Dec. 8, 1936. C. SCHINDLER 2,063,464

PISTON ASSEMBLY

Filed March 3, 1932

Fig. 1.

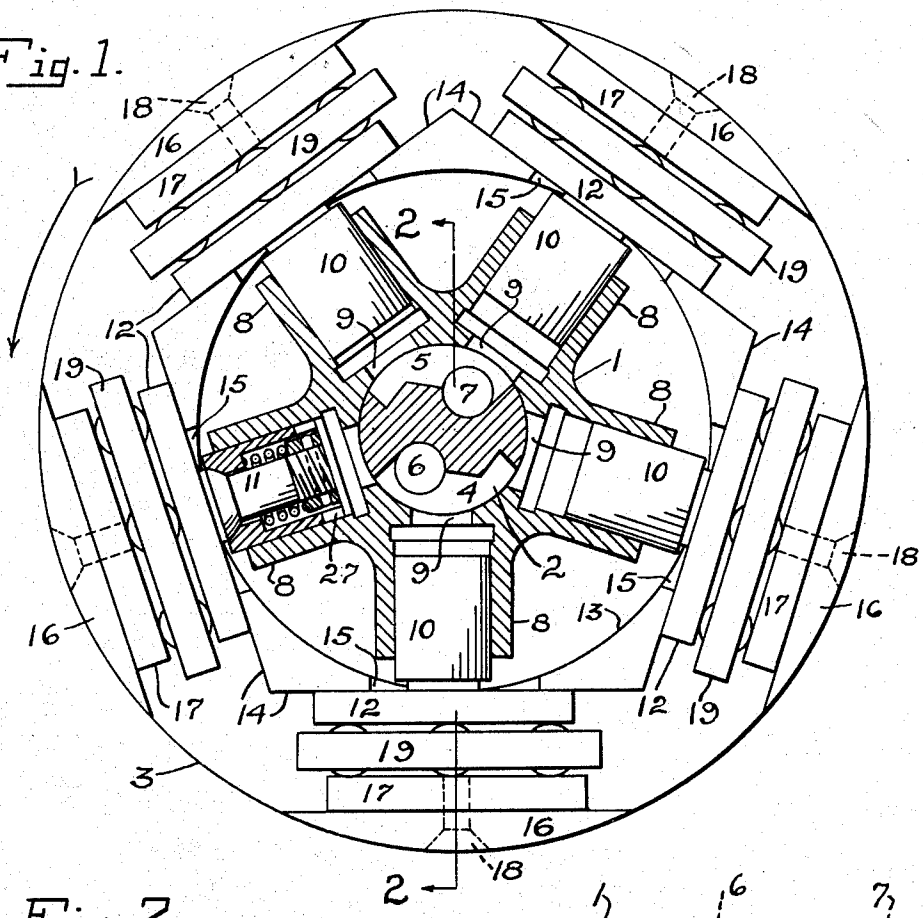
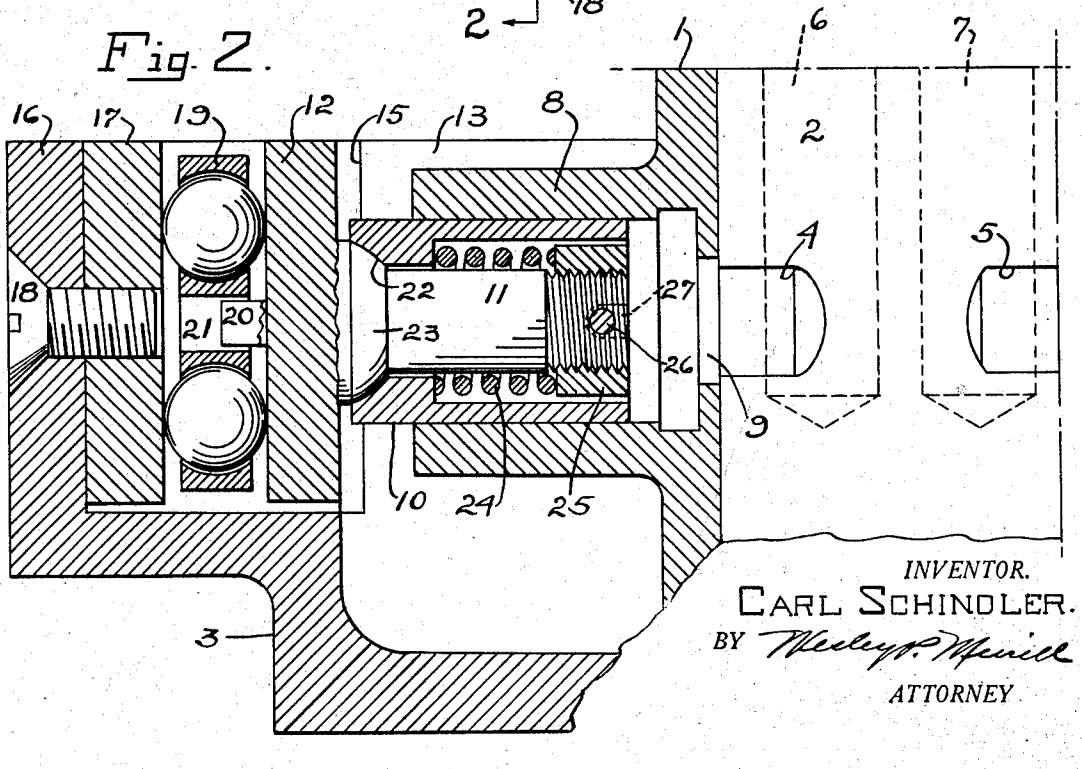


