

Nov. 30, 1954

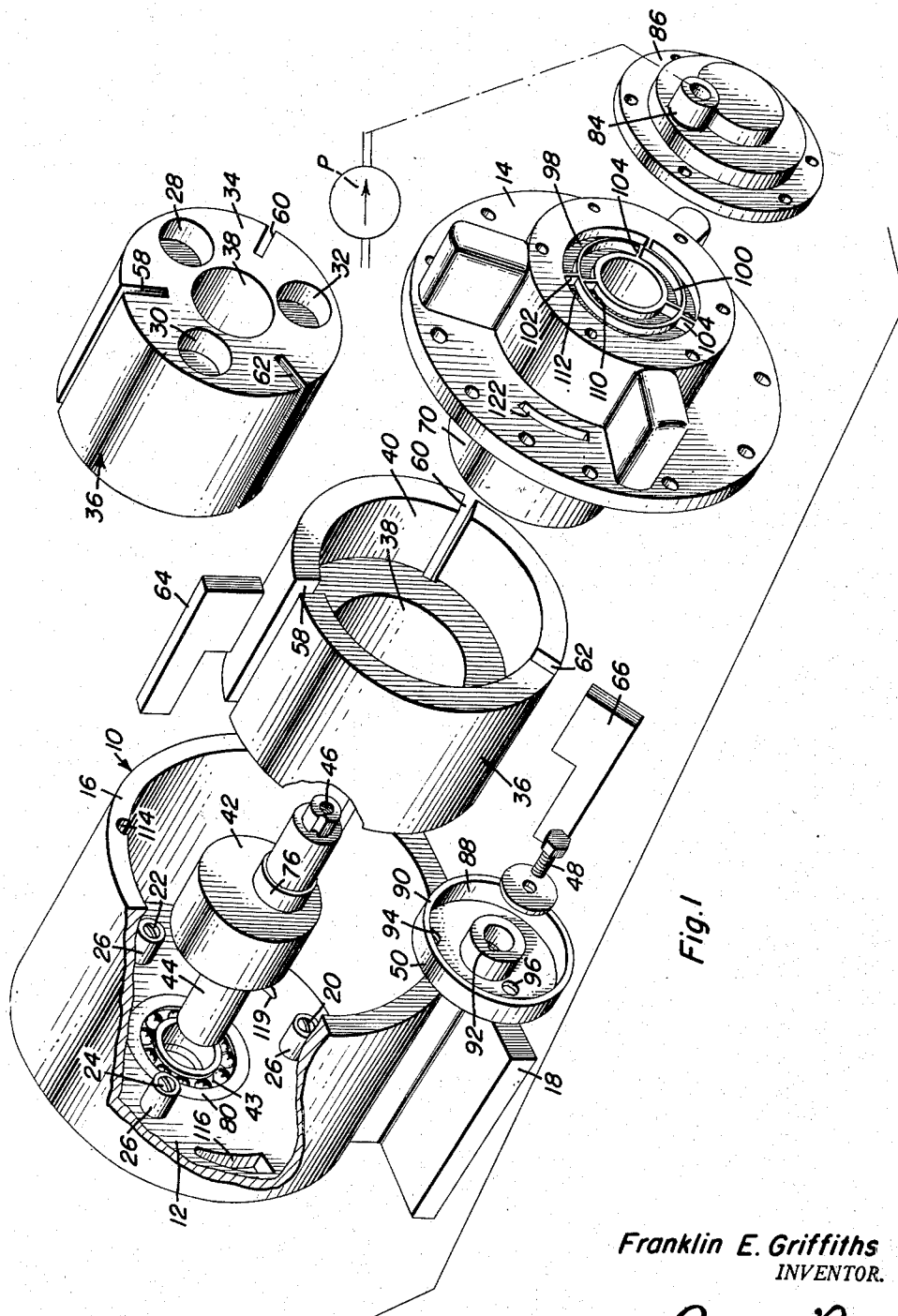
F. E. GRIFFITHS

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FLUID ENGINE

Filed Dec. 13, 1950

3 Sheets-Sheet 1



Franklin E. Griffiths
INVENTOR.

INVENTOR.

