

Nov. 19, 1929.

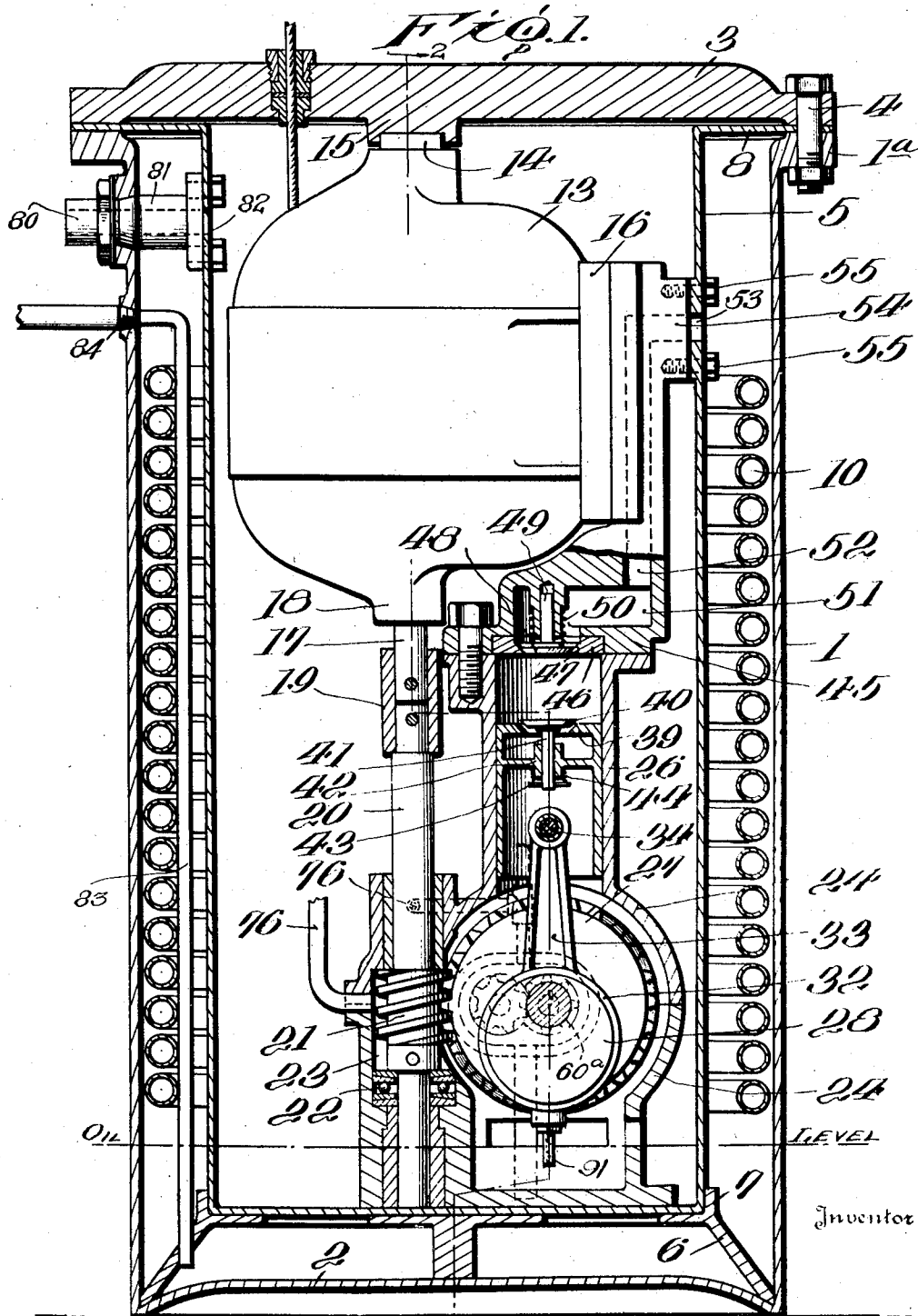
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REFRIGERATING APPARATUS

