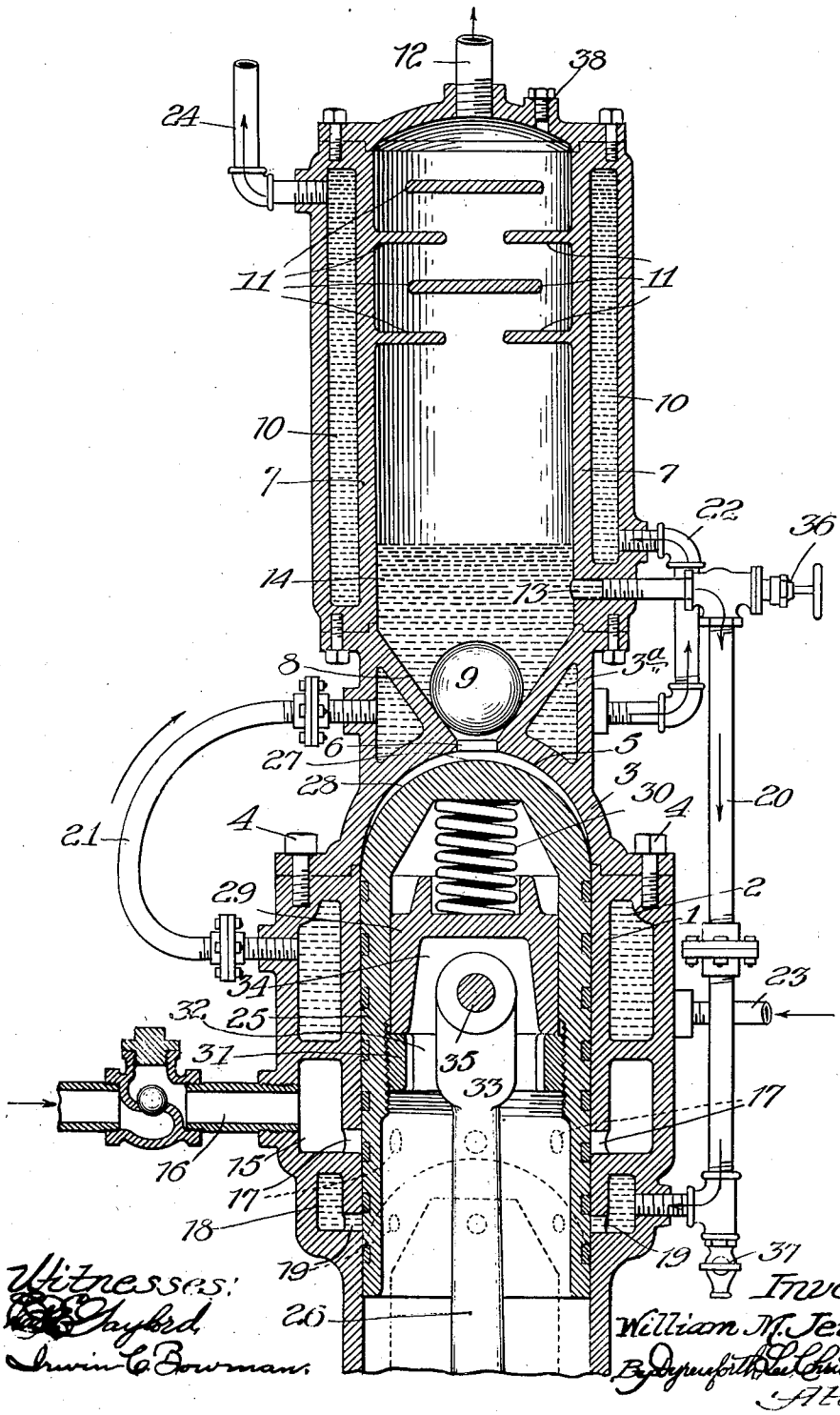
W. M. JEWELL.

ART OF LUBRICATION.

