

June 12, 1928.

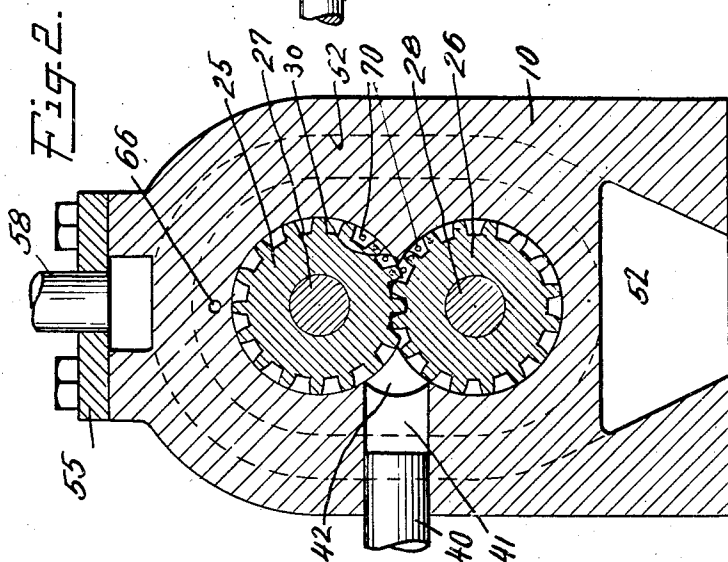
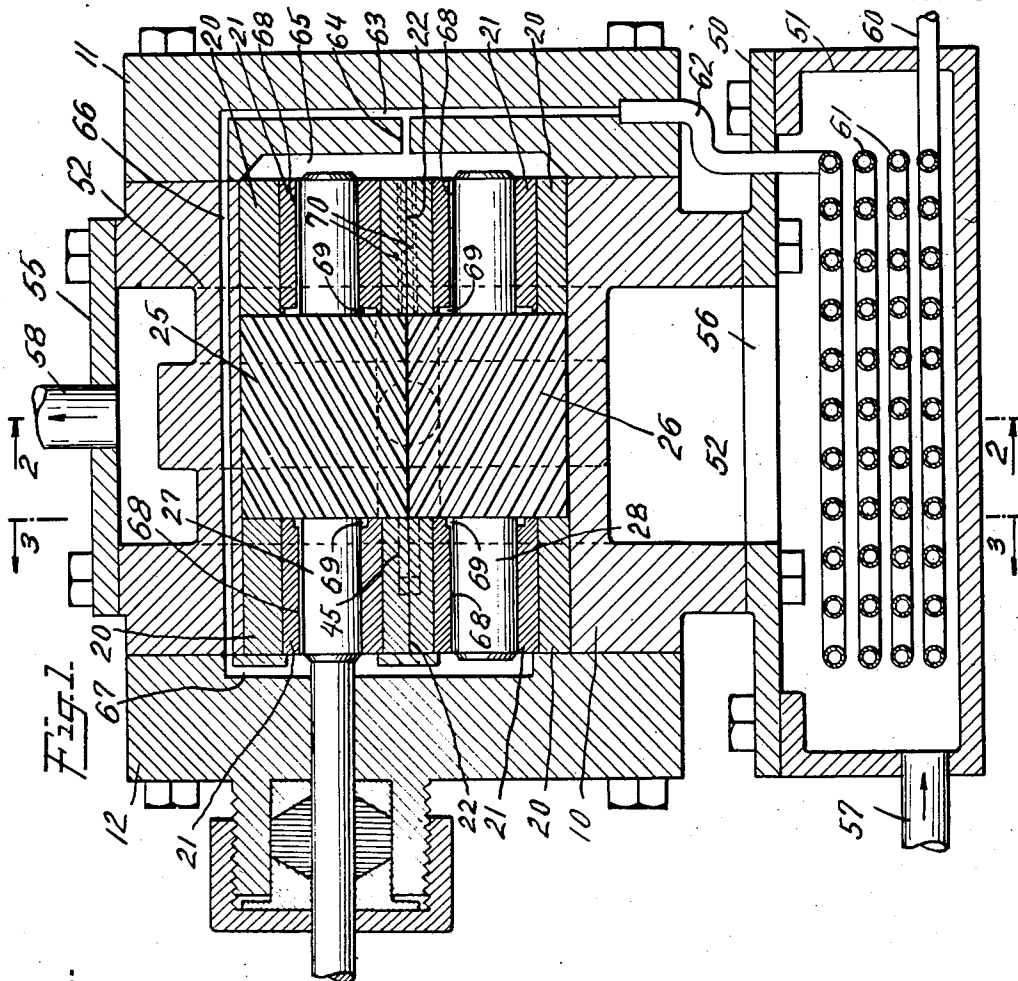
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1,673,261

