June 12, 1928.

1,673,259

C. R. MESTON ET AL

PUMP

Filed March 11, 1926

4 Sheets-Sheet 1

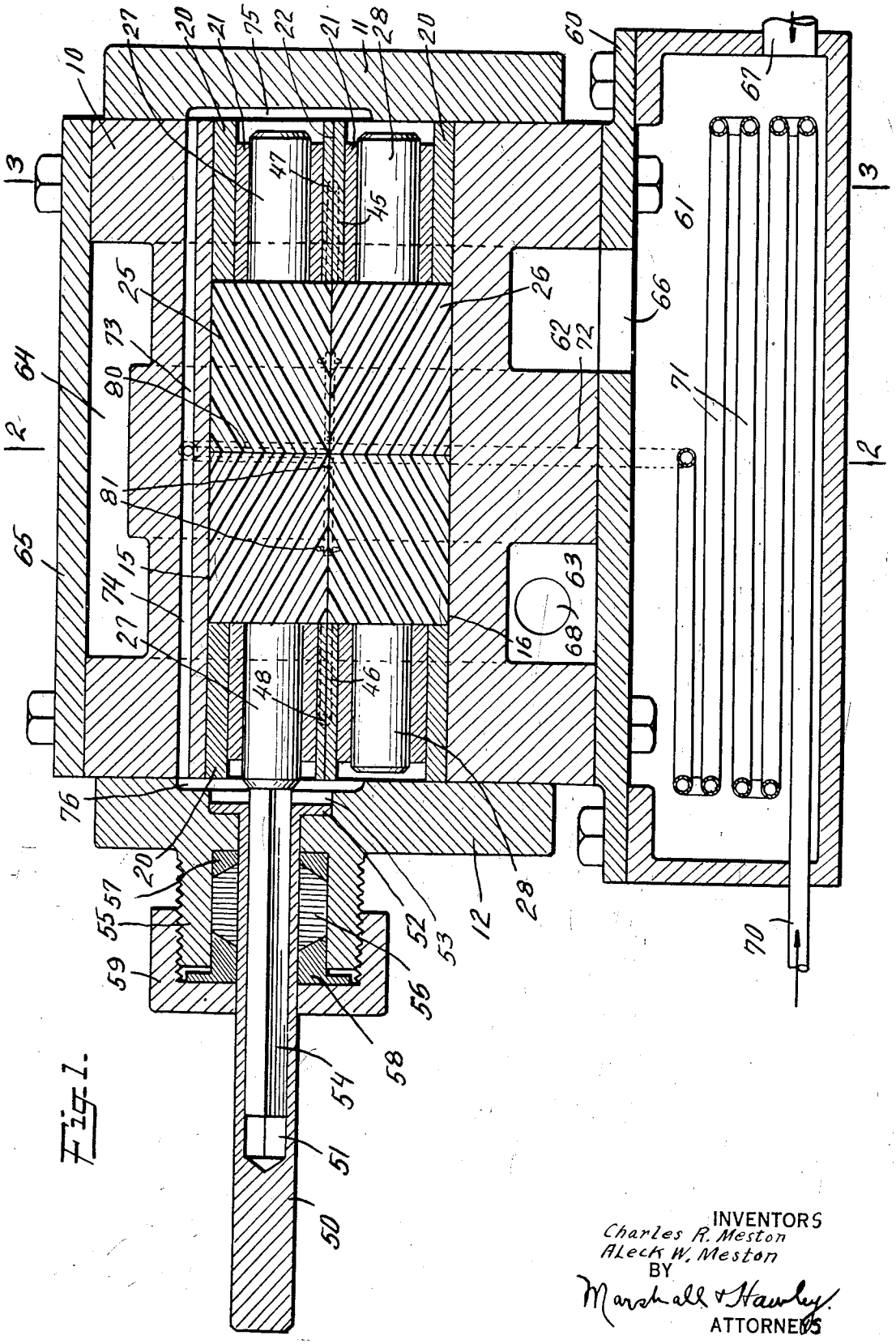

Fig. 1.

