July 28, 1936. E. F. LOWEKE 2,049,211

VACUUM PUMP

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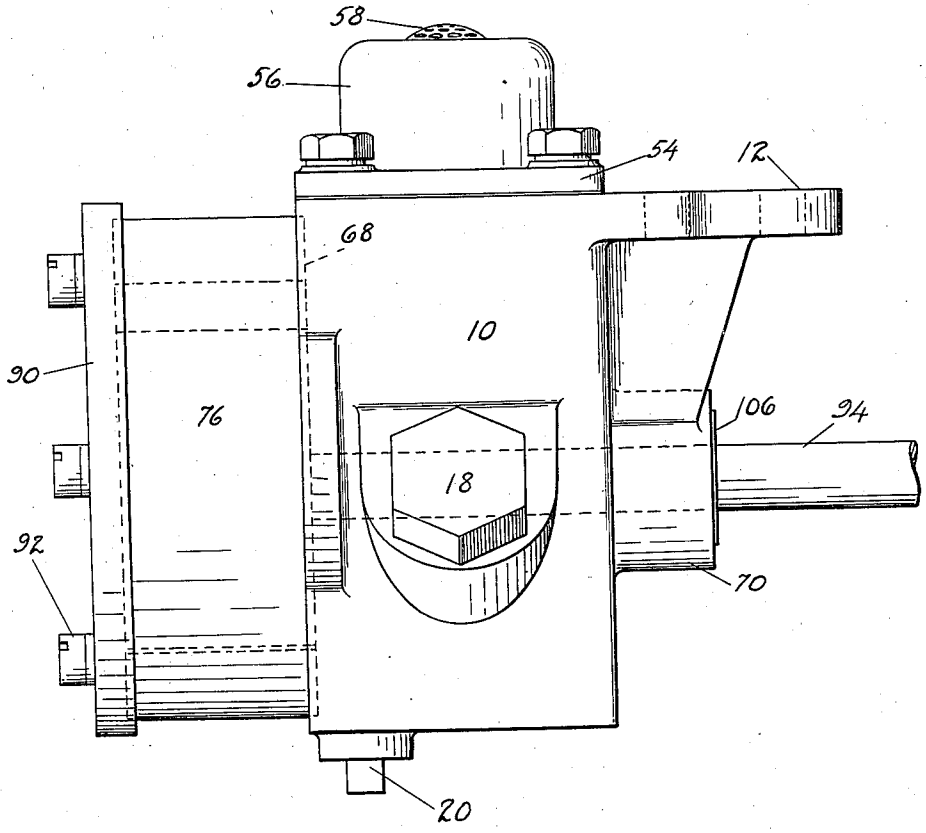


Fig. 1

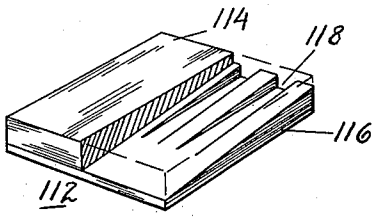


Fig. 6

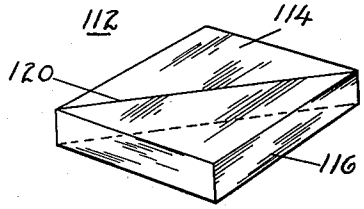


Fig. 7

INVENTOR.

ERWIN F. LOWEKE

BY O. H. Fowler

ATTORNEY.

