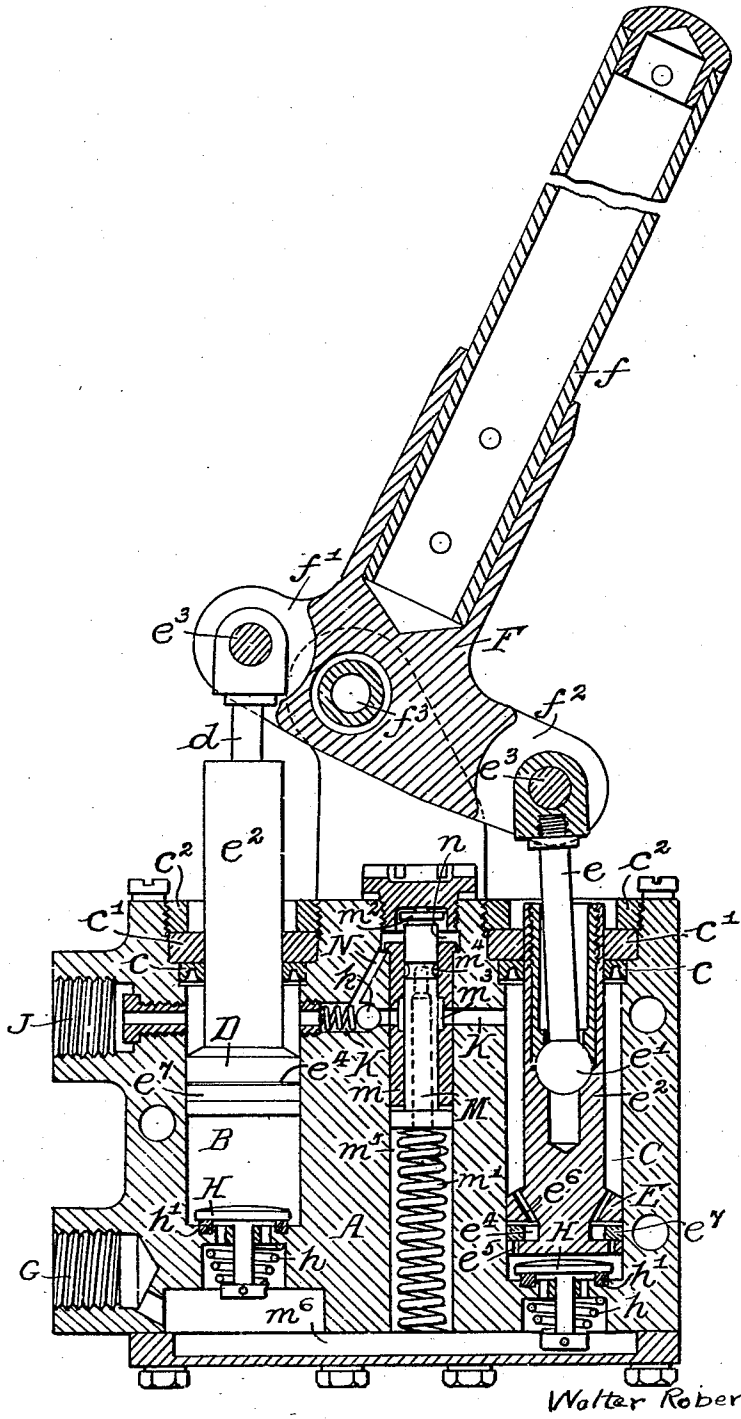
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PUMP FOR USE IN HYDRAULIC TRANSMISSION OF POWER

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PUMP FOR USE IN HYDRAULIC TRANSMISSION OF POWER

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The invention relates to hydraulic pumps used in connection with hydraulic power transmission; and, while it is more immediately concerned with hand operated pumps for hydraulic power systems on aircraft, it is also applicable to other hydraulic power transmission systems, and also to power operated pumps for such purpose.

