Nov. 6, 1934. B. CONKLIN 1,979,368

PUMP, MOTOR, COMPRESSOR, OR THE LIKE

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Fig. 1

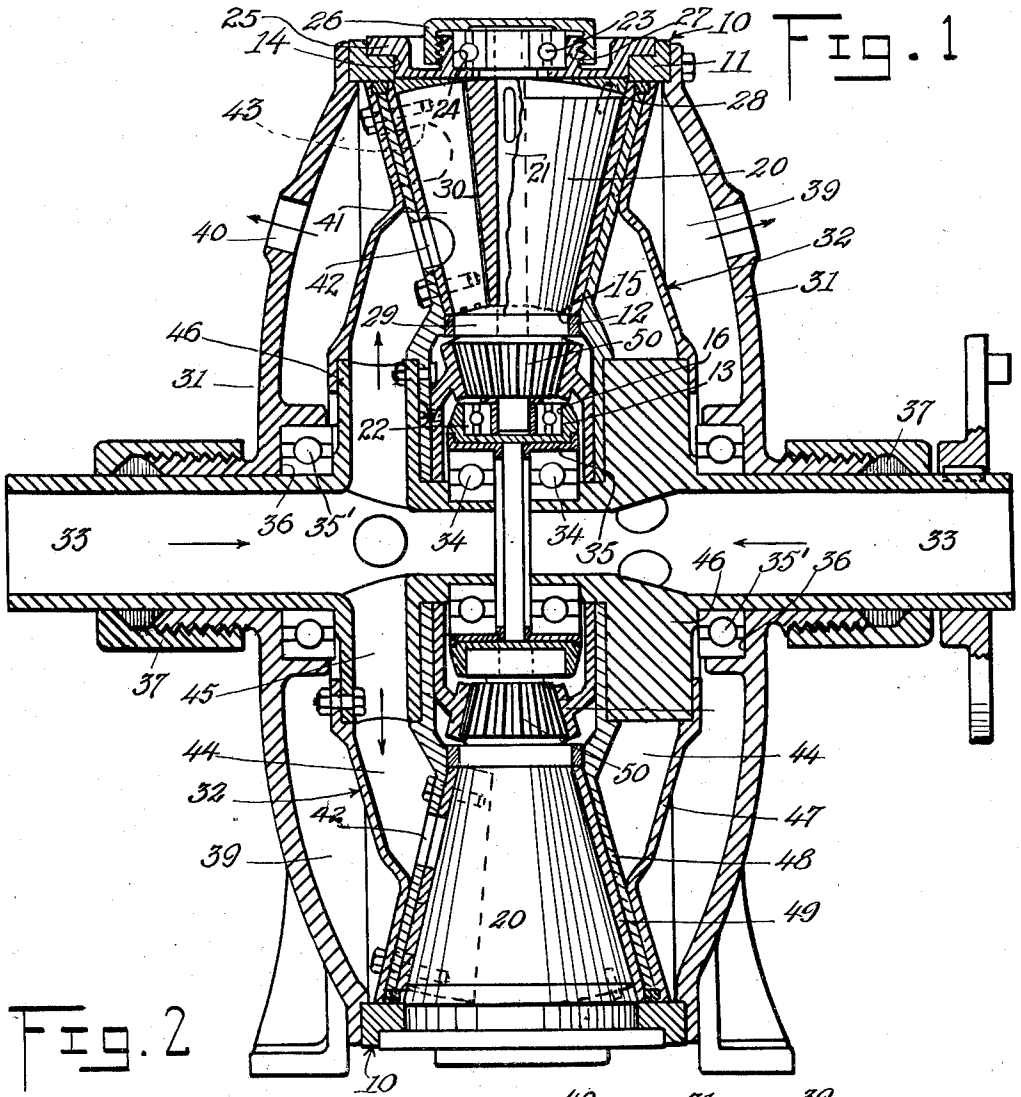
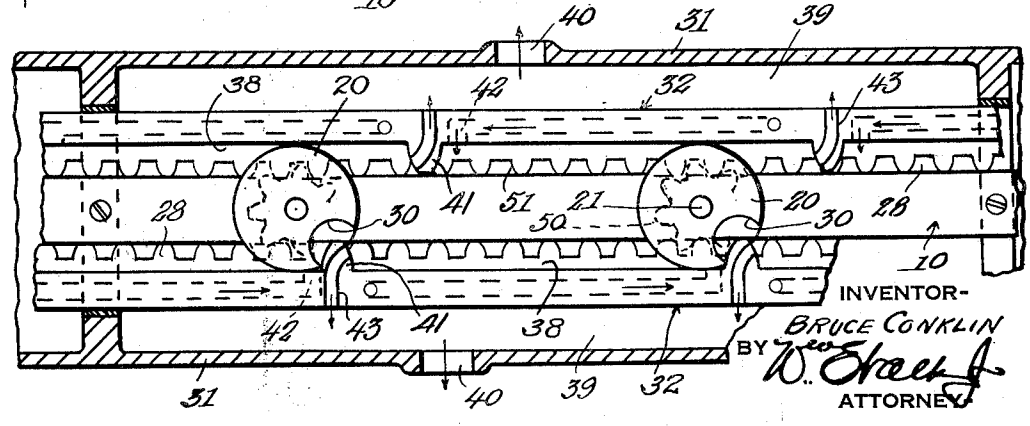


