

June 12, 1928.

C. R. MESTON ET AL

1,673,262

PUMP

Filed July 10, 1926

3 Sheets-Sheet 1

Fig. 1

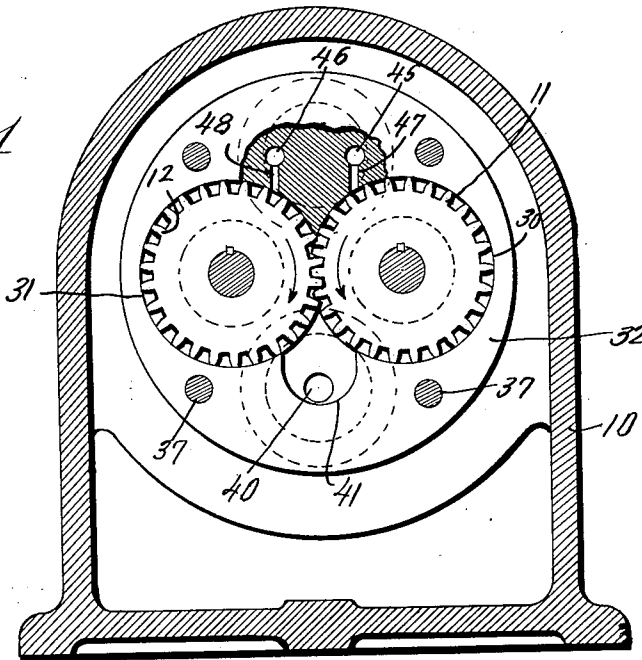
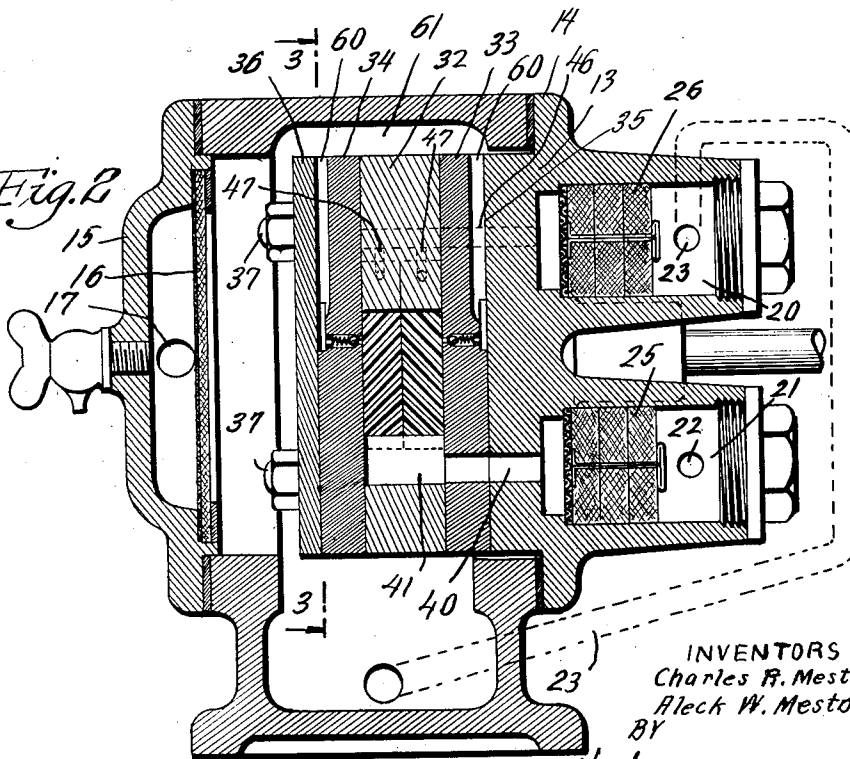