Filed Oct. 11, 1924

2 Sheets-Sheet 1



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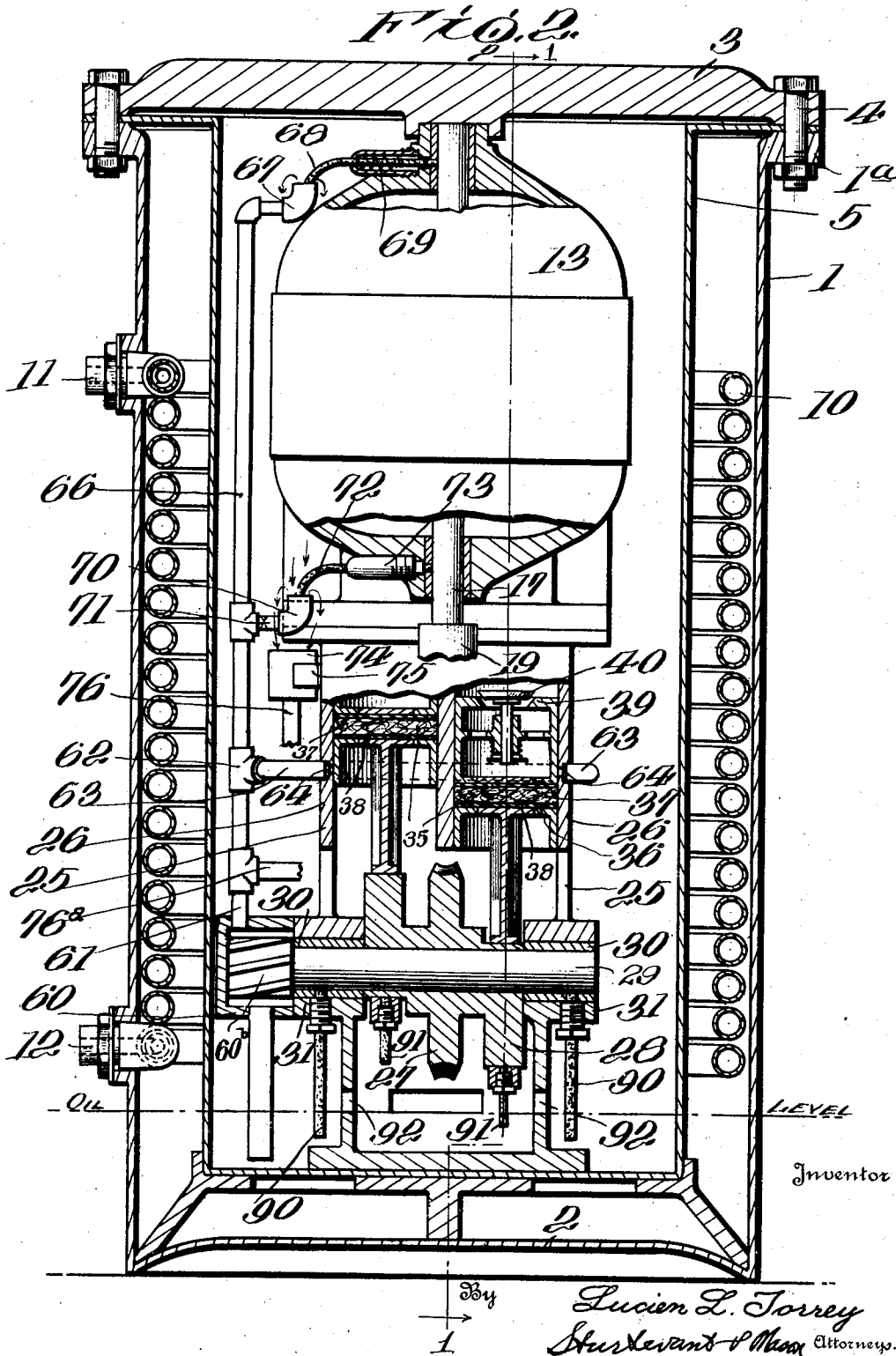
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UNITED STATES PATENT OFFICE

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REFRIGERATING APPARATUS

Application filed October 11, 1924. Serial No. 743,072.

