Aug. 19, 1941. K. K. PROBST 2,253,306

MOTOR

Filed Jan. 20, 1939

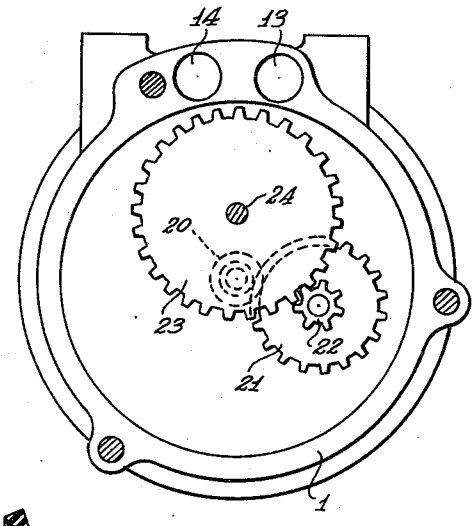


Fig. 1.

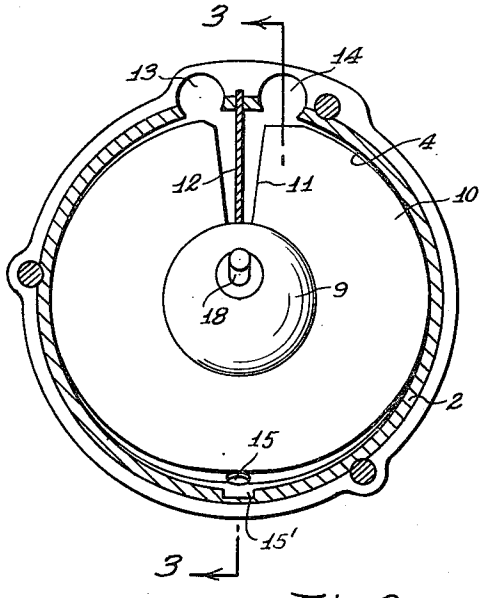


Fig. 2.



Fig. 6.

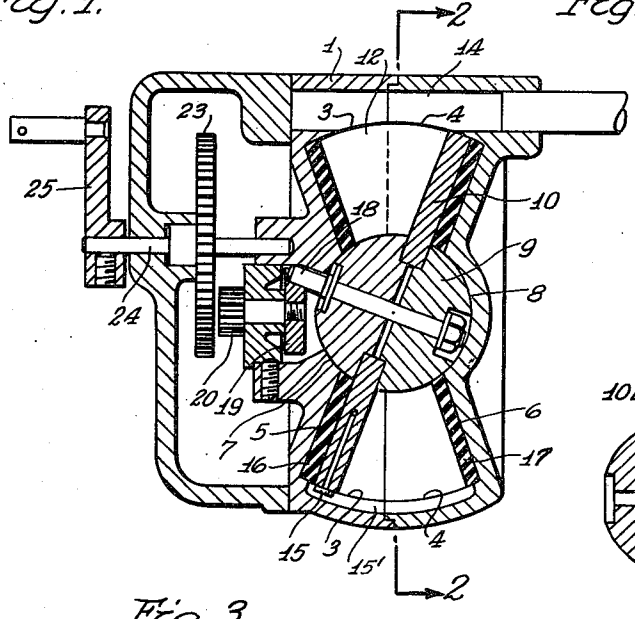


Fig. 3.

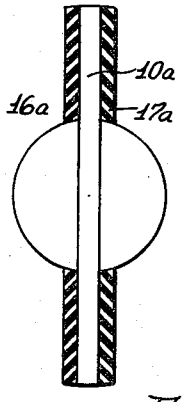


Fig. 4.

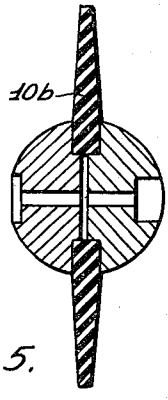


Fig. 5.

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2,253,306

MOTOR

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Application January 20, 1939, Serial No. 251,939

6 Claims. (Cl. 121—69)

This invention relates to a motor embodying a wobble plate actuated by fluid pressure and has for its primary object to provide the wobble plate with fluid pressure sealing means enabling efficient operation with air under pressure as the actuating medium.

A conventional wobble plate motor comprises a plate or disc mounted centrally upon a sphere which is seated in a spherical bearing formed at the convergence of two opposed conical end walls of an enclosing chamber having a spherical side wall. A radial partition extends from the supporting sphere to the spherical side wall and fluid pressure intake and exhaust ports are provided on opposite sides of the partition. When a fluid under pressure is circulated through the chamber, from the intake around the partition to the exhaust, it causes the plate or disc to gyrate or rock circularly, with a tilting or wobbling motion.