Fig. 2



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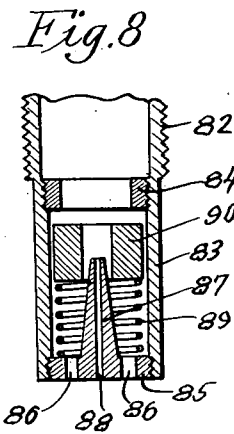
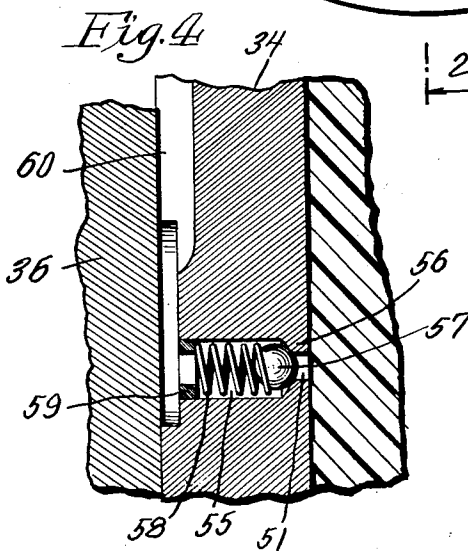
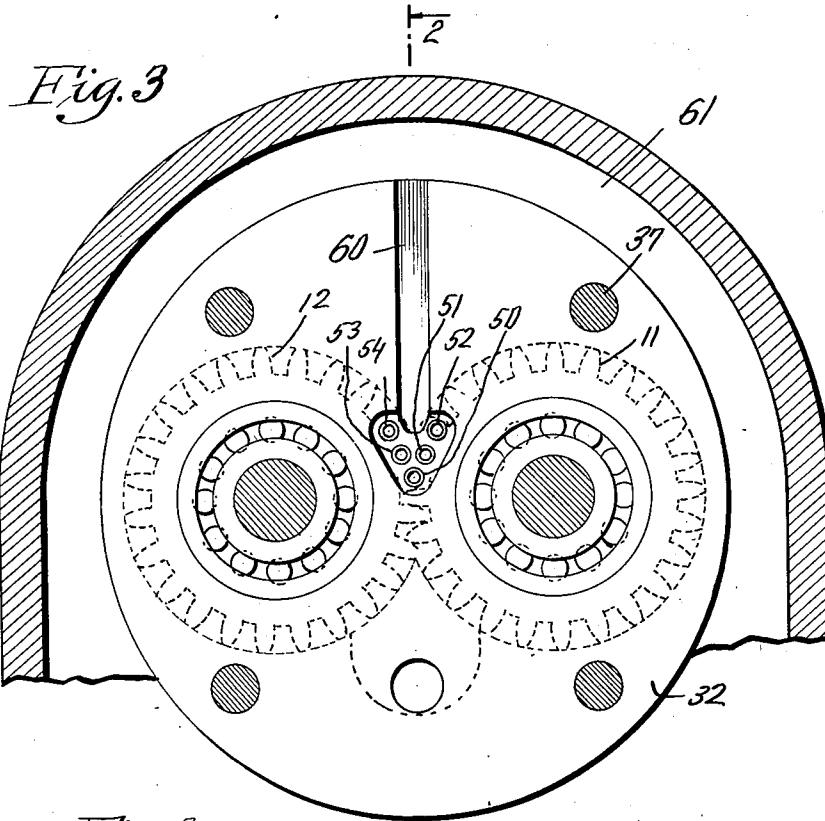
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3 Sheets-Sheet 3