It has become usual to operate certain parts of aircraft, for instance the undercarriages and bomb doors, by hydraulic means operated, in some cases, by power from the engines when such are running, but operated, at other times, by hand. The method is to pump liquid into an operating cylinder in which is a movable piston operable under liquid pressure in either direction. For most of the travel of the piston of said cylinder the pressure required to move it is relatively small; but, at some point of the stroke, the pressure required is relatively great. Hence for hand operation the pump plunger has had to be of relatively small diameter with the result that only a relatively small quantity of liquid is pumped into the operating cylinder at each stroke of the pump, so that a relatively large amount of time is taken in imparting the full movement to the operating piston.

According to this invention there are provided, in respect of the hydraulic system, two pumps, one of which has preferably a larger capacity than the other, both pumps being operated from the same source of power during the main part of the transmission of power, the one pump being cut out or short-circuited automatically when the pressure in the hydraulic system reaches a predetermined value.

The cutting out or short-circuiting of the one pump may be effected by a spring-pressed plunger carrying a valve or being adapted to engage with a valve, in either case to open a passage leading from the delivery to the suction side of the one pump, such plunger being exposed to pressure from the delivery side of the other pump (which is not cut out) and also to the general hydraulic system, a non-return valve being provided to prevent flow of liquid from the said system back into the short-circuited pump.

The two pumps may be arranged side-by-side with the spring-pressed plunger and its chamber between them, and the two pump pistons may connect to the two ends of a pivoted lever fitted with a handle by which it may be rocked by hand.

The pumps may be of the single acting or double acting or differential type.

The spring-pressed plunger above referred to may slide within a chamber exposed at the top to the delivery pressure and open at the bottom to the suction passage, and such chamber may cut across a passage joining the delivery sides of the two pumps this passage being widened at such place to form an annular chamber. The spring-pressed plunger has a transverse port or annular groove communicating with an axial passage in the plunger which serves to keep the transverse port in communication with the suction passage. Hence, when the plunger has been moved a given distance by delivery pressure, the said port enters the annular chamber, and so opens communication between the suction and delivery sides of the one pump.

One important application of the invention is to presses for moulding plastics, and other hydraulic presses, where the primary and larger portion of the stroke of the ram offers little resistance and can therefore be operated quickly with advantage; whereas a high pressure is essential at the last part of the stroke.

A convenient embodiment of the invention is described with reference to the accompanying drawing which is a vertical section with some of the parts shown in elevation.

In this drawing, A is the pump shell comprising two pump cylinders B, C, of the same diameter and in which work two pistons D, E, of the same diameter, but the stroke of the piston E is longer than that of the piston D. Otherwise the two pistons are identical.

For reciprocating the pistons there is provided a three-armed lever F pivoted at f^3 and having one arm f forming a handle, a short arm f' connected to the piston D by a connecting rod d, and a longer arm f^2 connected to the piston E by a connecting rod e.

Each of the pistons has a hollow piston rod e^2 having an external cross-sectional area which is one half the cross-sectional area of the piston, so as to render the pump double-acting in a manner already well known; and each piston rod passes at its upper end through a packing ring c and guide ring c' pressed down by a ring c^2 screwed into the top of the cylinder. Both connecting rods connect with their respective piston rods at points well down in relation thereto and by ball joints e'. They connect at their upper ends to the lever F by pivot joints e^3.

G is an inlet passage leading to the under sides of the two cylinders B and C at the bottom of each of which is a valve H pressed by a coil spring h on to a rubber seating h'. As each piston goes up it can therefore draw oil into the respective cylinder, but such oil cannot return.

Each piston has a deep groove e^4 in which is placed a rubber packing ring e^7 which is shallower than the groove so that when the piston is moving down the ring lies against the upper wall of the groove e^4 leaving a space below it whereas, when the piston moves up, the space occurs above the ring. In its lowermost position the ring covers ports e^5 leading to the space in the cylinder above the valve H. Ports e^6 lead from the groove e^4 to the space in the cylinder above the piston.

J is an oil delivery passage connecting directly to the upper end of the cylinder B but only indirectly with the cylinder C by way of the cylinder B and a passage K in which is placed a spring-pressed non-return ball valve k.

