

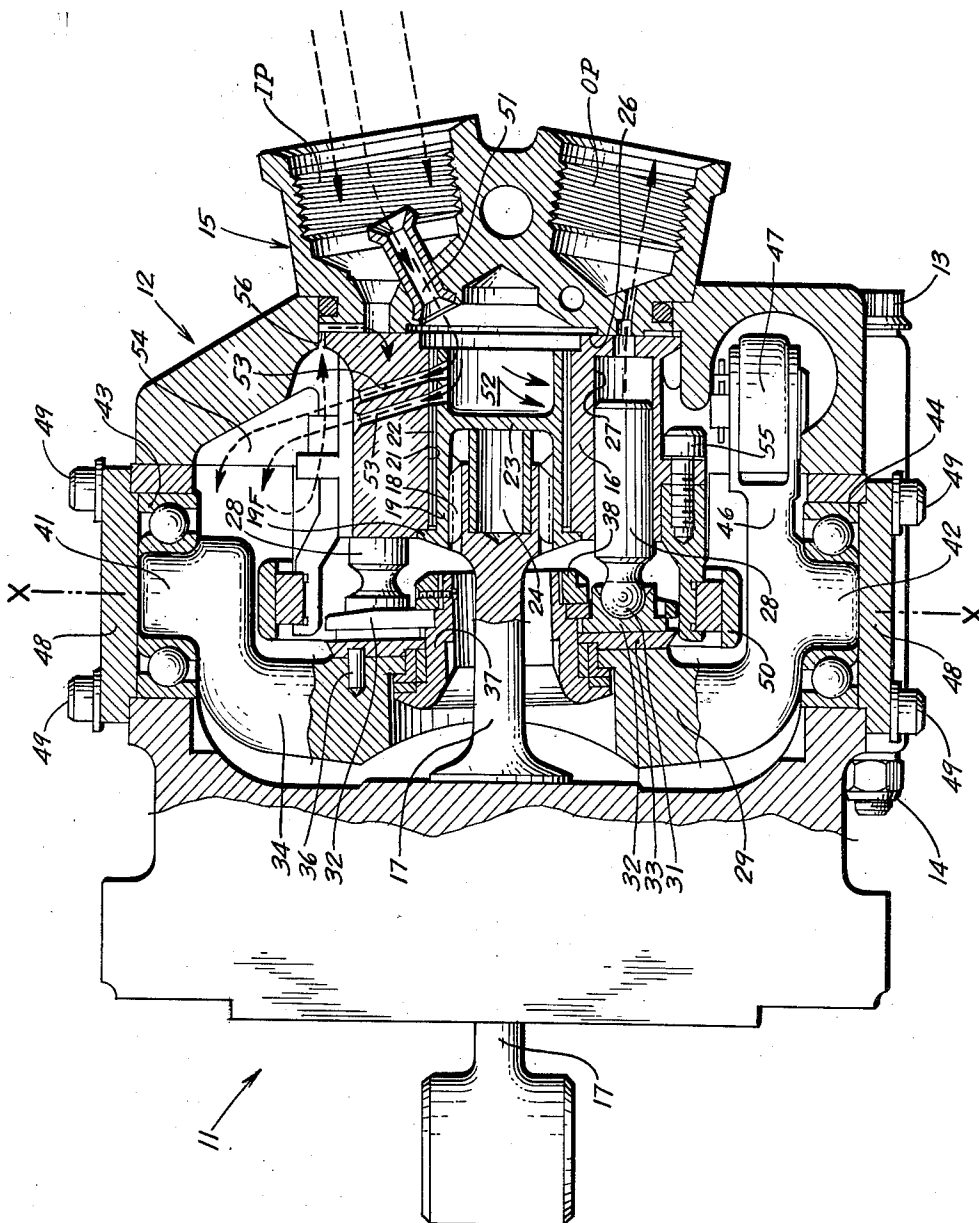
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HYDRAULIC PUMPS

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HYDRAULIC PUMPS

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3 Claims. (Cl. 103—162)

This invention relates to a hydraulic pump and particularly to a hydraulic pump of the kind which is subjected to operation at high speed and high fluid pressures.

