Dec. 13, 1949 J. R. FREI 2,491,100

PUMP

Filed Nov. 18, 1942

Fig. 1

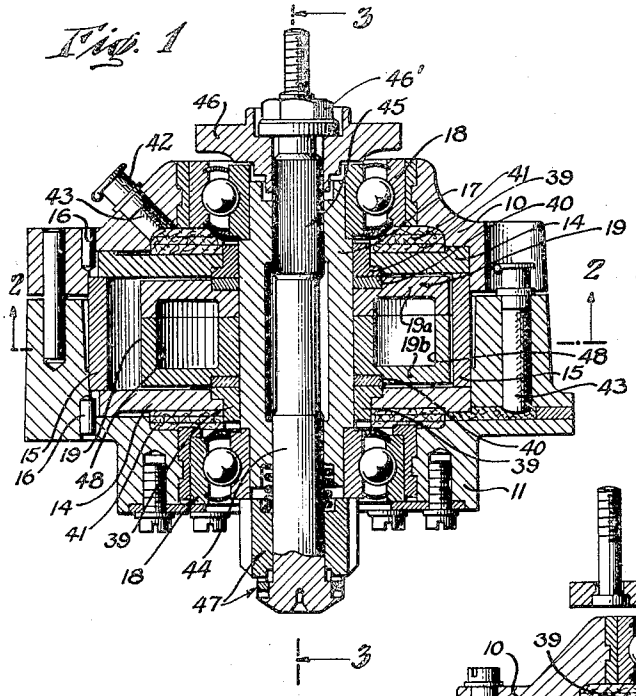


Fig. 3

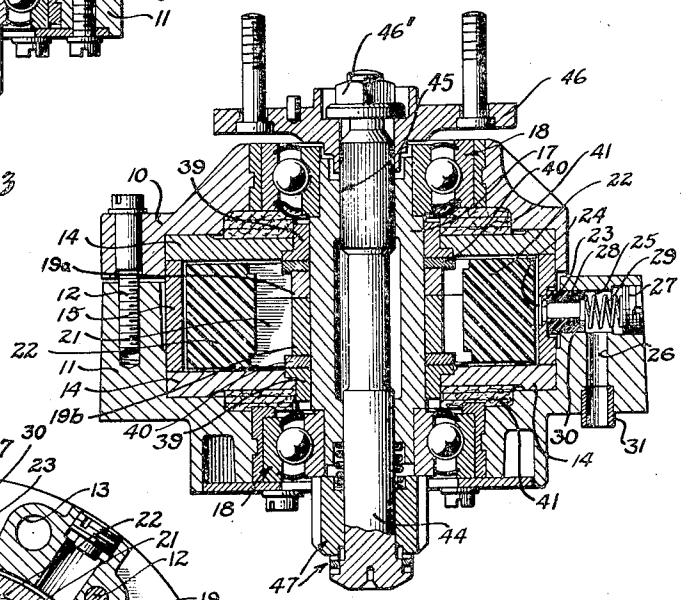
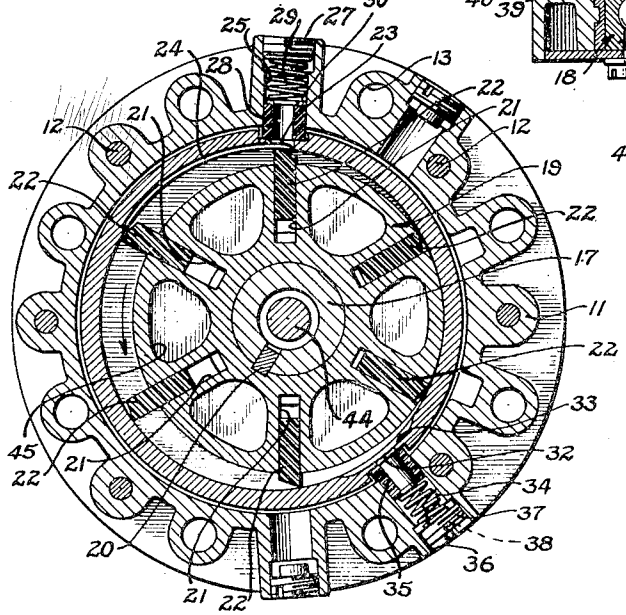


