Jan. 6, 1953 E. J. HIRVONEN 2,624,283

HYDRAULIC PUMP

Filed Jan. 5, 1949 2 SHEETS--SHEET 1

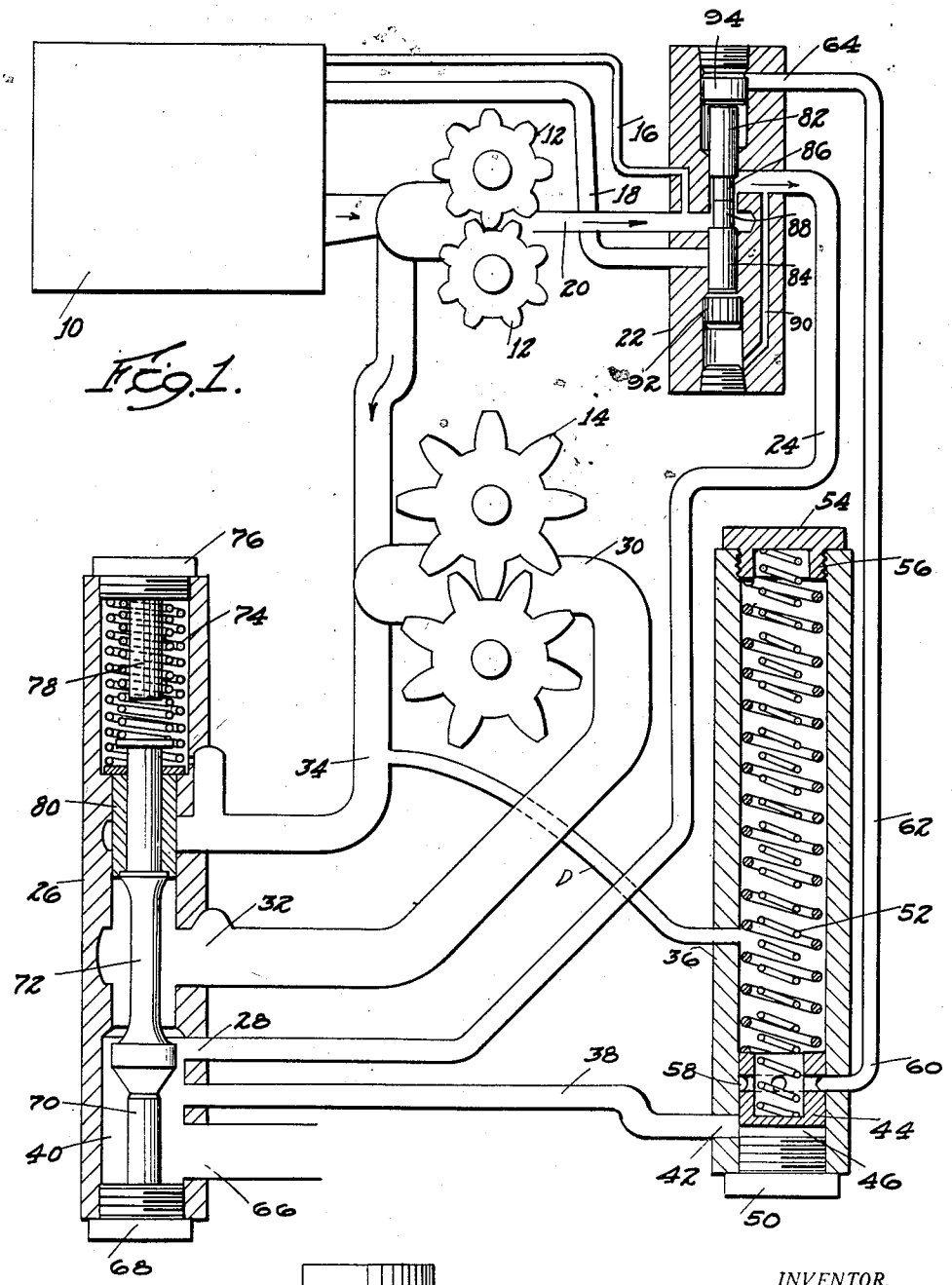

FIG. 1.

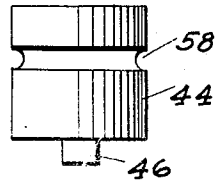

FIG. 3.