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3 Sheets-Sheet 1



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Fig. 7.

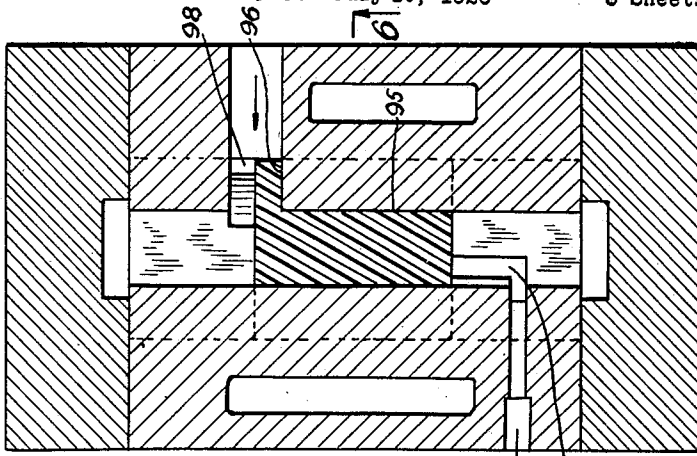


Fig. 6.

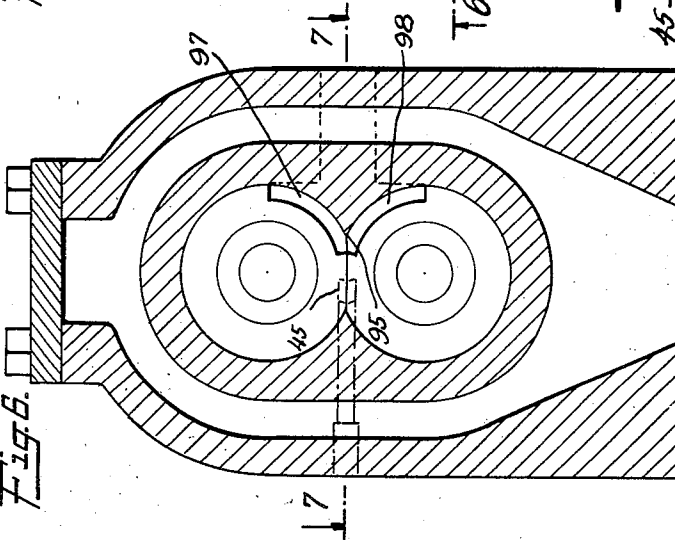
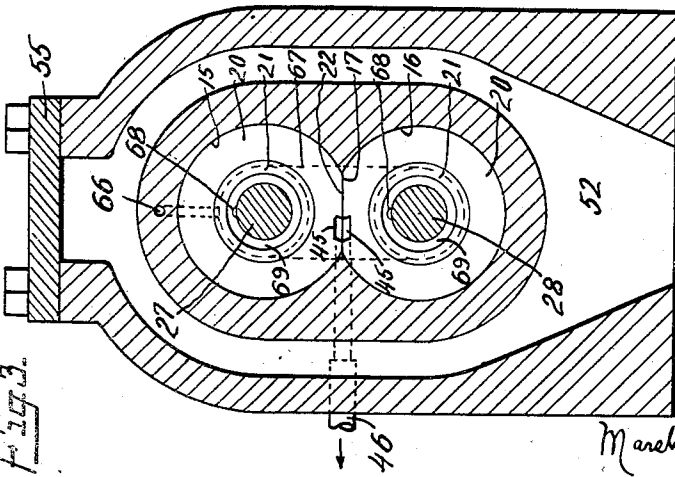


Fig. 3.