Fig. 2



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Patented Dec. 13, 1949

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UNITED STATES PATENT OFFICE

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Application November 18, 1942, Serial No. 466,047

8 Claims. (Cl. 230—152)

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This invention relates to pump means and more particularly to a rotary fluid pressure pump adapted for supercharging purposes.

This application is a continuation-in-part of my copending application Serial No. 462,126, filed October 15, 1942, now issued as U. S. Patent No. 2,391,958, dated Jan. 1, 1946.

One object of the present invention is to provide novel rotary pump means having the operating parts thereof arranged and housed in a novel manner.

A further object is to provide the above pump means with a novelly constructed rotor and a novel method of forming the same.

Another object of the invention is to provide pump apparatus embodying novel drive means.

A further object is to provide fluid pressure pump apparatus wherein the inlet and discharge ports are arranged and constructed in a novel manner.

Still another object is to provide the above apparatus with novel lubricating means for the movable parts.

Still another object is to provide a rotary pump with novel means for mounting the rotor thereof whereby a predetermined working clearance between said rotor and the parts housing the same is accurately established during assembly and maintained during operation.

A still further object is to provide a pump apparatus of the type having an eccentrically mounted rotor and centrifugally actuated vanes wherein the parts are associated in a novel manner so as to adapt the apparatus for mounting intermediate the driving means and the driven member, for example, of an ignition distributor.

Still another object is to embody pump apparatus of the above type with novel means for insuring the safe operation of other parts driven by the same shaft.

The above and further objects and novel features of the invention will more fully appear from the following detailed description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not intended as a definition of the limits of the invention, reference for this latter purpose being primarily had to the appended claims.

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In the drawings, wherein like reference characters refer to like parts throughout the several views,

Fig. 1 is a sectional view of one form of pump apparatus and mounting means therefor embodying the present invention, the section being taken substantially along a plane coincident with the axis of rotation of the drive means for the apparatus;

Fig. 2 is a sectional view taken substantially along line 2—2 of Fig. 1; and,

Fig. 3 is a sectional view taken substantially along line 3—3 of Fig. 1.

Referring to the drawings, there is shown an embodiment of the invention adapted for use, for example, as the supercharging means for the distributor of the ignition system of an internal combustion engine. As shown, the novel pump apparatus comprises an outer or main housing consisting of two sections 10 and 11 separated along a transverse plane and connected together by suitable means, such as screws or bolts 12. Sections 10 and 11 are preferably provided with a plurality of holes 13 (Fig. 3) adapted for receiving bolts or other suitable holding means whereby said housing may be operatively mounted in another housing to be supercharged or connected to an engine casing within said supercharged housing. Within housing 10, 11 there is mounted a pump casing comprising end plates 14 and a cylindrical wall member 15, which parts are held in operative axial position relative to each other by sections 10 and 11. One or more holding members, such as pins 16 (Fig. 1), may be provided in each housing section for cooperation with said end plates to prevent angular movement of the latter relative to said housing, and suitable means, such as pins (not shown), may be employed to hold the parts of casing 14, 15 in fixed angular relation to each other. Eccentrically mounted relative to said casing is a hollow rotor shaft 17 which has the ends thereof suitably journaled in bearings 18 preferably provided in each of sections 10, 11, said bearings serving also to axially position said shaft. Concentrically mounted on rotor shaft 17 in casing 14, 15 so as to be eccentric to the latter is a pump rotor 19 which is secured, for example, by a key 20 (Fig. 2) to said rotor shaft for rotation therewith. Key 20 is preferably formed from a readily shear-

