May 16, 1933. E. H. DAVIS ET AL 1,909,046

OIL PUMP

Filed April 2, 1930 2 Sheets-Sheet 1

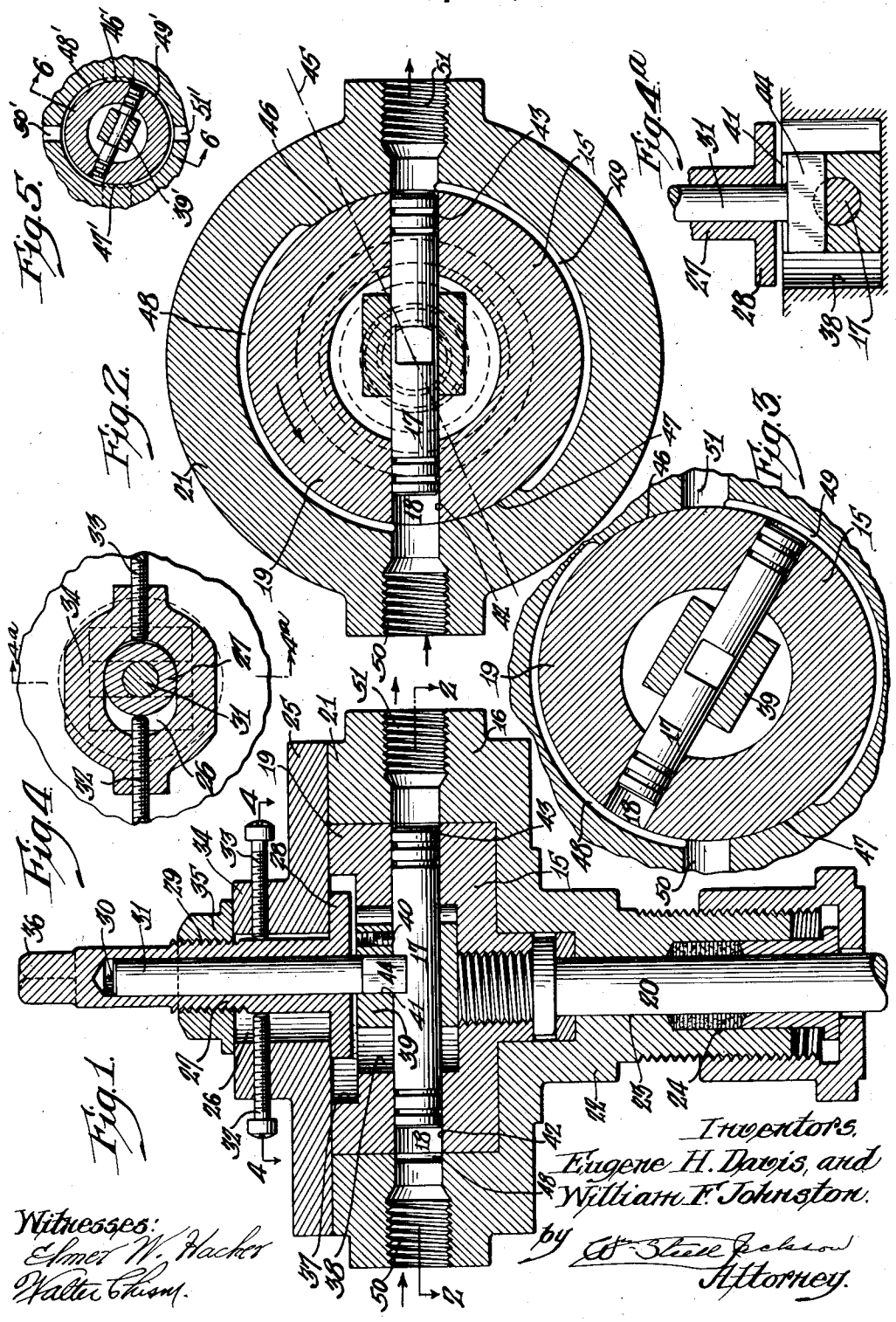

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Fig. 6.