BY

*Albion A. O'Brien
and Harvey B. Jacobson*
Attorneys

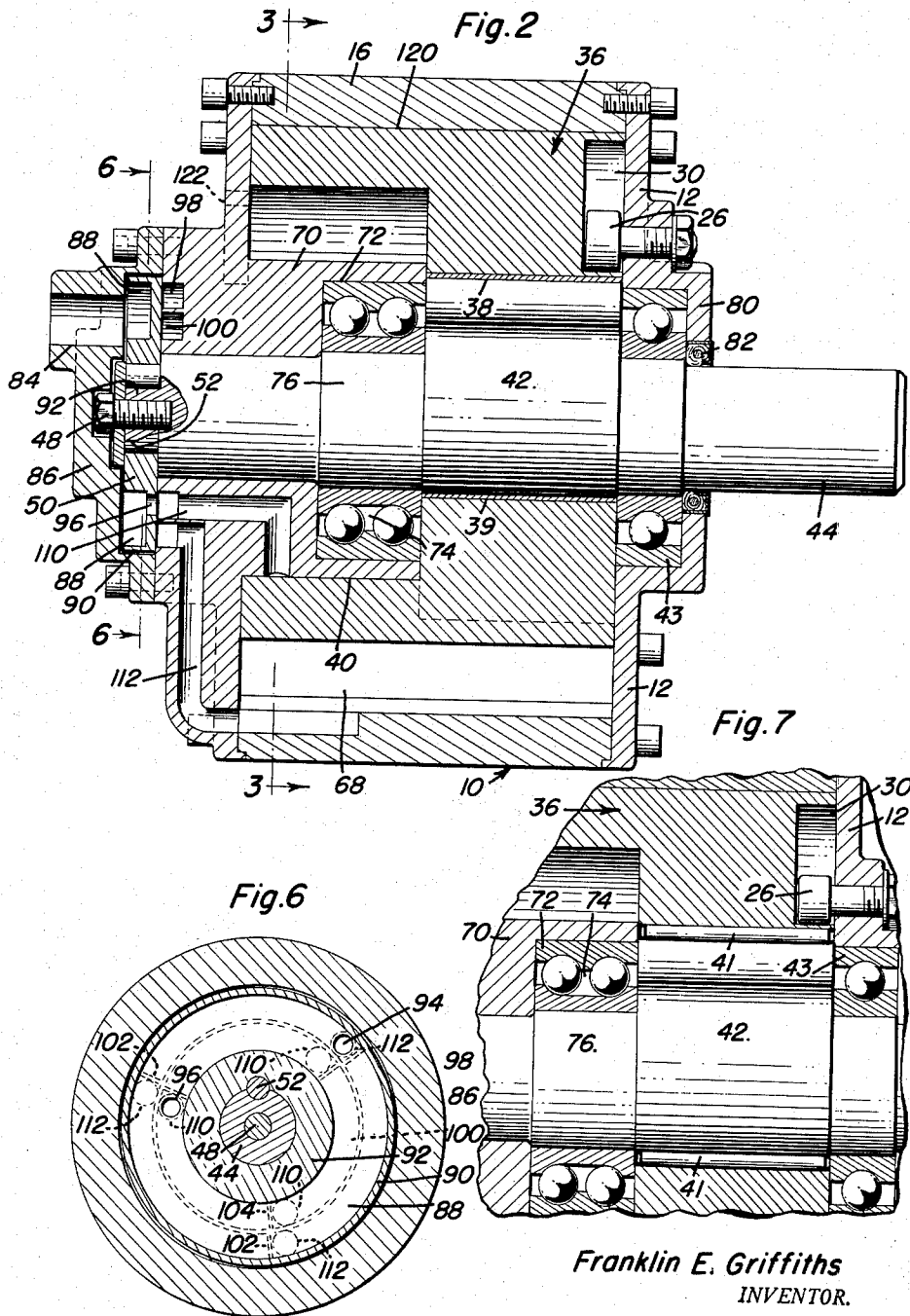
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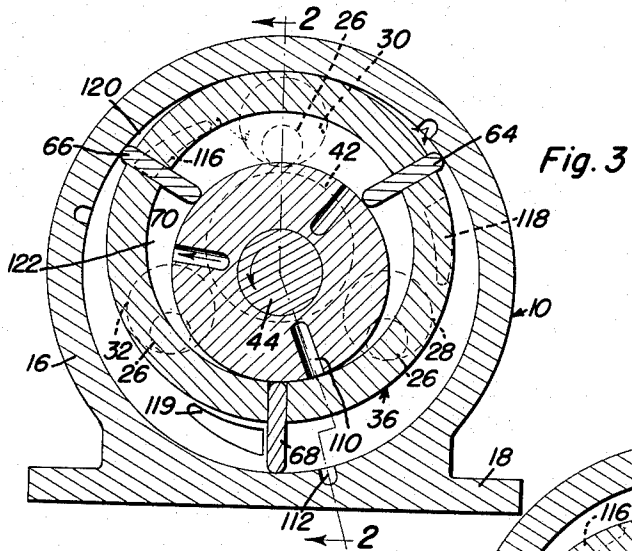
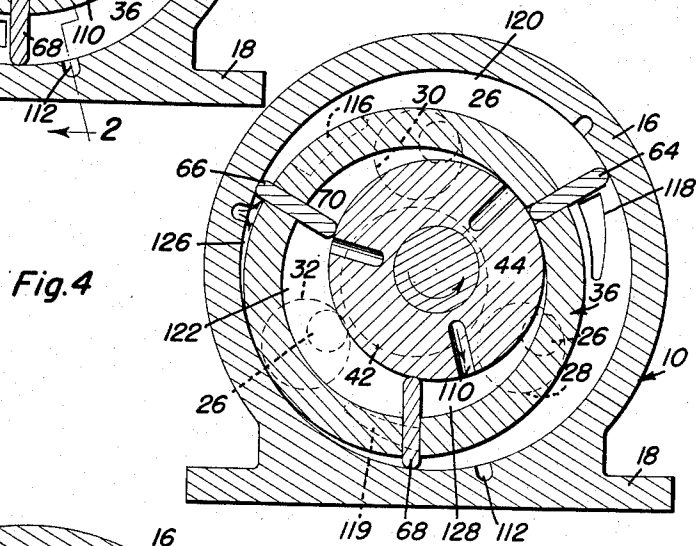
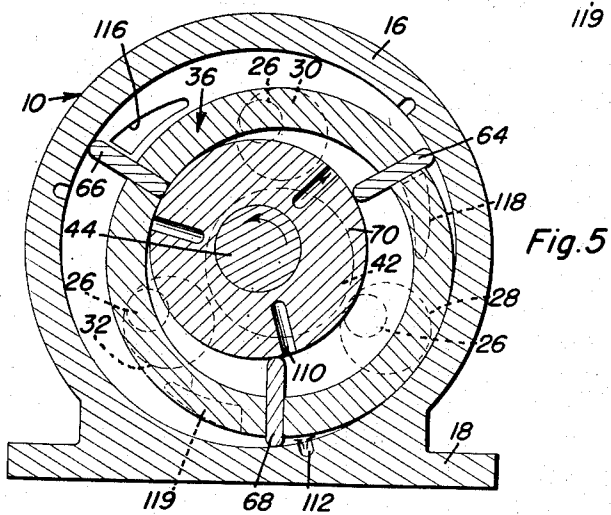
F. E. GRIFFITHS