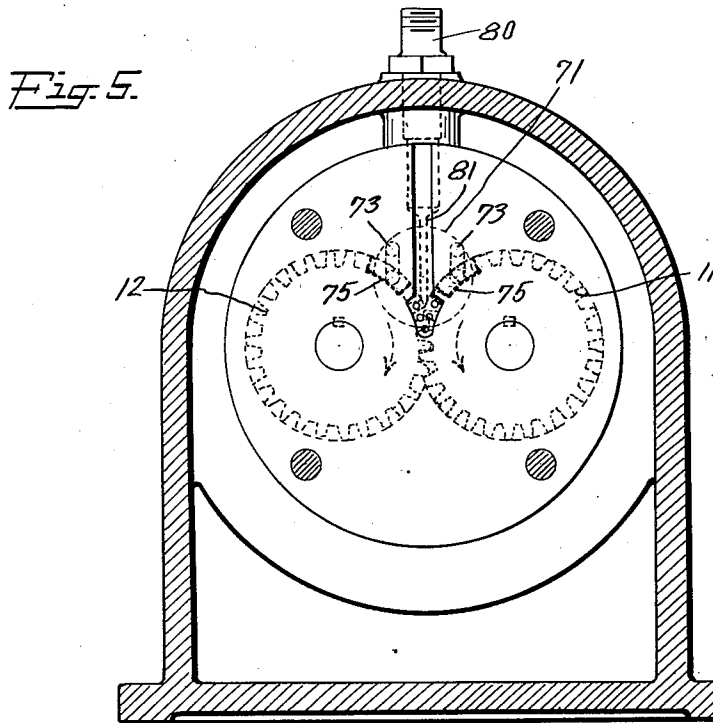
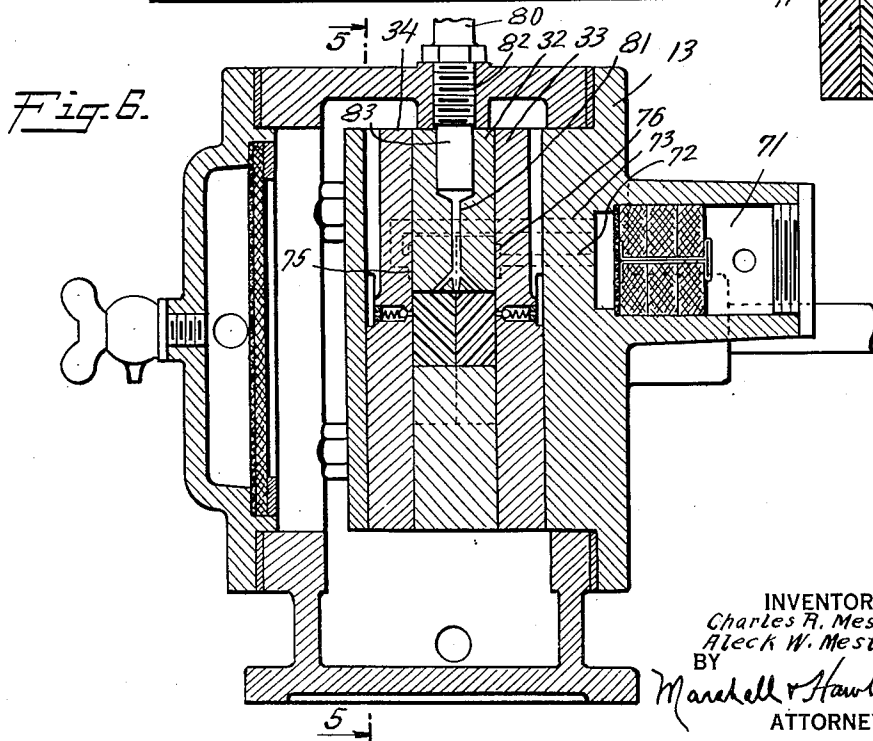
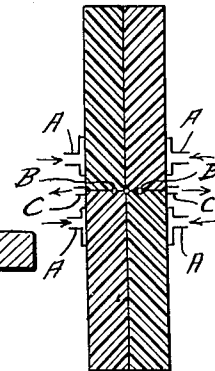


Fig. 7.



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UNITED STATES PATENT OFFICE.

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PUMP.

Application filed July 10, 1926. Serial No. 121,516.

