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SILENCING DIAPHRAGMS ON CYLINDER COVERS FOR FLUID MOTOR MECHANISMS

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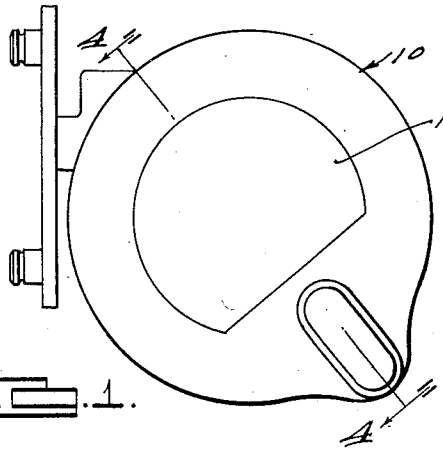


Fig. 1.

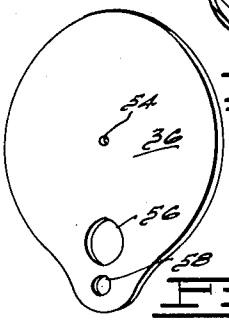


Fig. 2.



Fig. 3.

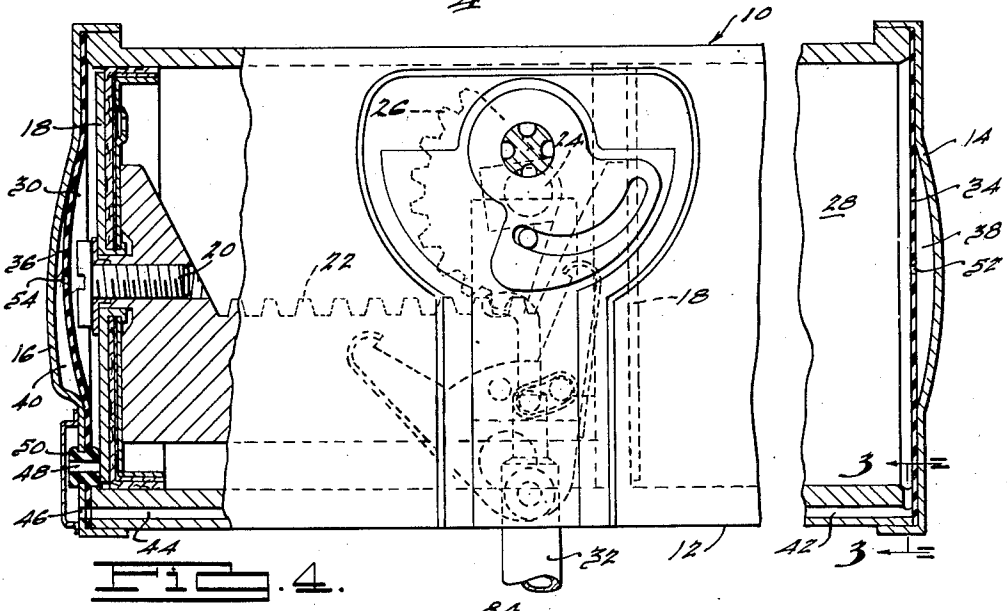


Fig. 4.

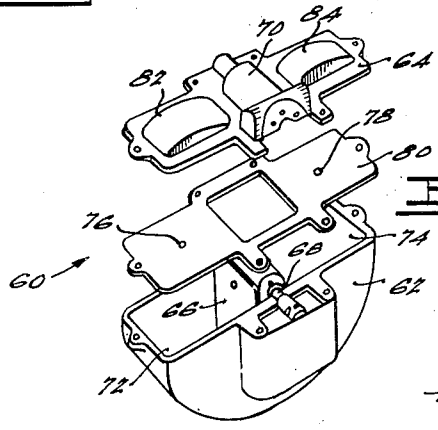


Fig. 5.

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SILENCING DIAPHRAGMS ON CYLINDER COVERS FOR FLUID MOTOR MECHANISMS

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4 Claims. (Cl. 121—132)

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The present invention relates to fluid motor mechanisms and particularly is directed to the provision of a reciprocating fluid motor mechanism embodying improved cushioning means for automatically eliminating the slap or thump of such fluid motor mechanisms at the instant of reversal. The fluid motor mechanisms, while not limited thereto in their application, have a particular utility in connection with automotive windshield wiper systems.

Principal objects of the present invention are to provide fluid motor mechanisms of the above generally indicated type, which are simple in arrangement, economical of manufacture and assembly and which are reliable and efficient in operation; to provide such construction of the reciprocating type, employing automatically operated reversing valve mechanism and further employing cushioning mechanism effected to prevent slap or thump of the reciprocating mechanism at each instant of operation of the reversing valve mechanism; and to generally improve the construction and operation of fluid motor mechanism of the above generally indicated type.