Hydraulic pumps which are operated at high speed and high fluid pressures for sustained periods of time generate a large amount of internal heat, which, if not dissipated quickly enough, can cause undue wear in the operating parts of the pump, particularly in the bearings. Under severe operating conditions the internal heat thus generated can build up to the point where seizure between operating parts of the pump can occur and cause destruction of the pump.

It is a primary object of this invention to circulate a secondary flow of cooling fluid through a hydraulic pump as an incident of operation of the pump to effectively dissipate the internal heat which is generated by the operation of the pump. It is a specific object of this invention to continuously extract a portion of the fluid from the inlet of the pump and circulate such extracted fluid internally within the pump, in a flow path separate from that occurring through the pumping chambers, and thereafter to return such fluid to the inlet of the pump at a point which is downstream from the part of the inlet from which the fluid is initially extracted. In this manner, relatively cool inlet fluid is caused to circulate through the pump to cool the internal structure of the pump before such fluid is passed to the pumping chambers and subjected to the heat generated by the pressure buildup developed in the pumping chambers. Additionally, inasmuch as the cooling fluid is ultimately pumped through the outlet thereof, the fluid within the pump is continuously being changed. Thus, the internal heat developed within the pump is effectively transferred from the pump and dissipated by the fluid circulated by the pump.

In one form of the present invention structure for effecting such circulation of cooling fluid is incorporated in a pump of the kind in which a cylinder barrel is rotatable within an outer casing and wherein piston members are reciprocated within a series of generally axially extending bores in said barrel by movement of end portions of the piston members about an inclined face of a swash plate during rotation of the cylinder barrel to pump fluid between inlet and outlet ports formed in the outer casing. In accordance with this form of the present invention a Pitot tube is disposed within the inlet port in a manner such that the Pitot tube directs fluid from the inlet port to the interior of the cylinder barrel. The barrel is formed with generally radially extending passageways between the cylinder bores, and rotation of the cylinder barrel is effective to centrifugally pump the fluid which has been directed to the interior of the barrel radially outwardly through the passageways and to the space between the barrel and the casing. The fluid thus delivered under pressure to the space between the cylinder barrel and the casing is subsequently returned to the inlet port at a point downstream of the Pitot tube inlet through a conduit interconnecting the interior of the casing with the inlet port, whereupon the fluid thus returned to the inlet port is delivered to the interior of the axially extending bores of the cylinder barrel and subsequently pumped through the outlet port. It is another object of this invention to incorporate the foregoing structural features in a novel hydraulic pump.

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Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawing which, by way of illustration, shows a preferred embodiment of the present invention and the principles thereof and what is now considered to be the best mode contemplated for applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawing:

The FIGURE is a longitudinal sectional view of a hydraulic pump constructed in accordance with one embodiment of the present invention.

In the drawing a hydraulic pump constructed in accordance with one embodiment of this invention is indicated generally by the reference numeral 11 and includes an outer casing 12 of multiple-part construction suitably assembled together as by a plurality of tie bolts 13 and fastening nuts 14. The outer casing 12 includes a head 15 which is formed with an inlet port IP and an outlet port OP, each of which is adapted to have a conventional hose coupling attached therein.

A generally annular-shaped cylinder block or barrel 16 is generally centrally disposed within the outer casing 12 and is adapted to be rotated therein by a drive shaft 17. Thus, the shaft 17 is formed with external splines 18 at the inner end thereof which are engageable with internal splines formed on a sleeve member 19, which is in turn axially disposed within a longitudinally extending central bore 21 formed in the annular cylinder barrel 16. The sleeve member 19 is connected to drive the cylinder barrel 16 through a splined connection 22. As illustrated in FIG. 1, the sleeve 19 is preferably formed with a web 23 extending across the interior thereof and a thrust bearing 24 is interposed between the web 23 and the end of the shaft 17. The sleeve 19 also includes a radially extending flange 19F which is seated within an annular recess formed within one face of the cylinder barrel 16 to thereby prevent axial movement of the cylinder barrel 16 in one direction. The opposite face of the cylinder barrel 16 is engageable with and slidable on the inner face of the head 15 in the area indicated by the reference numeral 26 so that the cylinder barrel is maintained in a fixed axial position within the outer casing.