This invention relates to pumps and particularly to gear pumps of the type used for vacuum or pressure pumps.

Rotary gear pumps were originally of simple displacement type and their chief characteristics were simplicity, large capacity and freedom from valves. They were made for low pressure liquid pumps and were considered specially suitable for thick or viscous liquids and little or no attention was given to power consumed or efficiency.

Later, such pumps, while retaining the valveless feature, were designed to handle gases, such as refrigerants, and sealing mediums, such as water, oil or glycerine, were used as packing to obtain pressure or vacuum.

Various improvements have been made to give this type of pump increased efficiency and to render it capable of handling high gas pressure, but these improvements on account of the valveless feature of the pumps were only theoretically efficient at one assumed differential of pressure between the intake and the outlet while in many cases, such as refrigerating machines, this differential is not constant and varies both at the inlet and at the outlet. For instance, the gears and teeth have their temperature raised by the operation of the pump and friction and when the gas remains in contact with the hot teeth, it expands, thus creating pressure in the teeth before the mechanical compression takes place by the intermeshing of the teeth. This is particularly true if any wet gas or liquid comes in contact with the hot teeth. This pressure created in the teeth requires more power for compression and thus cuts down the efficiency of the pump.

Also, the discharge port is located and dimensioned to fulfill certain predetermined theoretical conditions. For instance, assume the intake gas or air at zero gauge or one atmosphere pressure and an outlet pressure of four atmospheres or forty-five pounds pressure. The inlet will fill a tooth at one atmosphere and the pressure will reach four atmospheres at a point where the intermeshing of the teeth has reduced the area three-quarters and the resultant capacity is one-quarter. In the valveless pump if the outlet control is uncovered exactly at this point it will give efficient compression provided the port is the right size.

If the outlet port is too large and thus

opens too soon, that is before four atmospheres pressure has been developed, then the air or gas from the tank at four atmospheres will rush back into the pump and into the tooth having the partially compressed gas therein and this high pressure air or gas must be expelled, thus requiring unnecessary and additional power and cutting down the efficiency of the pump.

On the other hand, if the outlet port is too small, and the port is not uncovered until a higher pressure than four atmospheres has been reached in the tooth, this excess pressure will consume unnecessary power.

In other words, if the valveless pump is correctly designed for zero gauge inlet and forty-five pounds outlet, or any other predetermined differential in pressures, it will be efficient under that exact differential and any variations in inlet or outlet pressures will render the pump inefficient.

In the type of pump above described, oil or some other sealing liquid is introduced into the pump to seal the tooth. This oil is fed under pressure developed by the pump and unless some means is provided for maintaining a constant supply of oil under varying pressures, the pump will receive too much oil when the high pressure is developed and too little oil when the pump pressure is low.

This invention, therefore, has for its salient object to provide a pump of the type specified so constructed and arranged that it will operate efficiently under varying conditions of inlet and outlet pressures.

Another object of the invention is to provide a pump having its inlet port or ports so located that pressure created in the teeth due to expansion or volatilization of the gas will be reduced to a minimum.

Another object of the invention is to provide a pump having inlet ports so located that the incoming gas or air or other fluid will be in contact with the gear teeth a minimum period of time.

Another object of the invention is to provide a pump having outlet ports so arranged that back pressure from the pressure tank will not reach the gear teeth and operate to cut down the efficiency of the pump.

Another object of the invention is to provide a pump having outlet ports so constructed and arranged that the pump will operate efficiently through a wide range of

differentials of pressure between the intake and outlet gas.

Another object of the invention is to provide in a pump of the type specified, means for insuring a uniform and constant supply of sealing liquid for the gear teeth regardless of variations in pressure in the pump and in the liquid.

