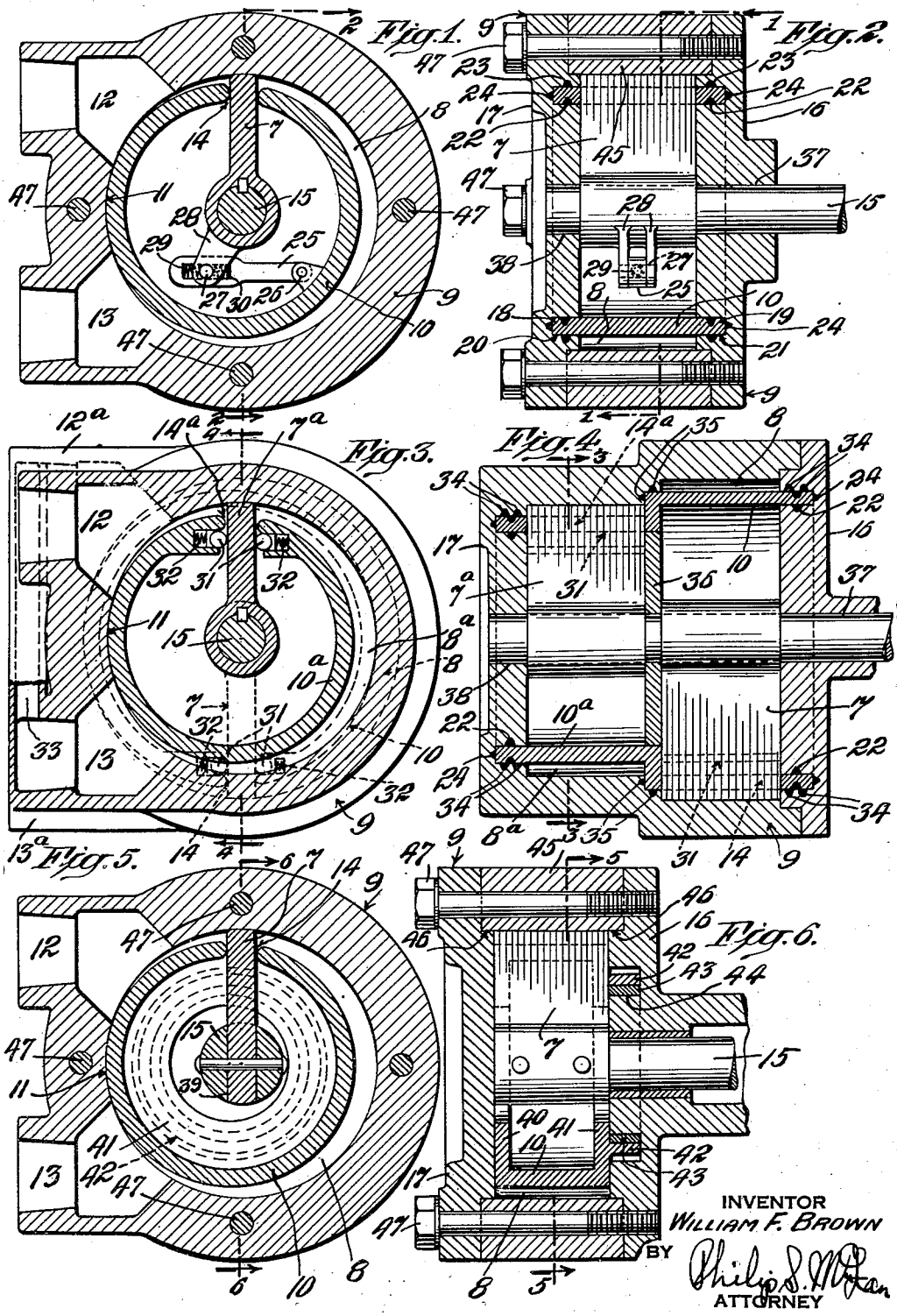
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FLUID PRESSURE MACHINE

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FLUID PRESSURE MACHINE

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The invention herein disclosed relates to fluid pressure machines for developing or for utilizing fluid under pressure.