Fig. 2



INVENTOR-
BRUCE CONKLIN
BY W. Strack Jr.
ATTORNEY

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Fig. 3

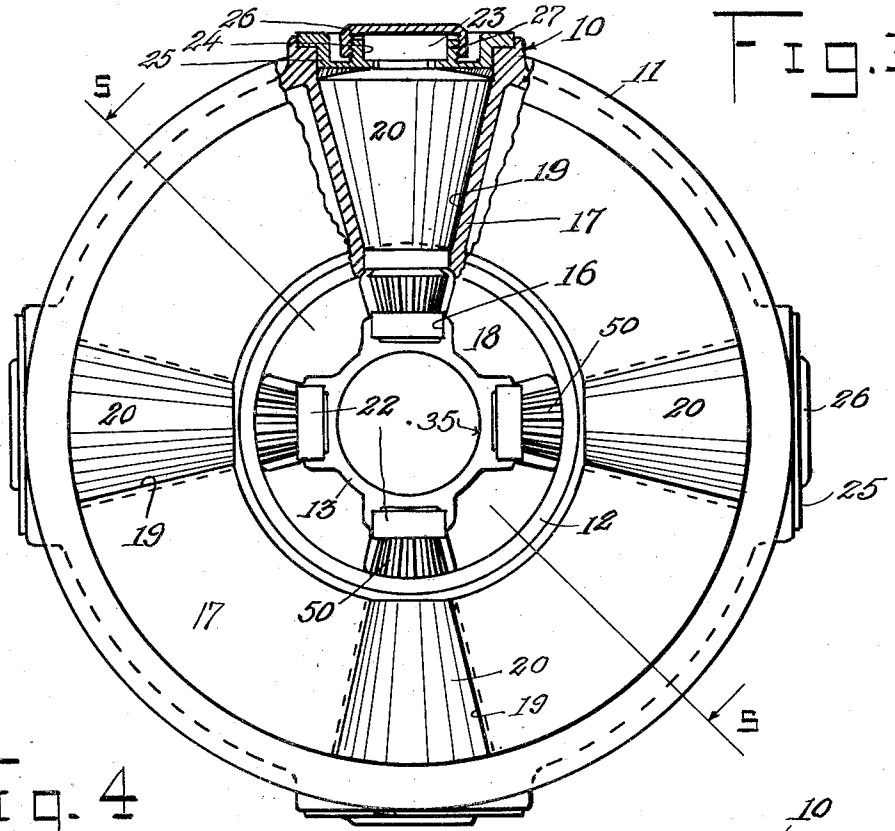
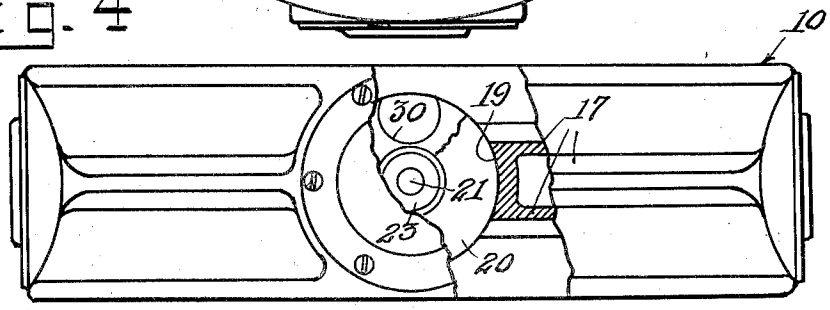