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Fig. 3

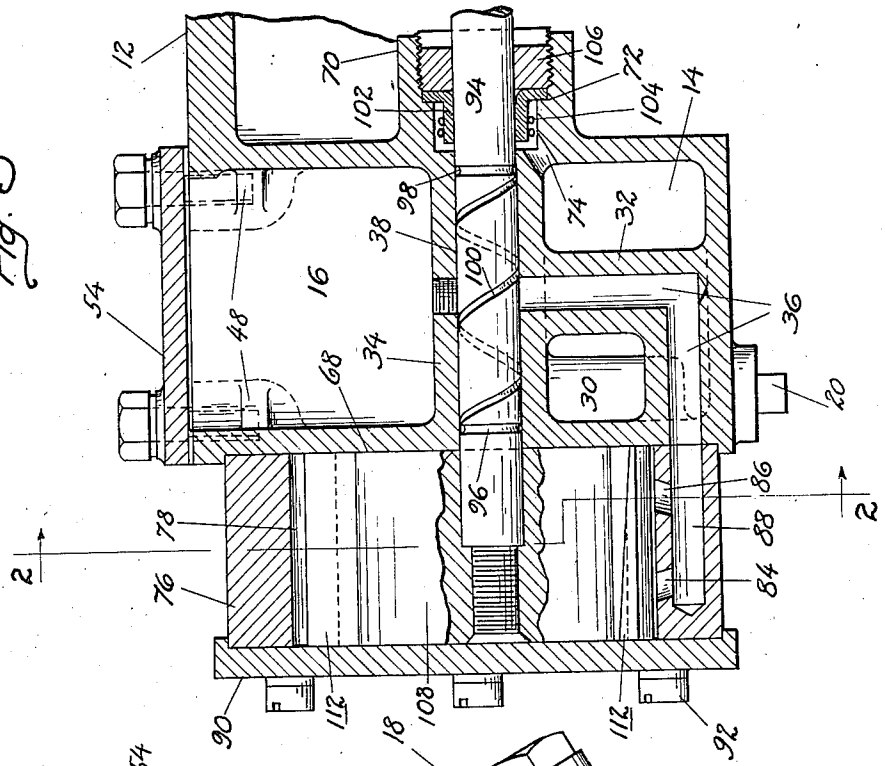
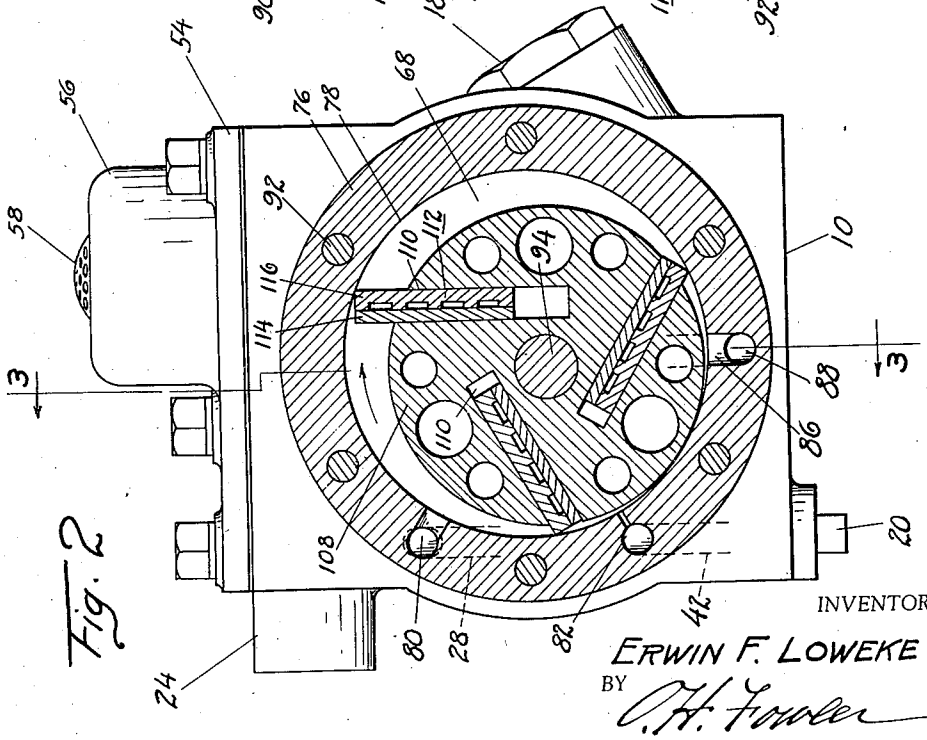


Fig. 2



INVENTOR.