able material so that if said rotor seizes or becomes otherwise locked against movement during operation, the key will be first to fail and will thereby protect the pump structure and the drive means connected thereto against damage and also permit continued operation of the other parts. A plurality of radial slots 21 are provided in said rotor and each of said slots is adapted to slidably receive a vane or blade 22 so that during operation of said rotor, said vanes are centrifugally actuated into operative engagement with the inner wall of casing member 15. Said vanes are preferably formed from molded phenolic material. Each pair of said vanes cooperates with the inner walls of casing 14, 15 to form a peripheral pressure chamber therein, the latter having a volume which varies from a minimum to a maximum during each revolution of the rotor.

Suitable means are provided in the illustrated embodiment to admit air to each of the pressure chambers as the latter attain a maximum volume and to discharge air from each of said chambers as the latter approach a minimum volume. As shown, the air admission means comprises a suitable passageway in housing 10, 11, which connects with an inlet port 23 in casing 14, 15, said port being provided in wall member 15 and connecting with a transverse groove 24 in the inner surface of said member. Said groove subtends a substantial arc in the direction of travel of the vanes and is adapted to connect said port with each pressure chamber from the time shortly after air is discharged from said chamber until the time the chamber assumes its maximum volume. The inlet passageway in housing 10, 11 is preferably provided in section 11 and, as shown, comprises a radial passage 25 (Fig. 3) and a vertical passage 26, said radial passage connecting at one end with port 23 and being sealed at the other end by means of screw member or plug 27. To connect and minimize air leakage between passage 25 and port 23, a sleeve or tube 28 preferably lines the interior of said passage and extends into an indentation in the outer wall of member 15 to connect with said port. Sleeve 28 is preferably made of resilient material, such as neoprene, and is pressed into fluid-tight engagement with wall member 15 around port 23 by a spring 29, which applies a pressure to said sleeve by bearing at one end thereof against a washer 30 which engages the end of said sleeve. The other end of said spring bears against screw member 27 and the latter may have a lug formed on the inner end thereof to serve as a guide for said spring. Passage 26 connects at its upper end with passage 25 and is preferably provided at its lower end with a bushing 31 to facilitate a connection to the atmosphere through an outer housing within which the illustrated structure may be mounted.

Air is successively discharged from each pressure chamber of the pump through a port 32 which connects with the chamber by means of a transverse slot or groove 33, said groove keeping said port in communication with the chamber until substantially all the air in the latter has been ejected therefrom. Connecting with said port is a radial passage 34 which extends through housing section 11 and has a liner 35 retained in operative position therein by a spring and plug arrangement 36, 37 similar to that which holds liner 28 of the inlet passage 25. It is desirable that passage 34 open into the atmosphere surrounding housing 10, 11, i. e., into the interior of the apparatus containing said housing, so that said apparatus may be supercharged, and to this end a duct 38 may be provided in screw member 37 or a suitable connection may be made through parts 10 or 11.

In order to prevent binding without introducing excessive clearance and attendant air leakage, novel means are provided for fixing the axial position of the rotor relative to the pump casing whereby satisfactory working clearances may be obtained during assembly and maintained during operation without necessitating exact machining of all the assembled parts. As shown, said means comprise a pair of thrust bushings or bearings 39 (Figs. 1 and 2) mounted in each end wall 14 in engagement with shaft 17. In order to fix the bushings against axial displacement, each of the latter is preferably provided with a flange on the end thereof facing said rotor, which flange bears against a shoulder provided in each end wall 14. To bear against the flanged inner ends of bushings 39 and thereby predetermine the clearance between rotor 19 and end plates 14, thrust rings 40 are mounted in opposite ends of said rotor. It is to be understood that the clearances in the drawings have been exaggerated for purposes of illustration and that the outer or bearing surface of each of rings 40 may be flush with each end surface of the rotor. The clearance at the ends of the rotor is preferably determined by the extension of bearings 39 beyond the inner surfaces of end plates 14.