Fig. 4



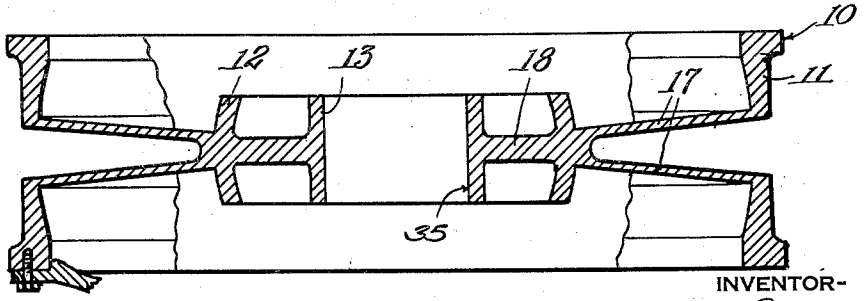


Fig. 5

INVENTOR-
BRUCE CONKLIN
BY W. E. Stoeckel
ATTORNEY

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Fig. 6

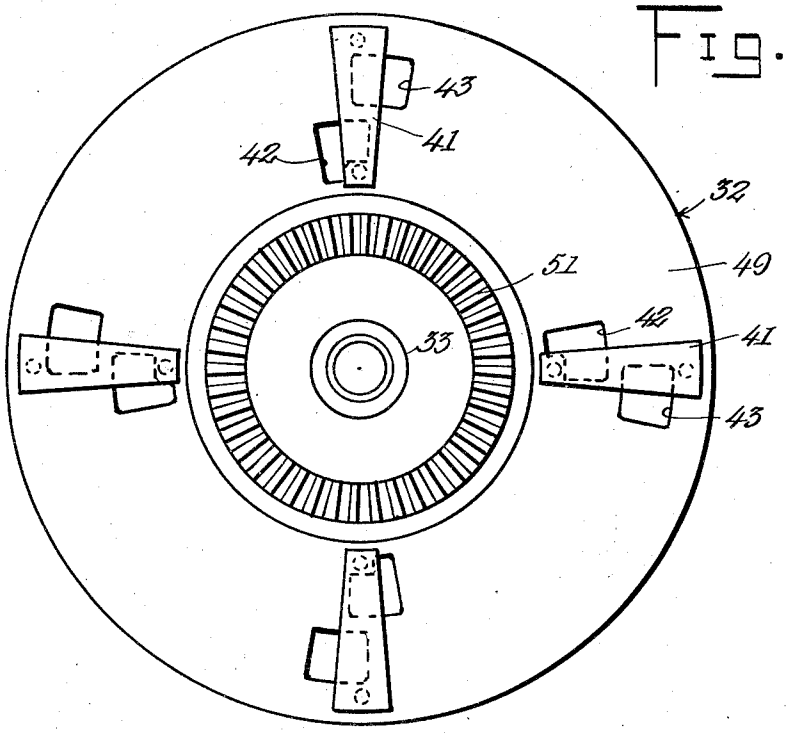
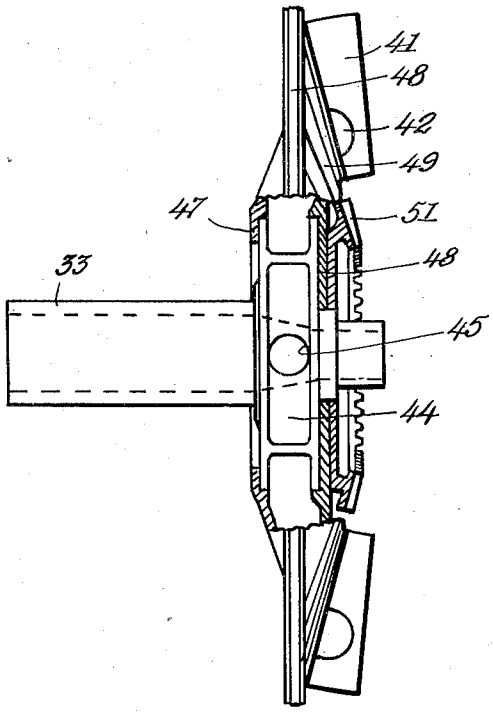