INVENTOR.
Eric J. Hirvonen
BY Charles R. Fay
Attorney

Jan. 6, 1953 E. J. HIRVONEN 2,624,283

HYDRAULIC PUMP

Filed Jan. 5, 1949 2 SHEETS--SHEET 2

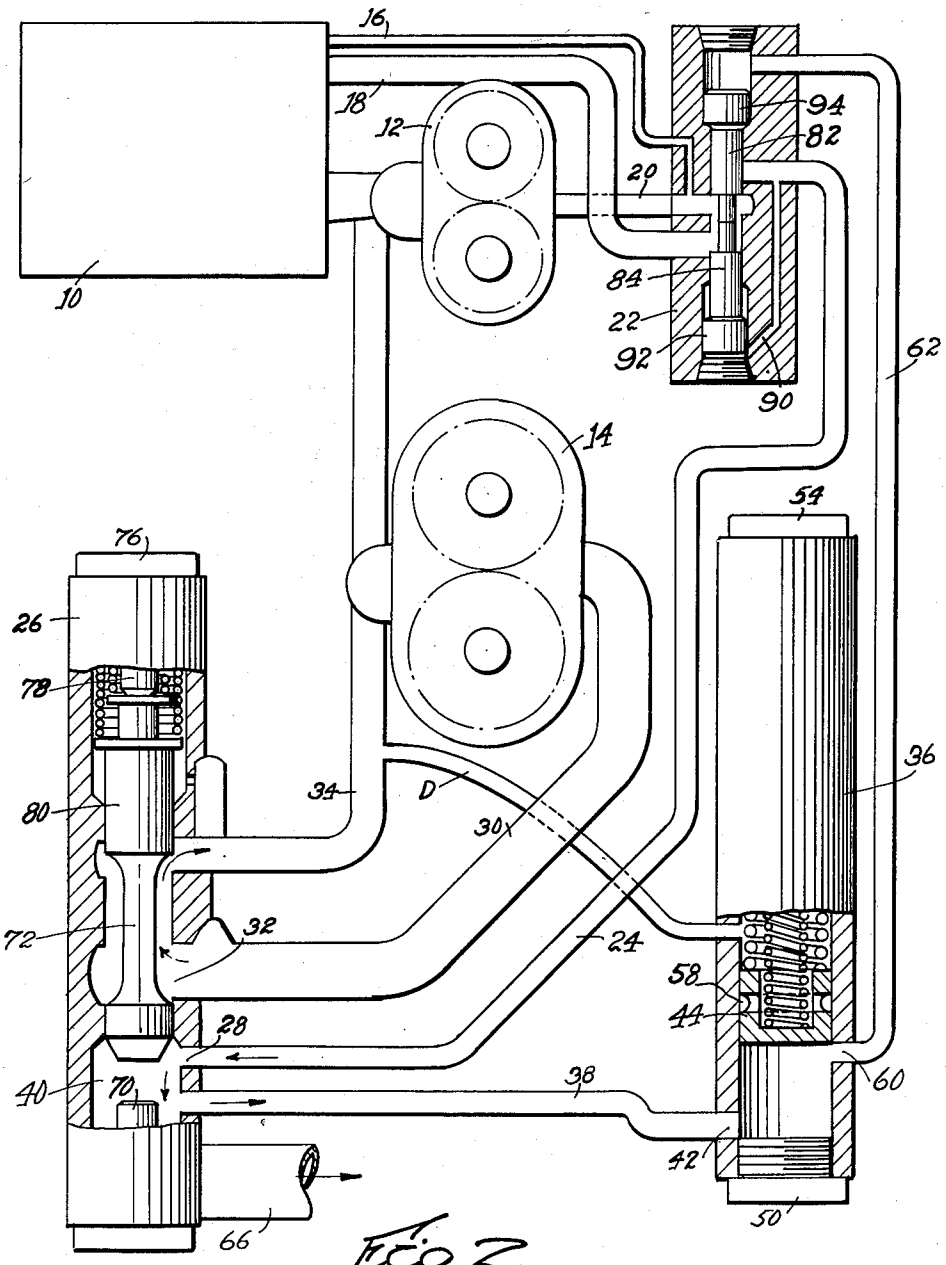

Fig. 2.

INVENTOR.
Eric J. Hirvonen
BY
Charles R. Fay
Attorney

Patented Jan. 6, 1953 2,624,283

UNITED STATES PATENT OFFICE

2,624,283

HYDRAULIC PUMP

Eric J. Hirvonen, Shrewsbury, Mass., assignor to Leland-Gifford Company, Worcester, Mass., a corporation of Massachusetts

Application January 5, 1949, Serial No. 69,358

3 Claims. (Cl. 103—11)

1

This invention relates to improvements in a hydraulic pump and feed device, this application being a continuation in part of my copending application Serial No. 741,139, filed April 12, 1947, now Patent No. 2,579,116.

