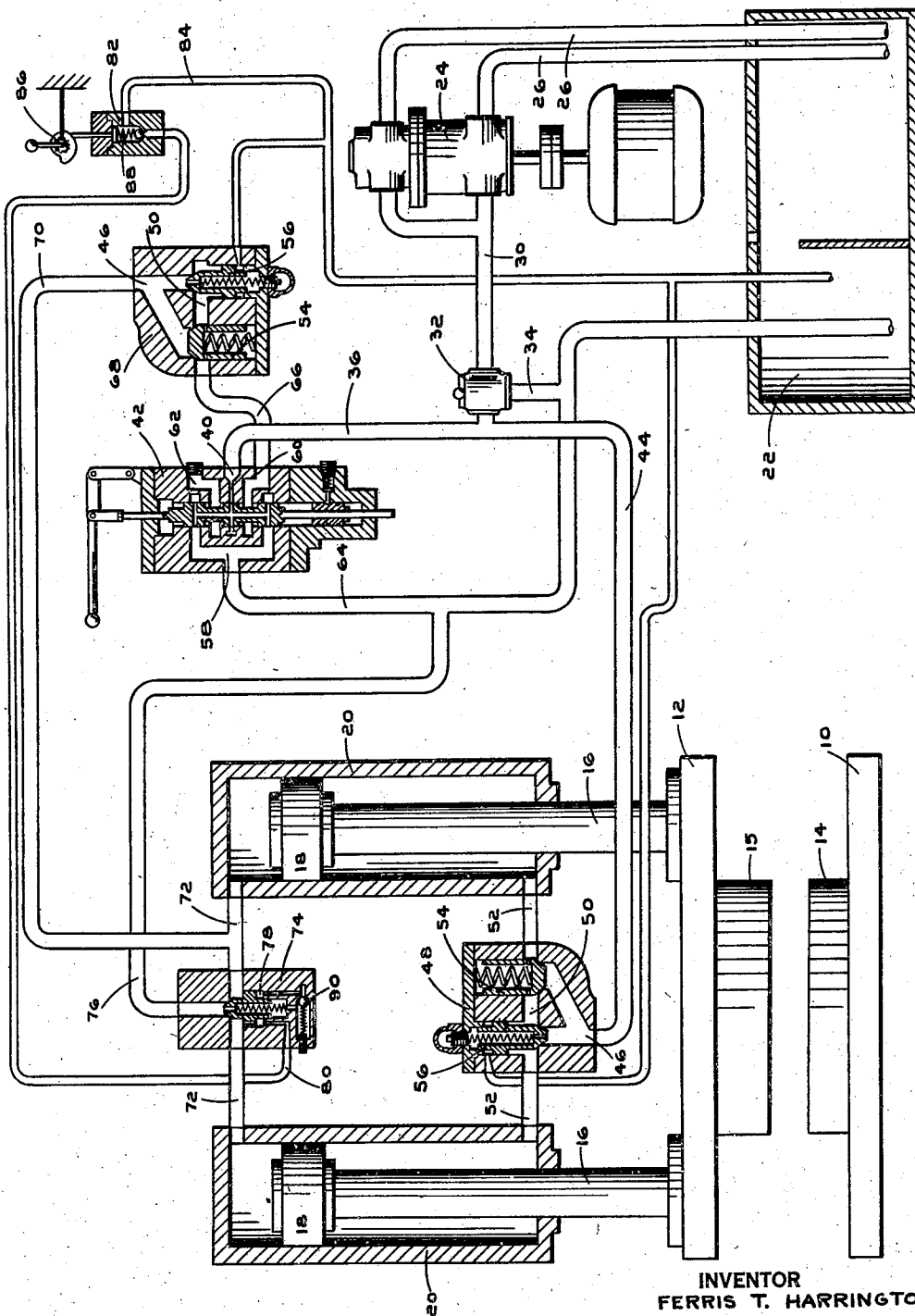


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F. T. HARRINGTON
HYDRAULIC DYE SPOTTING PRESS

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HYDRAULIC DIE SPOTTING PRESS

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This invention relates to power transmissions and more particularly to those of the type comprising pump means and fluid motor means with a hydraulic circuit connected therebetween. The invention is concerned with a power transmission system particularly adapted for operating a press for spotting or trying out dies.