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 showing the inlet port and the conduits for conducting sealing liquid to the gear teeth;

Fig. 2 is a sectional elevation taken at right angles to Fig. 1, this view being taken substantially on line 2—2 of Fig. 3;

Fig. 3 is an enlarged elevational view taken substantially on line 3—3 of Fig. 2;

Fig. 4 is an enlarged sectional elevation showing the check valve in the outlet port of the pump;

Fig. 5 is a sectional elevation of another embodiment of the invention showing particularly the position of the intake or inlet ports, this view being taken substantially on line 5—5 of Fig. 6;

Fig. 6 is a sectional elevation taken at right angles to Fig. 5;

Fig. 7 is a diagrammatic view illustrating the positions of the inlet and outlet ports of the pumps shown in Figs. 5 and 6; and

Fig. 8 is an enlarged sectional elevation of the metering valve for the sealing liquid.

The invention briefly described consists of a pump having intermeshing gears therein and in the preferred embodiment of the invention, the inlet ports as shown in Figs. 5, 6 and 7 are located on the same side of a plane passing through the axes of the intermeshing gears as the discharge or outlet port or ports. The inlet ports are preferably located in a position to conduct the gas or fluid to the teeth just prior to their moving into mesh so that the gas, such as a refrigerant, will remain in contact with the teeth a minimum amount of time. Furthermore, the inlet ports should cut off the intake before the injection of sealing liquid. This prevents the gas from being expanded by long contact with the hot teeth. In order to prevent back pressure from the pressure tank from being communicated to the gears and teeth, the outlet port or ports of the pump are provided with check valves so constructed that they will open outwardly away from the teeth but will be closed by the tank pressure if the pressure developed in the pump is not equal to the pressure in the tank. In addition to the features enumerated, the pump is provided with a metering device so constructed that a constant and uniform

supply of sealing liquid will be introduced into the pump under varying conditions of pressure. This is accomplished by so constructing the metering device that as the pressure increases, the inlet opening from the sealing liquid conduit to the pump will be decreased in area and as the pressure of the liquid decreases, the inlet opening will be increased in area, thus insuring a uniform and constant supply of sealing liquid. Further details of the invention will appear from the following description.

In the embodiment of the invention illustrated in Figs. 1 to 4 inclusive, the pump comprises a casing 10 having a pair of gears 11 and 12 rotatably mounted therein and disposed in intermeshing relation with respect to each other. These gears are carried by a casing block or head 13 which is inserted in the casing 10 and has a flange 14 secured thereto. The opposite end of the casing is closed by a head 15 and a strainer 16 of gauze or other suitable material is carried by the casing head 15 and is positioned between the casing and the outlet conduit 17 for the gas or other fluid pumped.

In the pump illustrated the gears 11 and 12 have herring-bone teeth. The casing block 13 has a pair of chambers 20 and 21 formed therein, the gas or other fluid to be pumped being introduced into the chamber 21 through a conduit 22 and the sealing liquid or oil being introduced into the chamber 20 through conduit 23.

The chambers 20 and 21 preferably have filters 25 and 26 therein to filter the inlet gas and the sealing liquid.

The pump gears are mounted in openings 30 and 31 formed in a block 32 and the ends of the gears are closed by plates 33 and 34. The plate 33 abuts at its outer face against a surface 35 of the casing head or block 13 and the plate 34 abuts at its outer face against a plate 36. The parts 32, 33, 34 and 36 are all carried by the casing block or head 13, being secured thereto by bolts 37.

The intake gas is conducted to the gears below the intermeshing portions thereof as shown in Fig. 1. A conduit 40 leads from the chamber 21 to the intake port or passage 41 formed in the block 32. The sealing liquid is conducted from the chamber 20 through conduits 45 and 46 to branch conduits 47 and 48 and is led through the conduits 47 and 48 to the teeth of the gears.

In the form of the invention shown in Figs. 1 to 4 a plurality of outlet ports is provided. These ports are arranged as shown in Fig. 3 in the form of a V, the lower port 50 being located approximately at the point of deepest mesh of the gear teeth. The ports 51 and 52 are located opposite the periphery of the gear 11 and the ports 53 and 54 are located opposite the periphery of the gear 12.