The principal object of the invention is to provide an improved constant feed hydraulic pump particularly adapted for operation in conjunction with a hydraulic piston which may be used, for example, to operate a drill head or other device, and including a slow feed for the same piston. Another object of the invention is to provide a high pressure to the hydraulic feed control mechanism at all times that it is needed regardless of leaks in the fluid system or demands upon the feed control mechanism, and including a new and improved accumulator therefor.

Further objects of the invention include the provision of a double pump unit having a high pressure line and a low pressure volume line in combination with a novel automatic valve into which both of the lines enter and merge to supply the machine tool, drill head, or other device, said novel automatic valve being operable by back pressure from the feed control mechanism to close the low pressure line leaving the high pressure line open and in communication with the accumulator to load the latter, further in combination with a high pressure valve operative upon pressure derived from the accumulator when the latter is fully loaded to close off the high pressure line from the first named valve, thus insuring high pressure for instant use by the machine tool unit or drill head derived from the accumulator without, however, using pressure from either the high pressure or low pressure pump units, thus avoiding high temperature rises when the machine tool is not demanding fluid; the second named valve being operative to again open the high pressure line immediately upon dropping of pressure in the accumulator due to demand by the machine tool or drillhead, and the low pressure volume line being opened in the first named automatic valve immediately upon demand, i. e., by removal or slacking off of the back pressure from the machine tool or drill head.

Another object of the invention resides in the provision of the dual pump accumulator and the two automatic valves above referred to, the first valve being a merging valve for the high pressure and low pressure lines and the second named valve being an automatic valve in the high pressure line only; and the accumulator being arranged to derive its fluid pressure directly from the merging valve, and the high pressure automatic valve comprising a pair of plungers having different areas for positiveness of operation—i. e. —overbalancing of pressure one by the other so that the said high pressure automatic valve will operate immediately as required by the demand.

Other objects and advantages of the invention will appear hereinafter.

2

Reference is to be had to the accompanying drawings, in which

Fig. 1 is a diagrammatic view of the hydraulic layout of a device according to the present invention and showing the parts in low pressure positions thereof;

Fig. 2 is a similar diagrammatic view but showing the relationship of the parts in high pressure position; and

Fig. 3 is an enlarged view of the sliding plunger in the accumulator.

This invention is designed to operate by and provide hydraulic fluid means for the feed control of a machine tool or drill head or the like, as more fully explained in my copending application above referred to. There has always been a high fluid temperature rise in systems of this nature because the pump being a constant volume type generates heat when passing fluid through relief valves. It will be understood that a high pressure is not necessary when the working piston of a machine tool or drill head is under a rapid traverse condition but high pressure is necessary under slow traverse condition, such as is in the case of a drill engaging the work and feeding in slowly and also under idle condition to operate the controls; the same being true as to other machine tools, as, for instance, milling machines or the like.

The reference numeral 10 in the drawings in this case represent an oil supply or reservoir which may contain an oil cleaning means as more fully illustrated in my copending application above referred to and not pertinent to the present invention. The fluid proceeds in the direction of the arrows to the high pressure part of the pump generally indicated at 12 and in larger volume to the low pressure part of the pump indicated at 14. A small supply line 16 operates the oil cleaning means above referred to and the line 18 is a high pressure direct return to the sump.

The high pressure part of the pump 12 delivers fluid in a line 20 and to an automatic high pressure valve 22 and therethrough into a line 24 leading into the automatic merging valve housing 26 in the port 28.

The low pressure part of the pump 14 delivers the fluid through a line 30 into the same valve housing 26 at a port 32. The low pressure part of the pump 14 is provided with a return line 34.

The accumulator is generally indicated at 36 and is provided with fluid under pressure from the automatic merging valve 26 through a line 38. It is to be noted that the accumulator is always in communication with the chamber 40 of the merging valve 26 through the line 38, which leads into the accumulator housing adjacent the bottom thereof at a port 42 in position to feed fluid to a point underneath a plunger 44, this plunger having a rib or the like 46 at the bottom thereof to space the same from the end plug

50 so that the fluid may enter in under the plunger 44, raising the same against the action of the double spring arrangement 52, these springs being lodged against the top plug 54, the same having a flange 56 positioning the outside spring of the pair thereon and the inside spring of the pair therein. The plunger 44 is provided with a peripheral groove 58 and when pressure in the line 38 has risen sufficiently high to retract the plunger 44 to a position uncovering a port 60 to a line 62, the high pressure automatic valve 22 is operated, as will be later described, the line 62 entering valve 22 at a port 64.

The groove 58 is provided for leakage and return of fluid through line 62 when the valve 22 is operated in the reverse direction.

