Oct. 13, 1936. I. M. HAYWARD 2,056,936

MOTOR PUMP UNIT

Filed June 1, 1934 2 Sheets-Sheet 1

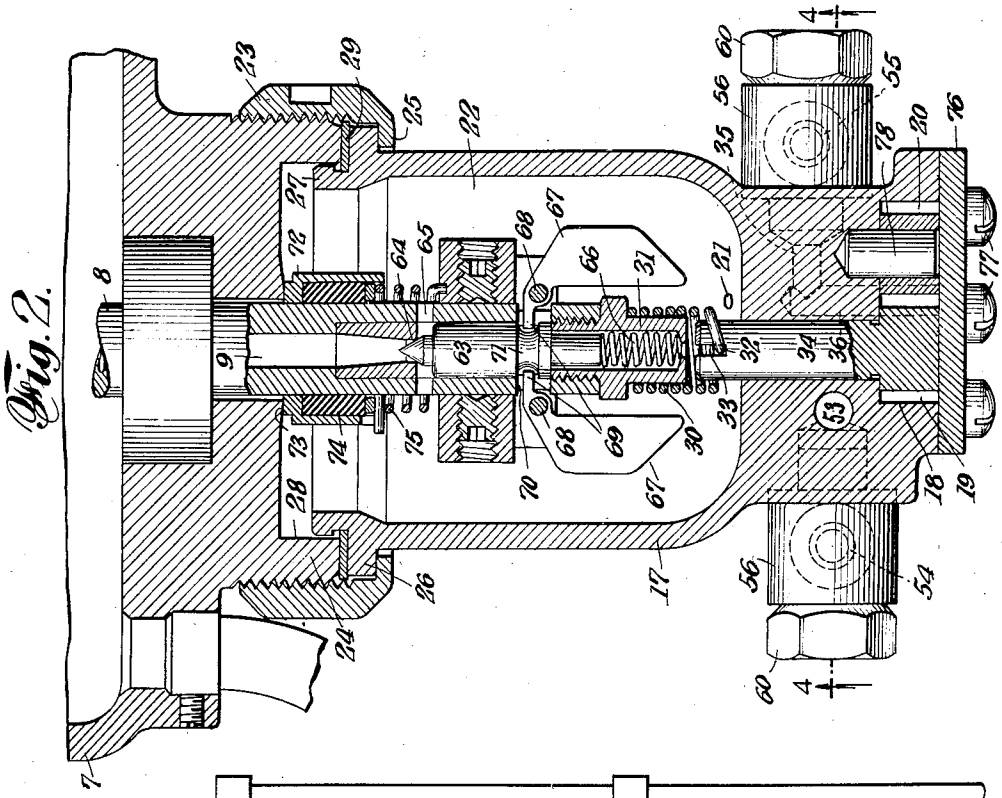

Fig. 2.