It is readily apparent that the efficiency of this type of motor is mainly dependent upon sealing the wobble plate by a means which does not introduce excessive friction. For example, if fluid passes between the periphery of the disc and the spherical side wall, a power loss occurs. Further, when one side of the wobble plate contacts one conical end wall, the other side must contact the other conical end wall, with both contacts on the same diametric line. If one side fails to contact, even by a few thousandths of an inch, the wobble plate will stall unless the actuating fluid is of viscous character.

The fluid loss between the periphery of the wobble plate and the spherical side wall of the chamber may be reduced materially by employing standard production assembly methods. It is possible to hold the spherical surface to fairly close plus or minus tolerances, and to select a plate having plus or minus dimensions corresponding to those of the chamber in which it is to be mounted. Therefore, the major problem is in sealing the sides of the wobble plates with respect to the conical end walls with which they coact.

The motor chamber, in order to facilitate assembly of the wobble plate, must be formed in at least two sections, which introduces a multiple factor of error in that the conical end walls must be accurately located with respect to their sections, and the sections must be accurately located with respect to each other. Formation of the wobble plate, its supporting sphere, the bearings at the convergence of the conical walls, and assembly of the wobble plate all introduce possible dimensional variances. The result is that with all dimensions held to comparatively small limits the accumulation of tolerances almost invariably results in loss of efficiency due to improper correlation of the wobble plate and the conical end walls. Tests indicate that the average efficiency of production motors actuated by air under pressure is about 10%, although the same motors have higher efficiency when operated by liquids under pressure, particularly liquids of viscous nature such as oil.

Accordingly, it is the object of this invention to provide means for sealing the wobble plate in the presence of dimensional discrepancies, which ordinarily would result in loss of power. More specifically, the object is to interpose sealing means in the form of a layer of soft, resilient material, such as rubber, between the sides of the wobble plate and the conical end walls with which they coact.

A further object is to provide a wobble plate motor embodying sealing means enabling efficient operation with the exhaust connected to a source of suction and the intake connected to the atmosphere, with the air at atmospheric pressure providing the means for actuating the motor. The motor is, therefore, adapted for operating the windshield wiper of an automotive vehicle.

Other objects and advantages will become more apparent as reference is had to the accompanying drawing wherein my invention is illustrated, and in which:

Fig. 1 is an end elevation with the gear housing removed;

Fig. 2 is a section taken on the line 2—2 of Fig. 3, with disc and fittings shown in elevation;

Fig. 3 is a section taken on the line 3—3 of Fig. 2;

Fig. 4 is a section of a modified wobble plate;

Fig. 5 is a section of a resiliently flexible wobble plate, and

Fig. 6 is a section illustrating sealing means of varied resiliency.

The motor housing is formed of two sections 1 and 2 having complemental internal surfaces 3 and 4, respectively, which constitute a spherical side wall of the motor chamber. The sections 1 and 2 have inwardly converging conical walls 5 and 6 which constitute the end walls of the motor chamber, the conical walls being truncated and having spherical bearings 7 and 8 in the truncated ends thereof.

A sphere 9 is rotatably mounted in the bearings 7 and 8 and has a plate 10 thereon in dia-

metric relation thereto. The plate 10 has a recess 11 accommodating a radial partition 12 on opposite sides of which are provided a fluid inlet 13 and a fluid outlet 14. A pin 15, loosely mounted in the plate 10, engages in a slot 15' in the housing wall, the slot 15' extending parallel to the axis of the housing and diametrically opposite the partition.

When fluid is circulated through the housing, from the inlet 13 to the outlet 14, it imparts a gyratory motion to the plate 10, providing such fluid cannot pass between the sides of the plate and the adjacent conical walls. To prevent such leakage of fluid the conical walls 5 and 6 have pads of soft, resilient material 16 and 17 secured thereon, an example of such material being soft rubber, or sponge rubber. As the plate 10 is gyrated it has a line contact with the pad 16 on one side thereof and with the pad 17 and inasmuch as both pads are capable of being compressed the several parts of the pump may be proportioned to cause the plate to compress the same on the lines of contact. The pads 16 and 17 also contact the sphere 9 and prevent leakage of fluid through the bearing 7 and 8.

In the case of a windshield wiper motor, the port 13 is connected to the atmosphere and the port 14 is connected to a source of suction such as the intake manifold. The average pressure under such conditions, considering variations in throttle position, amounts to about five pounds per square inch. In such a case the pressure which tends to hold the plate against the rubber amounts to say ten pounds, and the rubber should be sufficiently soft to compress about .006 of an inch on the line of contact in the presence of ten pounds pressure.