The merging valve 26 has an outlet through a port 66 to the unit to be operated. A bottom plug 68 is provided with a stop post 70 against which the valve element 72 comes to rest in the low pressure position of the valve as illustrated in Fig. 1, wherein both high and low pressure enter the merging valve, merge and supply the unit as long as demand is present, but it will be seen that upon back pressure in the port 66 the valve element 72 will rise to the position shown in Fig. 2, blocking off the low pressure line 32 which, however, is then opened to the return line 34 back to the low pressure pump. The valve element 72 is normally maintained in the Fig. 1 position by means of a double spring arrangement 74 arranged on a block 76 having a stop post 78 similar to that at 68 and for stopping the element 72 in its upward position. In order to prevent a kick-back of the trapped oil in the valve, a sleeve 80 is slidably mounted on the valve element 72 as described in my copending application.

The high pressure valve 22 is provided with a pair of sliding plungers 82 and 84 of similar diameter, each of which is provided with a reduced portion 86 and 88, which when located in their uppermost positions as shown in Fig. 1, allow progress of the high pressure fluid through the line 20 to the line 24. A line 90 maintains the plungers in their uppermost position by supplying fluid under pressure to a sliding plug 92, working in opposition to a similar sliding plug 94, the latter, however, having a greater diameter than that of the sliding plug 92, so as to insure operation as described above by providing for sufficient power to be derived from the pressure in the accumulator to overcome the pressure in the line 24.

Assuming that back pressure has closed the low pressure line 32 from the chamber 40, the device operates on the high pressure alone until such time as this pressure is sufficient to retract the plunger 44 in the accumulator to the Fig. 2 position i. e., maximum retraction and maximum spring loading thereof, whereupon, of course, the port 60 is uncovered to the maximum pressure and the plunger 94 is then actuated to push down plunger 82 and plunger 84 so as to close off line 20 from line 24 by opening line 18 to line 20, so that the high pressure fluid is returned to the sump.

Under these conditions, of course, the only pressure to the unit is provided by the accumulator but this will supply sufficient pressure for all purposes until the port 60 should again be closed due to use of this pressure, whereupon the pressure in the line 24 will cause

sliding plug 92 to again rise because the pressure in line 62 is now exhausted and there is sufficient pressure still being exerted on the fluid in line 24 to raise the plug 92 and the plungers 82 and 84. Of course, as soon as the plungers are raised the high pressure again proceeds to the chamber 40 and the port at 66 so that the plungers 82 and 84 are maintained in the Fig. 1 position unless and until the accumulator plunger 44 is again raised to the Fig. 2 position.

The position of the high pressure valve 22 as shown in Fig. 1 obtains at all times, except when the accumulator is full, even though this is referred to as the low pressure position; on the other hand, the merging valve 26, as shown in Fig. 1, is in a low pressure condition and as shown in Fig. 2 in high pressure condition. This valve is not dependent so much upon the condition of the accumulator as is the case with reference to the high pressure automatic valve 22.

Having thus described my invention and the advantages thereof, I do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what I claim is:

1. A hydraulic pump comprising a reservoir, separate high and low pressure pumping means connected thereto, a merging valve for the high and low pressure, the low pressure being directly connected to the merging valve, a high pressure valve, a stem in the latter shiftable to direct the high pressure either to the reservoir or to the merging valve, a plunger in the merging valve shiftable to direct the low pressure to the reservoir under conditions of back pressure in the merging valve, an accumulator receiving pressure from the merging valve and storing pressure for use on demand, a line from the accumulator to the high pressure valve to shift the stem thereof under conditions of pressure in said line, a movable member in the accumulator closing said line in one position and opening the line to high pressure in another position wherein the accumulator is loaded, the high pressure valve stem being shifted to close the high pressure pumping means from the merging valve when the said line from the accumulator is open, and hydraulic means to re-shift the high pressure valve stem to again open the high pressure to the merging valve upon closing of said line.

2. The hydraulic pump of claim 1 wherein the merging valve and accumulator are connected to the opposite side of the high pressure valve stem from that of the said line.

3. The hydraulic pump of claim 1 wherein the stem of the said high pressure valve is larger in area at the side to which the said line is connected than at the opposite side, the latter being connected to the merging valve and being in communication therewith at all times.

ERIC J. HIRVONEN.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
846,266	Von Philp	Mar. 5, 1907
1,905,133	Bishop et al.	Apr. 25, 1933
1,982,711	Vickers	Dec. 4, 1934
2,074,618	Roeder	Mar. 23, 1937
2,264,375	Hill et al.	Dec. 2, 1941
2,283,516	Tyler	May 19, 1942