Each of the outlet ports consists of a valve chamber 55 having a valve seat 56 at one end and a valve such as a ball valve 57 adapted to seat on the valve seat. A spring 58 acts to press the valve against the seat and is enclosed by a ring or collar 59 disposed at the outer end of the valve chamber.

The outlet ports as shown in Fig. 2 are mounted in the plates 33 and 34 at opposite sides of the gears and the plates are longitudinally grooved as shown at 60, the grooves forming conduits for the outlet gas. From the groove or conduit 60, the gas and, of course, portions of the sealing liquid pass into a chamber 61 which surrounds the pump proper and is formed in the casing 10. The gas passes outwardly from the chamber through the gauze or strainer 16 and the oil or sealing liquid drops down into the bottom of the casing and is returned therefrom to the chamber 20 through the conduit 23.

In the embodiment of the invention shown in Figs. 5 to 8 inclusive, the pump elements are mounted in the same manner as in the preceding figures but the pump inlet ports are located in different positions from the inlet ports in the first embodiment of the invention and a metering device is provided in the oil intake conduit.

Referring to Figs. 5 to 8 inclusive, it will be seen that the intake gas passes from the intake chamber 71 into conduits 72 and 73. The conduits 73 lead through the block 13, plates 33 and 34 and block 32 over the tops of the gears and downwardly to slots 75 formed on the plate 34 opposite the ends of the teeth of the gear 12 and located opposite portions of the teeth just prior to their moving into mesh. The conduits 72 lead through the block 13 and plate 33 to slots 76 formed in the plates 33 opposite ends of the teeth of the gear 11. In this manner the intake gas is conducted to the gear teeth just prior to their moving into mesh and, therefore, is in contact with the teeth a minimum period of time. This, of course, will prevent as far as possible the expansion of the gas due to its contact with the hot teeth.

The metering device shown in detail in Fig. 8 is introduced into the oil or sealing liquid system intermediate the conduit 80 which receives the oil from the pump casing and the conduit or conduits 81 which conduct the oil to the gear teeth.

The metering device consists of a tubular member having a threaded portion 82 which is threaded into the pump casing and a longitudinally extending portion 83 which forms the valve chamber. The valve chamber has positioned at one end thereof a ring 84 and has positioned at its opposite end a plug 85 having a plurality of openings 86 therethrough and having a tapered, longitudinal portion 87 provided with a longitudinal opening 88 therein. The portion 87

extends upwardly into the valve chamber and is surrounded by a spring 89, one end of which seats against the plug 85 and the other end of which engages a sleeve or collar 90. It will be noted that the sleeve or collar 90 overlaps the ring 84 or, stated differently, has a smaller opening therethrough than the ring 84.

Furthermore, the collar 90 has a smaller outside diameter than the inside diameter of the valve chamber formed by portion 83.

The metering device operates as follows. When the pump is operating at low pressure and the pressure of the sealing liquid is, therefore, low, it will pass through the metering device by passing through the ring 84 around and through the collar 90 and through the central passage 88 in the plug 85 and also through the openings 86 in the plug 85. If, however, the pressure of sealing liquid is increased, its increased pressure will cause the collar or sleeve 90 to be forced downwardly, thus decreasing the area of the passage through the opening in the collar and decreasing the amount of liquid passing through the openings 86. In this way variations in pressure are compensated for by the metering device and a uniform and constant supply of sealing liquid is fed to the gears.

From the foregoing specification it will be seen that the pump is so constructed and arranged that it will operate efficiently under wide variations in the differential between the intake and outlet pressures and by reason of the check valves, the efficiency of the pump is increased since back pressure from the pressure tank cannot reach the gear teeth. Furthermore, in the embodiment of the invention shown in Figs. 5 to 7 inclusive, the intake ports are so located that the pressure created in the teeth due to the contact of the intake gas with the hot gears is reduced to a minimum.