APPLICATION FILED DEC. 17, 1917.

1,350,551. Patented Aug. 24, 1920.



# UNITED STATES PATENT OFFICE.

WILLIAM M. JEWELL, OF CHICAGO, ILLINOIS, ASSIGNOR TO CHLORINE PRODUCTS COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

## ART OF LUBRICATION.

1,350,551. Specification of Letters Patent. Patented Aug. 24, 1920.

Application filed December 17, 1917. Serial No. 207,462.

*To all whom it may concern:*

Be it known that I, WILLIAM M. JEWELL, a citizen of the United States, residing at 132 N. Menard Ave., Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in the Art of Lubrication, of which the following is a specification.

My invention relates in general to the general art of lubricating relatively movable contacting parts, as for example bearings and the parts movable therein, and pistons and the cylinders containing them, and more particularly to the lubrication of those surfaces of machines, as for example compressors, with which contact, in the operation of the machines, gases of such character that when in wet condition, namely when they contain free moisture, they attack the metal with which they contact and corrode the same, and furthermore so act upon lubricating media, as heretofore commonly employed, as to greatly reduce and oftentimes destroy, the lubricating properties of the lubricants.

One of my objects is to provide for the most effective lubricating of parts of machines in general, with the minimum amount of lubricating material. Another object, and this in connection with the lubrication of compressors for compressing gas of a character which injuriously affects lubricants hitherto used, and, when in wet condition, namely carrying free moisture, attacks metal, is to provide a lubricating medium for the parts of the compressors contacted by the gas, the lubricating properties of which are not affected by contact of the lubricant with the gas, and which serves to absorb the free moisture in the gas being compressed, and another object is to provide a lubricant which will not have its lubricating properties injuriously affected when contacted by gas of such character that lubricants as hitherto provided, have been injuriously affected by subjection thereto.

In the accompanying drawing, I have shown my invention as utilized in a compressor designed for the compressing, more particularly, of chlorin gas into liquid form, wherein the compressor is shown by a broken view in vertical, sectional elevation.

The compressing of chlorin gas into liquid form for commercial purposes, presents in accordance with previous practises which include preliminary drying as by towers the serious disadvantage of the chemical action of the gas on the metal of the compressors and in time impairing the compressors for effective service, and so acting on the lubricants as commonly provided, as to render them inoperative for their lubricating function, and cause certain parts of the mechanism to clog and stick, oftentimes these actions being brought about with such severity and so quickly that the machine is rendered inoperative after a comparatively few hours of use.

I have discovered that by lubricating the piston and cylinder of the compressor, with a lubricant which will not be chemically acted upon by the chlorin gas, or other gas being compressed, and which has the characteristic of absorbing moisture, the moisture will be absorbed from the gas being compressed which renders the gas by reason of its resultant dry condition, non-corrosive of the metal of the compressor where the metal is such as is attackable only when the gas is in wet condition as is usually the case, and thus the compressor will be maintained in lubricated condition, and not injured or impaired by the action of the gas being compressed; and I have discovered that comparatively dry sulfuric acid is a very desirable material to use for this purpose, the lubricating property of sulfuric acid being very great, and such substance, while not being subject to chemical change by contact with the chlorin gas, acts as an absorber of the moisture in the gas coming in contact with it. Furthermore, I have discovered that sulfuric acid when maintained in relatively dry condition is a very desirable medium for lubricating purposes in general and its utility is not limited to use in connection with the pistons and cylinders of gas compressors.

In the use of sulfuric acid as a lubricant, it is desirable that it be maintained in as dry condition as possible, and I have found in practice that the acid used by preference be of 1.84 specific gravity at 66 degrees Baumé 95% pure and maintained at not less than 1.70 specific gravity at 60 degrees Baumé, approximately 77% pure, this being desirable as a moisture-content of the sulfuric acid reducing its specific gravity below 1.70 at 60 degrees Baumé, causes the sul-

furic acid to have such action on the metal of the compressor with which it contacts that the effects produced thereby may be disadvantageous from a practical standpoint.