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FLUID ENGINE

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3 Sheets-Sheet 3



Franklin E. Griffiths
INVENTOR.

BY *Charles W.'Brien*
and Harvey B. Jacobson
Attorneys

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FLUID ENGINE

Franklin E. Griffiths, Salt Lake City, Utah

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2 Claims. (Cl. 121—68)

This invention relates to improvements in fluid engines, motors and pumps of the piston type.

An object of this invention is to provide a device which with minor changes may be used as a motor, pump or other analogous machines, the device having for its main purpose to provide a new assembly which operates on a new principle of movement, there being a casing or housing with a piston therein, the piston having sliding vanes which constitute the side walls of expansion chambers, the expansion chambers being in a series on the outside surface of the piston and in a series defined by the inside surface of the piston and there being a means provided to constrain the movement of the piston so that it does not rotate in an exact circular path of movement about the shaft as an axis and does not move in the standard path of movement as in a sliding vane type of pump but rather moves from an initial starting position arbitrarily considered at the top of the housing, downwardly and toward one side of the housing, and then sideways to the other side of the housing, and then upwardly to the initial starting position.

Ancillary objects and features of importance will become apparent in following the description of the illustrated form of the invention.

In the drawings:

Figure 1 is an exploded perspective view of some of the parts of the device.

Figure 2 is a sectional view of the assembled device and taken substantially on the line 2—2 of Figure 3 and in the direction of the arrows;

Figure 3 is a transverse sectional view taken on the line 3—3 of Figure 2 and in the direction of the arrows;

Figure 4 is a sectional view somewhat similar to that of Figure 3 but showing the piston in a second position;

Figure 5 is a sectional view similar to Figure 4 but showing the piston in a third position;

Figure 6 is a sectional view taken on the line 6—6 of Figure 2 and in the direction of the arrows; and

Figure 7 is a fragmentary sectional view of the device, showing a modification.