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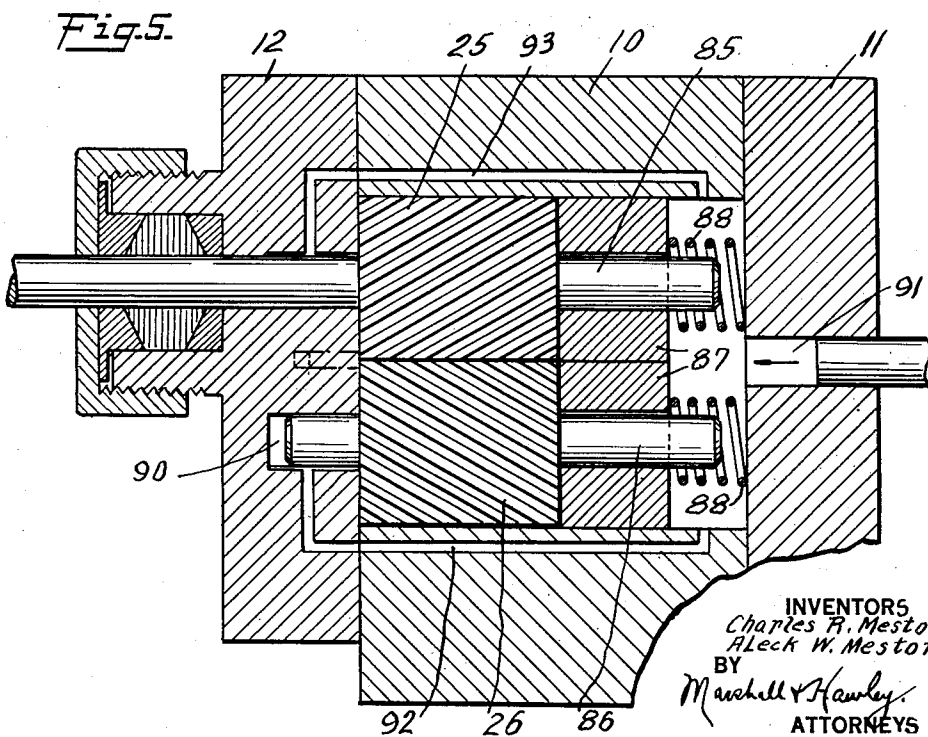
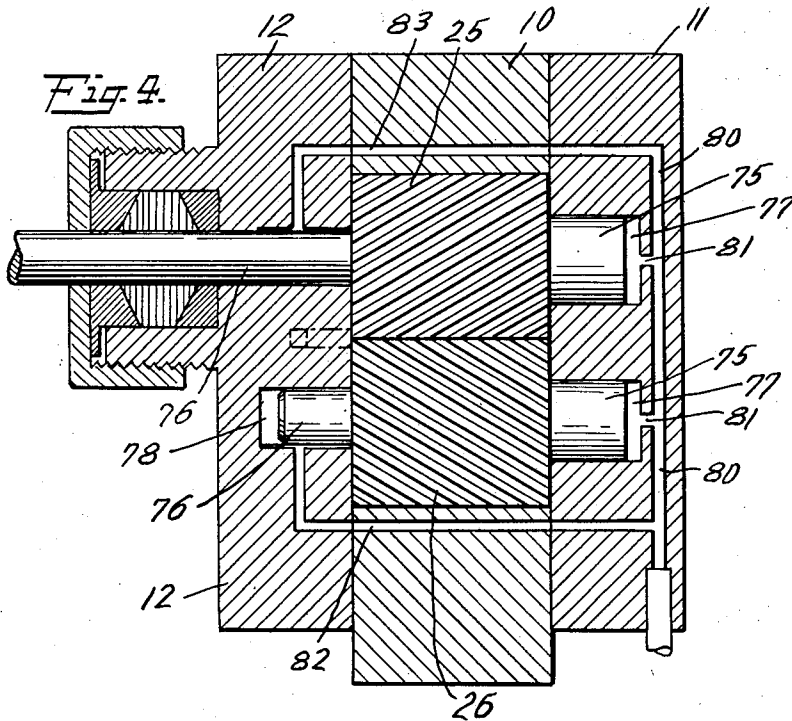
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

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PUMP.