Fig. 7



INVENTOR-
BRUCE CONKLIN
BY W. E. Stacy Jr.
ATTORNEY

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PUMP, MOTOR, COMPRESSOR, OR THE LIKE

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Fig. 8

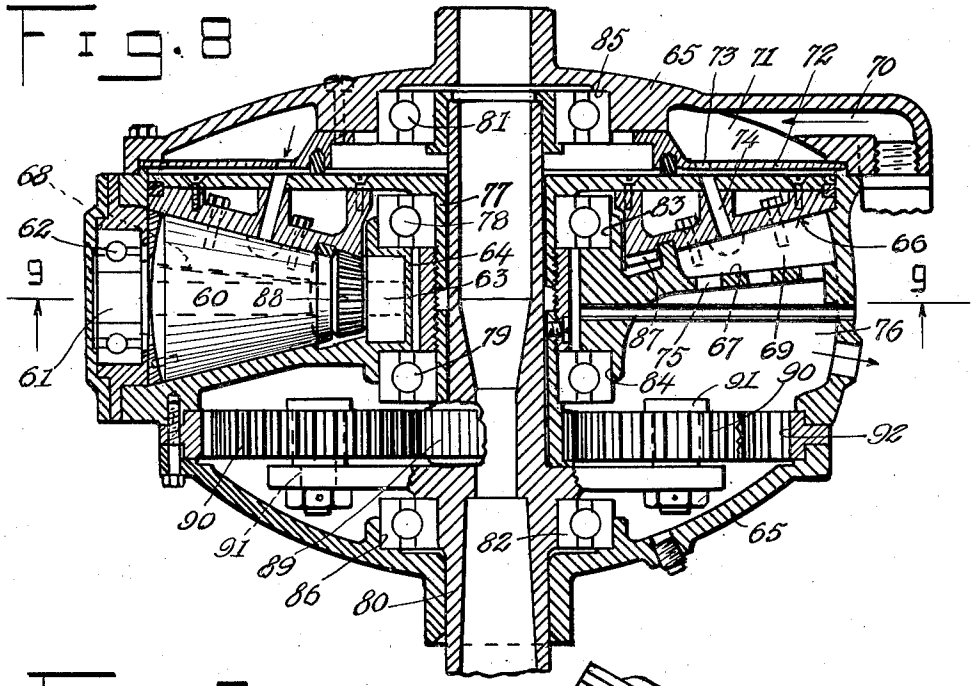
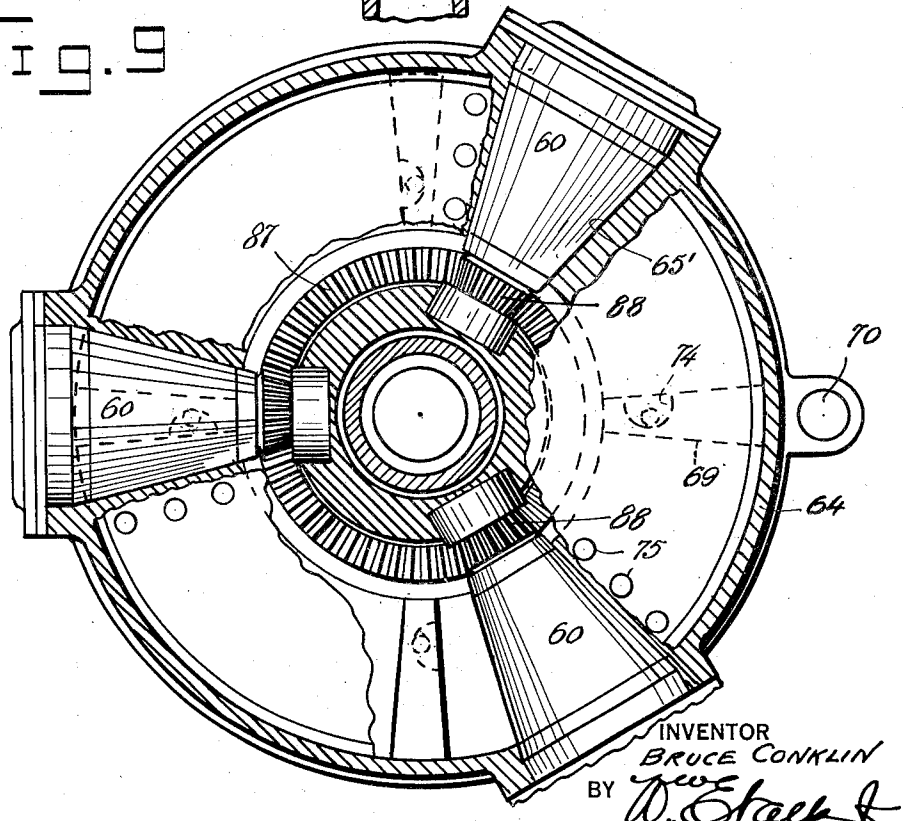