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4 Sheets-Sheet 2

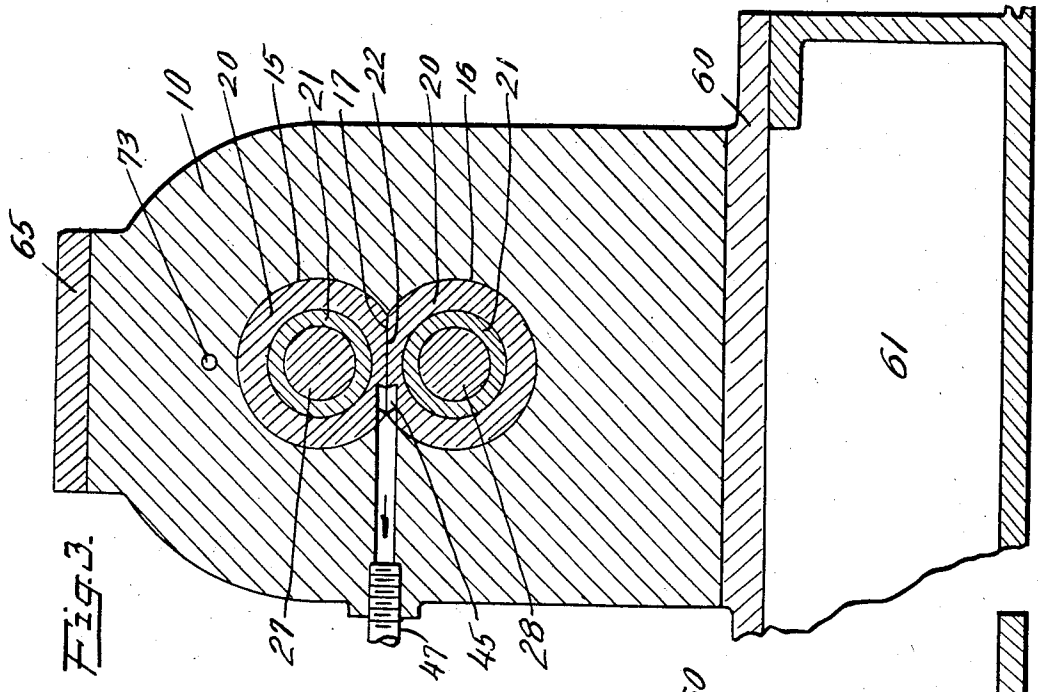

Fig. 3.