Objects of the invention are to provide such a machine, which will rotate in balance and which will operate effectively for displacement of fluid, for example, as a pump or a compressor, or to utilize fluid such as steam or expanding gases for generation of power.

Further special objects are to provide an efficient rotary machine of simple, sturdy construction, consisting of but few parts and operating with a minimum of friction.

Additional objects are to provide a low cost design, readily adaptable to many usual or special purposes and particularly in the latter category, to submarine propulsion and to aircraft propulsion in the stratosphere.

Other objects of the invention will appear as the specification proceeds and as the novel features of the invention are set forth in the following specification.

The drawing accompanying and forming part of the specification illustrates a number of the possible embodiments of the invention. Structure and arrangement may be modified and changed however, all within the true spirit and broad scope of the invention, as hereinafter defined and claimed.

Figs. 1 and 2 are sectional views on planes at right angles to each other and illustrating an embodiment adapted for operation as a motor, pump or compressor, Fig. 1 being a view as taken on substantially the plane of line 1—1 of Fig. 2 and Fig. 2 being a view as taken on substantially the plane of line 2—2 of Fig. 1.

Figs. 3 and 4 are similar views, illustrating a dual cylinder embodiment of the invention, adapted for operation as a multiple expansion steam engine or the like, Fig. 3 a section on line 3—3, Fig. 4, and Fig. 4 a section on line 4—4 of Fig. 3.

Figs. 5 and 6 are corresponding sectional views showing the invention embodied in a simple form of liquid displacement pump and taken on line 5—5 of Fig. 6 and line 6—6 of Fig. 5.

In the several forms of the invention illustrated, a blade 7, serving as an impeller in the case of a pump, or as a piston in the case of a power producing machine, is mounted to rotate concentrically and in continuous cooperative relation with the walls of a cylindrical chamber 8, within a casing 9, and a cylindrical rotor 10, is journalled eccentrically in and sealing cooperation with one side of said cylindrical chamber, at 11.

The eccentrically journalled rotor thus cooperates with the surrounding walls of the chamber to define a crescent-shaped displacement or expansion chamber. Inlet and outlet ports 12, 13, open into this chamber at opposite sides of the sealing cooperation at 11, between chamber and rotor.

The rotor is shown slotted at 14, for passage of the blade out into running engagement with the walls of the cylindrical chamber.

The blade is shown fixedly secured on a shaft 15, journalled centrally in the cylindrical chamber. This shaft may extend through and be journalled in both end walls 16, 17, of the casing, as illustrated in Figs. 2 and 6, or extend through and be journalled in only one end wall 16, as indicated in Fig. 4.

The rotor, serving in the illustration merely as a rotating cylindrical partition defining the inner wall of the crescent-shaped expansion or displacement chamber, may be a relatively light cylindrical shell or ring and various ways of journalling this element may be employed.

One simple method is that illustrated in Fig. 2, where the annular member 10, is shown as simply having its continuous cylindrical end portions 18, 19, rotatably seated in annular grooves 20, 21, provided in the end heads of the casing. Lubricating and sealing channels 22, 23, are shown provided in the rotor and in the bearing grooves, at opposite sides of the rotor and in the casing at 24, at opposite ends of the rotor.

To avoid or lessen sliding friction between the blade and rotor, the edges of the slot 14, may be rounded as indicated in Fig. 1, or otherwise shaped and, if desired, a free floating pull or push connection may be provided between the blade and rotor, independently of any engagement between these parts at the slot.

Thus in Figs. 1 and 2, there is shown a form of drag link connection 25, pivotally connected at one end with the rotor at 26, and pivotally connected at the opposite end at 27, with an arm 28, projecting from the hub portion of the blade. This arm and the drag link are shown disposed at the opposite side of the center of rotation from the blade, thus to serve more or less as a counterweight or counterbalance for the blade.