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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 or gas 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.

Also, in pumps of this character, when oil is used as the sealing liquid, a certain amount of oil will leak from the high pressure side to the low pressure side of the pump. This oil becomes impregnated to a greater or less degree with the gas or refrigerant when the pump is used in refrigerating apparatus and this is carried back with the oil. The oil and refrigerant tend to separate if given the necessary time and opportunity and the freed gas on the low pressure side obviously cuts down the capacity of the pump and lowers its efficiency. Since it is practically impossible even with the best combinations of oil and gas or refrigerant to prevent the impregnation of the oil with the gas it is most important to prevent the gas from being freed and expanding, thus taking up the space that should be taken by the intake gas.

In the usual construction of pumps of this type, the oil and impregnated gas that leaks to the low pressure side of the pump passes into an elongated cavity and there the gas or refrigerant has an opportunity to separate from the oil.

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 object of the invention is to provide a pump of the character described so constructed that there will be as little leakage as possible at the outlet or high pressure side of the pump.

Another object of the invention is to provide a construction by means of which the thrust on the gears can be regulated to maintain the gears and casing or contacting parts in contact at the discharge end of the pump, thereby preventing leakage.

Another object of the invention is to provide a pump so constructed that any oil and impregnated gas that leaks from the high pressure to the lower pressure part of the pump will be trapped and prevented from escaping into the intake.

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;

Fig. 2 is a sectional elevation taken substantially on line 2—2 of Fig. 1;

Fig. 3 is a sectional elevation taken substantially on line 3—3 of Fig. 1;

Fig. 4 is a sectional elevation similar to Fig. 1 but showing a different manner of regulating the pressure of the gears against the end plate at the discharge side of the pump;

Fig. 5 is a view similar to Fig. 4 but showing still another manner of regulating the thrust of the gears against the end wall of the casing;

Fig. 6 is a view similar to Fig. 3 taken substantially on line 6—6 of Fig. 7 and showing a different manner of introducing the intake fluid into the pump; and

Fig. 7 is a sectional elevation taken substantially on line 7—7 of Fig. 6.

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.

Means is also provided for so regulating the thrust on the gears that the gears will be maintained in contact with the end plate of the casing at the outlet or discharge ends thereof, thus preventing leakage.

In one embodiment of the invention the

pump intake or low pressure side is so constructed that any oil and impregnated gas is trapped in the teeth and prevented from escaping. The intake is located at the ends of the teeth and does not extend longitudinally or parallel to the axis of the gears as in the usual construction.

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. 1.) 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 may be mounted bushings or bearings 21. If desired, the two plugs at each end of the bores could be made in one piece. The bushings may be rotatable or stationary, as desired. 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, spiral 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 bearings 21 carried by the 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. 2 and 3, 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.

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. In Fig. 2 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 formed in the plugs 20 and communicating with discharge conduits 46.

In the particular pump construction illustrated, the body 10 of the pump casing is mounted on a base plate 50 which in turn is mounted on and forms the top for a cooling

reservoir or chamber 51. The casing body 10 has formed in its outer surface an annular recess 52 which extends around the body 10. The recess or passage 52 at the top of the casing is covered by a plate 55. The annular passage 52 communicates through an opening 56 in the base 50 with the cooling chamber or reservoir 51. The cooling fluid enters the reservoir 51 through a conduit 57 and leaves the casing by a conduit 58 which is secured to plate 55 and extends therethrough.

In the embodiments of the invention illustrated, the liquid used for sealing and lubricating the pump elements enters the cooling reservoir or chamber 51 through a conduit 60 and passes around a coil 61 disposed in the chamber 51 and outwardly through a conduit 62.