ERWIN F. LOWEKE

BY C. H. Fowler

ATTORNEY.

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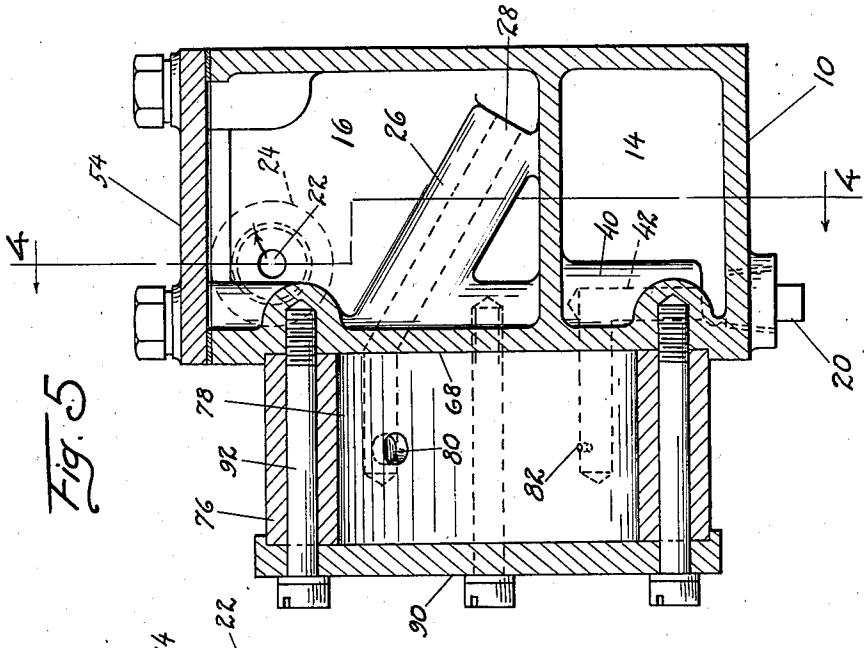


Fig. 5

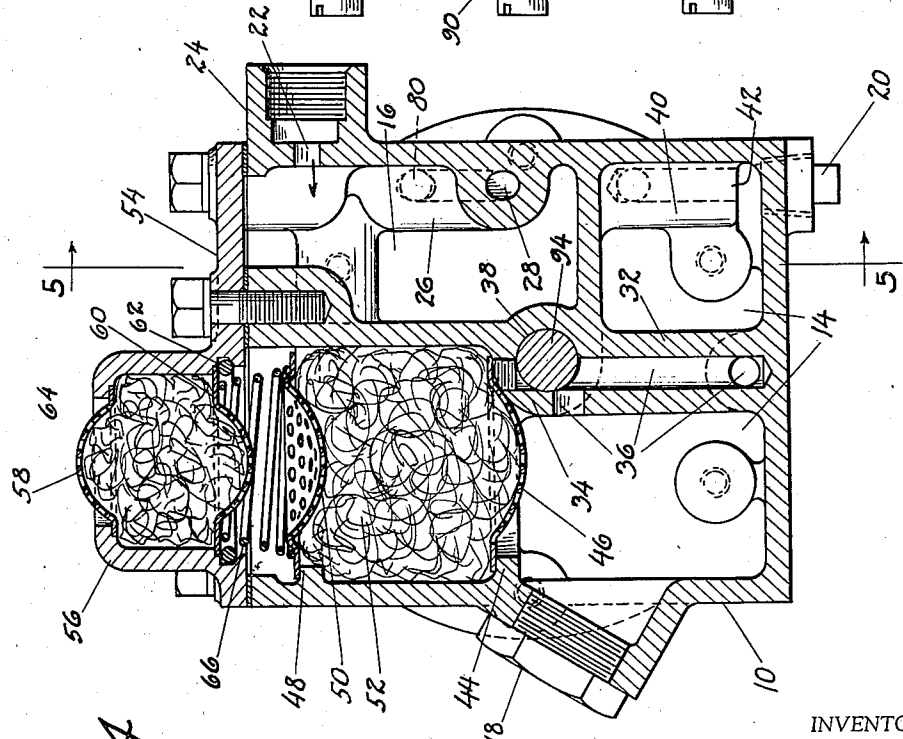


Fig. 4

INVENTOR.