Springs 29, 30, are shown interposed at opposite sides of the pivotal connection between the blade and link to permit the parts to accommodate themselves to relative changes in speed and angular relation.

In another form of connection between the concentrically rotating blade and the eccentrically turning rotor or cylinder, rolls such as **31**, Fig. 3, are journalled in the rotor at opposite edges of the slot, bearing against opposite faces of the blade, thus to provide an antifriction driving connection between the two. These rolls may be backed up by springs as indicated at **32**, thus to provide a resilient form of coupling and packing between the parts.

The machine may be built in single or compound form.

Thus as shown in Figs. 3 and 4, there may be two or more cylindrical working chambers **8**, **8***a*, in concentric coaxial relationship one alongside the other and the shaft extend centrally through both or all such chambers.

Also in this multi-cylinder construction, a single rotor may be employed having cylindrical portions **10**, **10***a*, in register with the respective chambers and slotted as at **14**, **14***a*, for the blades **7**, **7***a*, operating in those chambers.

The chambers in the multi-cylinder machine may be of the same or different diameters and the same is true as to the rotor sections operating in such chambers.

In the illustration, Figs. 3 and 4, one chamber is larger than the other and the rotor elements similarly are one of larger diameter than the other. Such a construction is particularly suited for operation as a multiple expansion steam engine, the casing then being ported or piped as indicated at **33**, to carry the exhaust at **13** from the smaller high pressure cylinder **8***a* to the intake **12***a* of the larger, low pressure cylinder **8**.

The greater radius is desirable as utilizing a longer blade and thus gaining greater leverage and providing for the fullest expansion of the driving fluid.

In designing the machine as a steam engine or in fact as any engine operating on expanding gases or fluids, suitable valves will ordinarily be provided, such as in the case of steam, variable cutoff and the like.

Also packing suited to the operation of the machine may be provided, such as the lubricating and sealing grooves heretofore referred to or a labyrinth type of packing, such as indicated at **34**, in Fig. 4.

In the case of a rotor having portions of different diameters, packing grooves **35**, Fig. 4, or the like, may be provided at the shoulders of the different diametered portions.

To avoid cross leakage between adjoining cylinders, a partition **36**, Fig. 4, or partitions may be arranged in the rotor between the different blades.

The different cylinders may be utilized for entirely different purposes, for example, one cylinder operating as an engine cylinder producing power and an adjoining or other cylinder serving as a compressor, blower, supercharger or the like, for the first mentioned or other cylinder.

The construction disclosed permits the shaft being made as large and heavy as need be and all in one continuous piece extending through all the working chambers and mounted in as large bearings as considered best, at opposite ends of such shaft. These may be plain bearings, such as indicated at **37**, **38**, or be ball, roller or other forms of bearings and the rotor, if desired, may be journalled on anti-friction or other type bearings.

In Figs. 5 and 6, the machine is shown embodied in a form suitable for pumping liquids. In this particular illustration, the shaft is journalled only at one side, the blade is held by being secured in a slot **39**, cut in from the end of the shaft, instead of being sleeved over the shaft and the rotor is in the form of an annulus having end flanges **40**, **41**, the latter provided with an axially extending flange **42**, carrying a bearing ring **43**, riding the annular bearing shoulder **44**.

The casing may be made in one or a number of sections, one particularly practical form being that illustrated in Figs. 2 and 6, embodying a central casing section **45**, carrying the cylindrical wall of the working chamber, shouldered at **46**, over the end heads **16**, **17**, and the whole firmly held together by through bolts **47**.

The blade constitutes the impeller or piston whether the machine be designed as for pumping functions or for power generation. In one instance, the blade propels a fluid and in the other case, the blade drives the shaft. In the constructions disclosed, the blade is always centered and can be made as heavy as required for all purposes. Operating concentrically, the blade may have a relatively wide arcuate edge in free running engagement or sealing cooperation with the cylindrical wall of the chamber.