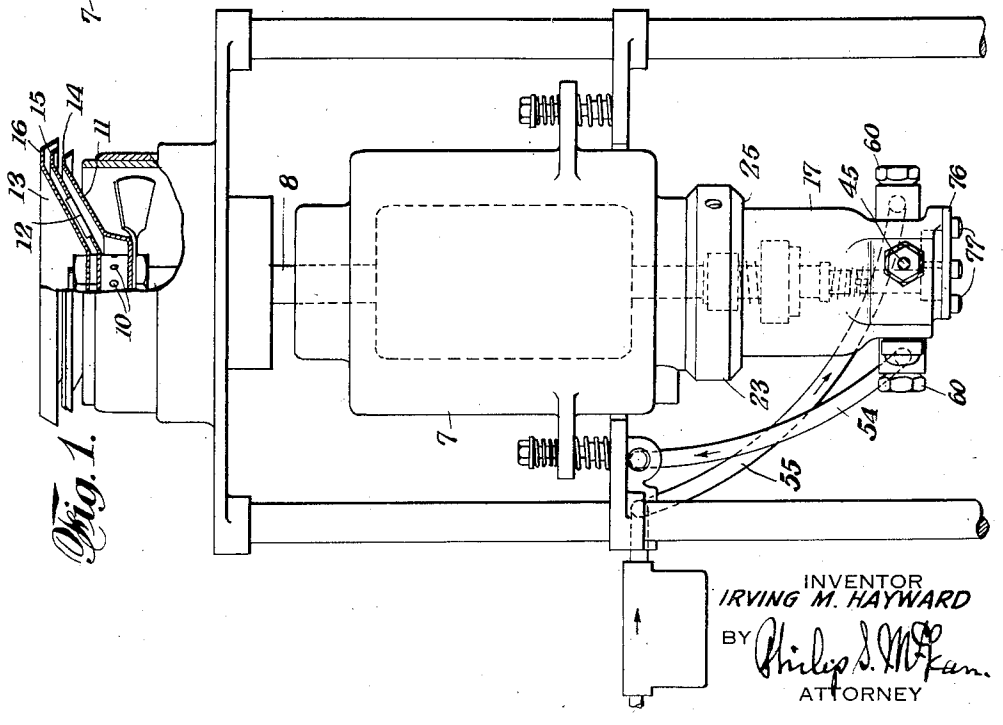

Fig. 1.

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MOTOR PUMP UNIT

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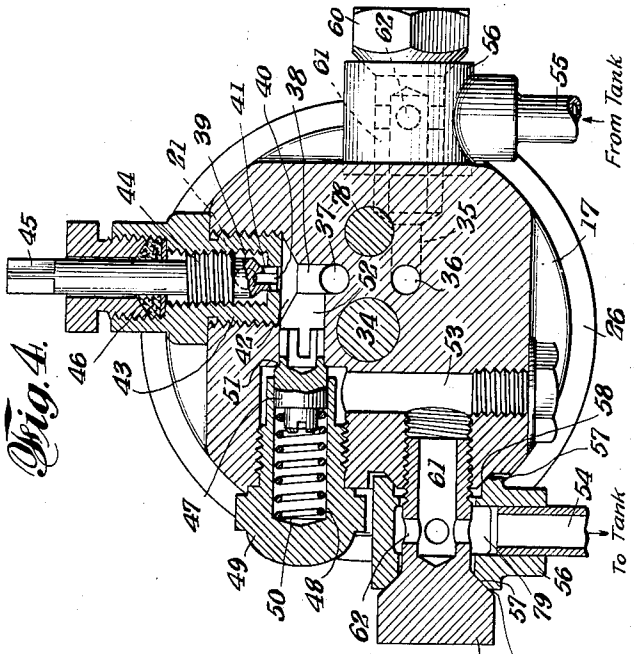


Fig. 4.

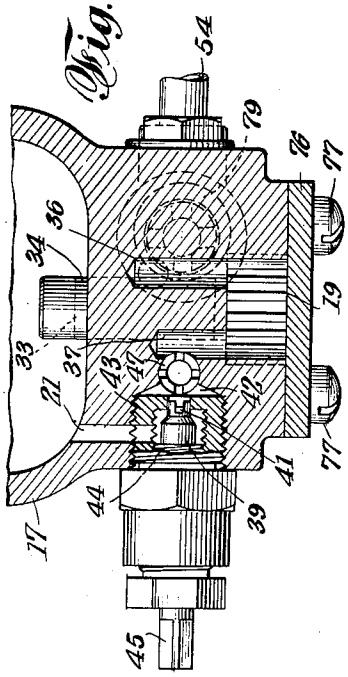

Fig. 5.