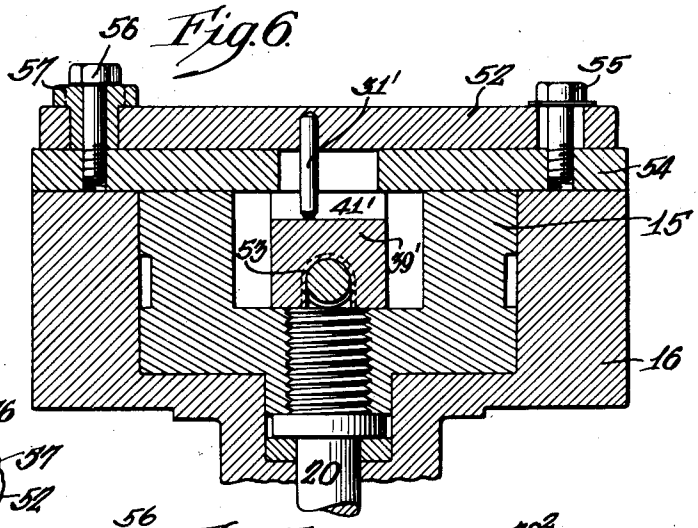


Fig. 6a

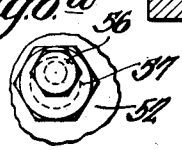


Fig. 7.

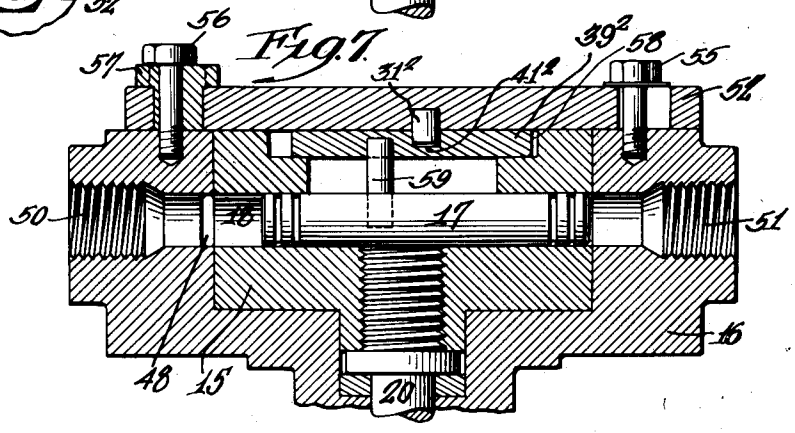
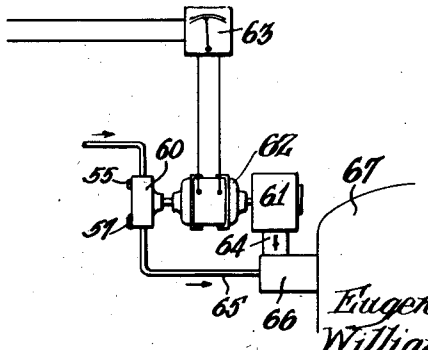


Fig. 8.



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UNITED STATES PATENT OFFICE

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OIL PUMP

Application filed April 2, 1930. Serial No. 440,929.

Our invention relates to a pump believed to have its widest application in supplying fuel oil to oil burners but intended for other applications to which it is adapted, and to an oil burner assembly including the pump.

A purpose of our invention is to provide equipment of the character indicated adapted to easy and inexpensive manufacture and well suited to the needs of service.

A further purpose is to provide a burner assembly adapted to particularly easy simultaneous control of oil and air.

A further purpose is to provide pump equipment of the character indicated adapted to silent operation and free from valves.

A further purpose is to combine a plunger with a cylindrical rotor axially transverse thereto, mounting the plunger in a diametral bore of the rotor and to use the rotor movement to reciprocate the plunger in the bore.

A further purpose is to reciprocate a plunger back and forth along a diametral bore of a rotor cylinder by means of an eccentric connection between the plunger and stationary structure at one end of the cylinder and to provide arcuate inlet and outlet passages between the rotor and its casing intermediate the opposite dead centers of the eccentric, sealed from one another at the dead center positions and when the plunger is moving along the bore respectively open into the increasing and decreasing end spaces of the bore, end spaces that are separated by and at opposite ends of the moving plunger, the plunger being substantially stationary with respect to the bore while the opposite ends are passing across the dead center seals.