This invention relates to certain improvements in my refrigerating apparatus described in my co-pending applications, Serial Numbers 700,824 and 739,579, filed March 21, 1924 and September 24, 1924, respectively.

One of the objects of this invention is to provide an apparatus in which the lubricating oil is at all times maintained separate from the liquid refrigerating agent used.

Another object is the provision of an improved pump assembly involving a reduction in the number of parts and by which the compressed gases are led directly to the discharge opening through the body of the pump.

Another object is the provision of a lubricating system for supplying oil to the motor and to the pump bearings under a predetermined constant head.

Another object is to provide an arrangement of the parts so that lubrication of all moving parts of both the compressor and the motor are thoroughly and positively lubricated without immersing of such moving parts in oil.

It has been found that difficulties arise when liquid sulphur dioxide is brought into contact with the lubricating oil, or when the oil is splashed or atomized in the presence of sulphur dioxide gas, due to the formation of an oily foam which may be carried over to the expansion valve in which it may provoke stoppage or clogging by separating waxy or tarry constituents upon cooling. These difficulties are avoided in the present invention by separating the oil supply from the liquid sulphur dioxide, by a partition wall, and by providing a mechanical lubricating system for the moving parts. The apparatus is so constructed that only sulphur dioxide gas under reduced pressure comes in contact with the oil while the pump is in operation, and that no splashing or spraying of the oil is employed.

It has heretofore been impracticable to utilize a cylinder and piston construction in which the gas is sucked in through the crank case, as the splash lubricating system employed resulted in the discharge of oil into the discharge pipe, from which it passed to

the expansion valve with the results set forth above. In my improved construction in which all splash lubrication of the cylinder is dispensed with, the piston head suction valve may be employed, and the discharge valve and chamber formed integrally in the cylinder head. In this way the motor bracket, cylinder head, and upper discharge may be formed as a unit.

A further advantage arises in this construction in that little or no oil has access to the liquid sulphur dioxide sump, and hence does not pass to the expansion valve. In former apparatus, the passage of lubricating oil through the expansion valve has resulted in a collection of paraffin wax or asphaltum tar in and around this reducing valve. The elements of the valve are necessarily very small, and a very minute quantity of impurity from the oil, when solidified out by the low temperature, will cause sticking or plugging of the valve.

With these and other objects in view, I have represented on the accompanying drawing one form of execution of my device, in which—

Figure 1 represents a section on the line I—I of Fig. 2;

Fig. 2 is a section on the line II—II of Fig. 1.

Referring now to the structure represented, 1 is the tank or container for the apparatus, having the bottom 2 and the cover 3. This cover is held in place by a series of bolts 4.

Within this outer tank an inner tank 5 is concentrically disposed and supported at its bottom by a pedestal 6 having an upturned flange 7 to assure the inner tank against lateral movement. At the upper end the tank has an outturned flange 8 which is received between the cover 3 and the flange 1^a on the upper end of the outer tank: the cover and the two tanks are held together with a hermetic seal by the use of the single series of bolts 4.

Disposed immediately within the wall of the outer tank is the cooling coil 10, connected at the nipple 11 with a water inlet and at the nipple 12 with a water outlet. The circulation of the water downwardly in the coil en-

ables the coil to clean itself, and to pass any sand or sediment out at the lower nipple.