Fig. 2.



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Patented Dec. 8, 1936 2,063,464

UNITED STATES PATENT OFFICE

2,063,464

PISTON ASSEMBLY

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Application March 3, 1932, Serial No. 596,479

4 Claims. (Cl. 103—161)

This invention relates to pistons for hydraulic pumps and motors.

The pump or motor to which the invention is particularly adapted is of the type which is provided with a central valve or pintle having intake and discharge ports and passageways, a cylinder barrel rotating on the pintle and provided with radial cylinders having ports at the inner ends thereof to register with the intake and dicharge ports alternately as the cylinder barrel rotates, and a driver rotating in unison with the cylinder and connected to the pistons to reciprocate the same whenever its axis of rotation is eccentric to the axis of the pintle, such as the pump disclosed in Patent No. 1,619,200 issued March 1, 1927 to Walter Ferris.

The pistons of such pumps are ordinarily provided with a central bore or socket having a push pin arranged therein with its inner end in engagement with the inner end of the socket and its outer end connected to a crosshead which is engaged by the driver.

The entire force required to expel liquid from the cylinder is thus carried by the relatively small bearing surface between the end of the push pin and the end of the socket, and this surface is unlubricated.

The pintle is ordinarily supported at one end only and, when the pump is delivering liquid at sufficiently high pressure, the pintle is deflected and causes the cylinders to revolve in a plane which is displaced from the normal plane of revolution and at an angle thereto. Displacement of the plane of revolution causes the unlubricated bearing surfaces on the push pin and the piston to move relatively to each other.

This invention has an object to provide a piston assembly having increased bearing surfaces through which pumping forces are transmitted from the crosshead to the liquid.

Another object is to lubricate the bearing surfaces through which pumping forces are transmitted from the crosshead to the liquid.

Another object is to provide a piston assembly in which a part of the pumping force is transmitted to the liquid independent of the piston.

According to the invention as ordinarily applied and embodied in practice, a substantially tubular piston is provided with an open concave seat, a crosshead carries an annular convex seat which is fitted in the concave seat, and a spring holds the convex seat in engagement with the concave seat.

The accompanying drawing illustrates an embodiment of the invention and shows the same incorporated in a pump rotor of the type disclosed in Patent No. 1,619,200.