As the plate 10 gyrates the outer end of a stem 18 secured to the sphere 9 is moved through a circular orbit, and thereby imparts rotation to a disc 19 which it engages. Through gears 20, 21, 22 and 23 rotation is imparted to the final shaft 24 which carries the arm 25. The arm 25 may be connected through suitable linkage to a device to be operated, which might readily be imagined as comprising a windshield wiper.

Mounting rubber pads on the conical walls is desirable from the standpoint of manufacture and assembly, but it is readily apparent that the function would be substantially similar in a case where the elastic pads are secured to the wobbler plate. In Fig. 4, rubber pads 16*a* and 17*a* are shown mounted on the wobble plate 10*a*. From Fig. 5 it also becomes apparent that the wobbler plate might be made entirely of yieldable material. In this case the plate 10*b* is composed of material having the characteristics of rubber, but with sufficient rigidity to withstand collapse under the pressures to which it it to be subjected.

It is apparent that if the wobble plate 10 and sphere 9 is moved rotatively about an axis coinciding with the center of the sphere 9 and perpendicular to the sheet as Fig. 3 is viewed by the reader, the peripheral edge of the plate travels a greater distance than a point adjacent the sphere for a movement through a given number of degrees. Therefore, the edge of the seals 16 and 17 adjacent the spherical surface 3 must be deflected to a greater extent than the edge adjacent the sphere. To accommodate this condition, the elastic pad 16*b* may be grooved as illustrated in Fig. 6, the grooves being arranged to provide greater yieldability adjacent the outer edge than the inner edge.

Although specific embodiments of the invention have been illustrated and described, it will be understood that changes may be made within the scope of the appended claims without departing from the spirit of the invention, and such changes are contemplated.

What is claimed is:

1. In a motor having inwardly converging conical end walls, a spherical side wall, a radial partition and inlet and outlet ports on opposite sides of the partition, a wobble plate mounted at the convergence of said conical walls, and elastic sealing pads interposed between said wobble plate and conical walls and in direct contact with said wobble plate, said wobble plate having a thickness such that it normally distorts the elastic pads at the lines of contact therewith.

2. In a motor having inwardly converging conical end walls, a spherical side wall, a radial partition and inlet and outlet ports on opposite sides of the partition, a wobble plate mounted at the convergence of said conical walls, and pads of soft rubber on said conical walls for direct contact by said wobble plate and normally deformed thereby.

3. In a motor having inwardly converging conical end walls, a spherical side wall, a radial partition and inlet and outlet ports on opposite sides of the partition, a wobble plate mounted at the convergence of said conical walls, and elastic sealing pads interposed between said wobble plate and conical walls, said sealing pads being of greater elasticity at their outer edges than at their inner edges.

4. A motor having an air inlet port open to the atmosphere and an outlet port adapted to be connected to a source of suction, said motor having inwardly converging conical end walls, a spherical side wall, a radial partition, said inlet port being disposed on one side of said partition and said outlet port being disposed on the other side, a wobble plate mounted at the convergence of said conical walls, and sealing pads interposed between said wobble plate and conical walls, said sealing pads being of a thickness such that they are normally compressed approximately .006 in., and having resilient qualities such that in the presence of such compression the reaction pressure thereof does not exceed approximately ten pounds.

5. A motor having an air inlet port open to the atmosphere and an outlet port adapted to be connected to a source of suction, said motor having inwardly converging conical end walls, a spherical side wall, a radial partition, said inlet port being disposed on one side of said partition and said outlet port being disposed on the other side, a wobble plate mounted at the convergence of said conical walls, and sealing pads interposed between said wobble plates and conical walls, said pads comprising preformed conical members and being secured to said conical walls, said sealing pads being of a thickness such that they are normally compressed approximately .006 in., and having resilient qualities such that in the presence of such compression the reaction pressure thereof does not exceed approximately ten pounds.

6. A motor having an air inlet port open to the atmosphere and an outlet port adapted to be connected to a source of suction, said motor having inwardly converging conical end walls, a spherical side wall, a radial partition, said inlet port being disposed on one side of said partition

and said outlet port being disposed on the other side, a wobble plate mounted at the convergence of said conical walls, and sealing pads interposed between said wobble plates and conical walls, said pads comprising preformed discs secured to opposite faces of said wobble plate, said sealing pads being of a thickness such that they are normally compressed approximately .006 in., and having resilient qualities such that in the presence of such compression the reaction pressure thereof does not exceed approximately ten pounds.

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