Referring to the compressor illustrated in the accompanying drawing and which is designed for use with sulfuric acid as the lubricating medium for its piston and cylinder mechanism, the upper end of the cylinder of the compressor, which stands in upright position, is represented at 1, its lower end (not shown) being of common construction care being taken to exclude air. The upper end of the cylinder 1 which is water-jacketed as indicated at 2, has its head 3 formed of a separate section, water-jacketed at 3ª and secured, as by the screws 4, to the body of the cylinder 1, the under surface 5 of this head being of semi-spherical contour and containing an opening 6 in its top portion which opens into a chamber 7, this opening being formed at the lower end of the funnel-shaped bottom 8 of the chamber and controlled by a ball-valve 9 which normally closes the opening 6, the chamber 7, which is preferably water-jacketed, as indicated at 10, containing baffles 11 in its upper portion, and having an outlet 12 at its top for the compressed gas, and an outlet 13 at its lower end for supplying the fluid lubricant to the cylinder from the supply thereof, located in the bottom of the chamber 7 and represented at 14. The upper end of the cylinder 1 contains an annular passage 15 in its wall in communication with a check-valve-equipped passage 16 leading from the source of supply (not shown) of gas to be compressed, the passage 15 communicating with the interior of the cylinder through ports 17, which are arranged in an annular series about the inner-surface of the cylinder and preferably equally-distantly spaced apart. Below the passage 15 is another annular passage 18, which surrounds the cylinder 1 and communicates with the interior of the latter through ports 19 arranged in an annular series about the inner-surface of the cylinder, the passage 18 opening into the lower end of a pipe 20, the upper end of which communicates with the lower portion of the chamber 7 through the outlet 13.

The various water-jackets described are connected together in series in the particular construction shown, by the pipe 21 connecting the jackets 2 and 3ª, and a pipe 22 connecting the jackets 3ª and 10, the inlet pipe for the series being represented at 23 and the outlet at 24.

The piston of the compressor is represented at 25, it being reciprocable in the cylinder 1 from the full line position shown in the drawing to the dotted position illustrated therein, by any suitable means, such as is common in compressors, connected with the pitman 26. The piston 25 is hollow and the outer surface of its upper end is of general spherical contour, as represented at 27, but it is desired that the surfaces 5 and 27 bear such relation to each other, as for example as shown, as to provide a slight clearance between them, as represented at 28, when the piston is at the limit of its upward stroke, and to provide a channel, preferably annular, between the cylinder wall and the piston to receive lubricant from the passage 18 through the ports 19, when the piston is in lowermost position, represented by the dotted lines in the drawing.

The part of the piston just described forms the outer section thereof within which is housed a plunger section 29 which guidingly fits within the outer shell section of the piston and is adapted for reciprocable movement up and down therein, the section 29 being located between a coiled spring 30 which bears at its upper end against the under side of the outer shell of the piston and at its lower end against the top of the plunger, and a ring 31 which is screwed into the outer shell of the piston, as represented. The pitman 26 extends upwardly through the ring 31 which is provided with webs 32 spaced apart and located substantially the same distances from the center of the ring 31 and between which the flat portion 33 of the pitman 26 is disposed, these webs being so arranged relative to the pitman that the latter operates to prevent unscrewing of the ring 31, the upper end of this pitman extending into a recess 34 in the underside of the plunger 29 to which it is secured by the pivot-pin 35.