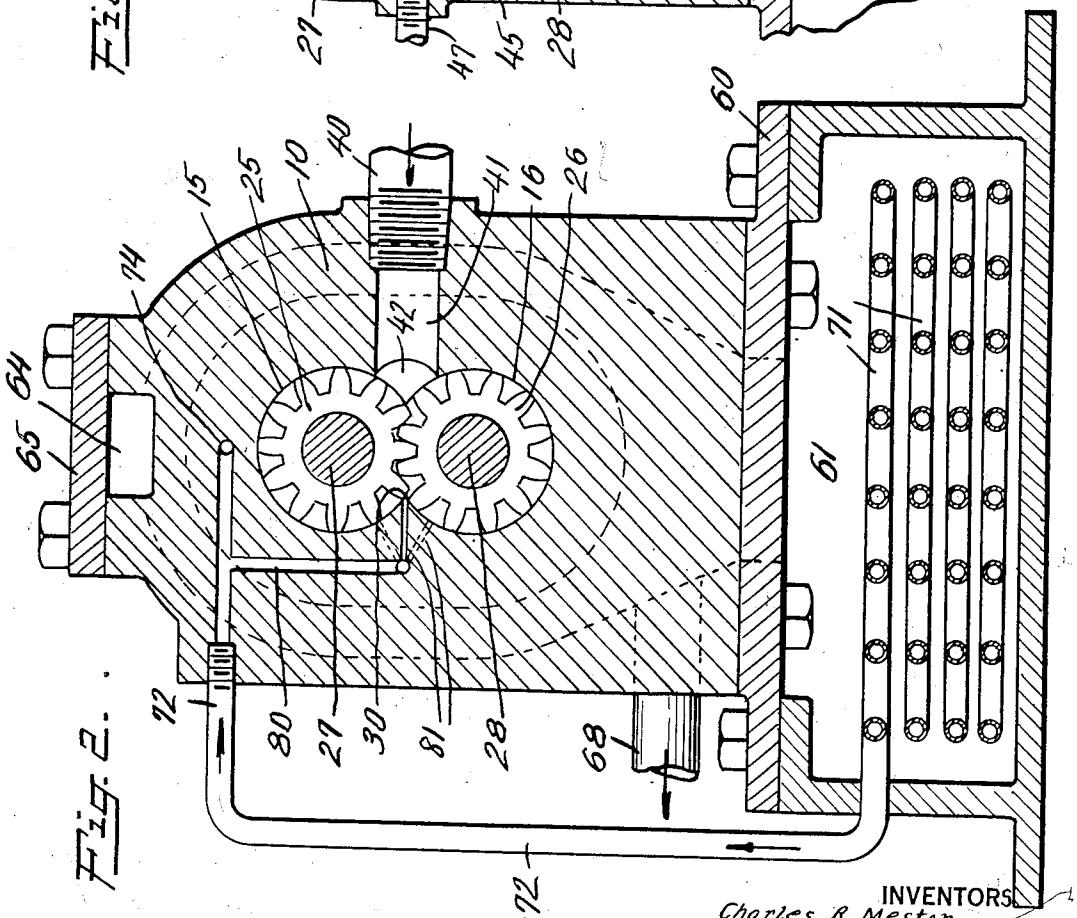

Fig. 2.

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Fig. 5.

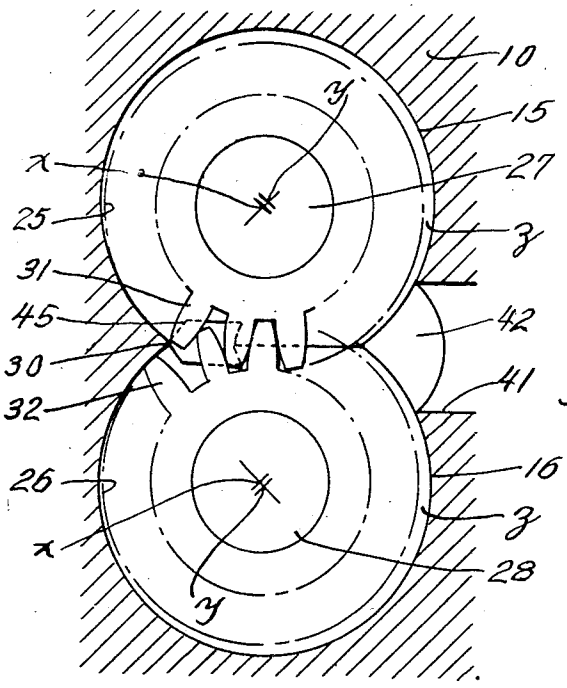


Fig. 4.

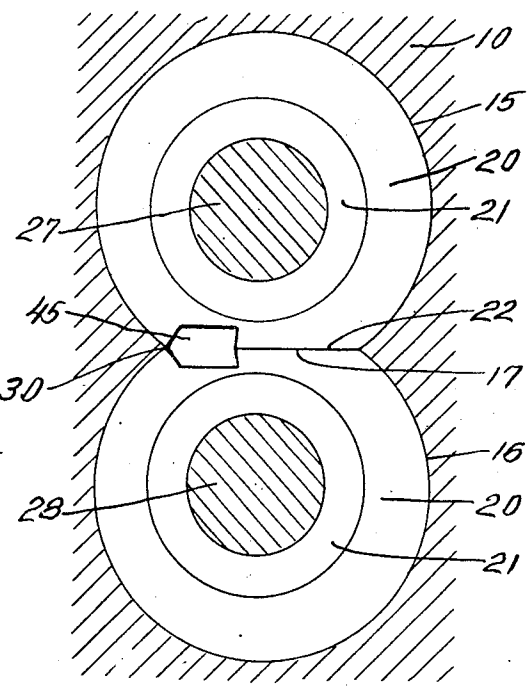


Fig. 6.