A further purpose is to simultaneously connect inlet and outlet passages respectively to opposite ends of a diametral bore through a rotor cylinder during a considerable portion of each rotation of the rotor, reciprocating a plunger inside the bore once during each rotation of the rotor so that the ends of the plunger alternately draw liquid into the bore from the inlet passage and alternately discharge liquid from the bore into the outlet passage, each stroke of the reciprocation simultaneously discharging into the outlet and drawing in liquid from the inlet.

A further purpose is to provide each end of a transversely rotating plunger pump with a conduit connection to an inlet conduit as long as the plunger of the pump is moving along its bore in one direction and with a conduit connection to an outlet conduit as long as it is moving in the reverse direction.

Further purposes will appear in the specification and in the claims.

We have elected to show one main form only of our invention, selecting a main form of pump structure embodying an important feature of our invention with detail modifications and showing diagrammatically an assembly embodying another feature of our invention, selecting a main form and modifications thereof that are practical and efficient in operation and which well illustrate the principles involved.

Figure 1 is a longitudinal section through structure embodying a desirable form of an important detail of our invention.

Figure 2 is a section taken upon the line 2—2 of Figure 1.

Figure 3 is a fragment of Figure 2 but with the rotor in a different position from that shown in Figure 2.

Figure 4 is a detail section taken upon the line 4—4 of Figure 1.

Figure 4*a* is a detail section taken upon the line 4*a*—4*a* of Figure 4.

Figure 5 is a reduced scale view corresponding generally to a portion of Figure 2 but showing a somewhat different form.

Figure 6 is an enlarged section taken upon the line 6—6 of Figure 5.

Figure 6*a* is a fragmentary plan of Figure 6.

Figure 7 is a view corresponding generally to Figure 6 but showing a somewhat different form.

Figure 8 is a diagrammatic assembly showing the mechanism of Figures 1 to 7 combined with a fan, motor and burner and embodying another important feature of our invention.

Like numerals refer to like parts in all figures.

Describing in illustration and not in limitation and referring to the drawings:—

The structure illustrated in Figures 1 to 4*a* inclusive includes a cylindrical rotor 15, stationary supporting and casing structure 16 and a ram or plunger 17 adapted to reciprocate within a diametral bore 18 of the rotor during each rotation of the rotor.

The motor comprises a cylinder 19 rigidly mounted on the end of a shaft 20 driven in any suitable way, not shown.

The stationary structure includes a body 21 casing the outside circumference and one end of the cylinder, and a tubular extension 22 around the rotor shaft, providing the shaft with a bearing at 23 and with a packing gland at 24.

The stationary structure also includes a cover plate 25 that cases the other end of the cylinder, is rigidly fastened to the body 21 and is provided with a slot 26 across the extended axis of the rotor.

In the slot 26 we provide a pin bearing member 27 which is flanged at 28 inside the cover, is externally threaded at 29 and bored at 30 to receive a pin member 31 that has a connection with the ram eccentric with respect to the rotor axis.

The pin bearing member 27 and therefore the pin 31 is adapted to be set to different positions along the slot 26 in order to vary the maximum eccentricity of the pin with respect to the rotor axis, the member 27 being adjusted to the desired position by set screws 32 and 33 that extend into opposite ends of the slot 26 through a boss 34 on the cover member and clamped in set position by a nut 35.

The bearing member 27 is extended and provided with a suitable wrench hold at 36 for use in holding the member from turning when tightening or loosening the nut 35.

The end of the cylinder is cylindrically hollowed at 37 and 38 to provide clearances respectively for the flange 28 at different positions of the bearing member along the slot 26 and for the reciprocation of a ram block 39.

An intermediate portion of the ram extending across the hollow 38 carries the ram block 39 which is fastened to the ram at 40 and slotted in a direction transverse to the length of the ram at 41, the slot optionally extending into the body of the ram.

The opposite ends of the ram reciprocate in the bore portions 42 and 43 through the diametrally opposite portions of the circumferential wall around the hollow 38.

The inner end of the block pin is provided with lateral extensions 44, the T end fitting in the slot 41 of the block 39.