Novel means are provided for constantly supplying a suitable quantity of lubricant to the parts of the above-described pump structure and, as shown, said means comprise annular masses 41 of fibrous oil-absorbent material, such as felt, disposed to surround shaft 17 and to engage each of end plates 14, said masses being mounted in annular chambers formed between each of sections 10, 11 and said end plates. Oil is supplied to said absorbent masses by suitable means comprising oil cups 42 mounted in each of said sections, said cups being connected to said masses by wicks 43. Each of sections 10 and 11 is suitably recessed to mount said cups for ready access and to cause said wicks to contact the oil pads. Bearing bushings 39 are preferably constructed of porous bronze or similar material so that oil from pads 41 will seep therethrough to the surfaces thereof which engage shaft 17 and thrust washers 40 which are preferably of a hardened metal.

The above-described pump apparatus is adapted to be connected to the drive shaft 44 of a distributor or the like, said shaft, in the form illustrated, extending through the bore of rotor shaft 17 and being drivably connected to the latter shaft at its upper end, as viewed in Figs. 1 and 2, by suitable means, such as a spline and groove arrangement 45. A flange 46 is also preferably splined to the upper end of said drive shaft for rotation therewith and is axially held by a nut 46' threaded on said shaft, said flange being adapted to have a distributor finger or other driven member mounted thereon. A suitable adjustable coupling mechanism 47, for example, of the type illustrated in the Spengler U. S. Patent No. 2,266,283, is incorporated in the lower end of said drive shaft and is adapted to drivably connect the latter to the drive means therefor which may be the crankshaft of an internal combustion engine.

Although rotor 19 may be of standard construction, it is preferably constructed in a novel manner to provide an extremely light but strong structure. In the form illustrated, said rotor is formed in two axial sections 19*a* and 19*b* sepa-

rated along a transverse plane perpendicular to the axis of rotation, said sections being preferably cast and having recesses therein which open in the direction of said transverse plane of separation. The recesses are so arranged that when said sections are secured to each other, said recesses are in substantial alignment and produce completely enclosed chambers 48 between each pair of slots 21 (Fig. 2). To rigidly and permanently secure the sections to each other, the same are welded together along their plane of separation. As a result, a maximum reduction of weight can be effected without reducing the required strength of the rotor or introducing sources of leakage.

There is thus provided novel pump apparatus of the rotary type embodying a novel eccentrically mounted rotor, said apparatus being driven and housed in a novel manner so as to be mounted as a unit on the drive shaft of the apparatus adapted to be supercharged thereby. There is also provided novel lubricating means, air inlet and discharge means and means for mounting the movable parts, whereby the efficient and safe operation of the pump is assured. In addition, the invention comprehends a novel method for forming the rotor of a pump whereby a light, strong and inexpensive structure is produced. Although only a single embodiment of the invention has been illustrated and described, it is to be expressly understood that the invention is not limited thereto. Various changes in the design and arrangement of parts may be made without departing from the spirit and scope of the invention as will now be apparent to those skilled in the art. For a definition of the limits of the invention, reference is had primarily to the appended claims.

What is claimed is:

1. In apparatus of the class described, a housing comprising at least two longitudinally spaced sections, a pump casing comprising end plates and a cylindrical wall member fixed in said housing against rotary movement relative thereto, a rotor shaft extending through said casing and journaled at opposite ends in separate sections of said housing, said shaft being eccentrically mounted in relation to said casing wall member, a rotor concentrically mounted on said shaft for rotation therewith in said casing, thrust means including members fixedly mounted in opposite ends of said rotor and in each of said casing end plates, said members being adapted to engage each other to fix the axial position of said rotor relative to said casing, radially disposed blades slidably mounted in said rotor and adapted to be centrifugally actuated during rotor operation to form pressure chambers with said casing, means including a radial passage in the inner surface of said casing wall member for admitting air into each of said chambers until the latter are substantially at maximum volume, and means including a radial passage in the inner surface of said casing wall member for effecting air discharge from said chambers as the latter approach a minimum volume.