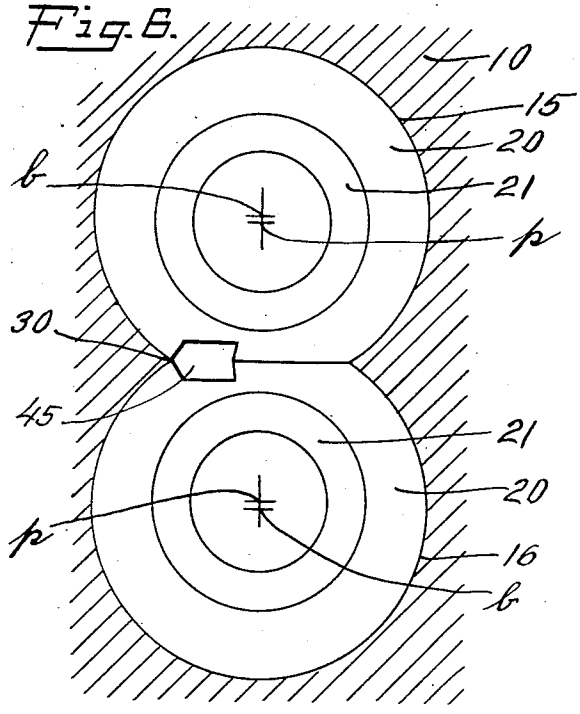
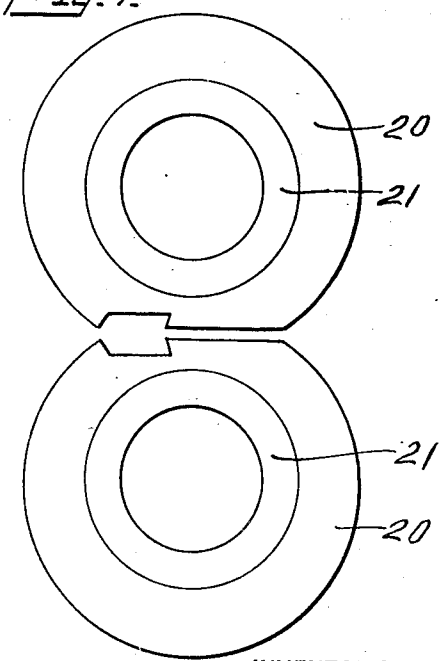


Fig. 7.



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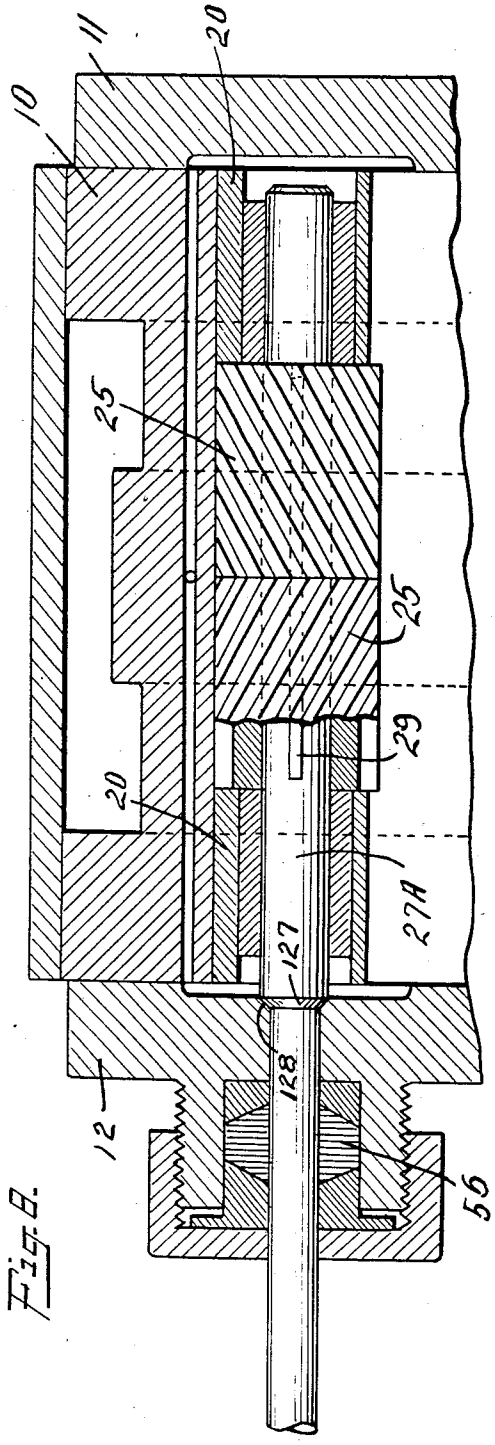

Fig. 8.