In the manufacture of dies for drawing sheet metal articles, particularly large and heavy dies such as are used for forming parts of automobile bodies, the process of fitting the two die parts together requires a considerable amount of hand filing and grinding and necessitates repeated trial engagements of the die parts to determine where high spots exist which must be removed. Since this is a long and tedious procedure it has been customary in the past to provide a special press for the fitting procedure so that presses used for production need not be kept out of service for this purpose. Where the dies which are being fitted are large and heavy it has been difficult heretofore to maintain the downward movement of the platen under precise and accurate control at all times. It is essential that the operator must be able to stop the downward movement of the platen instantly at any point and no overtravel can be permitted. It is also necessary that the net downward force exerted during downward movement of the platen be adjustable through a fairly wide range. Without such provision it frequently occurs that the die parts are forced together too far or with too great a pressure causing damage to the expensive dies which may be difficult and costly to repair.

Another requirement in a press for this purpose is that the possibility of the press platen falling by gravity, due to failure of fluid conduits or of the source of fluid pressure, must be absolutely prevented. In carrying out this die fitting process the die maker is required frequently to do his work in a position beneath the movable platen which is extremely hazardous should there be any possibility of the press platen falling from any cause whatsoever.

It is an object of the present invention therefore to provide a hydraulic transmission system for operating a die spotting process wherein these requirements are satisfactorily provided for.

It is a further object to provide such a power transmission system wherein a fluid motor is utilized for constantly supporting the weight of the movable platen and its attached dies and wherein additional means are provided for causing the platen to descend against the supporting effort of the fluid motor.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing wherein a preferred form of the present invention is clearly shown.

In the drawing the single figure illustrates diagrammatically a power transmission system incorporating a preferred form of the present invention. The press is illustrated diagrammatically as having a bed 10 and a movable platen 12 to which die parts 14 and 15 may be attached for the purpose of fitting the parts to each other. The platen 12 is slidably mounted in the usual ways, not shown, and is supported by rods 16, have pistons 18 at their upper ends. The pistons 18 are slidable in cylinders 20 suitably mounted on the press frame and together with the pistons 18 and rods 16 provide a pair of differential fluid motors for operating the platen 12.

A sump 22 contains a supply of power transmission fluid such as oil and hereinafter referred to as such. Oil may be withdrawn from the sump 22 by a pump means 24 through suction pipes 26. The pump means may comprise either a single or double rotary pump as illustrated and may be driven by an electric motor 28. Pump 24 delivers oil to a pressure conduit 30 having the usual relief valve 32 therein for by-passing oil to the sump through a by-pass conduit 34 whenever a predetermined safe pressure is exceeded. The discharge conduit 30 has a branch 36 leading to a port 40 of a four-way valve 42 and another branch 44 leading to a port 46 of a combined by-pass and check valve 48.

The valve 48 has a chamber 50 which communicates by conduits 52 with the lower end of the cylinders 20. A check valve 54 closes communication between the chamber 50 and port 46 to flow in the direction from chamber 50 to port 46 and opens for free flow in the opposite direction. A pressure responsive by-pass valve 56 is adapted to also normally close communication between chamber 50 and port 46 and to open whenever a predetermined pressure exists in the chamber 50.