M is a plunger adapted by slide in a sleeve m set in the pump shell, the plunger being constantly pressed in an upward direction by a coil spring m'. The plunger M has a head m^2 at its upper end of somewhat increased diameter such head being adapted to seat down on the top of the sleeve m when the plunger is fully down.

The sleeve m has an internal annular passage m^3 communicating with the passage K so that oil can pass from the cylinder C along such passage and around the plunger M. In the latter is an annular groove m^4 which communicates by a central passage m^5 with a space m^6 which is in communication with the inlet passage G. N is a passage leading to a space n above the sleeve m from the passage K between the cylinder B and the non-return valve k.

When oil is required to be delivered at a relatively high rate, and at a relatively low pressure, the plunger M is kept up by its spring. Both pump pistons are then pumping oil, the piston D, directly to the delivery J, and the piston E to the delivery J by way of the passage K, valve k and upper part of the cylinder B. The major part of the oil is pumped by the piston E because of its longer stroke.

When the oil is no longer able to flow at a high rate it experiences a sudden rise of pressure which is communicated to the top of the plunger M by way of the top of the cylinder B and passages K and N but it is, of course, not transmitted past the ball valve k. The pressure so transmitted forces down the plunger M until the head m^2 seats on the top of the sleeve m. As the diameter of the head m^2 is greater than that of the interior of the sleeve it tends to assist in holding the plunger down. In this lowermost position of the plunger M the groove m^4 coincides with the annular recess m^3 thus putting the portion of the passage K which is to the right of the non-return valve k, in communication with the inlet passage G. The piston E then simply pumps oil back to the inlet passage and offers little resistance to movement. The oil is now pumped wholly by the piston D which has by far the shorter stroke so that a much increased pressure at a slower rate can be maintained.

Having fully described my invention what I claim and desire to secure by Letters Patent is:

I claim:

1. A pump unit for hydraulic power transmission comprising two separate pumps arranged side by side, a lever linking the pistons together, a pivot mounting offset from the center of said lever whereby one piston has a longer stroke than the other, a source of power from which both said pumps are driven both pumps being operative during the main part of the transmission of power, and means by which the one pump is automatically rendered inoperative when the pressure in the hydraulic system reaches a predetermined value.

2. A pump unit for hydraulic power transmission comprising two separate pumps of different capacity, a pivoted lever connecting the pistons, an offset pivot mounting for said lever, the pistons having different lengths of stroke, an arm on said lever forming a handle, a source of power from which both pumps are driven, both pumps being operative during the main part of the transmission of power, and means by which the pump of larger capacity is automatically rendered inoperative when the pressure in the hydraulic system reaches a predetermined value.

3. A pump unit for hydraulic power transmission comprising two separate pumps the pistons of which are of the same diameter but of which one piston has a longer stroke than the other, a lever connecting said pistons, an offset mounting for said lever, and an arm on the lever functioning as a handle, the pistons being arranged side by side in spaced relation, a source of power from which both pistons are driven, both pistons being operative during the main part of the transmission of power, and means by which the pump having the piston of longer stroke is automatically rendered inoperative when the pressure in the hydraulic system reaches a predetermined value.

4. A pump unit for hydraulic power transmission comprising two separate pumps, a three-armed lever from which the pistons of both the pumps are driven by connecting rods which connect the respective pistons with two of the arms of said three-armed lever, the said lever having an offset mounting whereby the pistons will have different lengths of stroke, both pumps being operative during the main part of the transmission of power and means by which the one pump is automatically rendered inoperative when the pressure in the hydraulic system reaches a predetermined value.

5. A pump unit for hydraulic power transmission comprising two separate pumps, a hollow piston rod of each said piston, a three-armed lever, an offset mounting on which said lever is pivoted, two connecting rods pivotally connected to two arms of said three-armed lever and connected to points well down within said hollow piston rods near to the respective pistons, both pistons being operative during the main part of the transmission of power and means by which the one pump is automatically rendered inoperative when the pressure in the hydraulic system reaches a predetermined value, the pistons having strokes of different lengths.

