

[54] **GEARED HYDRAULIC APPARATUS**
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F04C 15/00; F01C 21/04

[58] Field of Search 418/102, 131, 132

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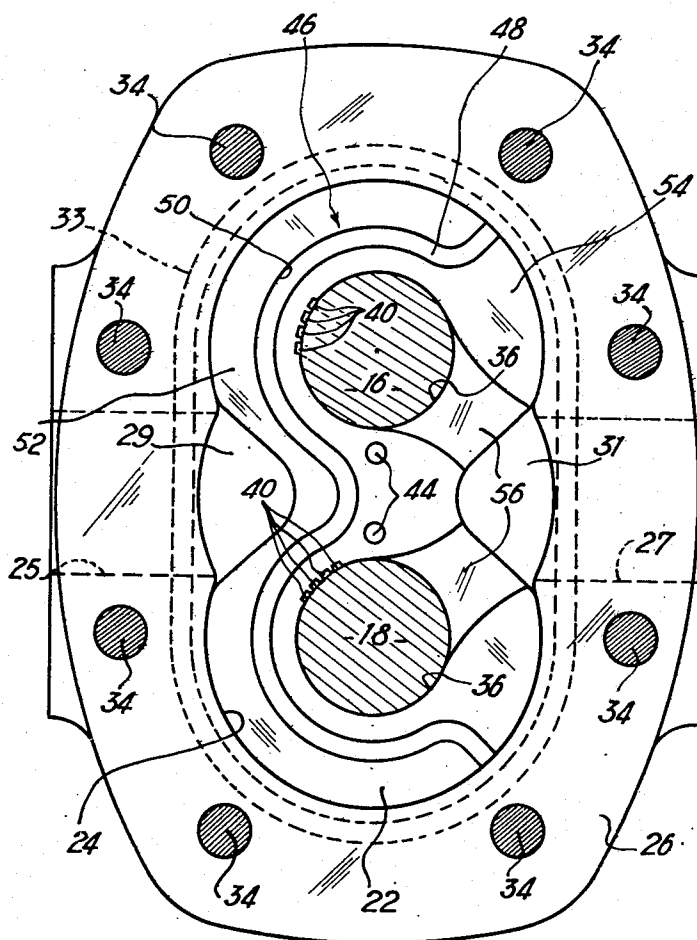
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[57] ABSTRACT

Geared hydraulic apparatus comprising a sealing system for counter-balancing a side plate of the apparatus, which system is constituted by a single open gasket defining on the face of the side-plate adjacent a cover, two independent pressure regions respectively connected to the high and low pressure chambers defined by the toothed wheels in the recess of the body of the apparatus, the high pressure region being in the general shape of W skirting two bearings of the side-plate in order to terminate on the side opposite that corresponding to the central part of this high pressure region with respect to the plane of symmetry of the side-plate passing through the axes of the bearing of the latter.