The illustrated embodiment of the invention includes a housing 10 which is made of a first end wall 12, a second end wall 14 and a side wall 16. The end wall 14 is bolted or otherwise rigidly secured to the side wall 16, and the side wall is mounted on a base 18.

Spindles 20, 22, and 24 are circumferentially spaced from each other and extend from the inside surface of the wall 12. Rollers 26, constituting guides, are disposed on the spindles, 20, 22 and 24 and are arranged to be located in the circumferentially spaced recesses 28, 30 and 32 formed in the end wall 34 of the piston 36.

The piston is located within the housing 10 and is of special construction. There is a bore 38 formed in the piston 36 and a counterbore 40 in communication therewith. This counterbore opens toward the end wall 14 of the housing, and the bore 38 accommodates the eccentric 42 which is fixed to the shaft 44. This shaft is mounted axially within the housing 10 and has one end passed through standard anti-friction bearings 43, which are disposed in an opening in the end wall 12 of the housing. The opposite end of the shaft has a threaded axial opening 46 to accommodate a fastening element, as a bolt 48 which is employed for the purpose of holding the valve member 50 fixed to the shaft for rotation therewith. This valve member is keyed as at 52 to insure that there will be no relative movement between the valve member and the shaft 44.

The piston 36 is provided with a plurality of slots 58, 60 and 62 which are arranged radially therein and which open outwardly through the side wall of the piston. Dividers 64, 66 and 68 are slottably disposed in the slots 58, 60 and 62 and have their outer ends in contact with the inner surface of the side wall 14 of the housing 10. The dividers with the outside surface of the side wall of the piston and the inside surface of the side wall 16 of the housing constitute separate expansion chambers 10 for the fluid under pressure which is introduced into the main chamber of the pump.

Internal expansion chambers are arranged between the sides of the dividers, the inside surface of the side wall of the piston and the outside surface of an extension element 70 fixed to or integrally connected with the inside surface of the end wall 14.

This extension element has a recess 72 formed therein in order to accommodate the bearing 74. The bearing is so designed as to withstand the loads and thrusts of the shaft 44 inasmuch as the enlargement 76 of the shaft 44 is disposed on the inner race of the bearing 74.

In order to help support the load of the shaft 44 the bearing 43 is provided in the bearing cap 80 which is formed in the material of the end wall 12. A standard oil seal 82 is used in the opening of the bearing cap 80 to serve its usual function.

Means for introducing fluid, as air, under pressure into the inner expansion chambers and the outer expansion chambers, are provided. Preferable means consist of an air inlet member 84 which is fixed to the air inlet assembly cap 86 and which opens into an air conducting channel 88. This channel is formed in the valve member 80 and is spaced between the outer flange 90 and the hub 92 of the valve member 50. A first air inlet opening 94 is formed in the valve member 50 and a second opening 96 formed in the valve member 50, the opening 94 being in a circle of larger diameter than the circle containing the opening 96. Accordingly the opening 94 is arranged to communicate with the air conducting channel 98 while the opening 96 is arranged to communicate with the air conducting channel 100. The channel 98 is divided into three sections by means of the partitions 102, and the channel 100 is divided into three sections by means of the partitions 104. When the cap 86 is bolted to the end wall 14 the valve member 50 is disposed between the cap 86 and the channels 98 and 100 in order to control the admission of air into the sections of the channels 98 and 100. Inasmuch as the valve member 50 is fixed to the power output shaft 44 the admission of air under pressure is controlled as to the selection of expansion chambers in accordance with the position of the piston and the position of the shaft 44 in the casing or housing 10.

There are two sets provided in the end wall 14. One set opens into the inner expansion chambers and the air conducting channel 100, while the other set of channels open into the outer expansion chambers and the air conducting channel 98.

In this respect attention is invited to Figure 2 where the passage 110 is shown as being in communication with the closed expansion chamber and the channel 112 of the other set of passages is illustrated as being in communication with the open outer expansion chamber.

Inwardly opening channels 114 are provided in the side wall 16 of the housing 10 and form continuations of the passages 112 so that the fluid under pressure is introduced into the expansion chamber along the same axially of the piston and shaft 44.

The end wall 12 is provided with three curved discharge ports 116, 118 and 120. The end wall 14 is provided with three discharge ports 122.

The operation of the device is as follows:

Air under considerable pressure is introduced into the expansion chambers. Any standard means of putting the air under pressure may be used, as the pump schematically shown in Figure 1.

When the air pressure is applied at the inlet member 84, the channel 88 receives this air under pressure. The aperture 84 being in communication with the passage 112 conducts the fluid under pressure into one action chamber for example the chamber 120 (Figure 3).