The four-way valve 42 may be of any suitable construction for slidably reversing the connection of pressure port 40 and a return port 58 with a pair of ports 60 and 62. The port 58 is connected with the sump 22 by a return conduit 64. The port 60 communicates by a conduit 66 with a combined by-pass and check valve 68 which may be identical in construction with valve 48. The port 62 is blocked. In its mid portion the valve 42 is adapted to connect ports 40 and 58 while

ports 60 and 62 are blocked. The chamber 46 of the valve 68 communicates by a conduit 70 having branches 72 with the upper ends of the cylinders 20. A pilot operated relief valve 74 of the type shown in Vickers Patent 2,043,453 is situated in the branch conduits 72 and has a discharge conduit 76 leading to the conduit 64 and sump 22. The pressure at which the valve 74 opens may be controlled by controlling the pressure at which fluid is released from a pilot chamber 78. For this purpose a conduit 80 extends to a pilot relief valve 82 which opens whenever a predetermined pressure exists in the conduit 80. The valve 82 when opened relieves oil to the sump through a drain conduit 84. The pressure at which valve 82 opens may be adjusted by a manually operable cam 86 which controls the pressure on a spring 88 which normally holds valve 82 closed. In addition a second pressure responsive pilot valve 90 is provided in the valve 74. Valve 90 is preferably adjusted so as to act as a maximum pressure limiting valve.

In operation the motor 28 may be started and fluid is withdrawn through the conduits 26 by the pump 24 and delivered to discharge conduits 30, 36 and 44. In the normal or rest position of the valve 42, as shown in the drawing, the discharge from the pump is by-passed from the port 40 to the port 58, thus causing the fluid to be circulated at no pressure. Under these conditions the platen 12 remains stationary due to the trapping of oil in the lower ends of cylinders 20 beneath pistons 18. This oil is trapped by the check valve 54 and by-pass valve 56, the latter being set to open only at a pressure slightly above that produced by the weight of the platen 12 and the die part 16. When it is desired to move the platen 12 downwardly the spool of valve 42 is shifted upwardly to connect port 40 with port 60 and port 58 with port 62. The pump discharge is thereby directed through conduit 36 ports 40 and 60, and conduit 66 to the chamber 50 of the valve 68. Pressure accordingly builds up until the setting of the by-pass valve 56 in valve 68 is reached at which time the latter opens permitting oil to flow into the conduits 70 and 72 and the upper ends of cylinders 20. Due to the greater area of the top side of the pistons 18 the platen 12 is caused to descend building up pressure in the lower ends of cylinders 20 sufficient to open by-pass valve 56 in the valve 48 causing this oil to be discharged through port 46 and conduit 44 to join with the pump discharge in supplying the upper ends of the cylinders 20.

It will be noted that under these conditions the platen 12 is forced downwardly against the pressure in the lower ends of cylinders 20 which pressure is slightly greater than that necessary to support the weight of the platen 12 and die part 16. Accordingly whenever the valve 42 is moved back to stop position the platen stops immediately without overtravel. This is due to the fact that the pressure in the lower end of the cylinders 20 changes only a relatively small amount between the condition of downward movement and the stop condition, which amount is determined by the setting of the by-pass valve in valve 48. The net force which is exerted on the platen 12 in the downward direction is easily adjustable by operation of the cam 86 which varies the pressure exerted in the upper ends of cylinders 20. It is thus possible to cause the platen to descend with only a very small net downward force so that the dies may be engaged

with an extremely light touch. Alternatively if it is desired the cam 86 may be moved to the extreme position in the direction of decreased pressure previous to raising of the valve 42. When the valve 42 is then raised the low pressure setting of the control valve 82 for relief valve 74 is such that insufficient pressure is maintained in the head ends of the cylinders 20 to overcome the pressure maintained in the rod ends thereof by the back-pressure valve 56. The platen may be caused to descend by operation of the cam 86 to gradually increase the pressure setting of valve 82 and thus cause the pressure in the head ends of the main cylinders to rise gradually until sufficient to overcome the pressure acting in the rod ends thereof.

This method of operation presents the advantage that the platen may be lowered with the lowest possible force which is sufficient to overcome the starting friction of the platen and rams.