2 Claims, 2 Drawing Figures



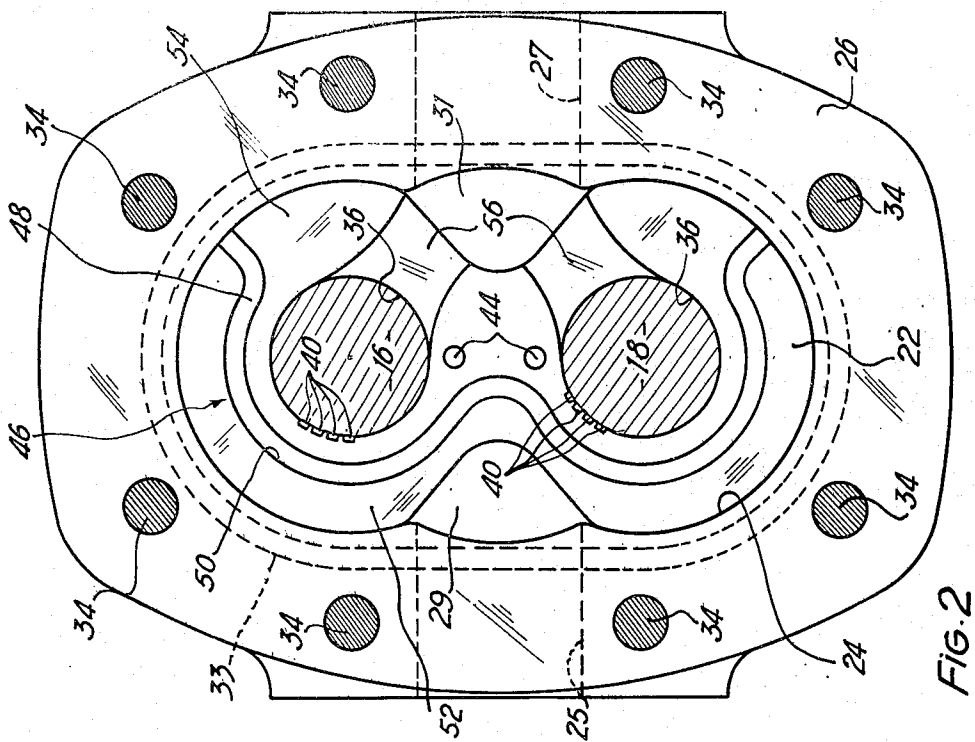


FIG. 2

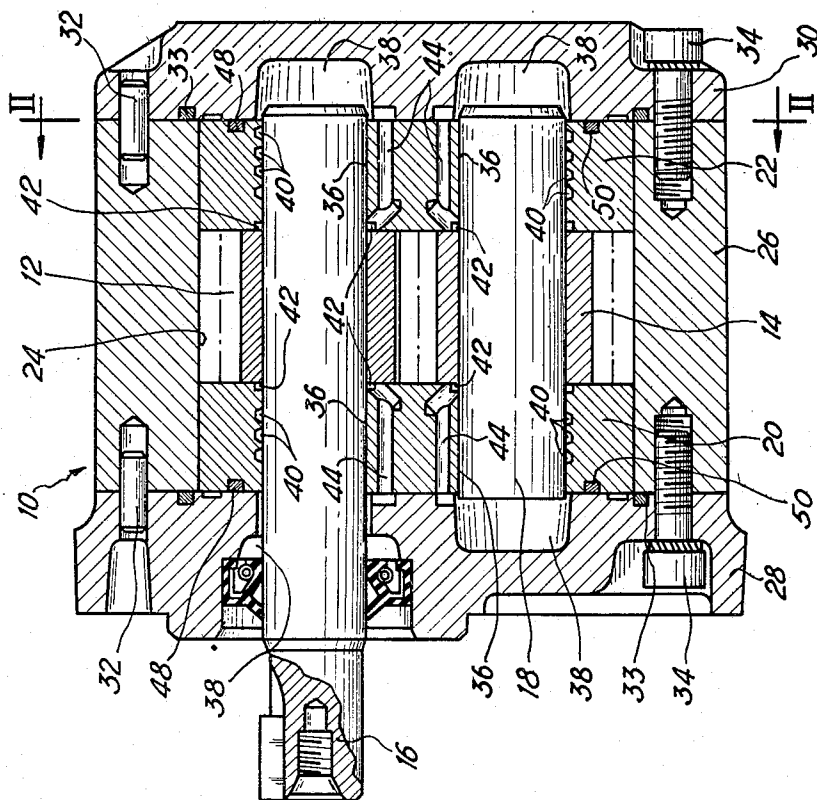


FIG. 1

GEARED HYDRAULIC APPARATUS

The present invention relates to geared hydraulic apparatus intended to be used either as a pump or as a motor.

In the field of high performance geared hydraulic apparatus, apparatus has already been proposed which comprises two co-operating toothed wheels rotatable between two side-plates providing bearings and which are disposed in a cylindrical recess provided in a central body and defined by two opposed covers fixed to the latter in a fluid-tight manner, the pressure on each side plate being substantially counter-balanced by a sealing system between the side-plate and the adjacent cover.

In previous such apparatus, the sealing system ensuring the counter-balancing of pressure of each of the two side-plates in order to limit to the maximum leakages which are able to occur between the opposing sides or the latter and the sides of the toothed wheels, is constituted by a plurality of co-operating gaskets or portions of gaskets disposed in appropriate grooves in the inner side of each cover in order to bear in a sealed manner partly against the adjacent side-plates and partly against the body. These gaskets or portions of gaskets thus define on each side-plate, a number of independent pressure regions, overlapping each other in order to counter-balance on this side-plate, the effects of hydraulic pressures occurring during operation, in the spaces of the two toothed wheels, over a wide range of speeds of rotation of the latter.

Such apparatus type provides complete satisfaction while making it possible to obtain excellent mechanical and volumetric efficiency for an acceptable cost price considering the performance obtained.

Nevertheless, in certain relatively basic application, such as agricultural machines, for example, the more modest performances which are required of the apparatus no longer justify the relatively complex machining of various grooves to be provided on the inner faces of the covers.