The cylinder barrel 16 is formed with a plurality of axially extending bores 27 disposed in an annular array. These bores afford the pumping chambers and are placed in alternate communication with the inlet port IP and the outlet port OP during rotation of the cylinder barrel 16.

Pistons 28 are slidable within the bores 27 and are adapted to be reciprocated back and forth therein to pump fluid from the inlet port to the outlet port by a swash plate mechanism indicated generally by the reference numeral 29. Thus, each of the pistons 28 is rounded, as indicated by the reference numeral 31, at the end which projects from the cylinder barrel 16. The rounded ends of the pistons 28 are received within complementary-shaped recesses formed in slippers or shoes 32, thus affording a ball and socket connection between the pistons 28 and the shoes 32. The shoes 32 are in turn slidable along the surface of a swash plate 33 in the course of the rotation of the cylinder barrel 16 and the pistons 28 carried therein. The swash plate 33 is suitably affixed to a spindle member 34 as by a series of pins 36, and the shoes 32 are maintained in engagement with the swash plate 33 by a retainer assembly 37 which includes a ring 38 engageable with a radial flange formed integrally on the shoes 32.

The spindle 34 is journaled for rotation about an axis XX by means of pivot bosses 41 and 42 disposed within bearings 43 and 44 mounted within the outer casing. The spindle member 34 also includes a crank arm 46 which is connected to an actuating member 47. Thus, the angular inclination of the swash plate 33 and thus the stroke of the pistons 28 and the displacement of the pump 11 is variable in response to the signal applied to the actuating member 47. Preferably, access plates 48 are removably secured, as by cap screws 49, to the outer casing 12 to facilitate installation or replacement of the bearings 43 and 44. Also, a bearing which includes a circumferentially extending outer race 50 is mounted on the cylinder barrel 16 as by cap screws 55. The bearing race 50 acts with other structure, not illustrated, to position the barrel and reduce the friction due to rotation at high speeds.

As thus far described the structure of the pump 11 is effective to operate in a conventional mode of operation to draw fluid from the inlet port IP during the time that a piston 28 is moved outwardly of a bore 27 by the inclination of the swash plate 33, and movement of the piston 28 inwardly of the bore 27 during continued rotation of the cylinder barrel 16 is effective to transfer the fluid to the outlet port OP.

Such pumping action of the pump 11 develops a large amount of internal heat within the pump 11 by reason of the pressures developed in the bores 27 during the movement of the pistons 28 inwardly of the bores. As noted hereinabove, if such heat is not dissipated, undue wear of the operating parts of the pump 11 and possible seizure between the relatively movable parts of the pump can result.

In accordance with the present invention means are incorporated in the pump 11 for extracting a portion of the fluid flow in the inlet port IP and circulating the fluid thus extracted internally of the pump in a flow path which is separate from that which occurs between the inlet and outlet ports by reason of the pumping action developed in the bores 27. As illustrated in the drawing, a Pitot tube 51 is mounted within the head 15 so as to project into the interior of the inlet port IP and afford a path of communication between the inlet port and a chamber 52 defined in the interior of the cylinder barrel 16. The Pitot tube 51 takes advantage of the stagnation pressure of the in-rushing fluid in the inlet port IP to divert a portion of such in-rushing fluid and direct the diverted fluid to the interior of the cylinder barrel 16. The cylinder barrel 16 is in turn formed with one or more generally radially extending passageways 53 which communicate the chamber 52 with the space or chamber 54 defined between the cylinder barrel 16 and the interior of the outer casing 12. The passageways 53 are formed in the parts of the cylinder barrel 16 which are disposed between pairs of adjacent bores 27, and the rotation of the cylinder barrel 16 causes a centrifugal pumping effect to be developed within such passageways to positively pump fluid from the chamber 52 to the chamber 54. Preferably, the passageways 53 are slightly diagonally inclined as illustrated to thereby achieve a vortex flow in the chamber 54 in the manner indicated by the arrows. By reason of the centrifugal pumping action noted hereinabove, the hydraulic fluid builds up pressure within the chamber 54, very much like a centrifuge. A return conduit or passageway 56 is formed in the outer casing 12 and interconnects the chamber 54 with the portion of the inlet port IP which is immediately adjacent the inlet to the bores 27. Thus, the conduit 56 affords a path for the return of the cooling fluid to the inlet port at a location which is downstream of and at a considerably lower pressure than the inlet to the Pitot tube 51. Thus, the fluid extracted by the Pitot tube 51 and caused to flow through the cylinder barrel 16 and within the casing 12 is ultimately pumped through the outlet port OP so that the cooling fluid circulated with-