The machine may be adapted to many other uses than those previously mentioned, for example, for Diesel or other internal combustion engine operations. Particularly, it may be operated as a stratosphere engine, deriving the expanding gases for operating the same from a rocket motor type of combustion chamber, directly or valve-connected with the intake port or ports of the machine. If desired, more than one rotor may be employed, one journalled concentrically within the other and all rotating with the blade extending through the same.

In the case of a multi-cylinder machine with one cylinder operating as a super-charger for another cylinder, by suitable connections and valves, the super-charger cylinder may be run idle, with substantially no load on the machine, until required for super-charging purposes. The piston blades in the multi-cylinder machines may be offset 180 degrees or set in any other desired angular relation. If necessary to keep the cylinders to the same diameter, variations in capacity may be obtained by simply lengthening the machine, to increase the length instead of the diameter of the cylinder.

While ordinarily it might be considered preferable to construct the parts of metal, it is to be noted that different elements of the machine may be made of plastics or other materials. These elements are of such simple design that they may be produced as die castings or produced in other special ways.

As there are only the two moving parts, the piston blade and the cylindrical shell, and both travel in circular paths, lubrication may be provided by the liquid or fluid passing through the machine; but if found desirable, lubricants may be admitted or forced direct to any parts or portions needing the same.

If necessary or considered desirable, the piston blade may be sealed where it passes through the rotating sleeve, by packing or by means such as a flexible diaphragm. A packing strip or shoe may be utilized as a sealing means at the point of cooperation of the rotating sleeve with the side of the cylindrical chamber.

What is claimed is:

1. In a machine of the character disclosed, the

combination of a casing having a cylindrical chamber, a shaft journalled concentrically in said cylindrical chamber, a blade carried by said shaft in cooperative relation with the walls of said cylindrical chamber and a cylindrical rotor journalled eccentrically in said cylindrical chamber and in cooperative relation therewith at one side of the chamber, said rotor having a slot therein for extension of said concentrically mounted blade into cooperative relation with the walls of said chamber, said chamber having ports at opposite sides of the point of said cooperative relation with said rotor and a pivotal drive connection for carrying rotational loads between said blade and rotor located within said rotor, including a link pivotally connected with said rotor at one end and pivotally connected at the other end with the rotating blade structure and free to turn at its opposite ends to accommodate itself to the varying conditions of relative eccentricity occurring in the rotation of said blade and rotor on different centers.

2. In a machine of the character disclosed, the combination of a casing having a cylindrical chamber, a cylinder eccentrically journalled in said chamber and in sealing cooperation therewith at one side of said chamber, an abutment blade mounted for rotation concentrically in said chamber and extending out through one side of said cylinder in sealing cooperation with said cylindrical chamber and a link pivotally connecting said blade with said cylinder and located within the cylinder and pivoted at its opposite ends to the blade structure and cylinder and thereby arranged to adjust itself to the changing relation between said eccentrically journalled cylinder and said concentrically rotating abutment blade.

3. In a machine of the character disclosed, the combination of a casing having a cylindrical chamber, a cylinder eccentrically journalled in said chamber and in sealing cooperation therewith at one side of said chamber, an abutment blade mounted for rotation concentrically in said chamber and extending out through one side of said cylinder in sealing cooperation with said cylindrical chamber and a connection between said blade and cylinder and disposed at the opposite side of the rotational mounting of said blade from said blade to serve in the nature of a counterbalance for the blade.

4. In a machine of the character disclosed, the combination of a casing having a cylindrical chamber, a cylinder eccentrically journalled in said chamber and in sealing cooperation therewith at one side of said chamber, an abutment blade mounted for rotation concentrically in said chamber and extending out through one side of said cylinder in sealing cooperation with said cylindrical chamber and a resilient connection between said blade and cylinder inclined with respect to both the axis of the cylinder and the axis of the blade and located wholly within said cylinder.

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