United States Patent [19]

Rubery

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[54] **PISTONS FOR HYDRAULIC PISTON TYPE PUMPS AND MOTORS**

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[22] Filed: **June 22, 1971**

[21] Appl. No.: **155,618**

Related U.S. Application Data

[63] Continuation of Ser. No. 844,280, July 24, 1969, abandoned.

[52] **U.S. Cl.** **91/506,** 91/507, 92/68

[51] **Int. Cl.**.....**F04b 7/00**

[58] **Field of Search**.....92/68, 70, 71, 72, 92/57, 157, 169; 163/162; 91/198, 199, 506, 507, 201, 200; 308/5 R, 160, 238

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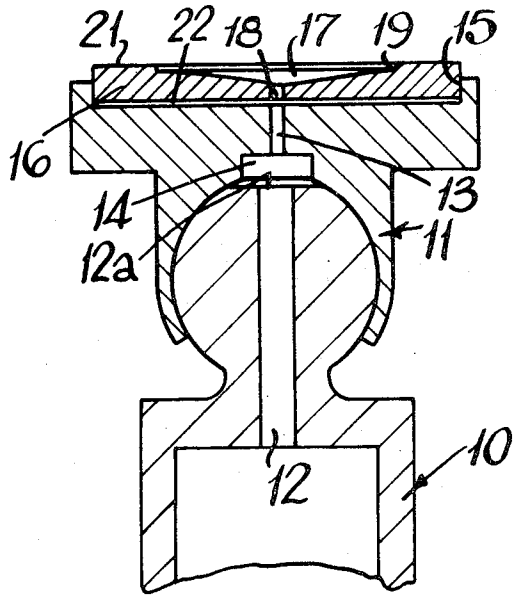
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[57] **ABSTRACT**

A piston slipper for an hydraulic pump or motor comprises a main portion and an insert of different materials, the running face of the insert having a recess which is conical, and the recess terminates at its inner edge at a drilling for entry of lubricant, and at its outer edge at a step.