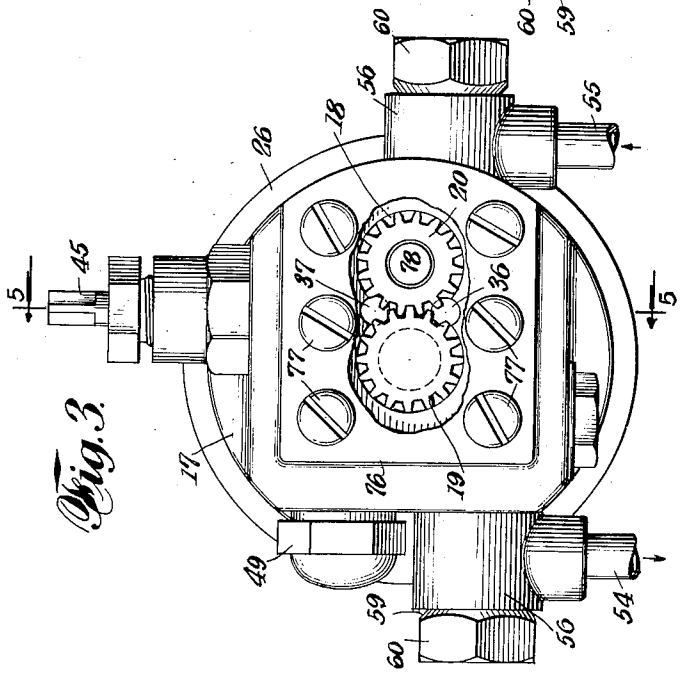

Fig. 3.

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# UNITED STATES PATENT OFFICE

2,056,936

## MOTOR-PUMP UNIT

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Application June 1, 1934, Serial No. 728,502

2 Claims. (Cl. 10?—87)

This invention relates particularly to oil burners of the rotary atomizer type and in which an upright tubular motor shaft serves as an oil conduit to an atomizer head on the upper end of such shaft, as disclosed in Patents 1,928,688 and 1,935,318.

Special objects of the present invention are to provide a practical and efficient pump for forcing the oil up through the motor shaft, which will be small in size and compactly combined with the burner structure, so as not to add objectionable size or weight, which will be quiet in operation and which can be readily connected to and disconnected from the motor shaft and in which any discrepancies in alignment will automatically be taken care of.

Further objects of the invention are to effect the coupling of the pump with the motor in such a way as to leave the motor shaft free for self-adjusting movements under magnetic pull of the armature, to cushion the drive from motor to pump and to save the motor from injury in case of accidental stoppage of the pump.

Other objects of the invention and the novel features of construction, combinations and relations of parts by which all objects are attained are hereinafter described, illustrated in the accompanying drawings and broadly covered in the claims.

The drawings show by way of illustration one practical commercial embodiment of the invention and it will be understood that the structure may be modified and changed with respect to this particular disclosure all within the true intent and broad scope of the claims.

Fig. 1 is a broken part vertical sectional view of the burner.

Fig. 2 is an enlarged broken sectional detail view of the lower portion of the burner unit showing in particular the pump flexibly coupled to the lower end of the motor shaft.

Fig. 3 is a bottom plan view with the pump cover broken away to show the cooperating gear elements of the pump.

Fig. 4 is a broken horizontal sectional view as on substantially the plane of line 4—4 of Fig. 2.

Fig. 5 is a broken vertical sectional view as on substantially the plane of line 5—5 of Fig. 3.

The burner shown consists of an electric motor 7 having a vertical armature shaft 8 of tubular form to provide an oil passage 9 upward therethrough. At the upper end of this shaft, the oil escapes through lateral passages 10 to an atomizer head shown as consisting of spaced discs or plates 11, 12, 13, the lower disc having a sharp atomizing shoulder 14 at the rim of the same and the intermediate and upper discs having overstanding rim portions 15, 16.

Oil is supplied to the lower end of the tubular motor shaft by a small pump unit consisting in the illustration of a pump body 17, having a pump chamber 18 at the bottom of the same, containing intermeshing pump gears 19, 20, which force the oil upward through a passage 21 into a well or chamber 22 in the top of the pump body forming an enclosure about the lower end of the motor shaft.