The object of the present invention is to propose for such a geared hydraulic apparatus a particularly simple and economical sealing system providing a good compromise for counter-balancing the hydraulic pressure on each of the side-plates for the range of customary speeds of rotation of the toothed wheels in order to make it possible to obtain acceptable volumetric and mechanical efficiency.

With this aim in view, the geared hydraulic apparatus according to the invention is characterized in that the sealing system is constituted by a single open gasket defining on the face of the side plate adjacent the cover, two independent pressure regions respectively connected to the high pressure and low pressure chambers defined by the wheels in the recess of the body, the high pressure region being in the general form of a W skirting the two bearings of the side-plate in order to terminate on the side opposite that corresponding to the central part of this high pressure region with respect to the plane of symmetry of the side-plate passing the axes of the bearings of the latter.

The W shape of the high pressure region makes it possible to obtain appropriate pressure counter-balancing of each side-plate in the field of current uses, either as a motor or as a pump, of the apparatus. The mounting of the open gasket may be effected simply by

moulding it in one piece with the side plate due to the simple shape of the gasket.

Preferably, each open gasket is disposed in a groove provided in the side of the corresponding side-plate which is adjacent the cover, the length of the gasket being such that it ends abut against the walls of the cylindrical recess of the central body. With this particular arrangement, the ends of the gasket resulting from its asymmetrical shape and its location between high and low pressure regions, tend to be urged into close contact with the walls of the cylindrical recess of the body thus eliminating the possibilities of leakages in the vicinity of these walls between said high and low pressure regions, at the ends of the gasket.

Advantageously, each side-plate comprises on its side adjacent the cover, two clearances capable, for the purpose of lubrication, of connecting the two bearings of the side-plate to the low pressure chamber of the recess and to the pressure region which is connected thereto. This arrangement makes it possible to eliminate the internal passages which are always difficult to machine and which it was previously necessary to provide in the covers with a view to connecting the low pressure compensation regions, and possibly reservoirs for the lubricant for the bearings, to an appropriate external low pressure source.

An embodiment of the present invention will now be described, by way of example with reference to the accompanying drawing, in which:

FIG. 1 is a sectional view of an apparatus according to the invention;

FIG. 2 is a view on line II- of FIG. 1.

In the drawings, the reference numeral 10 designates a geared hydraulic apparatus intended to be used either as a pump or as a motor. The apparatus 10 comprises two co-operating toothed wheels 12 and 14 respectively fixed to a driving shaft 16 and a driven shaft 18. The two shafts 16 and 18 are supported to rotate on either side of the set of wheels 12, and 14 by two side-plates forming a bearing 20 and 22 kept in abutting relationship, as explained hereafter, against the opposed side faces of the wheels 12 and 14.

The arrangement constituted by the wheels 12 and 14 and of the side-plates 20 and 22 is spectacle-shaped and is in a cylindrical recess 24 of corresponding shape provided in the body 26. The latter comprises two radial passages 25 and 27 which open out respectively into a high pressure chamber 29 and a low pressure chamber 31 defined by the wheels 12 and 14 in the recess 24 of the body 26 in the vicinity of the male part of the spectacle-shaped arrangement on either side of the plane of symmetry of the apparatus passing through the axes of rotation of the two wheels 12 and 14. The recess 24 is closed at these ends by two covers 28 and 30 appropriately retained on the opposed sides of the body 26 by positioning pins 32 and screws 34. An annular gasket 33 housed in a closed groove provided in each cover 28 and 30 ensures the outer seal of the recess 24.

A hydraulic circuit for the circulation of low pressure fluid of conventional type is provided for the lubrication of the bearings 36 provided in the side plates 20 and 22 for the shafts 16 and 18. As shown, such a circuit consists of providing for each bearing 36, a set of four helical grooves 40 capable of connecting a recess 38 forming a lubricant reservoir provided in the cover 28 or 30 corresponding to the side-plate 20 or 22 to a

fluid-tight groove 42 and of providing between the latter and the recess 38, a recycling conduit 44 in order to ensure a hydrodynamic circulation of the lubricant in the grooves 40 with a direction which depends on the direction of rotation of the toothed wheels 12 and 14.

It is known that in the abovedescribed apparatus, it is necessary to compensate for the effect on each of the side-plates 20 and 22 of the hydraulic pressures occurring, during operation of the apparatus 10, in the spaces between the teeth of the wheels 12 and 14 in order to keep to a minimum leakages which may occur between the sides of these wheels 12 and 14 and the opposing sides of the side-plates 20 and 22 towards the grooves 42.