ERWIN F. LOWEKE

BY C. H. Fowler

ATTORNEY.

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UNITED STATES PATENT OFFICE

2,049,211

VACUUM PUMP

Erwin F. Loweke, Detroit, Mich., assignor to Hydraulic Brake Company, Detroit, Mich., a corporation of California

Application May 11, 1933, Serial No. 670,613

3 Claims. (Cl. 230—207)

This invention relates to pumps and more particularly to vacuum pumps of the rotary type.

Broadly the invention comprehends a vacuum pump having one rotating element eccentrically located in a suitable casing and provided with a plurality of blades, free to slide tangentially with respect to the rotor. Because of the frictional engagement of the blades with the casing and their tangential relation to the rotor, there is a tendency to draw the blades outward rather than to move them outward by centrifugal force. The blades are preferably formed in two parts, one slidable upon the other, to effectively take up clearance between the blades and the wall of the casing.

Associated with the pump is a casing including an oil reservoir and an air chamber and passages leading from the reservoir and chamber, respectively, to the pump. The chamber is adapted to be connected to pipe lines or a chamber to be evacuated, and air and oil are drawn concurrently from the chamber and reservoir, respectively, into the pump casing and discharged therefrom into the reservoir, which is provided with means for extracting the oil from the air preparatory to discharging the air to the atmosphere.

An object of the invention is to provide a vacuum pump comprising a single rotor having blades movable tangentially thereto.

Another object of the invention is to provide a vacuum pump including a single rotor having blades movable tangentially thereto, each blade being formed of two parts, slidable one upon the other to take up clearance.

Another object of the invention is to provide a blade for a rotor including two parts, one slidable on the other.

Another object of the invention is to provide a blade for a rotor comprising two wedge shaped members, one slidable on the other, with means for reducing friction between the members.

A further object of the invention is to provide a vacuum pump including a single rotor provided with a plurality of blades, means for feeding air and oil to the pump concurrently, and means for discharging the air and oil from the pump including means for separating the oil from the air.

Yet a further object of the invention is to provide a vacuum pump including a single rotor having a plurality of blades arranged to move tangentially thereto, a casing associated with the pump including an oil reservoir, and an air chamber and passages leading therefrom to the pump, a passage leading from the pump to the reservoir, and means in the reservoir for extracting the oil from the air prior to discharging the air to the atmosphere.

Other objects and structural details will appear from the subjoined description taken in connection with the drawings forming a part of this specification, and in which,—

Figure 1 is a side elevation of a pump embodying the invention;

Figure 2 is a vertical sectional view substantially on line 2—2, Figure 3;

Figure 3 is a sectional view substantially on line 3—3, Figure 2;

Figure 4 is a sectional view substantially on line 4—4, Figure 5;

Figure 5 is a sectional view substantially on line 5—5, Figure 4;

Figure 6 is a perspective view of one of the blades of the pump, and

Figure 7 is a perspective view of a modification of the blades.

Referring to the drawings for more specific details of the invention, 10 represents a casing having an exterior flange 12 for attaching the casing to a suitable support. The casing includes a reservoir 14 and a chamber 16 open at the top of the casing. The reservoir has a filling opening closed by a plug 18, and a drain opening closed by a plug 20. The chamber 16 has adjacent its top an air inlet port 22 communicating with a sleeve 24 formed on the wall of the chamber and internally threaded for the reception of a conduit which may lead to a chamber to be evacuated, and arranged within the chamber on the side wall thereof is a boss 26 extending at an incline from the bottom of the chamber near the back wall to the front wall. This boss is bored to provide a passage 28 extending through the front wall of the chamber.