In the present disclosure, this pump unit is removably secured to the motor unit and in rotatable or angularly adjustable relation by means of a ring 23, which screws onto a hub extension 24 at the lower end of the motor casing, this screw ring having a flange 25 engaging under an outstanding annular flange 26 at the upper end of the pump well to seal the latter against the lower end of the motor casing. The pump well is shown as having an upstanding guide flange 27 at its upper end entering within a circular seat 28 in the lower end of the motor frame or casing and a packing washer is indicated at 29 between the flange of the pump well and the end of the screw hub or boss 24, to assure a liquid tight seal between the motor and pump unit. Loosening the screw ring 23 permits the pump unit being shifted angularly with respect to the motor unit and upon fully unscrewing this ring, the pump unit may be "dropped" without disturbing the motor structure.

Drive from the motor to the pump is effected in the illustration by means of a coil spring 30, surrounding the lower end portion of a plug 31 screwed into and in effect forming part of the motor shaft and shown as having its end 32, turned into a slot 33, in the shaft 34, of pump gear 19. This shaft is in alignment with the motor shaft and projects up through the bottom of the pump well into close relation with the lower end of the motor shaft thereby enabling the pump and motor shafts being readily coupled and uncoupled.

A special feature of the coupling spring is that it surrounds the motor shaft closely enough to grip the same and is coiled so that with rotation of the motor shaft, it will wrap itself the more closely on that shaft and hence automatically grip the shaft sufficiently for pump drive purposes, without actually being keyed to the shaft. This engagement while sufficient for all normal pump driving purposes, preferably is such that

the spring will slip on the shaft, if the pump should be stopped by an obstruction and thus save the motor from burning out or being otherwise injured. This method of coupling also is an advantage in the assembling and disconnection of the parts, enabling the spring to be placed either on the lower end of the motor shaft or on the upper end of the pump shaft and the parts to be then connected by bringing them together, so as to carry the free or open end of the spring over the other shaft member.

Any misalignment is automatically absorbed in this spring coupling and this serves also as a vibration damper. Because of the fact that misalignment is automatically compensated, the interfitting parts of the motor and pump structures need not be machined with such absolute precision. This also requires less care in securing the pump to the motor and in adjusting it in various angular relations, for slight resulting inaccuracies will automatically be taken care of by the spring coupling between motor and pump.

The necessary pump passages are provided in the pump body as follows:

An inlet passage **35** in one side of the pump body opens into a vertical passage **36**, at one side of the meshing teeth of the pump gears and from the opposite meshing side of the gears a passage **37** leads upward and by way of lateral passage **38** past a metering valve **39** to the pump well inlet **21**.

The metering valve is shown particularly in Figs. 4 and 5 as having a hollow cylindrical inner end **40** with slots **41** of different length cut in the sides of the same, this slotted cylindrical portion extending into passage **42**, in the inner end of a screw plug **43**, set in the side of the pump body. The movable element **39** of the metering valve is shown as having a screw mounting at **44** in the plug body **43** and as having an external adjusting stem **45**, suitably packed by gland **46**. It will be evident that by turning this valve element in or out, the oil flow may be accurately metered by the flow throttling slots **41** of different lengths.

Excess pump flow is automatically by-passed in the illustration by a relief valve indicated at **47**, Fig. 4, operating in the cylindrical bore **48** of a screw plug **49** set in the side of the pump body and thrust by spring **50** in said plug toward a valve seat **51** at the end of a lateral passage **52** taken off from the pump chamber outlet **37**. The unseating of this valve, it will be observed, opens flow from the pump chamber outlet passage **37** to a passage **53** in communication with a relief conduit **54**. This relief conduit may carry the excess liquid back to storage.