This is done by providing a gasket means 46 between each of covers 28 and 30 and the adjacent side-plate 20 and 22 in order to define on the latter, independent regions kept at predetermined pressures, the arrangement of these regions and the value of these pressures being such that one achieves good counter-balancing of the various pressures acting on each of the side-plates, at least within the range of normal rotational speeds of the apparatus, or at approximately 15000 r.p.m. for example.

Each gasket means 46, according to the invention, is constituted by an open gasket 48, of round or rectangular section, housed in a groove 50 provided in the face adjacent the cover of the corresponding side-plate. This gasket 48 thus defines on this face, a pressure region 52 which is connected to a high pressure chamber 29 and a pressure region 54 which is connected to the low pressure chamber 31. As shown in FIG. 2, the groove 50 partly skirts the bearings 36 to open out in the outer cylindrical wall of the side-plate at approximately 45° beyond the plane of symmetry of the latter passing through the axes of the two bearings 36. With such a configuration of the groove 50 and of the gasket 48 which is placed therein, the high pressure region 52 has the shape of a W skirting the two bearings 36 of the side-plate in order to terminate adjacent the aforesaid plane of symmetry which is opposite that corresponding to the central part of this region 52.

The low pressure region 54 which naturally has a complementary shape to the region 52 from which it is separated by the gasket 48, advantageously comprises two clearances 56 capable of connecting the recesses 38 of the adjacent cover to the low pressure chamber 31 of the apparatus in order to keep the pressure in the lubrication circuits 38, 40, 42, and 44, at a relatively low constant value.

When the apparatus 10 is used as a pump, the aperture 27 forms the intake aperture intended to be connected to a fluid reservoir (not shown) whereas the aperture 25 forms the delivery aperture intended to be connected to a utilisation circuit (not shown), the driving shaft 16 naturally rotating in counter-clockwise direction in the case of FIG. 2.

The high delivery pressure which thus occurs in the chamber 29 exerts an action on the region 52 which substantially compensates for the action on the side-plate envisaged of the pressures appearing in the spaces of the teeth of the wheels 12 and 14 within the range of normal speeds of rotation.

It may be noted that the high pressure prevailing in the region 52 tends, due to the extension of the ends of

the gasket 48 beyond the plane of symmetry of the side-plate, to cause this gasket 48 to flow towards its end; such a flow taking into account the arrangement of this gasket in a groove provided in the side-plate and not in the cover can only improve the contact between these ends and the opposing walls of the recess 24 and thus prevent a possible leakage between the regions 52 and 54 in the vicinity of the ends of the gasket 48.

When the apparatus 10 is used as a motor, the aperture 25 forms, in contrast to the case of use as a pump, the intake aperture intended to be connected to a source of fluid pressure (not shown) whereas the aperture 27 forms the delivery aperture intended to be connected to a tank (not shown). In this case, the rotation of the shaft 16 takes place in clockwise direction in the case of FIG. 2.

If it desired to retain the same direction of rotation of the apparatus when it is used as a motor as well as a pump, it is sufficient to rotate the side-plates 20 and 22 by half a revolution in order to connect the region 52 to the chamber 31 and the region 54 to the chamber 29.

From the manufacturing point of view, it should be noted that the grooves to be provided in the side-plates 20 and 22 and in the covers 28 and 30 for housing the gaskets 33 and 48 as well as the recesses 38 and clearances 56 may be simply moulded in one piece with these parts which, as will be easily understood, simplifies the machining of the latter.

I claim:

1. A geared hydraulic apparatus comprising:

a body defining a central recess, covers secured to opposite ends of said body to close the ends of said recess, said body having high and low pressure fluid ports,

two spaced apart side plates within said recess, each side plate being adjacent to one of said covers,

two cooperating toothed wheels within said recess and mounted on shafts rotatably supported in bearings carried by said side plates,

a substantially W-shaped groove in the face of each side plate which faces its respective cover, each of said grooves partially skirting the bearings carried by its side plate and the ends of said groove terminating at the edge of said side plate and normal to wall of said recess, the ends of said groove being arranged on opposite sides of said low pressure port and the top of the W opening toward said low pressure port, and the cross-sectional shape and dimensions of said groove in directions perpendicular to the length of said groove being constant, and an elongated gasket in said groove, said gasket being of constant cross-sectional shape and dimensions in directions perpendicular to its length, and said gasket being elongatable in response to fluid pressure at said high pressure fluid port so that the ends of said gasket are pressed against the wall of said recess to prevent fluid leakage around the ends of said gasket.

2. A geared hydraulic apparatus as defined in claim 1 including clearances formed in the face of each side plate which faces its respective cover, said clearances connecting the bearings carried by that side plate to said low pressure fluid port.

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