As shown, the reservoir has formed in the bottom thereof a boss 30 extending from the front wall of the reservoir to substantially the center of the reservoir where it terminates in a perpendicular boss 32, the upper end of which is integral with a transverse boss 34 connecting the front and back walls of the reservoir. The bosses 30 and 32 are bored to provide a passage 36 extending through the front wall of the reservoir and communicating with the interior of the reservoir, and the boss 34 has a bore 38 extending through the front and back walls of the reservoir and intersecting the passage 36. The reservoir also has formed therein a boss 40 bored to provide a passage 42 leading from the

interior of the reservoir through the front wall of the reservoir.

The reservoir has formed therein immediately above the filling opening a shoulder 44 providing a support for a perforated diaphragm or baffle plate 46, preferably concave, and a shoulder 48 adjacent the top of the reservoir providing a support for a perforated diaphragm or baffle plate 50, also concave. The space in the reservoir between the baffle plates 46 and 50 is filled with suitably absorbent material 52, the purpose of which will hereinafter appear.

The reservoir 14 and the chamber 16 are closed as by a cover plate 54. The plate has a dome 56 arranged immediately above the reservoir. The top of the dome has an opening in which is fitted a perforated convex diaphragm or baffle plate 58, and fitted in the dome at the base thereof is a perforated concave diaphragm or baffle plate 60 secured against displacement by a lock ring 62. The space between the diaphragms 58 and 60 is filled with a suitably absorbent material 64, and arranged between the diaphragms 50 and 60 is a coil spring 66 for retaining the diaphragm 50 on the shoulder 48.

The front or face of the casing is machined to provide a smooth, polished, circular, countersunk surface 68 arranged eccentrically to the bore 38. Formed on the back of the casing concentric to the bore 38 is a sleeve 70 having a double diametral bore providing an internal shoulder 72, and a duct 74 provides a communication between the sleeve and the reservoir 14.

Fitted on the face of the casing is a cylindrical pump casing 76 providing a chamber 78. The casing 76 has in its wall an air inlet port 80 communicating with the air passage 28 leading from the bottom of the chamber 16 and an oil inlet port 82 communicating with the oil passage 42 leading from the bottom of the reservoir. The casing 76 also has in its wall outlet ports 84 and 86 and a connecting passage 88 communicating with the passage 36 leading to the reservoir. These outlet ports are for the oil, the air and the airified oil. The pump chamber is provided with a cover plate 90, and bolts 92 threaded in the wall of the casing 10 pass through the wall of the casing 76 and the cover plate 90 to secure these elements in position.

Positioned for rotation in the bore 38 is a shaft 94 provided with spaced circumferential grooves 96 and 98 connected by a spiral groove 100. The shaft has thereon an oil retaining washer 102 suitably held in close engagement with the shaft as by a split ring 104. The oil retaining washer is secured on the shoulder 72 in the sleeve 70 by a collar 106 sleeved on the shaft and threaded into the sleeve 70.

The shaft 94 is adapted to be driven by any suitable motive power, and threaded on the free end of the shaft within the chamber 78 is a rotor 108 preferably drilled parallel to its axis to lighten the structure. The rotor is concentric with respect to the shaft 94 and is eccentrically positioned in the chamber, and the respective faces of the rotor fit snugly against the faces 68 on the casing and the back of the cover plate 90 on the chamber.

The rotor has a plurality of slots 110 arranged tangentially to the axis of the rotor, and slidable in the slots are blades 112. The arrangement of the slots in the rotor is such that due to the direction of rotation of the rotor and frictional engagement of the outer ends of the blades with the wall of the pump chamber, sufficient drag is imposed on the blades to draw them outwardly rather than to cause outward movement due to centrifugal force.

The blades 112 are preferably made in two parts, 114 and 116, slidable one upon the other to take up clearance between the blades and the end walls of the pump chamber. The preferred type of blade includes two wedge shaped members arranged in reverse position and flat one against the other. In this type one of the members is preferably grooved or channeled as at 118 to reduce friction. In another desirable type of blade, shown in Figure 7, a rectangular member is cut diagonally at 120 and assembled with the respective diagonal edges abutting one another.