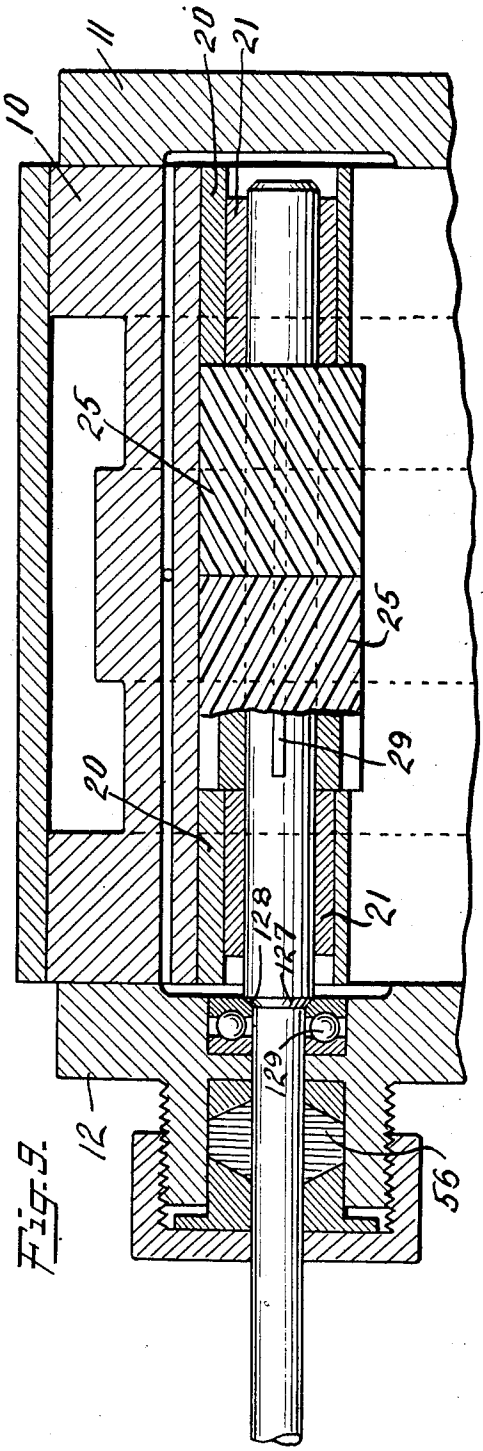

Fig. 9.

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UNITED STATES PATENT OFFICE.

CHARLES R. MESTON AND ALECK W. MESTON, OF YONKERS, NEW YORK, ASSIGNORS TO THE STACOLD CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

PUMP.

Application filed March 11, 1926. Serial No. 93,819.

This invention relates to pumps and particularly to air or gas pumps such as are used in refrigerating apparatus.

The invention has been particularly worked out in connection with pumps utilizing intermeshing gears for pumping air or gas. With this type of pump, it is essential that the gear teeth fully intermesh and that there be no leakage of air around the teeth in the casing at the outlet side of the pump or leakage from the casing around the pump shaft. When the pump is used as a high pressure pump, it is very difficult to prevent leakage of air or gas from the discharge side of the pump. Furthermore, the high pressure acting on the pump elements tends to exert a thrust thereon and cause wear of the gears and contacting parts of the pump.

The invention has for its salient object to provide a pump so made as to obtain extreme accuracy in construction at a minimum manufacturing cost.

Another and important object of the invention is to provide a pump in which the pump elements and bearings will be accurately alined.

Another object of the invention is to provide a pump of the character described so constructed that there will be practically no leakage at the outlet or high pressure side of the pump.

Another object of the invention is to provide a pump of the character described in which the intermeshing gears will accurately fit the casing at the discharge side of the pump but will rotate freely at the inlet side of the pump.

Another object of the invention is to provide a structure of the character described in which the pressure is equalized at the ends of the gear elements so that no appreciable thrust is exerted on the gears.

Another object of the invention is to provide a pump of the character described in which the drive shaft is so connected to the pump that no leakage from the casing will occur around the shaft.

Further objects of the invention will appear from the following specification taken in connection with the drawings, which form a part of this application, and in which—

Fig. 1 is a sectional elevation of a pump constructed in accordance with the invention;

Figs. 2 and 3 are transverse sectional views taken substantially on line 2—2 and 3—3 of Fig. 1;

Fig. 4 is an enlarged detail sectional view of the gear elements showing the method of mounting these elements in the casing;

Fig. 5 is a view similar to Fig. 4, but illustrating the intermeshing teeth of the gear elements;

Figs. 6 and 7 are views similar to Figs. 4 and 5 showing another method of mounting the gear supporting plugs or bushings in the casing; and

Figs. 8 and 9 are sectional elevations, broken away, showing other methods of driving the gearing and sealing means for the casing.

The invention briefly described consists of a pump comprising a casing bored to receive the gear elements and bearing plugs and bushings for the gear elements. By mounting the gears and shaft bearings in straight bores, the bearings, bushings and gears will be positioned in accurate alinement thus providing extreme accuracy at a minimum of expense in manufacturing.