In the embodiment of the invention illustrated in Figs. 1 to 3 inclusive, the sealing and lubricating liquid passes from a conduit 62 into a conduit 63 having a by-pass 64 leading to a recess or pocket 65 in the end plate 11. The conduit 63 also communicates with a conduit 66 which in turn communicates with a recess or pocket 67 formed in the end plate 12.

The pockets 65 and 67 are disposed opposite or in alinement with the plugs 20 and bushings 21 and grooves 68 are formed in the bushings to conduct the lubricant and sealing liquid inwardly along the inner surface of the bushings. Each of the bushings 21 has formed on its inner end an annular recess or groove 69 and it will be noted in Fig. 1 that the grooves 69 on the bushings 21 at the right hand end of the gears has a larger outside diameter than the groove 69 in the inner end of the bushing at the left hand end of the gear.

By varying the dimensions of the bushings and of the grooves, the amount of pressure between the bushings and the ends of the gears can be varied.

For instance, the bushings at the right hand end may be made thicker or may have a greater outside diameter than the bushings at the left hand end. If the bushings so constructed are rotatable and float, then the pressure of the liquid in the pocket 65 will force the bushings against the right hand end of the gears and as the pressure is exerted over a greater surface the pressure at the right hand end will be greater than at the left hand end, thus causing the gears to be maintained in contact with the plugs and bushings at the left hand end of the casing or discharge side of the pump.

If the bushings are non-rotatable or stationary and longitudinal grooves such as 68 are provided communicating with the annular groove 69, then the dimensions of the annular grooves will determine the area over which pressure is exerted on the gears and if, as illustrated, the grooves 69 are larger

at the right hand end than at the left hand end of the gears a greater pressure will be exerted toward the left, thus again tending to maintain gears in close engagement with the bushings and plugs at the discharge end thereof.

It is desirable that the pressure toward the left in Fig. 1 be greater than the pressure toward the right in order to cause the left hand or delivery ends of the gears to be maintained in close contact with the bushings and plugs. This result can be obtained in various ways as pointed out above.

In Fig. 1 there are shown also a plurality of small or minute conduits 70 which lead from the pocket 65 to the right hand ends of the gears 25 and 26. These passages conduct the sealing liquid to the gear teeth and seal the teeth, thereby preventing loss of pressure.

In Fig. 4 the pressure on the gears is regulated by varying the size of the gear shafts at the two ends of the gears. For instance, it will be noted that the shafts or trunnions 75 at the right hand end of the gears 25 and 26 have a greater diameter than the shafts 76 at the left hand ends of the gears. The lubricating and sealing liquid is led to pockets 77 in casing end plate 11 through conduits 80 and 81, and to a pocket 78 in the end plate 12 through a conduit 82. Also the sealing liquid is conducted from a conduit 80 through a conduit 83 to the shaft 76 which is extended through the end plate 12 and constitutes the drive shaft.

It will be evident that the pressure toward the left in Fig. 4 is greater than the pressure toward the right and thus the left hand faces or the delivery end of the gears will be maintained in close contact with the end plate 12.

In Fig. 5 the gears 25 and 26 are carried by the shafts 85 and 86. The right hand ends of the shafts 85 and 86 are surrounded by bearing bushings or plugs 87 and extend through the plugs, the outer ends of the shafts being surrounded by springs 88 interposed between the end plate 11 and the bushings 87. The shaft 86 at its opposite end extends into a bearing pocket 90 and the opposite end of the shaft 85 extends outwardly through the end plate 12 and is connected to the drive shaft.

The sealing and lubricating liquid enters the pocket formed between the end plate 11 and the bushings 85 and 87 through a conduit 91 and from this pocket the lubricating and sealing liquid is led through a conduit 92 to the pocket 90. Also, a conduit 93 connects with the pocket at the right hand end of the casing and conducts the lubricant to the left hand end of the shaft 85.

From the showing in Fig. 5 it will be evident that the pressure on the right hand end of the gears which is transmitted through the bushings 87 will be greater than

the pressure toward the right or the pressure on the left hand ends of the gears, thus maintaining the gears in close contact with the end plate 12.