The electric driving motor 13 is mounted in the upper end of the inner chamber, and has its reduced upper shaft bearing 14 carried in a centering cup 15 formed integrally with the cover 3. The motor is formed with the regular foot or connecting bracket 16 at one side as shown in Fig. 1. The driving shaft 17 of this motor passes through a lower bearing 18 of the motor and into a coupling sleeve 19 in general as shown in my co-pending application which forms a connection with the worm shaft 20 carrying a worm 21 and which is supported at its lower end by a thrust bearing represented at 22. The worm and the thrust bearing are carried in a cavity 23 formed in the two casting halves 24, 24 forming the support and structure of the motor and compressor assembly. These castings also embody the supporting brackets 25 and the cylinder block 26, 26 for the compressor. The worm 21 drives the worm wheel 27 which is formed integrally with a double eccentric member 28, 28 and mounted on the main shaft 29. This main shaft is carried in bronze bushings 30, 30 mounted in the pedestals 31, 31 formed integrally with the castings 24.

Mounted on each of these eccentrics is a strap 32 connected by the link 33 to the wrist pin bearing 34 journaled on the hollow wrist pin 35. This wrist pin is retained in the piston 36 and is packed with a mass of wick or similar material 37, for the purpose which will be set forth hereinafter. For the purpose of lubricating the wrist pin bearing, small apertures 38 are provided through the wall of the wrist pin 35.

The head of the piston 36 is formed as a valve seat 39 to receive a conical valve 40. This valve has a stem 41 which is guided in a member 42 formed integrally with the upper portion of the piston. A pin 43 serves as the retaining member for the valve seating spring 44 which takes its other bearing against the guide member 42.

Mounted on the upper end of the cylinder block 26 is a head casting 45 formed with cavities to receive the valve cage members 46. These valve cage members have formed thereon the conical valve seats 47, to receive the outlet valves 48 of the compressor cylinders. These valves have the guide stems 49 mounted in an appropriate manner and provided with the valve seating springs 50.

The casting 45 is cored out as indicated at 51 to form a communication between the valve chambers above the valves 48 and a bore hole 52 formed within the body of the casting 45 and leading to the outlet 53 in the attaching boss 54 on the upper portion of the casting 45. The motor foot 16 is secured to this casting 45 by means of bolts or in any other appropriate manner. The bore hole 52 may be formed partly in the casting 45 and partly in

the motor foot 16, if so desired. The bolts 55 are used to hold the casting 54 in rigid relation with regard to the inner tank 5.

Mounted at the end of the shaft 29 and formed integrally with the casting 31 is a housing 60 of a gear oil pump 60^a, which takes up lubricant from the oil supply contained in the bottom of the inner tank through the pipe 60^a and delivers it through a pipe 61. A T 62 permits diversion of a portion of this oil to the pipes 63, 63 opposite the lowermost position of the two wrist pins. At these points, the oil is delivered to the interior of the cylinders through felt washers 64 or similar devices to limit the passage of oil. It will be understood that the oil supply coming to these felt washers 64 is held back and only a minute quantity permitted to pass through into the cylinder. This serves to take a small quantity of oil to the reserve contained in the wick 37, and this supply, by seepage through the openings 38 will keep the wrist pins well lubricated at all times.

The upper branch 66 of the oil supply pipe leads to an oil basin 67 into which is immersed a wick 68 feeding the upper oil cup 69 of the electric motor. Since the particular construction of this oil cup forms no part of my present invention, it is sufficient to refer to it as being a wick system for lubricating the shaft of the motor.

The oil which is delivered to the basin 67 in excess of the requirement of the wick 68 is permitted to drip downward and be caught in a similar basin 70 supported by a short closed pipe or rod 71 held on the piping system 66. A wick 72 is immersed in this oil basin 70, and performs the function of supplying a limited but sufficient quantity of lubricant to the lower oil cup 73 of the electric motor.

Any excess of oil in the basin 70 is permitted to drop into a funnel 74 attached to the cylinder block by the lugs 75. From this funnel 74 the oil passes into the pipe 76 leading to the worm 21. In this way, the supply of flooding oil is provided for the worm, and thereby to the worm wheel.