The slot being continuously transverse to the length of the ram permits sliding movement between pin and block at the same time that the pin impels the block and ram to move longitudinally of the bore 18.

It will be seen that the rotation of the rotor causes a reciprocating movement of the ram in its bore, the ram aligning twice during each rotation with a plane through the parallel axes of the rotor and of the pin.

This plane, indicated by the line 45 of Figures 2 and 3, may be called the "dead center" position of the ram, the ram being at opposite ends of its range of movement along the bore 18 and temporarily stationary with respect to the rotor, or on "dead center", when the ram is successively aligning with this line.

We provide a sealing fit between the rotor and its casing at opposite ends of the dead center line 45, as best seen at 46 and 47 and provide arcuate passages 48 and 49 between the rotor and casing intermediate the sealing fits at 46 and 47.

Inlet and outlet ports 50 and 51 connect into the passages 48 and 49 which provide conduit connection between the inlet and outlet ports and the intaking and discharging ends of the ram.

Assuming the direction of rotation to be that of the arrow, the ram begins to recede from the end 42 of the bore and to move toward the end 43 as soon as the ram is carried angularly beyond the dead center line, the movement however being insignificant for small angular movement beyond the dead center line, therefore insignificant while the open ends of the bores are not yet past the arcuate sealing surfaces 46 and 47.

As the open end 43 of the bore is carried along the passage 48 the receding ram draws liquid from the inlet port, while liquid is expelled from the other end of the ram into the passage 49 and thence to the outlet port 51.

By the time the open end 43 has been carried to the end of the passage 48 the stroke of the ram along the bore is substantially over, the reverse stroke taking place as the open end is carried along the passage 49, to end at the dead center line.

A little before the plunger has reached its dead point the open end of the bore is sealing against the sealing surface of the body.

It will be seen that each end of the ram continuously draws liquid out of the passage 48 and of the inlet port 50 while it is open to the passage 48 and that it continuously expels liquid into the passage 49 and outlet port 51 while in connection with the latter passage.

We have illustrated the arcuate passages 48 and 49 between the rotor and casing as comprising grooves in the casing.

Optionally we may make these passages as comprising a continuous groove around the outside of the rotor member as indicated at 48′ and 49′, Figure 5, with portions 46′ and 47′ of the casing filling and sealing the groove for a suitable short distance each side of the dead center diameter 45, in order to rela-

tively seal the passages at the dead center, that is during the angular portion of each rotation during which the ram is substantially without movement along the rotor bore.

For convenience of manufacture the sealing projections may comprise inner ends of inserts through suitable perforations of the casing.

In Figures 1 to 3 we have illustrated the inlet and outlet ports 50 and 51 as into the ends of the inlet and outlet passages 48 and 49.

Obviously however the inlet and outlet ports may connect into the arcuate passages at any point along the length of the passages as indicated in Figure 5 where they connect into an intermediate point of the passage.

The method of using an eccentric connection between stationary supporting structure at an end of the rotor and a plunger carried by the rotor in order to effect reciprocation of the plunger along a bore across the rotor axis may be widely varied and we illustrate three only, of the many different ways of accomplishing this result, in each case showing an easy adjustment of the stroke of the ram by an adjusting of the pin 31 radially of the rotor axis.

In the form of Figure 1 the pin 31 rotates in an adjustable bearing 27 and has a transversely slidable connection with the ram, and there is an ampleness in the areas of the engaging surfaces of the relatively moving members that makes the form particularly desirable from the standpoint of a long life without material wear.

In the embodiment of Figures 5 and 6, the pin 31′ is mounted rigidly with the cover plate 52 that is adapted to be set at positions suitably variant along a diameter of the rotor in order to set the pin at different eccentricities to adjust the length of the stroke of the ram.

As shown an intermediate portion of the ram is recessed around its circumference at 53 to receive and longitudinally interlock with the block 39′ which is transversely slotted at 41′ to receive the inner end of the pin 31′.

The block is loosely mounted between the ram and a removable plate 54 which mounts the plate 52.

The plate 52 is shifted to different positions by suitably loosening the set screws 55 and 56, changing the angular position of an eccentric bushing 57, and retightening the screws.