The supply line **55** and the return line **54** are connected to the pump base by swivel couplings consisting in each instance of a collar **56** on the end of the line having bevel seats **57** in its opposite ends engaging one an outwardly beveled shoulder **58** on the side of the pump body and the other engaged by an inwardly beveled shoulder **59** on the head **60** of a hollow screw bolt **61** set into the side of the pump body and perforated at **62**, in line with the surrounding sleeve portion. Loosening these bolts permits the supply and return lines to be shifted in different angular relations and tightening these bolts, effects the sealing of these lines to the pump body in such selected angular relations.

Flow of oil from the pump well into the tubular motor shaft is governed in the illustration by a valve **63**, slidingly guided in the lower end of the motor shaft for cooperation with the valve seat **64**. The shaft is shown as having side ports **65** opening to this valve seat and the valve is shown as thrust toward the seat by spring **66**. Governor weights **67**, pivotally carried by the shaft at **68**, and having arms or lugs **69** extending through slots **70** in the shaft into a groove **71** in the valve, operate to hold the valve open while the motor is running and permit the valve to close when the motor stops or slows down below a proper operating speed. The stopping of the motor therefore effects an automatic closing of the hollow motor shaft and hence a sealing of the liquid well above the pump. This liquid is therefore trapped in the well and the pump is thus kept "primed" and no glands or stuffing boxes are necessary. The elimination of packing is a distinct advantage, enabling the pump to be operated with very little power and permitting use of the same motor which heretofore was only required to operate the atomizer.

The shaft is sealed in the illustration by a special rotary seal consisting of a cup **72** surrounding the shaft and having a rotary sealing engagement with shoulder **73** at the lower end of the motor casing, said cup containing compressible packing **74**, acted on by spring **75**. This packing seals the cup to the shaft, permitting sliding movements of the shaft therethrough, while the cup remains in rotary sealing contact with the motor frame. Consequently, the shaft may lift with the magnetic pull on the armature in starting and may drop back on cessation of such magnetic pull, without breaking the seal where the shaft passes up out of the pump well.

A special advantage in constructing the pump as a unit separate from the motor and coupling the two by a longitudinally extensible and contractible connection such as illustrated at **30**, Fig. 2, is that the armature of the motor is left free to find its normal magnetic center, so that it may operate at best efficiency without hindrance from the pump. Conversely, the pump is not subjected to undue wear, because of any armature movements of the motor shaft.

The pump elements, that is, the gears **19**, **20**, in the disclosure are made so that they may be quickly removed without disturbing other parts This is effected by forming the pump chamber **18** directly in the bottom of the pump body and closing it by a bottom plate **76**, holding the pump gears up in place and removably secured by screws or bolts **77**.

When this bottom plate is removed, it will be seen that the center gear with its shaft **34**, can drop down out of the pump body and that the companion gear **20**, can drop down off of its supporting stub shaft **78**.

Another feature of the structure last described is that the gears are made flush with the parting line between the pump body and cover plate and that the latter is flat, so that if the gears or the bottom plate wear, the bottom of the pump body and the bottom plate may be "lapped" down until the gears will again stand in flush relation and hence operate at best efficiency.

An additional feature of the spring pump coupling is that it permits endwise disconnection of pump shaft **34**. Thus when cover plate **76** is removed, the coupling spring **30** will have a tendency to force the pump shaft downward. The downward movement of this spring will be limited by it contacting with the bottom of the pump well. The spring thus will be stopped at this point, but the pump gear shaft can slide free, the slotted portion **33** at the upper end of

the shaft readily releasing the diametrically bent end portion **32**, at the lower end of the spring.

The inclusion of the metering valve and the bypass valve both in the body of the pump is advantageous for several reasons, bringing these parts close to the pump chamber, enabling all adjustments to be made at the pump and making them all part of the complete pump unit. The pump body is of relatively small diameter, permitting, before the several bolts are screwed into the sides of the same (Fig. 2), the screw ring **23** to be slipped thereover into position engaging the supporting flange **26**, at the top of the well. The swiveled inlet and outlet couplings at opposite sides of the pump body enable the supply and return connections to be made at the best or most convenient angles and the relatively rotatable support of the pump structure from the motor enables angular adjustments of the entire pump structure about a vertical axis to be readily made.