In the diagrammatic showing in Fig. 7, the gas intake is shown at A, sealing liquid intake at B, and discharge ports at C. Gas inlet ports A should cut off before the gear teeth pass into mesh and sealing liquid intake ports B also should be located to introduce the sealing liquid to the teeth before the teeth mesh.

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, a pair of intermeshing gears therein, pump intake ports and pump outlet ports, all of said ports being disposed on the same side of a

plane passing through the axes of said gears.

2. A pump comprising a casing, a pair of intermeshing gears therein, intake ports located adjacent the approaching portions of the gears, and discharge ports for said pump located adjacent the intermeshing portions of the gears.

3. A pump comprising a casing, intermeshing gears therein, intake ports communicating with said gears and located above the axes of rotation of said gears and adjacent the approaching portions thereof, and discharge or outlet ports communicating with the intermeshing portions of said gears.

4. A pump comprising a casing, intermeshing gears therein, intake ports communicating with said gears and located opposite and in communication with nonintermeshing portions of the gears at the ends of the teeth and above the axes of rotation of the gears and discharge or outlet ports communicating with the intermeshing portions of said gears.

5. A pump comprising a casing, a pair of intermeshing gears therein, a conduit for conducting sealing liquid to the teeth of said gears and pressure controlled means in said conduit for insuring the passage of a uniform quantity of liquid to the gears regardless of the pressure forcing the liquid through the conduit.

6. A pump comprising a casing, a pair of intermeshing gears therein, a conduit for conducting sealing liquid to the teeth of said gears and a pressure responsive metering device in said conduit for maintaining a uniform flow of liquid to the gears under varying conditions of pressure.

7. A pump comprising a casing, a pair of intermeshing gears therein, a conduit for conducting sealing liquid to the teeth of said gears and a metering device in said conduit, said device comprising a casing having an inlet port and an outlet port and means intermediate said ports adapted to control the flow of liquid through said ports.

8. A pump comprising a casing, a pair of intermeshing gears therein, a conduit for conducting sealing liquid to the teeth of said gears and a metering device in said conduit, said device comprising a casing having an inlet port and an outlet port and spring pressed means intermediate said ports adapted to control the flow of liquid through said ports.

9. A pump comprising a casing, a pair of

intermeshing gears therein, outlet ports communicating with the intermeshing portions of said gears at different stages in the intermeshing thereof and valves in said ports adapted to open away from the gears.

10. A pump comprising a casing, a pair of intermeshing gears therein, outlet ports communicating with the intermeshing portions of said gears at different stages in the intermeshing thereof and check valves in said ports adapted to open away from the gears.

11. A pump comprising a casing, intermeshing gears therein, a plurality of outlet ports disposed at the ends of said gears and in alinement with intermeshing portions of said gears at different stages in the intermeshing thereof, and outwardly opening valves in said ports.

12. A pump comprising a casing, intermeshing gears therein, a plurality of outlet ports disposed at the ends of said gears and in alinement with intermeshing portions of said gears at different stages in the intermeshing thereof and check valves in said ports.

13. A pump comprising a casing, a pair of intermeshing gears therein, intake ports communicating with the ends of the teeth of said gears as the teeth of the gears are approaching, said intake ports being located to cut off the intake prior to the meshing of the teeth.

14. A pump comprising a casing, a pair of intermeshing gears therein, intake ports communicating with the teeth of said gears as the teeth of the gears are approaching, said intake ports being located to cut off the intake prior to the meshing of the teeth, and means for introducing sealing liquid to the gear teeth after the intake gas is introduced and before the teeth move into mesh.

15. A pump comprising a casing, a pair of intermeshing gears therein, intake ports communicating with the teeth of said gears as the teeth of the gears are approaching, said intake ports being located to cut off the intake prior to the meshing of the teeth, and a discharge port communicating with the intermeshing teeth.

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.