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 Figs. 6 and 7 the pump intake or low pressure side is so constructed as to trap in the teeth the oil and impregnated gas that leaks from the high pressure side, thus preventing the escapement thereof.

This is accomplished by extending the casing to a knife edge 95 at the low pressure side and extending the knife edge to a point such as 96 adjacent the ends of the gears. The plugs are preferably grooved as shown at 97 and 98 at this end of the gears and the intake gas reaches the teeth when they are open or fully out of gear permitting the teeth to take up the maximum capacity of the gas, in addition to whatever oil and impregnated gas is trapped in the teeth.

Although, in the particular form of the invention illustrated, the intake ports are shown at the opposite ends of the gears from the discharge or high pressure end of the gears, it will be understood that these ports may be located intermediate the ends of the gears or at the same end as the discharge port or ports if desired.

It is important, however, that the intake be cut off before the gear teeth go into mesh and before the sealing liquid or oil is injected into the teeth.

From the foregoing specification it will be seen that by means of the structure described a pump has been provided that will operate efficiently and in which the gear elements will be maintained in close contact with the casing at the delivery ends thereof. Furthermore, by trapping the oil and impregnated gas in the teeth the escapement of the gas to the intake is prevented, the capacity of the pump is increased and the efficiency of the vacuum is increased.

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, intermeshing gears mounted therein, means for conducting lubricating and sealing liquid to the ends of said gears and means for transmitting the pressure of the sealing liquid to said gears, said means being con-

structed and arranged to exert a greater pressure against one end of the gears than against the other end thereof.

2. A pump comprising a casing, gear shafts therein, intermeshing gears mounted on said shafts, means for conducting lubricating and sealing liquid to the ends of said gears and means including bushings surrounding said gear shafts for transmitting the pressure of the sealing liquid to said gears, said means being constructed and arranged to exert a greater pressure against one end of the gears than against the other end thereof.

3. A pump comprising a casing, a pair of intermeshing spiral gears therein adapted to discharge air or gas at high pressure from the ends thereof, and means for conducting sealing and lubricating liquid to said gears, said means being constructed and arranged to press the ends of the gears at the discharge side of the pump against the casing.

4. A pump comprising a block having parallel bores therethrough, end plates closing the ends of said bores, gear shafts and gears mounted in said bores, rotatable bushings in said bores surrounding said gear shafts, said end plates having pockets disposed in alinement with said bores and means for conducting lubricating and sealing liquid under pressure to said pockets, thereby pressing said bushings against said gears, said bushings being so constructed and arranged that a greater pressure is exerted on the gears in a direction toward the high pressure side of the pump than in the opposite direction.

5. A pump comprising a block having

parallel bores therethrough, end plates closing the ends of said bores, gear shafts and gears mounted in said bores, rotatable bushings in said bores surrounding said gear shafts, said bushings having annular grooves in the ends thereof adjacent the gears, said end plates having pockets disposed in alinement with said bores and means for conducting lubricating and sealing liquid under pressure to said pockets, thereby pressing said bushings against said gears, said bushings being so constructed and arranged that a greater pressure is exerted on the gears in a direction toward the high pressure side of the pump than in the opposite direction.

6. A pump comprising a casing, having substantially parallel straight bores therein, bearings slidably mounted in the ends of said bores, gear shafts mounted in said bearings, and means for conducting liquid under pressure to the ends of said bearings.

7. A pump comprising a casing, having parallel bores therein, plugs in the ends of said bores, shafts rotatably mounted in said plugs, gears carried by said shafts and abutting said plugs, said gears being disposed in intermeshing relation, an outlet conduit at one end of the gears, the plugs at one end of the gears having grooves opposite portions of the gears that are out of mesh and an inlet conduit communicating with said grooves.

In witness whereof, I have hereunto set my hand this 6th day of July, 1926.

CHARLES R. MESTON.

In witness whereof, I have hereunto set my hand this 6th day of July, 1926.

ALECK W. MESTON.