6 Claims, 3 Drawing Figures

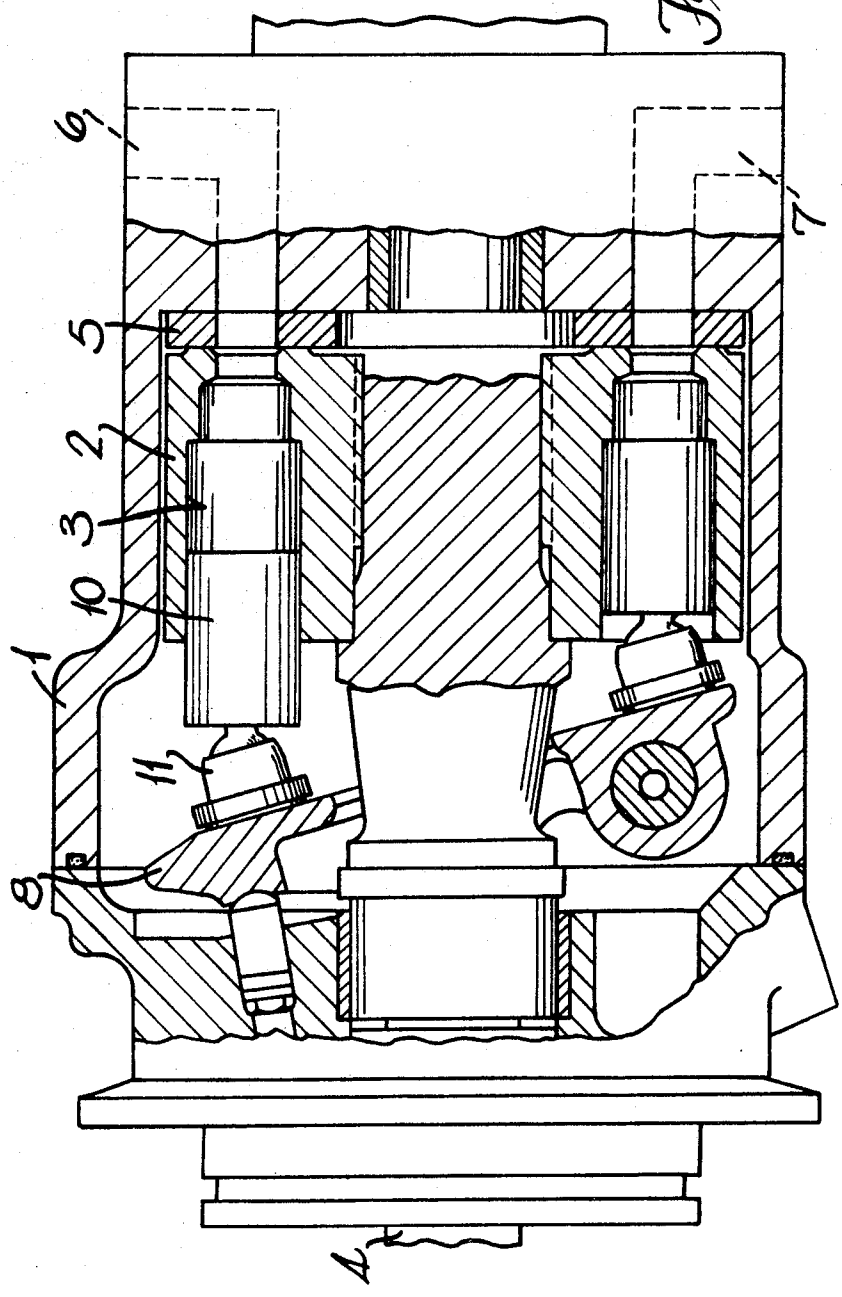


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SHEET 1 OF 2

Fig. 1.



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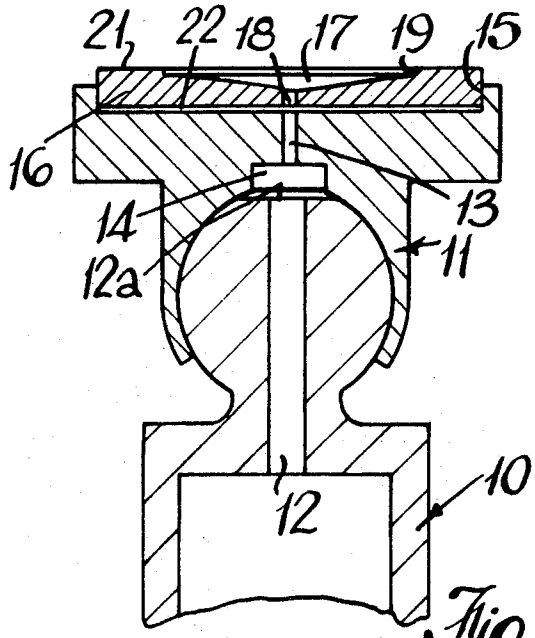


Fig. 2.

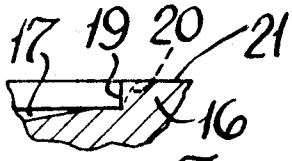


Fig. 3.

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PISTONS FOR HYDRAULIC PISTON TYPE PUMPS AND MOTORS

This application is a continuation of my copending application Ser. No. 844,280 filed 7-24-69, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to hydraulic piston type pumps and motors of the kind comprising a body, a rotor rotatably mounted in the body, a plurality of pistons mounted in respective bores in the rotor, the pistons, at their ends, carrying respective slippers which engage with a cam surface provided in the body, whereby the pistons are reciprocated as the rotor rotates, to cause liquid to enter and leave the bores in turn through an inlet and an outlet in the body.

In pumps and motors of the kind referred to, the materials most suitable for manufacture of the slippers to provide the necessary mechanical strength are not, in many cases, well suited for providing a bearing to run on the cam surface. It has therefore been proposed to apply to the running surface of a slipper, a layer of a more suitable bearing material, which, in some of the most suitable cases, has low mechanical strength. Such material has been applied by plating or as a separate insert.