2. In apparatus of the class described, a housing, pump means mounted in said housing and comprising a casing having a port therein, at least one fluid passage in said housing connecting with the interior of said casing through said port, an axially slidable tubular member lining the interior of said passage, and resilient means yieldably pressing an end of said member into fluid-tight engagement with said casing around said port.

3. In a pump means comprising a casing and a rotor mounted for operation in said casing, a shaft on which said rotor is mounted for axial movement relative thereto, thrust rings embedded in the end walls of said rotor with their outer surfaces substantially flush with the outer surfaces of said end walls, and thrust members mounted in the side walls of said casing for slidably engaging said rings to axially position said rotor relative to said casing.

4. In apparatus comprising a housing, a pump casing mounted in said housing and rotor means adapted for rotation in said casing and being constructed and arranged to form a plurality of peripheral pressure chambers in the latter, the combination therewith of means for successively connecting each of said chambers with the exterior of said housing, said last-named means comprising a channel on the inner wall of said casing extending in the path of travel of said rotor, a port connecting said channel to the exterior of said casing, a passage in said housing communicating with said port, and means including a spring-pressed sleeve slidably mounted in said housing and engaged with said casing for rendering the connection between said port and said passage fluid-tight.

5. In apparatus comprising a housing, a pump casing mounted in said housing and including a cylindrical wall member, and rotor means adapted for rotation in said casing and being constructed and arranged to form a plurality of peripheral pressure chambers in the latter, the combination therewith of means for successively connecting each of said chambers with the exterior of said housing, said last-named means comprising an arcuate groove in the inner surface of said casing wall member adapted to successively connect with each of said chambers, a port in said wall member communicating with said groove, a passage in said housing communicating with said port, and yielding means engaged with said casing and extending into said passage for rendering the connection between said port and passage fluid-tight.

6. A fluid pressure pump unit comprising a hollow housing which includes two main sections rigidly secured together, a shaft extending through said housing, a bearing in each of said sections for rotatably supporting said shaft, a cylindrical pump casing surrounding said shaft and clamped between said sections, said shaft being eccentric with respect to the inner wall of said casing, rotor means in said casing connected to said shaft for rotation therewith and axial movement relative thereto, said casing and rotor means being adapted to cooperate during rotation of the latter for compressing gases, and cooperable means fixed on said casing and rotor means for maintaining a safe operating clearance between the ends of the body portion of said rotor means and said casing.

7. A fluid pressure pump unit comprising a hollow housing which includes two main sections rigidly secured together, a shaft extending through said housing, a bearing in each of said sections for rotatably supporting said shaft, a cylindrical pump casing surrounding said shaft and clamped between said sections, said shaft being eccentric with respect to the inner wall of said casing, rotor means in said casing connected to said shaft for rotation therewith and axial movement relative thereto, said casing and rotor

means being adapted to cooperate during rotation of the latter for compressing gases, bearing rings in the ends of said casing closely surrounding said shaft, and hardened thrust rings on opposite ends of the body of said rotor means for engagement with said bearing rings, said thrust rings being embedded and fixed in said rotor body and extending in an axial direction slightly beyond the end surfaces of said rotor body.

8. A fluid pressure pump unit comprising a rotatable shaft a cylindrical pump casing surrounding said shaft, said shaft being eccentric with respect to the inner wall of said casing, means for rotatably supporting said shaft and fixing said casing against axial movement relative to said shaft, rotor means including a body portion mounted in said casing concentric with said shaft and operably connected to the latter for rotation therewith and axial movement relative thereto, said casing and rotor means being adapted during rotation of the latter for compressing gases, and cooperable means fixed on said rotor body and casing for maintaining a safe operating clearance between the ends of said rotor body and the end walls of said casing.

JAKOB R. FREI.

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