The accommodation between the axes of the pin and rotor incident to rotation of the rotor is effected by simultaneous relatively perpendicular sliding movements between the plunger and rotor and of the fixed pin 31′ along the slot 41′ of the block.

In the arrangement of Figure 7 the plate 54 of Figure 6 has been omitted, the pin 31^2 rigidly fastened to the adjustable cover plate extends into a slot 41^2 of a block or plate 39^2 that is guided at 58 to maintain the slot 41^2 continuously perpendicular to the ram and slid back and forth along its guideway by a pin 59 having opposite ends in suitable bores of the plate and ram.

While our invention is adapted to different uses, for example being particularly well suited for use with liquid proportions we have anticipated that one of its widest applications will be with burners and one portion of our invention comprises a burner assembly that provides a particularly easy simultaneous control of the air and oil to the burner.

We have illustrated this feature of our invention diagrammatically in Figure 8.

We mount the pump and fan 60 and 61 respectively on a common shaft, desirably that of a motor 62.

The motor is provided with any suitable speed control at 63 and the fan and pump are connected at 64 and 65 to the burner 66 which delivers its mixture of oil and air into the heater 67.

Adjustment of the speed control changes the speed of the motor and the quantities of air and oil going to the burner without changing the ratio between the air and oil which remains the same for widely different rates of delivery.

The great advantage of this arrangement will be obvious as it adapts the heated furnace to easy adjustment at a single regulator, the speed control of the motor or of the shaft common to the pump and fan.

From the illustrations of Figures 5–8 it will be evident that not only the pump may be used for a great variety of purposes but that the detail of the pump itself may be greatly varied and that the language of the specification and claims is intended to be interpreted with corresponding breadth.

In view of our invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of our invention without copying the structure shown, and we, therefore, claim all such in so far as they fall within the reasonable spirit and scope of our invention.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In a device of the character indicated, a casing having a cylindrical opening, a rotor therein hollow for some distance inwardly from one end, the casing and the rotor fitting throughout portions of the circumference and being spaced along the remainder of the circumference for inlet and outlet fluid connection, a shaft connected to the rotor, a piston movable transversely to the shaft axis in a bore in the rotor and extending trans-

versely across the hollow thereof, a block within the hollow of the rotor, enclosing the piston and engaging the rotor at the bottom of the bore, longitudinally movable and angularly locked with respect thereto, a pin eccentric to the shaft having a transversely sliding engagement with the block and with the piston and angularly locked with respect to the piston and with respect to the block, guiding means for the pin providing movement of adjustment transverse to the pin length and means for moving and holding the pin to adjust the eccentricity of the pin with respect to the shaft.

2. In a device of the character indicated, a casing having a cylindrical opening, a rotor therein hollow for some distance inwardly from one end and having alined and diametrally opposite bores into the hollow, the casing and the rotor fitting throughout portions of the circumference and being spaced along the remainder of the circumference for inlet and outlet fluid connections, a shaft connected to the rotor axially thereof and from the rotor end away from the hollow, a piston extending across the said hollow into the bores and movable therein transversely to the shaft axis, a pin parallel and eccentric to the shaft, angularly locked with respect to the rotor and having a transversely sliding engagement with the piston, the pin rotating with the rotor and longitudinally reciprocating the piston in the bores, the pin bearing having an inward flange across the perforation and toward its outer end externally threaded, a nut on the threaded end of the bearing clamping the bearing to the plate between the nut and flange and a screw adjustment between the plate and bearing operating in a direction alining with the said shaft diameter.

3. In a device of the character indicated, a casing having a cylindrical opening, a rotor therein hollow for some distance inwardly from one end and having alined and diametrally opposite bores into the hollow, the casing and the rotor fitting throughout portions of the circumference and being spaced along the remainder of the circumference for inlet and outlet fluid connections, a shaft connected to the rotor axially thereof and from the rotor end away from the hollow, a piston extending across the said hollow into the bores and movable therein transversely to the shaft axis, a block sliding on the rotor at the bottom of the bore, within the hollow and enclosing the piston, longitudinally movable and angularly locked with respect thereto, and a pin eccentric to the shaft having a transversely sliding engagement with the block and with the piston.

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