The main bearings and the eccentric cams are lubricated by wicks 90, 91, dipping into the crank case sump. This sump is kept at a predetermined level by the overflow openings 92 through which the excess of oil is returned to the general sump. It will be noted that this oil level is such that the wicks 91 on the cam straps just touch the surface, and no substantial spilling occurs. The oil level existing in the general sump is maintained at not greater than the level of the bottom of the openings 92, so that the oil within the crank case sump wilfully rises above such level. In this way, splashing of the oil by the momentary tapping of the sections is substantially avoided. The expression "tolerance level" has been employed

to designate the surface of a quantity of oil which does not exceed such predetermined level.

A further branch pipe 76^a leaves the pipe 61 and passes to the upper worm bearing.

The method of operation of this apparatus is as follows: the expanded sulphur dioxide gas returning from the expansion coil enters the apparatus at the nipple 80 and passes through the connection pipe 81 to the mouth 82 through which it enters the inner chamber. When the pump is started, it immediately creates a vacuum in this return pipe, by sucking the gas from the inner chamber through the lower valves 40 into the pump cylinders. The gas, after compression in these cylinders, is delivered through the chamber 51 and bore hole 52, and outlet 53 to the annular space between the two tanks. In this space, it is cooled and condenses until it collects in liquid form in the bottom of this annular space. The natural pressure of sulphur dioxide gas prevailing in this annular space causes the liquid sulphur dioxide to be forced upwardly through the supply pipe 83 and the nipple 84 to the expansion valve, and when this valve is opened by the reduced pressure on its other side as created by the operation of the compressor, the liquid is expanded upon passing the expansion valve to obtain a cooling effect in the cooling coil as shown in my co-pending application heretofore referred to. This expanded gas returns through the nipple 80 and the above process repeats itself.

If any sulphur dioxide be present in the oil when the apparatus is started, the vacuum immediately created by the pump in the inner tank and above the oil level, will cause the sulphur dioxide to be withdrawn from this oil, and restore to the latter its lubricating properties.

It has been found that difficulty arises from a solution of sulphur dioxide in the lubricating oil which I am enabled to avoid in my present apparatus, by maintaining this oil carefully separated from the liquid sulphur dioxide. It will be noted that only sulphur dioxide gas under reduced pressure comes in contact with the body of the oil while the pump is in operation, and that no splashing or spraying of the oil is used.

It is obvious that minor changes in the details of construction and arrangement of the parts may be made without departing from the spirit of the invention as set forth in the appended claims.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent, is—

1. In a refrigerating apparatus, the combination of a tank to receive expanded gases, a motor in said tank, a compressor in said tank to suck the expanded gases from said tank and deliver it under increased pressure

to the exterior of said tank, said compressor having a reciprocating piston with a hollow wrist pin, said tank being adapted to contain lubricating oil in its bottom, said motor and compressor being located above the level of the oil supply, an oil pump in said tank to draw oil therefrom, said motor driving said compressor and said pump, and a piping system connecting said pump and motor and the cavity of said wrist pin to supply lubricant to the bearings of the same, whereby only gases at low pressure come into contact with said lubricating oil and whereby splashing of oil in contact with the gases is avoided.

2. In a refrigerating apparatus, the combination of a tank to receive expanded gases, a motor in said tank having a vertical driven shaft, a reciprocating compressor having a horizontal shaft and located in said tank to suck the gases therefrom and to deliver the same outside said tank under increased pressure, a mechanical connection including a worm on said vertical shaft in mesh with a gear on said horizontal shaft whereby said motor drives said compressor, said tank being adapted to have a supply of oil therein to a tolerance level below said motor, said compressor shaft and said connection, a pump driven from said motor to draw oil from said tank, and a piping system connecting said pump, said motor and said connection, to supply oil to said motor and connection bearings and to the said worm.