In operation, assuming that the pump is properly installed and filled with oil to the level of the filling opening, upon movement of the rotor 108 in the direction indicated by the arrow, air is drawn in through the port 22, the chamber 16, the passage 28, and the port 80 to the pump chamber, and simultaneously therewith oil is drawn from the reservoir 14 through the passage 42 and the port 82 to the pump chamber where it serves to cool and lubricate the rotor, the rotor blades, and the pump chamber, and to provide a seal between the blades and the chamber. The air and oil and the aerated oil is exhausted from the pump chamber through the ports 84 and 86, the connecting passage 88 and the passage 36 to the reservoir. As the oil is exhausted through the passage 36 it is forced against the shaft 94, and a small portion of the oil is caught up by the spiral groove 100 to lubricate the shaft. Excess oil which may pass beyond the circumferential groove 98 in the shaft and into the sleeve 70 is returned to the reservoir through the duct 74.

The oil returning to the reservoir through the passage 36 drops to the level of the oil in the reservoir and the air and aerated oil passes upward through the diaphragm or baffle plate 46, the diaphragm or baffle plate 50, and the absorbing material between these members, where the heavier particles of oil are extracted from the air and seep downward through the absorption material into the reservoir. The finer or light particles of oil in the air are extracted as the air is forced through the space above the diaphragm 50 against the diaphragm 60, and through the diaphragms or baffle plates 58 and 60, and absorption material 64 between these plates.

Due to a differential pressure in the reservoir 14 and the chamber 16 and vacuum line connected to the chamber, and to a tendency of this pressure to equalize itself upon stopping the pump, oil is drawn from the reservoir 14 through the pump to the chamber 16 where it is trapped and thus prevented from entering the vacuum line. Upon subsequent operations of the pump air is drawn through the port 22 and evacuates the oil from the chamber 16 and circulates it back through the pump to the reservoir 14.

Although this invention has been described with certain specific embodiments, the principles involved are susceptible of numerous other applications that will readily occur to persons skilled in the art. The invention is, therefore, to be limited by the scope of the appended claims.

Having thus described the various features of the invention what I claim as new and desire to secure by Letters Patent is:—

1. A vacuum pump comprising an oil reservoir, an air chamber, a filter in the reservoir open to

atmosphere, a shaft extending through the reservoir, a pump chamber having an oil inlet port communicating with the reservoir, an air inlet communicating with a passage opening into the air chamber adjacent the bottom thereof, and a discharge port communicating with a passage in the wall of the reservoir and opening into the reservoir beneath the filter, and a rotor on the shaft within the pump chamber.

2. A vacuum pump comprising a reservoir having a filling opening and an outlet port, a filter in the reservoir, an air chamber associated with the reservoir having an inlet port and an outlet passage extending upwardly from adjacent the bottom thereof, a shaft extending transversely through the reservoir, a pump chamber having an air inlet port communicating with the outlet passage of the air chamber, an oil inlet port communicating with the outlet port of the reservoir, and a discharge port communicating with a passage in the wall of the reservoir opening into the reservoir beneath the filter, a rotor on the shaft within the pump chamber, and blades movable in slots in the rotor.

3. A vacuum pump comprising an oil reservoir having a filling opening and a discharge port, a filter in the reservoir, a cover for the reservoir having a dome opening to atmosphere, a filter in the dome arranged in spaced relation to the filter in the reservoir, an air chamber associated with the reservoir having an inlet port and an outlet passage extending upwardly from adjacent the bottom thereof, a shaft extending through the reservoir, a pump chamber mounted on the reservoir beneath the filter, and a rotor on the shaft and having an air inlet port communicating with the outlet passage of the air chamber, an inlet port communicating with the outlet port of the reservoir, and a discharge port communicating with a passage opening into the reservoir beneath the filter therein, a rotor on the shaft within the pump chamber, and blades movable on the rotor.

ERWIN F. LOWEKE.