Fig. 9



INVENTOR
BRUCE CONKLIN
BY W. E. Clark Jr.
ATTORNEY

Patented Nov. 6, 1934 1,979,368

UNITED STATES PATENT OFFICE

1,979,368

PUMP, MOTOR, COMPRESSOR, OR THE LIKE

Bruce Conklin, Huntington, N. Y., assignor to James R. Sloane, Princeton, N. J.

Application January 7, 1933, Serial No. 650,666

5 Claims. (Cl. 103—143)

My invention relates to fluid pumps, motors, compressors or the like, and is concerned more particularly with apparatus of the kind comprising two relatively movable parts or elements, one said part or element having one or more rotary abutments, and the other said part or element having one or more cooperating vanes, and the said two parts or elements having formed therebetween one or more chambers within which the fluid is adapted to be worked.

An object of the invention is to generally improve upon that type of apparatus disclosed in U. S. Patent No. 1,629,202, issued May 27, 1927.

Other and further objects and advantages of the invention will be hereinafter more fully set forth.

In the drawings, wherein like reference characters denote like or corresponding parts:

Fig. 1 is a longitudinal vertical sectional view of a fluid pump constructed according to the present invention;

Fig. 2 is a diagrammatic view;

Fig. 3 is a side elevation of a part of the stationary casing showing the relative arrangement of the several rotary abutments;

Fig. 4 is a plan view of that part of the apparatus illustrated in Fig. 3;

Fig. 5 is a section on the line 5—5 of Fig. 3;

Fig. 6 is a face view of one of the rotatable members;

Fig. 7 is an edge view, partly in section, of said rotatable member;

Fig. 8 is a view similar to Fig. 1 illustrating a fluid motor of a generally similar type; and

Fig. 9 is a section on the line 9—9 of Fig. 8.

Reference will first be had to that embodiment of the invention illustrated in Figs. 1 to 7, inclusive. In said embodiment a double acting fluid pump is shown. The same principle, if desired, may be applied, however, to fluid compressors. To obtain compression, it is only necessary to add to the pump structure suitable non-return valves such as are disclosed in said issued patent.

The intermediate part of the pump casing is designated in its entirety as 10. Said casing part is normally stationary and comprises an outer cylindrical part 11, an intermediate cylindrical part 12, and an inner cylindrical part 13. Within the outer cylindrical part 11, openings 14 are formed. Within the intermediate cylindrical part 12 openings 15 are formed. And within the inner cylindrical part 13 recesses 16 are formed. Said cylindrical parts are concentrically arranged and integrally united, the intermediate and outer parts by a double wall web member 17, and the intermediate and inner parts by a single wall web member 18.

The double wall web member 17 has formed therein transverse openings 19. These openings 19, viewed from the side, widen outwardly and have defining walls so shaped or formed as to provide in effect conical seats or recesses. The openings 14, the openings 15, the recesses 16 and the openings or recesses 19 are preferably radially arranged and uniformly circumferentially spaced, i. e., the one in each case is symmetrically disposed about the radial axis of the other. Collectively, said openings and recesses may be said to define four radially extending wells or seats within each of which an abutment 20 is adapted to be fitted.

The abutments 20, in each case, are mounted for rotation. The depth of the abutments is preferably equal to the distance between the outer and intermediate cylindrical parts 11 and 12 of the casing. Each abutment is of substantially frusto-conical shape, alike in size, and so angled or dimensioned as to cause the projected apices of the several cones to meet or coincide.