The gear form of pump shown occupies but small space and is simple and effective for the purpose. This particular form of pump also is quiet in operation. By making the gear faces long enough as in Figs. 2 and 5, sufficient pumping capacity can be gained to get this form of pump within a relatively small diameter pump body. The oil is admitted to the pump chamber downwardly through vertical passage **36**, and this is a further factor in keeping the pump properly primed. While for reasons stated the gear type of pump is preferred, it is possible that other forms such as sliding blade types and the like may be substituted.

The adjustable coupling sleeve **56**, for the oil service and return lines are indicated in Figs. 4 and 5 as having the chambers **79** therein as eccentrically disposed with respect to the end seats **57**, and hence with respect to the enclosed mounting bolts **61**, such eccentricity being arranged with the larger offset toward the fuel lines **54**, **55**. This equalizes flow through the ports **62**, in the sides of the hollow bolts giving the greatest clearance where the maximum flow must occur, namely, at the piping side of the coupling sleeve. The bolts **61** which bind these coupling sleeves in place being extended horizontally into the pump body from opposite sides are readily accessible at the front of the burner, being in convenient position for easy operation by a straight wrench or similar tool. The governor valve which closes automatically when the motor shuts down keeps the pump primed and eliminates any need for check valves, and the rotary seal by maintaining a constant seal about the shaft prevents air being sucked in which would break the priming of the pump.

What is claimed is:

1. In combination, an electric motor, comprising a motor casing and an upright tubular shaft vertically shiftable therein in the operation of the motor, said shaft having an inlet at the lower end of the same, below the motor casing, a pump body having a liquid well in the top of the same in sealed engagement with the lower end of the motor casing about said shaft, said pump body having a pump chamber, a pumping element operating in said chamber and having a shaft projecting upwardly therefrom into said liquid well in alignment with but spaced from the lower end of the tubular motor shaft, a coiled spring engaged over the opposed separated ends of said motor and pump shafts and having a frictional slip engagement with said motor shaft, said spring being coiled to wrap closer about the motor shaft in the rotation of said shaft and having a sliding driving connection with the pump shaft and axially extensible and contractible in accordance with the vertical movements of the motor shaft, a self-adjusting rotary seal between the motor shaft and the bottom of the motor casing automatically adjustable to he vertical shifting of the motor shaft, a liquid inlet to the pump chamber in the pump body and a liquid outlet from said pump chamber to said well in the top of the pump body sealed as described to the motor casing about said vertically shifting tubular motor shaft, said pump chamber being formed in the bottom of the pump body and including a removable cover plate holding the pump element in position and whereby upon removal of such cover plate, the pump element may be slipped downwardly out of the pump body with the coupling spring remaining in the pump well in position for reengagement by the pump shaft when the pumping element is replaced.

2. In combination, an electric motor, comprising a motor casing and an upright tubular shaft operating therein and having an inlet below the bottom of the motor casing, the bottom portion of said motor casing having a screw-threaded boss surrounding the projecting portion of the motor shaft, a pump body having a liquid well in the top of the same in sealing engagement with said boss and provided with an external flange, a screw ring engaged with said screw-threaded boss and having engagement with the flange of the pump well to removably secure the pump body in angularly adjustable, dependent relation to the bottom of the motor casing, the pump body having a pump chamber in the bottom portion of the same provided with an automatic pressure relief valve and with a valved passage communicating with the pump well, a pumping element operating in said chamber and having a shaft extending up into the well in alignment with but spaced from the lower end of the motor shaft, a coiled spring engaged over the opposing ends of the motor shaft and pump shaft and having a frictional slip connection with one of said shafts and an endwise separable connection with the other of said shafts and a liquid supply connection entered through the side of the pump body to the pump chamber therein.

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