When it is desired to move the platen upwardly the spool of valve 42 is moved downwardly connecting port 40 with the plugged port 62 and connecting port 58 with the port 60. Oil is then delivered from the pump through conduits 30 and 44, port 46, check valve 54, chamber 50 and conduits 52 to the lower ends of cylinders 20 and oil is discharged from the upper ends of cylinders 20 through conduits 72 and 70, port 46, check valve 54, chamber 50, conduit 66, ports 60 and 58 and conduit 64 to the sump 22. The platen may be stopped at any time during its upward movement by moving valve 42 to its mid position or may be permitted to move upwardly to the limit of its stroke, when pressure will build up sufficiently to open relief valve 32.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In a hydraulic die spotting press the combination of a differential ram means having its large area effective for closing movement of the press and its small area effective for opening movement thereof, means forming a single unidirectional source of pressure fluid, a supply line permanently open to free flow from the source to the small area of the ram, a directional control valve and conduits for selectively connecting the large area to said source or to exhaust, and valve means interposed in said supply line for preventing outflow from the small area of the ram except at a pressure above that produced by the normal gravity load on the ram means, said valve means including a check valve opening for free flow into the small area of the ram.

2. In a hydraulic die spotting press the combination of a differential ram means having its large area effective for closing movement of the press and its small area effective for opening movement thereof, means forming a source of pressure fluid, a supply line permanently open to free flow from the source to the small area of the ram, a directional control valve and conduits for selectively connecting the large area to said source or to exhaust, valve means interposed in said supply line for preventing outflow from the small area of the ram except at a pressure above that produced by the normal gravity load on the ram means, said valve means including a check valve opening for free flow into the small area of the ram, a relief valve communicating with the large area of the ram for limiting the

pressure effective on the large area only, and means for selectively varying the pressure setting of said relief valve.

3. In a hydraulic die spotting press the combination of a differential ram means having its large area effective for closing movement of the press and its small area effective for opening movement thereof, means forming a source of pressure fluid, a supply line permanently open to free flow from the source to the small area of the ram, a directional control valve and conduits for selectively connecting the large area to said source or to exhaust, valve means interposed in said supply line for preventing outflow from the small area of the ram except at a pressure above that produced by the normal gravity load on the ram means, said valve means including a check valve opening for free flow into the small area of the ram, a relief valve communicating with the large area of the ram for limiting the pressure effective on the large area only, and a valve interposed in one of said conduits for maintaining the pressure in said supply line higher than the pressure on the large area of the ram while the latter is connected to the source by the directional control valve.

4. In a hydraulic circuit the combination with an oppositely movable load device, a reversible fluid motor having a load advancing chamber and a load retracting chamber and operably connected to the load device, means forming a single unidirectional source of pressure fluid, a conduit permanently open to free flow from the source to the load retracting chamber, a conduit connecting the source with the load advancing chamber, and valve means in said conduits for maintaining a pressure in said advancing chamber variable at will while at all times maintaining the pressure in the retracting chamber substantially at a fixed value, whereby the load de-

vice can be advanced or retracted selectively with any force desired.

5. In a hydraulic die spotting press the combination of a vertically movable platen operating against gravity to open the press, a double-acting fluid motor having a platen raising chamber and a platen lowering chamber and operably connected to the platen, means forming a single unidirectional source of pressure fluid, a conduit permanently open to free flow from the source to the platen raising chamber, a conduit connecting the source with the platen lowering chamber, and valve means in said conduits for maintaining a pressure in said platen lowering chamber variable at will while at all times maintaining the pressure in the platen raising chamber substantially at a fixed value sufficient to overcome gravity, whereby the platen may be lowered or raised selectively with any force desired.

6. In a hydraulic die spotting press the combination of a vertically movable platen operating against gravity to open the press, a double-acting fluid motor having a platen raising chamber and a platen lowering chamber and operably connected to said platen, means including a unidirectional delivery pump having a permanently open connection for free flow to the platen raising chamber and a selectively opened connection to the platen lowering chamber with a back-pressure valve in the last-mentioned connection for maintaining during lowering of the platen a fluid pressure in the platen raising chamber greater than necessary to overcome the gravity force on the platen, means for limiting the fluid pressure in said platen lowering chamber to a constant value, and manually operable means for varying the pressure limit maintained by the last-mentioned means.

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