in the pump 11 is continuously changed, and a high degree of heat transfer from the operating parts of the pump 11 is thereby assured. Additionally, the hydraulic fluid passing through the passageways 53 is distributed about the entire periphery of the interior of the casing 12 by reason of rotation of the cylinder barrel 16, and the jets of fluid coming from the outlet end of the passageways 53 have the effect of causing the fluid within the chamber 54 to rotate in the same direction that the cylinder barrel 16 is rotated to thereby provide less viscous drag on the rotating parts and further reduce the input torque required to operate the pump.

Hence, while I have illustrated and described the preferred embodiment of my invention, it is to be understood that this is capable of variation and modification, and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. A hydraulic pump comprising: an outer casing provided with means affording inlet and outlet ports and wherein the means affording the inlet port is inclusive of upstream and downstream portions; a cylinder barrel rotatable within the outer casing and formed with a plurality of axially extending bores, which bores are placed in alternate communication with the outlet port and with the downstream portion of the inlet port by rotation of the cylinder barrel, said cylinder barrel also having passageways formed therein between a pair of adjacent bores, which passageways extend generally radially outwardly from a first chamber disposed generally centrally within the barrel to a second chamber disposed between the barrel and casing, piston members slidably disposed within said bores and having free ends projecting from a face of said cylinder block; an inclined plate member engageable with the free ends of said piston members for reciprocating said piston member within said bores as a consequence of rotation of said cylinder barrel to pump fluid from the inlet port to the outlet port; and means for circulating cool fluid from said inlet port, through the cylinder barrel, within the casing and then back to said inlet port to thereby cool the pump structure, said means including both a Pitot tube disposed to communicate with the upstream portion of the means affording said inlet port for directing cool fluid from the inlet port to the first chamber and return conduit means interconnecting the second chamber with the downstream portion of the inlet port for directing to the inlets of said bores the fluid which is centrifugally pumped from first chamber to the second chamber through the radial passageways formed in the cylinder barrel during rotation of said barrel.

2. In a hydraulic pump of the kind which includes a cylinder barrel rotatable within an outer casing and wherein piston members are reciprocated within a series of generally axially extending bores in said cylinder barrel by movement of end portions of said piston members about an inclined surface of a plate member during rotation of the cylinder barrel to pump fluid between means affording inlet and outlet ports provided in the outer casing, means for extracting a portion of the fluid flow at a point upstream of the means affording said inlet port and circulating the fluid thus extracted through the cylinder barrel and within the casing and subsequently returning the extracted fluid to the inlet port to cool said pump prior to delivering such extracted fluid to said bores for pumping from the inlet port to the outlet port, said means including; a Pitot tube having an end disposed in said inlet port at the upstream portion thereof for directing cooling fluid from the means affording the inlet port to the interior of the cylinder barrel, radially extending passageways formed in said cylinder barrel for centrifugally pumping fluid from the interior of the

barrel to the space between the exterior of the barrel and the interior of the casing during rotation of the barrel, and a radial passageway extending from said space to a point in the means affording said inlet port which is downstream of said end of the Pitot tube.

3. A hydraulic pump as defined in claim 2 wherein said means include a return conduit communicating the space between the barrel and casing with the inlet port.

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References Cited in the file of this patent

UNITED STATES PATENTS

2,273,468	Ferris	Feb. 17, 1942
2,292,125	Ifield	Aug. 4, 1942
2,620,733	Overbeke	Dec. 9, 1952
2,646,754	Overbeke	July 28, 1953
2,661,700	Towler, et al.	Dec. 6, 1953
2,733,666	Poulos	Feb. 7, 1956