The views in the drawing are as follows:

Fig. 1 is an end view of the rotor, the cylinders and one of the pistons being shown in central section.

Fig. 2 is a section taken on the line 2—2 of Fig. 1.

The pump rotor is provided with a cylinder barrel 1 which is journaled upon a central shaft or pintle 2 and rotated thereon by a driver 3 which is driven from an external source of power and supported independently of the pintle with its axis of rotation eccentric to the axis of the pintle.

The pintle is ordinarily supported at one end only by mechanism not shown and is provided with an intake port 4 and a discharge port 5 which are arranged diametrically opposite each other and communicate, respectively, with an intake passage 6 and a discharge passage 7 formed in the pintle longitudinally thereof.

The cylinder barrel is provided with five radial cylinders 8 each of which has a port 9 in the inner end thereof to register with the ports 4 and 5 alternately as the cylinder barrel rotates.

Each cylinder has a piston 10 fitted therein and connected by a piston pin 11 to a crosshead 12 by means of which the piston is reciprocated in the cylinder.

The cylinder barrel is arranged within an annular flange 13 which is formed upon the driver 3 and provided upon its outer periphery with five tangential faces 14 each of which is arranged at the end of a cylinder 8.

The flange 13 has a slot 15 formed therein intermediate the ends of each face 14 to permit the passage therethrough of the piston pin 11, and each slot ordinarily has sufficient length to permit the piston 10 to move therein longitudinally of the face.

The driver is provided upon its outer periphery opposite each face 14 with a segmental flange 16 which has a bearing plate 17 arranged upon its inner face parallel to the face 14 and secured in position by a screw 18.

The inner face of each crosshead engages a face 14 and is held in engagement therewith by an antifriction bearing 19 which is arranged between the outer face of the crosshead and the inner face of the bearing plate 17, the bearing 19 being ordinarily retained in position between the crosshead and the bearing plate by a pin 20 carried by the crosshead and extending into a slot 21 formed in the race of the bearing 19.

When the driver is rotated in the direction of the arrow, the cylinder barrel is rotated also and the pistons in the lower half of the cylinder barrel in respect to Fig. 1 are drawn outward by the crosshead bearing upon the faces 14 and the cylinders in the upper half of the cylinder barrel are forced inward by the thrust of the bearing plate acting through the anti-friction bearing.

The outward moving pistons draw liquid into their cylinders through the passage 6 and the ports 4 and 9, and the inward moving pistons expel liquid from their cylinders through the ports 9 and 5 and the passage 7.

The entire force exerted by the driver upon the pistons to expel liquid from the pump is carried by its pintle and, when the liquid meets a high resistance, this force is sufficient to bend the pintle and thereby deflect the cylinder barrel from its normal plane of rotation and cause relative movement between the push pin and the piston.

The pump rotor shown and thus far described is substantially the same as the rotor disclosed in Patent No. 1,619,200 with the exception of the piston assembly in which the invention is embodied and which will now be described.

The piston 10 is substantially tubular and provided at its outer end with an annular concave seat 22 through which the piston pin 11 extends.

The seat 22 is engaged by a complementary convex seat 23 which closes the outer end of the piston and is ordinarily in the form of a truncated spherical segment rigidly secured to the crosshead 12 as by being formed integral therewith. The piston pin 11 extends from the convex seat 23 through the concave seat 22 into the piston and is ordinarily formed integral with the seat 23 and the crosshead 12.

The convex seat 23 is held in engagement with the concave seat 22 by a helical compression spring 24 which encircles the pin 11 and has one of its ends abutting the underside of the seat 22 and its other end abutting a nut 25 threaded upon the inner end of the pin 11.

The nut 25 is fastened in adjusted position upon the pin 11 by a pin 26 which extends therethrough and through the pin 11, the piston 10 being provided at its inner end with opposed notches 27 to allow the pin 26 to be inserted and its ends upset to hold it in position.

The spring 24 holds the convex seat 23 against the concave seat 22 with sufficient force to maintain therebetween an oil tight joint which is lubricated by a film of oil supplied thereto from the high pressure oil within the piston when it is expelling oil from the cylinder.