3. In a refrigerating apparatus, the combination of a tank to receive expanded gases, a motor in said tank having a vertical driven shaft with upper and lower bearings for the same, a reciprocating compressor in said tank to suck the gases therefrom and to deliver the same outside said tank under increased pressure, said motor driving said compressor, said tank being adapted to have a supply of oil therein to a tolerance level below said motor bearings, an oil pump driven by said motor to draw oil from said tank, an oil receiving basin adjacent said upper motor bearing, and an oil receiving basin adjacent said lower motor bearing, means whereby the oil in said basins is delivered to said respective bearings, and a piping system connecting said pump and said upper basin whereby to maintain the same full to overflowing, the overflow of oil from said upper basin entering said lower basin.

4. In a refrigerating apparatus, the combination of a tank to receive gases, a motor in said tank having a vertical driven shaft, a compressor in said tank to suck the gases therefrom and to deliver the same outside said tank under increased pressure, a mechanical connection between said motor and compressor to drive the latter, said motor having upper and lower motor bearings, said

tank being adapted to have a supply of oil therein to a tolerance level below said motor bearing and mechanical connection, a pump driven from said motor to draw oil from said tank, receiving basins adjacent said upper and lower motor bearings, and a piping system connecting said pump and said upper receiving basin to maintain the same full to overflowing, the overflow from said upper basin entering said lower basin, means to deliver oil from said basins to said motor bearings, and a conduit to receive the overflow from said lower basin and conduct the same to said mechanical connection for the lubrication thereof.

5. In a refrigerating apparatus, the combination of a tank to receive expanded gases, a motor in said tank, a reciprocating compressor having a horizontal shaft and located in said tank to suck the gases therefrom, said compressor including a piston movable in a cylinder, said piston having the inlet valve of said compressor located in its head, said motor driving said compressor, said tank being adapted to have a supply of oil therein to a tolerance level below said shaft and motor, a pump driven from said motor to draw oil from said tank, a piping system connecting said pump with a port in said cylinder, in the line of movement of the end of the wrist pin for said piston, said piston at all times overlapping said oil port, whereby oil under pressure from said port is delivered to said hollow wrist pin, and means in said hollow wrist pin for delivering said lubricant, whereby the gases passing through said inlet valve are maintained out of contact with splashed oil.

6. In a refrigerating apparatus, the combination of a tank to receive expanded gases, a motor in said tank, a compressor in said tank having a discharge head at its top, and being adapted to suck the gases from said tank and to deliver the same into said discharge head under increased pressure, a connection on said head whereby to secure the same in sealed relation with the wall of said tank with communication between the interior of said head and a port in said tank, a cover closing and sealing said tank, said tank being adapted to have a supply of oil therein to a tolerance level below said motor and compressor, a pump driven from said motor to draw oil from said tank and a piping system connecting said pump, said motor and said compressor to supply oil to bearings thereof.

7. In a refrigerating apparatus, the combination of a tank to receive expanded gases, a motor in said tank, a compressor in said tank to suck the gases therefrom and to deliver the same outside said tank under increased pressure, said compressor structure including a housing, a mechanical connection in said housing driven from said motor

to actuate said compressor, said compressor assembly and housing being mounted on the bottom of said tank, said compressor also including a discharge head, means connecting and sealing said discharge head to the wall of said tank, the interior of said discharge head communicating through a port in said wall for the discharge of said gas under pressure to the outside of said tank, whereby said head and compressor assembly and housing are held in rigid position within said tank.

8. In a refrigerating apparatus, the combination of a tank to receive expanded gases, a motor in said tank, a compressor in said tank to suck the gases therefrom and to deliver the same outside said tank under increased pressure, said compressor structure including a housing, a mechanical connection in said housing driven from said motor to actuate said compressor, said compressor assembly and housing being mounted on the bottom of said tank, said compressor also including a discharge head, means connecting and sealing said discharge head to the wall of said tank, the interior of said discharge head communicating through a port in said wall for the discharge of said gas under pressure to the outside of said tank, whereby said head and compressor assembly and housing are held in rigid position within said tank, and a motor support on said discharge head, said motor being fastened to said support, whereby said tank, said motor, said compressor and said driving connection are held rigidly in fixed relation to each other.

In testimony whereof, I affix my signature.
LUCIEN L. TORREY.