For each abutment a shaft 21 is provided. The shafts, in each instance, are carried beyond the ends of the abutments, and each said shaft at its opposite ends is journaled for rotation in ball bearings 22 and 23. The ball bearings 22 at the inner ends of the shafts 21 are snugly fitted in the recesses 16 of the casing, whereas the ball bearings 23 at the outer ends of said shafts are fitted in recesses 24 formed in cover plates 25 fastened to the casing 10 over the openings 14. Caps 26 threaded over the walls 27 within which the recesses 24 are formed, hold the ball bearings 23 in place.

The ends of the abutments 20 are preferably spherically formed as indicated. Such a construction is preferred in that leakage at the ends of the abutments may be avoided by the use of fillers 28 and 29. The fillers 28 are designed to fill the spaces between the cover plates 25 and the outer ends of the abutments, while the fillers 29 are designed to snugly fit within and fill the openings 15 formed in the intermediate cylindrical part 12 of the casing. In Fig. 1, the fillers 28 are shown as pinned to the abutments, whereas the fillers 29 are shown as loosely mounted on the shafts 21. In each abutment a longitudinally extending groove or pocket 30 is formed in its outer angled surface. The purpose of these grooves or pockets 30 will be hereinafter more fully explained.

Besides the intermediate or transversely extending part 10, the casing includes detachable side cover plates or sections 31. These cover sections 31 are bolted to said intermediate casing part to provide therewith an outer casing wall. On each side of said intermediate casing part, and within the outer casing wall, a rotatable member, designated in its entirety as 32, is fitted. Like the abutments 20, the rotatable members 32 are of generally frusto-conical shape and so relatively arranged as to cause their respective apices to meet or coincide with the projected apices of the several conical abutments.

Shafts 33, one for each rotatable member, are journaled in the casing. These shafts 33 are axially aligned and are rotatable in opposite directions. Ball bearings 34 fitted in an opening 35 around which the inner cylindrical part 13 of the casing extends, support said shafts at their inner ends. Said shafts are additionally supported at points intermediately of their ends in ball bearings 35' fitted in recesses 36 formed in the inner faces, respectively, of the cover sections 31. At their outer ends, said shafts 33 extend without the casing through packing glands 37. One or both said shafts is or are adapted to be driven from a suitable source of power (not shown).

The shafts 33 are hollow, and it is through said hollow shafts that the fluid acted on by the pump enters the pump casing. The rotatable members 32, as intimated, have an overall diameter equal to the inside diameter of the outer casing part 11. Said rotatable members define with the casing part 10 two spaced annular working chambers 38. They also define with the outer casing wall and within said casing, two annular exhaust chambers 39. Openings 40 formed in the casing wall, one at each side of the intermediate casing part 10, and opening respectively to said exhaust chambers, admit of the pumped fluid being piped to the point or points desired. The piping (not shown) is adapted to be fitted over said openings 40.

Within each working chamber 38 vanes 41 are movable. Said vanes (four in each chamber to correspond with the number of rotary abutments 20), extend crosswise of the chambers, and as the rotatable members turn, traverse the abutments 20 by their fitting engagement in the pockets 30. Ports 42 and 43 formed in the wall of each working chamber admit of the fluid being admitted to and exhausted therefrom. The ports 42, i. e., the intake ports, are open to collecting chambers 44, one for each shaft 33, while the ports 43, i. e., the exhaust ports, are open to the respective exhaust chambers 39. Said intake and exhaust ports are located close to and on opposite sides, respectively, of the several vanes 41.

The collecting chambers 44, like the working chambers 38, are annular in form. One is formed in each rotatable member. Toward their centers, said chambers 44 are open to the hollow shafts 33, radial passages 45, formed in enlargements 46, being provided for this purpose. The enlargements 46 are preferably integral with the hollow shafts, and it is against the opposite faces of these enlargements that two of the three circular plates 47, 48 and 49, comprising each rotatable member, are fastened. The plates 47 and 48 of each rotatable member are the plates which define the collecting chambers 44. At their outer margins, said plates are brought together, fastened one to the other, and with the plates 49, constitute the respective outer walls of the two working chambers 38. The plates 49, which are the inner plates of the two rotatable members, are the plates to which the vanes 41 are fastened. As indicated in Fig. 1, the inner plates 49 overhang the intermediate cylindrical part 11 of the casing 10.