The object of the invention is to provide a piston slipper for an hydraulic piston type pump or motor of the kind specified, having adequate mechanical strength and a satisfactory running surface.

SUMMARY OF THE INVENTION

According to the present invention a piston slipper for an hydraulic pump or motor of the kind specified comprises a main portion and an insert formed from different materials, the insert being located on the main portion and secured thereto by a layer of adhesive material, the running surface of the insert having a conical recess communicating at its apex with a bore in the slipper through which lubricant can enter the recess, and the outer edge of the conical recess terminating at an annular step.

The invention will now be described by way of example with reference to the accompanying drawings in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view of a swash plate type pump or motor to which the invention has been applied,

FIG. 2 is an enlarged cross-sectional view of a piston and slipper assembly constructed in accordance with the invention, and

FIG. 3 is a still further enlarged cross-sectional view of the edge of the recess in the slipper bearing surface.

DETAILED DESCRIPTION OF THE DRAWINGS

The hydraulic swash plate type pump or motor shown has a body 1, a rotor 2 rotatably mounted in the body 1, and a plurality of pistons 10 occupying respective parallel, equi-angularly spaced bores 3 in the rotor 2. The rotor 2 is connected to a driving shaft 4. At the opposite end of the rotor from which the pistons extend, there is a port plate 5 through which the bores can communicate with an inlet 6 and an outlet 7 in the body 1 in turn as the rotor 2 rotates. The pistons 10 carry respective slippers 11 which bear against an angularly adjustable swash plate 8 mounted in the body 1. As the rotor rotates, liquid flows into and out of the bores in turn and through the inlet 6 and outlet 7 in the body 1.

The piston 10 has a hollow cylindrical portion one at one end. This portion engages in its rotor bore 3. At the closed end is an integral part-spherical portion 10*a* engaged within a complementarily shaped cup 11*a* formed in the slipper 11. A coaxial drilling 12 through the part-spherical portion 10*a* affords communication between the interior of the cylindrical portion of the piston 10 and its slipper engaging end. The drilling 12 terminates in the center of a flat portion 12*a* formed at the end of the part-spherical portion 10*a* of the piston 10. In the slipper there is a coaxial bore 13 which communicates with the drilling 12 through a cavity 14 formed at the base of the part-spherical cup 11*a*.

The cavity 14 and the flat portion 12*a* at the end of the piston are shaped to provide access for liquid between the drilling 12 and the bore 13 at any angular position of the slipper 11 with respect to the piston 10.

The slipper 11 has a shallow cylindrical recess 15 in its end presented away from the piston 10, with this recess 15 containing an insert 16 which extends beyond the annular end surface of the main portion of the slipper 11. The main portion and insert of the slipper are formed from different materials.

The insert 16 is in the form of a disc having, in its exposed flat surface, a conical recess 17. The apex of the recess 17 terminates in a bore 18 communicating with the bore 13 in the main portion of the slipper 11.

The outer edge of the conical recess 17 terminates at a short annular step 19 which is illustrated clearly in FIG. 3. The corner of this step may be rounded off as indicated by the dotted line 20 in FIG. 3. The step cylindrical surface is perpendicular to the running surface of the insert, with this running surface being a flat annulus indicated at 21 in FIGS. 2 and 3.

The insert 16 is secured in the recess 15 in the main portion of the slipper 11 by means of a layer of adhesive 22.

In the example shown, the piston 10 is formed from case hardened steel and the slipper main portion is formed from cast iron. The insert, however, is formed from a material which is more suitable to provide a running surface bearing on the swash plate 8, but which has poor mechanical strength. Such a material is lead-bronze.

The layer of adhesive 22 and the shape of the recess 15 in which the insert 16 fits provides adequate mechanical strength for the insert. The provision of the conical recess 17 tends to minimize erosion of the running surface 21 of the insert across which the flow of liquid occurs during use.

The size and depth of the conical recess 17 and of the size of the remaining flat surface 21 of the insert 16 are calculated in accordance with the required hydraulic balance in the associated pump or motor.