When pump pressure increases sufficiently to cause deflection of the cylinders from their normal plane of revolution, the seats 22 and 23 may move relatively to each other without undue friction as the same are efficiently lubricated.

The force exerted by the driver in expelling liquid from the cylinder is transmitted in part through seat 23 and the piston pin 11 direct to the liquid in the cylinder and in part through the seat 22 and the tubular piston. Consequently, the piston carries only a fraction of the pumping forces which had to be carried entirely by the piston of the prior pump.

The invention herein set forth is susceptible of various modifications and adaptations within the scope of the appended claims.

The invention is hereby claimed as follows:

1. The combination, with a pump having a radial cylinder revolvable within a circle, a thrust member rotatable upon an axis offset from the axis of said circle, and a reaction surface arranged upon said thrust member at a tangent to said circle, of a piston arranged in said cylinder and having a passage of substantial diameter extending therethrough, a concave seat arranged around said passage, a crosshead bearing against said reaction surface for transmitting pumping forces from said thrust member to the liquid in said cylinder, a piston pin rigidly secured to said crosshead at right angles thereto and extending through said seat and into said passage, and a convex seat rigidly secured to said piston pin and engaging said concave seat to thereby close said passage and transmit a substantial part of said pumping forces direct and through said pin to the liquid in said cylinder and to transmit another part of said pumping forces through said piston.

2. The combination, with a pump having a radial cylinder revolvable within a circle, a thrust member rotatable upon an axis offset from the axis of said circle, and a reaction surface arranged upon said thrust member at a tangent to said circle, of a piston arranged in said cylinder and having a passage of substantial diameter extending therethrough, a concave seat arranged around said passage, a crosshead bearing against said reaction surface for transmitting pumping forces from said thrust member to the liquid in said cylinder, a piston pin rigidly secured to said crosshead at right angles thereto and extending through said seat and into said passage, and a convex seat rigidly secured to said piston pin and bearing upon said crosshead and engaging said concave seat to thereby close said passage and transmit a substantial part of said pumping forces direct and through said pin to the liquid in said cylinder and to transmit another part of said pumping forces through said piston.

3. The combination, with a pump having a radial cylinder revolvable within a circle, a thrust member rotatable upon an axis offset from the axis of said circle, and a reaction surface arranged upon said thrust member at a tangent to said circle, of a piston arranged in said cylinder and having a passage of substantial diameter extending therethrough, a concave seat arranged around said passage, a crosshead bearing against said reaction surface for transmitting pumping forces from said thrust member to the liquid in said cylinder, a piston pin rigidly secured to said crosshead at right angles thereto and extending through said seat and into said passage, a convex seat rigidly secured to said piston pin and engaging said concave seat to thereby close said passage and transmit a substantial part of said pumping forces direct and through said pin to the liquid in said cylinder and to transmit another part of said pumping forces through said piston, an abutment carried by said pin, an abutment carried by said piston, and a spring arranged around said pin in engagement with said abutments for keeping said seats in contact with each other.

4. The combination, with a pump having a radial cylinder revolvable within a circle, a thrust member rotatable upon an axis offset from the axis of said circle, and a reaction surface arranged upon said thrust member at a tangent to said circle, of a piston arranged in said cylinder and having a passage of substantial diameter extending therethrough, a concave seat arranged around said passage, a crosshead bearing against said reaction surface for transmitting pumping

forces from said thrust member to the liquid in said cylinder, a piston pin rigidly secured to said crosshead at right angles thereto and extending through said seat and into said passage, a convex seat rigidly secured to said piston pin and bearing upon said crosshead and engaging said concave seat to thereby close said passage and transmit a substantial part of said pumping forces direct and through said pin to the liquid in said cylinder and to transmit another part of said pumping forces through said piston, an abutment carried by said pin, an abutment carried by said piston, and a spring arranged around said pin in engagement with said abutments for keeping said seats in contact with each other.

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