If desired, to provide for taking up wear or other contingencies and to further insure an accurate fit, the plugs or bearing boxes have their centers disposed very slightly eccentric to the center of the bores in the casing in such a manner that the pump gearing will accurately fit the casing at the discharge side of the pump but will clear the casing at the inlet side of the pump. This prevents leakage at the high pressure side of the pump and prevents the gears from dragging or rubbing on the casing at the intake side of the pump in case the gear shafts become worn or the bearings permit the gears to get out of alinement.

Means is also provided in the pump for eliminating end thrust and also for preventing leakage of the air or gas from the pump casing around the drive shaft. This is accomplished by providing a drive shaft with a longitudinal recess at one end for receiving a gear shaft. The recessed end of the drive shaft is flanged and the flange engages the wall of the casing or other suitable contacting surface and any outward pressure exerted by the air or gas tends to seal the engagement between the flange and the wall or contacting surface. The gear shaft is splined or otherwise connected to the drive shaft to be driven thereby. In another form

of the invention, the gear is splined to the drive shaft and a shoulder on the shaft seats against the casing or other contacting surface. The gears, therefore, float on the shafts and the shafts float in their bearings, the pressure at the ends thereof being equalized, as hereinafter described.

Another feature of the invention consists of conducting sealing liquid or lubricant to the ends of the gear shafts, thus equalizing the pressure at the two ends of these shafts.

Further details of the invention will appear from the following description.

The pump casing consists of a body portion 10 and end plates 11 and 12. The body portion is preferably cast in a solid block and is bored longitudinally to form straight bores 15 and 16. (See Fig. 3.) The bores 15 and 16 as illustrated, consist of overlapping cylindrical openings which intersect in a common plane 17.

There is positioned at each end of each bore a bearing box or plug 20 and in these bearing boxes or bearing plugs are preferably mounted rotatable bushings 21. In the particular form of the invention illustrated, the bearing boxes or plugs 20 have substantially cylindrical outer surfaces but are formed with flat sides 22 adapted to be positioned in alinement with the common plane 17.

The pumping elements consist of a pair of intermeshing gears 25 and 26, herring-bone gears being illustrated. The gear 25 is mounted on a shaft 27 and the gear 26 is mounted on a shaft 28, the shafts 27 and 28 being mounted in the bushings 21 carried by the bushing boxes or plugs 20.

The straight bores thus receive the gears, shafts and shaft bearings and because of this construction the elements specified can be accurately alined.

As shown in Figs. 4 and 5, the bores 15 and 16 intersect in a knife edge 30 at the high pressure or discharge side of the pump and it is very essential that the gear teeth 31 and 32 of the gears 25 and 26 accurately fit the casing at this knife edge so as to prevent escape of the high pressure air or gas. This is accomplished by locating the plugs or bearing boxes 20, the gears, and gear shafts in the straight bores 15 and 16.

It has been found advantageous to compensate for wear and to further insure an accurate fit of the pump elements in the bores by locating the centers of the plugs or bearing boxes 20 slightly eccentric to the centers of the bores 15 and 16. Such a structure is shown in Figs. 4 and 5, wherein the centers of the plugs are located at x and the centers of the bores are located at y. The point x is located on a line disposed substantially 45° from the line y—y connecting the centers of the bores. By so positioning the centers of the bearing boxes or plugs, it will be clear that the gear teeth 31 and 32 will be positioned in full intermeshing relation with reference to each other and these teeth will also accurately fit the casing at the knife edge 30. Furthermore, the gears will be so located that a clearance z will be formed at the intake side of the pump, thus preventing the gears from dragging on the casing or rubbing thereagainst at this side of the pump. In practice, the centers x are displaced from centers y only a few thousandths of an inch.

The air or gas or other substance to be pumped is admitted to the casing body 10 through a conduit 40 and opening 41 formed in the casing. The opening 41 communicates at its inner end with a recess 42 formed in the casing body opposite the knife edge 30.

The air or gas or other substance being pumped leaves the casing body through openings 45 and 46 formed in the plugs 20 and communicating with discharge conduits 47 and 48.

In the form of the invention shown in Fig. 1, the drive shaft for the pump is shown at 50 and it will be seen that the end of this shaft is provided with a longitudinally extending recess 51 angular in section. The recessed end of the shaft has a flange 52 formed therein, the flange being seated in a recess 53 formed in the casing end plate 12. The gear shaft 27 is squared at one end as shown at 54 and extends into the recess 51 in the shaft 50. This form of construction permits the gears and gear shaft 27 to float.