6. A pump unit for hydraulic power transmission comprising two separate pumps spaced laterally from each other and being of different lengths, a three-armed lever, a shorter and a longer arm of said three-armed lever, pistons of said pumps, connecting rods by which the one piston having a shorter stroke is driven from the said shorter arm, and the other piston having a longer stroke is driven from the said longer arm, both pumps being operative during the main part of the transmission of power and means by which the pump having the piston of longer stroke is automatically rendered inoperative when the pressure in the hydraulic system reaches a predetermined value.

7. A pump unit for hydraulic power transmission comprising two pumps, a source of power from which both said pumps are driven, both

pumps being operative during the main part of the transmission of power but the one pump being automatically rendered inoperative when the pressure in the hydraulic system reaches a given value, a spring-pressed plunger, a chamber within which said plunger works, a valve in said plunger, a passage leading from the delivery to the suction side of said pump, the suction side being rendered inoperative, said plunger being exposed to pressure from the delivery side of the pump (the delivery side of the pump not being rendered inoperative) and to the general hydraulic system, a passage connecting the delivery sides of the two pumps, a non-return valve in said passage, and said valve of said plunger normally closing the said passage connecting together the suction and delivery sides of the pump which is rendered inoperative, but operating to open such passage by the action of said plunger when the pressure in the hydraulic system reaches a predetermined value.

8. A pump unit for hydraulic power transmission comprising two pumps, a source of power from which both said pumps are driven, both pumps being operative during the main part of the transmission of power but the one pump being automatically rendered inoperative when the pressure in the hydraulic system reaches a given value, a spring-pressed plunger, a chamber within which said plunger works, a valve of said plunger, a passage leading from the delivery to the suction side of said pump which is rendered inoperative, said plunger exposed to pressure from the delivery side of the pump which is not rendered inoperative and to the general hydraulic system, a passage connecting the delivery sides of the two pumps, a non-return valve in said passage, and said valve of said plunger normally closing the said passage connecting together the suction and delivery sides of the pump which is rendered inoperative, but operating to open such passage by the action of said plunger when the pressure in the hydraulic system reaches a predetermined value, a chamber within which said plunger is adapted to slide, said chamber being exposed at one end to the pressure in the system, said chamber cutting across the said passage connecting the delivery sides of the two pumps and being widened out where it crosses said passage, a peripheral recess of said plunger, an axial passage of said plunger communicating with said peripheral recess, said recess coinciding with said widened-out portion when said plunger is pressed against the force of its spring by increase of pressure in the system.

9. A pump unit for hydraulic power transmission comprising two pumps, a source of power from which both said pumps are driven, both pumps being operative during the main part of the transmission of power, but the one pump being automatically rendered inoperative when the pressure in the hydraulic system reaches a given value, a spring-pressed plunger, a chamber within which said plunger works, a valve of said plunger, a passage leading from the delivery to the suction side of said pump which is rendered inoperative, said plunger being exposed to pressure from the delivery side of the pump which is not rendered inoperative and to the general hydraulic system, a passage connecting the delivery sides of the two pumps, a non-return valve in said passage, and said valve of said plunger normally closing the said passage connecting together the suction and delivery sides of the pump which is rendered inoperative, but operating to open such passage by the action of said plunger when the pressure in the hydraulic system reaches a predetermined value, and a head of increased diameter which closes down on the end of said chamber when the plunger has moved to its fullest extent under the increased pressure of oil in the system.

10. A pump unit for hydraulic power transmission comprising two pumps, a piston of each pump, a deep peripheral annular groove in one or each piston, a packing ring in such groove, said packing ring being shallower narrower than the groove, ports connecting said groove with the space on the delivery side of the piston, ports connecting the groove with the suction side of the piston and said packing ring adapted to close such second mentioned ports during the movement of the piston away from the suction end of the respective pump, a source of power from which both said pumps are driven, both pumps being operative during the main part of the transmission of power and means by which the one pump is automatically rendered inoperative when the pressure in the hydraulic system reaches a predetermined value.

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