At this time the piston 36 starts to move downwardly and toward one side of the housing. Downward movement of the piston 36 causes the shaft 44 to operate inasmuch as the eccentric 42 is located in the bore 38. Accordingly since there is rotation of the shaft 44, the valve member 50 is caused to rotate thereby moving the valve member 50 to such position that air under pressure from the channel 100 passes through the passage 110 and into one of the inner expansion chambers, for example the expansion chamber 122. The inner expansion chamber and the single outer expansion chamber which are being used at this time cooperate to produce a single movement of the piston. The result of this movement may be observed by comparing the location of the piston with respect to the housing in Figure 3 and the location of the piston with respect to the housing in Figure 4.

With the structure described previously pressure applied in the chambers 120 and 122 would in all probability cause rotation of the piston 36 instead of substantially linear displacement as disclosed in Figures 3-5. Therefore there is a means provided for the purpose of constraining the movement of the piston 36.

Noting the piston 36 of Figure 1 which is separate from the general assembly and which is inverted, the recesses 28, 30 and 32 are illustrated as being in the side walls 34 of the piston. This piston being fitted on the shaft 44 through the medium of the eccentric and its bore 38, causes the recesses to encompass the guides 26. Therefore, when force is applied to the piston it can move only in a prescribed travel inasmuch as the guides prevent true circular movement of the piston 36 and will not allow true reciprocatory movement of the piston. However when the piston is moved it is displaced laterally causing the rollers to assume positions in the recesses as disclosed in Figures 3-5 inclusive. The piston 36 being displaced laterally caused the guides 26 to assume different position on the inside circular walls of the recesses 28, 30 and 32. In other words, they ride upon the surfaces of the recesses.

When the piston 36 has moved down and to the side as disclosed in Figure 4 the expansion chamber 120 has been opened to the full extent and the same is true of the chamber 122. Slightly prior to this time the valve 50 has been moved by rotation of the shaft 44 to such position that air under pressure has started to enter the expansion chamber 126 and the inner expansion chamber 128. There is a considerable degree of overlap in the valve assembly, the overlap being up to sixty degrees of shaft rotation.

As the piston starts to move from the position shown in Figure 4 to the position of Figure 5, the exhaust port 116 for the chamber 120 is opened inasmuch as the outer wall of the piston moves from its covering position, and the corresponding outlet port 122 in the end wall 14 is opened for the same reason. Accordingly these chambers are exhausted and meanwhile the second impulse has begun because of the introduction of fluid under pressure through the appropriate passages 110 and 112.

The above cycle continues until such time that the air supply from the pump P is stopped.

By virtue of the described structure and its operation the piston 36 does not move rotatively in the sense that the shaft 44 rotates. Rather, it is shifted laterally within the housing 10 by the expansion of the motive fluid.

For balance purposes more than one eccentric 42 may be used with a corresponding change in design of the piston to accommodate the multiple eccentric on the shaft 44.

Attention is now invited to Figure 7 wherein a slight modification is illustrated. Instead of employing a bushing, as at 39 in Figure 2, roller bearings 41 may be used to reduce friction when the piston 36 and eccentric move with respect to each other, by being located between the piston 36 and eccentric 42 and in the bore 38.

Having described the invention, what is claimed as new is:

1. In a fluid motor, a cylindrical casing, a shaft disposed axially within said casing and mounted for rotation therein, an eccentric fixed to said shaft, a piston disposed within said casing, said piston having an axial bore receiving said eccentric, said piston also having an enlarged counterbore in one end, end walls closing the ends of said casing, an extension on one of said end walls projecting into said counterbore, said extension being of smaller diameter than the counterbore by an amount equal to the eccentricity of said eccentric and being disposed in concentric relation to said shaft whereby the points of engagement between said extension and said piston on the one hand and between said casing and said piston on the other hand are in diametrically opposed relation with respect to said piston, said piston having a plurality of equally and circumferentially spaced slots, a plurality of dividers slidably carried within said slots and having inner and outer edges continuously engaging said extension and the inner surface of said casing respectively, whereby inner expansion chambers are provided within said counterbore and outer expansion chambers are provided between said casing and said piston, guide means on one of said end walls contacting said piston and constraining movement of the center of the latter to revolution about the axis of said shaft, and means connected with said shaft and constituting a valve for controlling the simultaneous admission of fluid into pairs of said expansion chambers, said pairs comprising an inner and an outer expansion chamber.

2. The combination of claim 1 wherein at least three dividers are provided and said valve means includes mechanism for overlapping the admission of working fluid in successive inner and outer chambers.

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