The end plate 12 of the casing has formed thereon a boss 55 in which there is positioned packing 56, a wedge-shaped collar 57 being disposed at the inner end of the packing and a flanged wedge collar 58 being disposed at the outer end of the packing and engaged by a cap 59 which is threaded onto the boss 55.

In Fig. 8 instead of providing a shaft 50 extending into the pump casing, the gear 25 is splined to the shaft 27A as shown at 29 and shaft 27A extends outwardly through the casing wall or end plate 12. Shaft 27A has a beveled seat 128 in end plate 12. The pressure of the sealing and lubricating liquid conducted to the end plates 11 and 12, as hereinafter described, tends to force the shaft shoulder 127 against the seat 128 and thus prevent leakage from the pump casing. This is due to the fact that the liquid pressure is exerted over a greater area at the right hand end of the shaft, viewing Fig. 8. The outer end of the shaft 27A extends through packing similar to that shown in Fig. 1.

In Fig. 9 a similar construction is shown but in this embodiment the shoulder 127 seats against a ball thrust bearing 129.

The body 10 of the pump casing is mount-

ed on a base plate 60 which in turn is mounted on and forms the top for a cooling reservoir or chamber 61. The casing body 10 has formed in its outer surface a pair of annular recesses 62 and 63 which extend part way or substantially half way around the body 10 and are connected by a passage 64. The passage 64 at the top of the casing is covered by a plate 65. The annular passage 62 communicates through an opening 66 in the base 60 with the cooling chamber or reservoir 61. The cooling fluid enters the reservoir 61 through a conduit 67 and leaves the passage formed by the groove 63 and between this groove and the base 60 by a conduit 68.

In the embodiment of the invention illustrated, the same liquid is used for sealing the pump elements and for lubricating the bearings. This liquid enters the cooling reservoir or chamber 61 through a conduit 70 and passes around a coil 71 disposed in the chamber 61 and through a conduit 72 to branch conduits 73 and 74 which lead to recesses 75 and 76 formed in the end plates 11 and 12.

In order to form a seal at the delivery or high pressure side of the pump, a by-pass conduit 80 communicates with conduit 72 and also communicates with a plurality of minute passages 81 which conduct the sealing liquid to the gears.

It will be understood that the sealing liquid passes from the pump with the air or gas pumped, is extracted from the gas in a separator and returns to the coil 71 through pipe 70 and under pressure of the gas or air delivered by the pump.

In the form of the invention illustrated in Figs. 6 and 7, the centers of the plugs are disposed eccentric with reference to the centers of the bores. In this embodiment, however, the centers of the plugs are disposed at *p* and the centers of the bores are disposed at *b*, both of these centers being disposed on the line *b*—*b* which connects the centers of the bores. In this case as the plugs are inserted in the ends of the bores, the gears will be moved into full intermeshing relation and into a position in which they will accurately fit the casing at the knife edge 30. In Fig. 7 the parts are shown in separated position and in Fig. 6 they are shown in the position taken after the plugs are driven or forced into the ends of the bores.

From the foregoing specification, it will be seen that a pump structure has been provided in which the gear elements will accurately fit the casing and prevent escape of air or gas and loss of pressure at the discharge side of the pump and in which the pumping elements will be free from or clear of the casing at the intake side thereof. Furthermore, by reason of the fact that the lubricating and sealing fluid passes to both ends of the gear shafts, and by reason of the form of shaft seal, the pressure is equalized and end thrust is eliminated. The pump drive shaft has been so connected to the gearing that leakage from the casing around the shaft is minimized or practically eliminated and the pressure within the casing tends to prevent escape of air or gas from the casing.

Although certain specific embodiments of the invention have been particularly shown and described, it will be understood that the invention is capable of modification and that changes in the construction and in the arrangement of the various cooperating parts may be made without departing from the spirit or scope of the invention, as expressed in the following claims.

What we claim is:

1. A pump comprising a casing having a pair of openings therethrough, a pair of intermeshing gears mounted in said openings, said casing having an intake port at one side of the line of centers of said gears and having exhaust ports at the other side of said line and bushings or plugs in said casing openings for receiving said gear shafts, said plugs having their centers disposed eccentric to the centers of the openings in such a manner that the gears will accurately fit the casing openings at their discharge sides but will have a clearance from the casing at the intake side thereof.