A pump characterized as herein set forth, is, in effect, double acting. The radial abutments 20 are common to both working chambers 38. Like the vanes 41, said abutments extend crosswise of the working chambers, and it is between said vanes and abutments, within said chambers, that the fluid is worked. To synchronize the rotary movement of said abutments with the rotation of the rotatable members, each abutment is provided with a pinion 50 with which opposed ring gears 51 are in mesh. The pinions 50 are mounted on the abutment shafts 21 between the intermediate and inner cylindrical parts 12 and 13, and the gears 51 are fastened, one each, to the spaced rotatable members 32 at opposite sides of the dividing casing wall. Such an arrangement is effective regardless of which shaft 33 is power driven. Care should be exercised to insure that the corresponding vanes of the opposed rotatable members successively engage in the pockets 30. By staggering said vanes, the desired interfitting engagement is obtained.

Reference will now be had to the motor structure illustrated in Figs. 8 and 9. The motor, generally speaking, is similar in construction and operation to the pump. It is, however, single rather than double acting. As in the pump, a plurality of rotatable abutments, 60, are provided. Said abutments, three, instead of four in number, are uniformly circumferentially spaced. Each is mounted on a radially disposed shaft 61 journaled at its opposite ends in ball bearings 62 and 63. These ball bearings are carried by a fixed casing part 64 over the opposite side faces of which removable cover plates 65 are fastened. Said casing part 64, like the casing 10 of the pump, extends crosswise of the outer casing of the motor, and has formed therein radial pockets or recesses 65 within which the abutments 60 are fitted.

In conjunction with the casing wall 64, a rotatable member 66 is adapted to form within the casing an annular working chamber 67. Both the rotatable member 66 and the several rotary abutments 60 are of substantially frusto-conical shape and have their projected apices in coincidence. The rotary abutments 60 extend crosswise of said working chamber and have formed therein pockets 68 within which vanes 69 carried by the rotatable member are adapted to engage as said rotatable member turns. The rotatable member, however, instead of being mechanically driven, as are the shafts 33 of the pump, is fluid driven, the fluid (compressed air, for instance) being admitted to the casing by way of a fluid inlet duct 70.

A collecting chamber 71 is formed in the outer casing between one of said cover plates 65 and a cross plate 72. From the collecting chamber 71 the fluid enters the working chamber 67 through intake ports 73 and 74 formed in the cross plate 72 and the rotatable member 66, respectively. As the fluid enters the working chamber 67, it expands, and by its expansive force, turns said rotatable member. Exhaust ports 75 formed in the transverse casing wall permit the fluid to escape from the working chamber into an exhaust chamber 76.

The rotatable member 66 is mounted on a hol-

low shaft 77 journaled in ball bearings 78 and 79. Within said hollow shaft a power shaft 80, journaled in ball bearings 81 and 82 is fitted. The ball bearings 78 and 79 engage in recesses 83 and 84 formed in the opposite faces of the transverse center wall, whereas the ball bearings 81 and 82 engage in recesses 85 and 86 formed in the cover plates 65. As shown in Fig. 8, said two shafts 77 and 80 are concentric.

To the rotatable member 66 a ring gear 87 is fastened. Said gear 87 is in mesh with pinions 88 mounted, one on each shaft 61. By means of such gearing, the rotary movement of the abutments is synchronized with the rotation of the rotatable member. Thus synchronized, the vanes 69 are caused to engage in the pockets 68 as said vanes traverse said abutments.

The power shaft 80 is extended at one end without the casing wall. It is intended to drive a drill or other device designed for pneumatic or fluid operation. On the shaft 77 a gear 89 is fastened. This gear 89 is in mesh with other gears 90 mounted on stub shafts 91 rotatable both with and with respect to the power shaft 80. The gears 90 are also meshed with a fixed ring gear 92 extending around the inner wall of the casing. Thus geared, the power shaft 80 is made to rotate as the gears 90 individually rotate and at the same time bodily rotate within said casing around the common axis of both shafts 77 and 80.

In conclusion, it should be noted that the disposition of the intake and exhaust ports of the motor is substantially the same as the disposition referred to in the description pertaining to the pump. The diagrammatic view of Fig. 2 shows clearly the principle upon which a pump, motor, compressor or the like, constructed as herein disclosed, is designed to function. The arrows indicate the direction of the fluid flow. By actual test, it has been found that a device or apparatus utilizing tapered abutments and tapered rotatable members is a great deal more efficient per cubic inch of displacement than any similar devices or apparatus heretofore proposed.