With the above and other objects in view, which appear in the following description and in the appended claims, a preferred but illustrative embodiment of the invention is shown in the accompanying views throughout the several views of which corresponding reference characters are used to designate corresponding parts, and in which:

Fig. 1 is a view in side elevation of a fluid motor embodying the invention;

Fig. 2 is a view in perspective of a cushioning means of the present invention;

Fig. 3 is a fragmentary view in transverse section taken along the line 3—3 of Fig. 4;

Fig. 4 is a view in side elevation of the fluid motor, with parts in section taken along the line 4—4 of Fig. 1;

Fig. 5 is an exploded view in perspective of another fluid motor embodying the invention.

It will be appreciated from a complete understanding of the present invention, that the improvement thereof may be embodied in fluid motor mechanisms of widely different types and sizes and designed for widely different applications. In an illustrative but not in a limiting sense, the present improvements are herein disclosed as being embodied in two fluid motors, each of which, by way of example, is well adapted for use in automotive windshield wiper systems. The first of these motors, illustrated in Figs. 1–4 inclusive, is of the double piston type, an example

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of which is disclosed and claimed in applicant's copending application Serial No. 564,829, filed November 23, 1944. The second fluid motor, illustrated in Fig. 5, is of the paddle type, an example of which is disclosed and claimed in Patent No. 1,639,043, granted August 16, 1927, to B. I. Malouf.

Referring to the drawing, the improved motor 10 comprises generally a cylindrical housing or cylinder 12 which is provided with removable end closures 14 and 16. Cylinder 12 slidably receives a piston assembly, comprising a pair of spaced pistons 18, which are rigidly secured as by studs 20 to a connecting rack 22. The output shaft 24 of the motor has fixed thereon a gear segment 26 which continuously meshes with the rack 22. Accordingly, reciprocating movements of the piston assembly are translated into oscillatory or rocking movement of the shaft 24.

It will be appreciated that the piston movements are effected by applying differential pressures in the chamber spaces 28 and 30 between the piston 18 and the corresponding end closures 14 and 16, the space between the pistons 18 being continuously vented to atmosphere in the illustrated motor.

These differential pressures may, of course, be obtained from any suitable source. For example, in utilizing the present motor to drive a windshield wiper system, the pressure differential may be the difference between atmospheric pressure and a subatmospheric pressure obtained in usual fashion by connecting the motor inlet 32 to the intake manifold of the associated engine.

The motor 10 is provided with a conventional valve mechanism of the automatically operated type which responds to the arrival of the piston assembly 18 at its normal limit, and reverses the applied fluid pressure differential. Fluid motors of this and other types having reciprocating members of substantial size have a tendency to slap or thump at the instant of reversal of the applied pressure differential with a resulting undesirable noise and wear on the motor.

In accordance with the present invention, the fluid motor 10 is provided with a cushioning means for absorbing the shock produced by the rapid reversal of the pressure differential applied to the chamber spaces 28 and 30. In the fluid motor 10, the end closures 14 and 16 have the central portion thereof deformed outwardly and cooperate with resilient diaphragms 34 and 36, respectively, to form auxiliary chamber spaces 38 and 40, respectively. In the outline, the diaphragms 34 and 36 are similar to the ends of the cylinder 12 which they overlie. The outer por-

tions of said diaphragms 34 and 36 are received between the corresponding end closures 14 or 16 and the end wall of the cylinder 12, and in such position serve as gaskets to provide a fluid-tight seal between said end closures 14 and 16 and cylinder 12.

The motor inlet 32 communicates with the chamber space 28 through the above-mentioned automatic reversing valve, and the passage 42, and communicates with the chamber space 30, through the same reversing valve and the passage 44. The passage 44 passes through the end closures 16 at the aperture 46 and opens into the cylinder 12 through the aperture 48 in the end closure 16. The aperture 48 is provided with a grommet 50 against which the piston 18 abuts to close the passage 44 when said piston is in a parked position.

The diaphragms 34 and 36 are provided centrally thereof with small apertures 52 and 54, respectively, which are effective as bleed holes to slowly equalize the pressure between said auxiliary chambers 38 and 40 and the corresponding chamber spaces 28 and 30.

The diaphragms 34 and 36 are identical with the exception that the diaphragm 36 adjacent the end closure 16 is provided with an aperture 56 adapted to receive the grommet 50, and with an aperture 58 aligned with the aperture 46 in the end closure 16.

The improved fluid motor 10 of the present invention operates in the following manner. Commencing with the piston 18 in the parked position illustrated in Figure 4, the valve mechanism is effective to apply atmospheric pressure to the chamber space 30 through the passageway 44, and to apply subatmospheric pressure to the chamber space 28 through the passageway 42. As the piston 18 moves along the cylinder 12, the small apertures 52 and 54 are effective to equalize the pressure between the chamber spaces 28 and 30 and their corresponding auxiliary chamber spaces 38 and 40 respectively. Consequently, as the piston 18 approaches the normal limit of its travel, there is a subatmospheric pressure in the auxiliary chamber space 38 and an atmospheric pressure in the auxiliary chamber space 40. When the piston 18 reaches the end of its normal travel, the valve mechanism reverses, and applies atmospheric pressure to the chamber space 28 and subatmospheric pressure to the chamber space 30. As the result of the subatmospheric pressure in the auxiliary chamber space 38, the rapid introduction of atmospheric pressure into the chamber space 28, instead of causing an undesirable thump or slap, causes the resilient diaphragm 34 to bow outwardly toward the end closure 14. Incidentally also, at the other end of the cylinder, the atmospheric pressure in the auxiliary chamber space 40 causes the resilient diaphragm 36 to bow inwardly into the chamber space 30 to which a subatmospheric pressure is being applied.