In order to construct the piston slipper shown, the slipper is first formed with the cup and the recess 15, and a layer of adhesive is applied into the recess 15. The insert 16 is next fitted and the recess 17 is subsequently machined. It may be necessary to machine

the external cylindrical surface of the insert after its assembly onto the slipper main portion, to remove any adhesive which has become extruded from the recess **15** during the assembly operation.

Finally the corner of the step **19** is rounded off as at **20** in FIG. **3**, if required.

In this example, the maximum depth of the center of the conical recess **17** is 0.029 inches and the maximum depth of the step **19** is 0.010 inches.

What is claimed is:

1. A piston slipper for a hydraulic pump or motor of the kind comprising a body, said body being provided with a cam surface, a rotor rotatably mounted in the body, a plurality of pistons mounted in respective bores in the rotor, the pistons, at their ends, carrying respective slippers which engage with the cam surface, the improvement being that each slipper includes a main portion and an insert for the main portion, said main portion and insert being formed from different materials, the insert being located on the main portion at one end of the slipper, a layer of adhesive material securing the insert to the main portion, the insert providing a running surface of the slipper, the insert, in the running surface thereof having a conical recess communicating at its apex with a bore in the slipper through which lubricant passing through the piston can enter the recess, and the outer edge of the conical recess terminating at an annular step, with the conical recess, during operation, serving to minimize erosion of the running surface of the insert across which the flow of lubricant occurs.

2. The piston slipper as claimed in claim **1** in which the annular step is perpendicular to the running surface of the insert.

3. The piston slipper as claimed in claim **2** in which the edge of the annular step, at the inner edge of the surrounding annular end surface of the insert, is rounded.

4. The piston slipper as claimed in claim **1** in which the main portion of the slipper is formed from cast iron and the insert is formed from lead-bronze.

5. An hydraulic pump or motor of the kind comprising a body, said body being provided with a cam surface, a rotor rotatably mounted in the body, a plurality of pistons mounted in respective bores in the rotor, the pistons, at their ends, carrying respective slippers which engage with the cam surface, the improvement being that the slippers on the pistons each comprises a main portion and an insert, said main portion and insert being formed from different materials, the insert being located on the main portion at one end of the slipped, a layer of adhesive material securing the insert to the main portion, the insert providing a running surface of the slipper, the insert, in the running surface thereof having a conical recess communicating at its apex with a bore in the slipper through which lubricant passing through the piston can enter the recess, and the outer edge of the conical recess terminating at an annular step, with the conical recess, during operation, serving to minimize erosion of the running surface of the insert across which the flow of lubricant occurs.

6. A piston slipper for a hydraulic pump or motor of the type comprising a body, said body being provided with a cam surface, a rotor rotatably mounted in the body, a plurality of pistons mounted in respective bores in the rotor, the pistons, at their ends having a part spherical head carrying respective slippers which engage with the cam surface, the improvement being that each slipper includes a main portion having a part spherical recess receiving the part spherical head of the piston, said main portion being provided with a shallow cylindrical recess in its end remote from the piston head, a circular insert positioned in the cylindrical recess and having a running surface protruding beyond the end surface of the main portion, said main portion and insert being of different materials, a layer of adhesive material securing the insert within the cylindrical recess of the main portion, the insert providing a running surface of the slipper, said main portion having an axial passage leading at one end to the cylindrical recess and at the other end to a cavity, the running surface of the insert being provided with a conical recess communicating at its apex with the passage in the main portion, the outer edge of the cylindrical recess terminating in a short annular step perpendicular to the running surface of the insert, the piston head having a flat surface located opposite the cavity in the main portion of the slipper and an axial bore terminating at the center of the flat surface whereby lubricant passing through the piston can flow through the axial bore to the conical recess in the insert via the cavity, axial passage in the main portion of the slipper, and the bore in the insert, with the conical recess, during operation, serving to minimize errosion of the running surface of the insert across which the flow of lubricant occurs.

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