While I have described my invention in detail in its present preferred embodiment, it will be obvious to those skilled in the art, after understanding my invention, that various changes and modifications may be made therein without departing from the spirit or scope thereof. I aim in the appended claims to cover all such modifications and changes.

What is claimed is:

1. In a fluid compressor or the like, in combination, a shaft, said shaft having formed therein a fluid inlet passage, a rotatable member mounted on said shaft, said rotatable member having formed therein a fluid outlet port and also a fluid inlet port in open communication with said fluid inlet passage, a casing defining with said rotatable member at one side of said member an annular working chamber and at the opposite side thereof an annular exhaust chamber whereby any loss or leakage occurring within said annular working chamber is directed into said annular exhaust chamber, and means operable within said working chamber adapted to force the fluid entering said working chamber into said exhaust chamber through said outlet port.

2. In a fluid compressor or the like, in combination, a casing including a substantially cylindrical portion provided with a transverse casing wall and with end plates fitted over the ends of said cylindrical portion, a shaft jointly carried by one said end plate and said casing wall, a second shaft jointly carried by the other said end plate and said casing wall, said shafts being axially aligned and rotatable in opposite directions, a rotatable member mounted on one said shaft, said rotatable member being intermediately located between one said end plate and said casing wall to provide at one side of said casing wall both a working chamber and an annular exhaust chamber, a rotatable member mounted on the other said shaft, said last mentioned rotatable member being intermediately located between the other said end plate and said casing wall to provide at the opposite side of said casing wall a second working chamber and a second annular exhaust chamber, vanes carried by one said rotatable member and movable within one said working chamber, vanes carried by the other said rotatable member and movable within the other said working chamber, and means common to both said working chambers adapted to cooperate with said vanes in forcing the fluid entering said working chambers into said exhaust chambers, said means being journaled for rotation in said casing wall, and said annular exhaust chambers being so related to said working chambers as to cause any and all loss or leakage occurring within the working chambers to be directed into said annular exhaust chambers.

3. In a fluid compressor or the like, in combination, a casing including a substantially cylindrical portion provided with a transverse casing wall and with an end plate fitted over one end of said cylindrical portion, said casing having formed therein an annular exhaust chamber, a shaft extending out from said casing through said end plate, a rotatable member defining with said casing and said casing wall an annular working chamber, said annular working chamber being so related to said annular exhaust chamber as to cause all leakage from said working chamber to be directed into said exhaust chamber, vanes carried by said rotatable member and movable within said working chamber, and a rotary abutment adapted to cooperate with said vanes in forcing the fluid entering said working chamber into said exhaust chamber, said abutment having an axis of rotation perpendicular to the axis of rotation of said shaft.

4. In a fluid compressor or the like, in combination, a casing including a substantially cylindrical portion provided with a transverse casing wall and with an end plate fitted over one end of said cylindrical portion, a shaft jointly carried by said end plate and said casing wall, a rotatable member mounted on said shaft, said rotatable member having formed therein a fluid outlet port and being intermediately located between said end plate and said casing wall to provide at one side of said casing wall both an annular working chamber and an annular exhaust chamber, the relative arrangement of said annular working chamber and said annular exhaust chamber being such that any and all loss or leakage from said working chamber is directed into said exhaust chamber, a vane carried by said rotatable member and movable within said working chamber, and means cooperating with said vane adapted to force the fluid entering said working chamber into said exhaust chamber through said exhaust port, said means being journaled for rotation in said casing wall.

5. In a fluid compressor or the like, in combination, a substantially cylindrical casing provided with a transverse casing wall, a shaft journaled at one end in said casing wall and having formed

therein a fluid inlet passage, a rotatable member mounted on said shaft and having formed therein a fluid inlet port, a fluid outlet port, and also a fluid inlet passage in open communication with the fluid inlet passage formed within said shaft, said rotatable member being mounted within said cylindrical casing portion to define therewith and with said casing wall an annular working chamber in open communication with both said fluid inlet port and said fluid outlet port, and means operable to force the fluid entering said annular working chamber by way of said inlet port through said outlet port during rotation of said rotatable member.

BRUCE CONKLIN.