It will now be appreciated that the diaphragms 34 and 36 return to their normal flat conditions during the travel of the piston 18 as a result of the equalization of pressures effected by the bleed holes 52 and 54, respectively, and that a portion of the pressure differential, at the instant of reversal of the valve, is exerted against the diaphragms 34 and 36, and absorbed in deforming them from their normal position.

It will thus be appreciated that the fluid motor mechanism of the present invention is cushioned

at each instant when the valve reverses, thus eliminating noise and wear coincident with the immediate application of the entire pressure differential at the instant of reversal of the valve.

An application of the present invention to the paddle type motor is illustrated in the embodiment shown in Figure 5 of the drawing. The fluid motor 60 there illustrated comprises a semi-circular shaped housing 62, a single cover plate 64, and a paddle 66 disposed within said housing 62. The paddle 66 is rectangular in shape and mounted on a shaft 68 extending transversely thereof adjacent one end of said paddle. The shaft 68 is supported in the housing 62 centrally of its open end, and the paddle 66 is adapted to engage said housing 62 and the cover plate 64 at all points around its periphery. The end of the paddle 66 adjacent the shaft 68 engages the interior of a small semi-circular recess 70 formed in the cover plate 64.

It will thus be appreciated that the paddle 66, the housing 62 and the cover plate 64 cooperate to define the chamber spaces 72 and 74 similar to the chamber spaces 28 and 30 of the fluid motor 10. The cover plate 64 on opposite sides of the centrally disposed recess 70 is deformed outwardly to cooperate with the diaphragm 80 to form auxiliary chamber spaces 82 and 84 respectively. The diaphragm 80 is provided with apertures 76 and 78 corresponding to the apertures 52 and 54.

The motor 60 is provided with conventional means for applying a pressure differential to the chamber spaces 72 and 74 and a conventional reversing valve effective to operate when the paddle 66 reaches the normal limit of its travel.

It will now be appreciated that the auxiliary chamber spaces 82 and 84 and the diaphragm 80 operate in a manner similar to the auxiliary chambers 38 and 40 and the diaphragms 34 and 36 above described.

Although only two specific embodiments of the invention have been described in detail, it will be appreciated that various further modifications in the form, number and arrangement of the parts may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. In a fluid motor, first and second members defining first and second chamber spaces and movable relative to each other, means for reversably applying to said chamber spaces a differential between higher and lower fluid pressures effective to move said members relative to each other, and cushioning means associated with said members for cushioning the action of said members upon the reversal of said first-named means, said cushioning means including means defining first and second auxiliary chamber spaces and passageways connecting said first and second auxiliary chamber spaces to said first and second chamber spaces respectively, and said first named means including means defining passageways communicating with said chamber spaces intermediate said first and second auxiliary chamber spaces.

2. In a fluid motor, first and second members defining first and second chamber spaces and movable relative to each other, means for reversably applying a differential between higher and lower fluid pressures to said chamber spaces, and cushioning means associated with said members for cushioning the action of said members upon the reversal of said first-named means, said cushioning means comprising resilient diaphragm

means mounted in said chamber spaces and cooperating with one of said members to define first and second auxiliary chamber spaces and passageways connecting said first and second auxiliary chamber spaces to said first and second chamber spaces respectively.

3. In a fluid motor, first and second members defining first and second chamber spaces and movable relative to each other, one of said members having a cover plate, means for reversably applying a differential between higher and lower fluid pressures to said chamber spaces, and cushioning means associated with said members for cushioning the action of said members upon the reversal of said first-named means, said cushioning means comprising a resilient element having an outer portion received between said cover plate and said one of said members to provide a fluid-tight seal therebetween, and having a diaphragm-like central portion cooperating with said cover plate to define an auxiliary chamber space and a passageway connecting said auxiliary chamber space to one of said first and second chamber spaces.

4. In a fluid motor, first and second members defining first and second chamber spaces and movable relative to each other, means for reversably applying a differential between higher and lower fluid pressures to said chamber spaces, and cushioning means associated with said members for cushioning the action of said members upon the reversal of said first-named means, said cushioning means comprising resilient diaphragm means mounted in said chamber spaces and cooperating with one of said members to define first and second auxiliary chamber spaces and passageways connecting said first and second auxiliary chamber spaces to said first and second chamber spaces respectively, and said first named means including means defining passageways communicating with said chamber spaces intermediate said first and second auxiliary chamber spaces.

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