2. A pump comprising a casing having a pair of openings therethrough, a pair of intermeshing gears mounted in said openings, said casing having an intake port at one side of the line of centers of said gears and having exhaust ports at the other side of said line and bushings or plugs in said casing openings for receiving said gear shafts, said plugs being so mounted in said openings that the gears will fully intermesh and the gear teeth will just clear the casing at the discharge side thereof and will be spaced from the casing at the intake side thereof.

3. A pump comprising a casing having a pair of openings therethrough, a pair of intermeshing gears mounted in said openings, said casing having an intake port at one side of the line of centers of said gears and having exhaust ports at the other side of said line and bushings or plugs in said casing openings for receiving said gear shafts, said plugs being so mounted in said openings that the centers of the plugs are disposed closer together than the centers of the openings in the casing.

4. A pump comprising a casing having a pair of substantially cylindrical openings therethrough, said openings intersecting in a common plane, plugs mounted in the ends of said openings and having flat sides disposed substantially in alinement with the plane of intersection of said openings, the centers of said plugs being disposed closer together than the centers of the openings,

shafts mounted in said plugs and intermeshing gears mounted on said shafts.

5. A pump comprising a casing having a pair of openings therethrough, a pair of intermeshing gears mounted in said openings, said casing having an intake port at one side of the line of centers of said gears and having exhaust ports at the other side of said line and plugs in said casing openings for receiving said gear shafts, said plugs being so mounted in said openings that the centers of the bearings are disposed closer together than the centers of the openings in the casing.

6. A pump comprising a casing having a pair of openings therethrough, a pair of intermeshing gears mounted in said openings, said casing having an intake port at one side of the line of centers of said gears and having exhaust ports at the other side of said line and bushings or plugs in said casing openings, bearings in said plugs for receiving said gear shafts, said plugs being so mounted in said openings that the centers of the plugs are disposed closer together than the centers of the openings in the casing.

7. A pump comprising a casing having a pair of openings therethrough, a pair of intermeshing gears mounted in said openings, said casing having an intake port at one side of the line of centers of said gears and having exhaust ports at the other side of said line and bushings or plugs in said casing openings for receiving said gear shafts, said plugs being so mounted in said openings that the gears will accurately fit the casing openings at their discharge sides but will have a clearance from the casing at the intake side thereof.

8. A pump comprising a block having a pair of parallel, intercommunicating bores, each bore constituting a longitudinal segment of a cylinder, a plug in each end of each bore, a bushing rotatably mounted in each plug, shafts in said bushings, intermeshing gears on said shafts and means for conducting lubricating and sealing liquid under pressure to the ends of said plugs, bushings and shafts, said bushings contacting at their inner ends with said gears.

9. A pump comprising a body having a pair of straight intercommunicating bores therethrough, plugs mounted in said bores, shafts mounted in said plugs and intermeshing gears mounted on said shafts, and outlet conduits in said plugs communicating with the intermeshing portions of said gears.

10. A pump comprising a body having a pair of straight intercommunicating bores therethrough, a pair of intermeshing gears in said bores, the walls of said bores enclosing said gears substantially throughout the lengths thereof and around substantially the entire circumference thereof, an intake conduit communicating with the teeth of the gears as said teeth move out of mesh, and discharge conduits communicating with the intermeshing portions of said gears.

11. A pump comprising a body having a pair of straight intercommunicating bores therethrough, plugs mounted in the ends of said bores, shafts carried by said plugs, intermeshing gears mounted on said shafts, said plugs abutting the ends of said gears, discharge conduits in the plugs communicating with intermeshing portions of the gears, an intake conduit communicating with non-intermeshing portions of the gears, and means for injecting sealing liquid on said gears.

12. A pump comprising a body having a pair of straight intercommunicating bores therethrough, plugs mounted in the ends of said bores, shafts carried by said plugs, intermeshing gears mounted on said shafts, said plugs abutting the ends of said gears, an intake conduit communicating with said gears, and discharge conduits in said plugs disposed at the ends of said gears.

13. A pump comprising a casing, a pair of intermeshing gears mounted therein, said casing closely surrounding the peripheries of said gears except at the intermeshing portions thereof, a discharge conduit in said casing disposed at one end of the gears and an intake conduit in the casing adapted to communicate with portions of the gears which are out of mesh.

In witness whereof, I have hereunto set my hand this 8th day of March, 1926.

CHARLES R. MESTON.

In witness whereof, I have hereunto set my hand this 8th day of March, 1926.

ALECK W. MESTON.