In the operation of the compressor shown, assuming the chamber 7 to be charged with a desirable lubricant, as for example sulfuric acid, the body of which is represented at 14, the downward movement of the piston 25 creates a vacuum in the upper end of the cylinder 1 into which the gas to be compressed and supplied through the passage 16, rushes to charge the cylinder, when the ports 17 are uncovered by the downward movement of the piston. As the piston 25 nears the limit of its downward stroke, its upper portion opposes the ports 19 and causes them to be uncovered, which permits lubricating fluid to flow from the chamber 7 through the pipe 20 and ports 19 into the cylinder where it enters the annular groove provided between the inner-wall of the cylinder 1 and the reduced portion of the piston 25. In the upward movement of the piston, the ports 19 are the first to close and then the ports 17, and the charge of gas drawn into the cylinder, as hereinbefore stated, is compressed and discharges through the outlet 6 and around the ball-valve 9 which later rises, the gas flowing through

the body 14 of lubricant and thence around the baffles 11, discharging from the chamber 7 through the pipe 12 which would lead the gas, compressed to the desired degree, to condensing apparatus (not shown) for reducing it to liquid condition. On the upward stroke of the piston, as stated, the lubricant which enters the cylinder during the relatively brief period that the ports 19 are uncovered, is carried up along the walls of the cylinder by the rising piston to lubricate these surfaces and is discharged with the compressed gas through the opening 6.

It will be noted from the foregoing that by connecting the pitman 26 with the plunger 29 backed up by the spring 30, instead of attaching it directly to the outer section of the piston, and by providing the spring 30 of the desired tension, should a condition occur in the operation of the compressor, which would result in undue strains or breakage of the moving parts if the pitman were directly connected with the outer section of the piston, as for example the presence of a body of the lubricant of such amount that the back-pressure produced thereby in the clearance 28 would be such as to strain or break parts of the compressor, the spring 30 will yield upwardly under the pressure applied against it by the rising plunger 29 and thus avoid the objectionable stresses and strains, the plunger 29 returning to its seat against the ring 31 as soon as the pressure in the upper end of the cylinder 1 is less than the pressure exerted by the spring 30.

It will be understood from the foregoing that the lubricant for the piston and cylinder is caused to circulate by the action of the piston in reciprocating, through the chamber 7, pipe 20, and cylinder 2, the pipe 20 containing a valve 36 through the medium of which the amount of lubricant permitted to enter the cylinder 1 upon each downward stroke of the piston, may be regulated, as desired. In practice, it is preferred that the valve 36 be so adjusted that the amount of lubricant carried up by the piston upon each upward stroke be sufficient to at least completely fill the clearance 28 and in setting the valve, it is so set that the flow be such as to insure this result even though an amount of lubricant slightly in excess of that sufficient to fill the clearance 28 is caused to flow into the cylinder each time the piston is operated.

In the use of the lubricant as stated, it comes in contact with the gas which enters the cylinder 1 upon the downward stroke of the piston, as stated, the moisture in the gas being absorbed by the lubricant in the passage of the gas from the ports 17 to the outlet 12. While the gas being compressed is caused to be in the cylinder for a comparatively short time only, the absorbing action of the lubricant is rendered highly effective in view of the existence of the heat of compression, the forcing of the gas into intimate contact with the lubricant and the frictional contact of piston with cylinder, the existence of these conditions effecting a rapid and thorough moisture-absorbing action.

As the compressor continues in operation, the lubricant-fluid becomes more and more charged with the moisture taken up from the gas undergoing compression and when the moisture-content increases to such a point that the lubricant possesses the property of appreciably attacking the metal as commonly used, such for example, as cast iron or steel, in other words where the lubricant is sulfuric acid and its specific gravity drops to approximately 1.70 at 60 degrees Baumé, the lubricant in the lubricant-circulating system hereinbefore described, is removed through the valve-equipped drain-pipe 37, and replaced through a filling-opening 38 by a fresh charge of lubricant in condition to absorb a certain amount of moisture from compressed gas without rendering it in such condition as to produce objectionable injury to the metal with which it contacts.

The action of the lubricant in removing the moisture from the gas being compressed, particularly when it is chlorin gas, is of advantage not only because the gas is rendered in such relatively dry condition that it does not injuriously affect the metal from a practical standpoint when such as is commonly used, but because the liquefied gas is caused to be comparatively dry, which is of great advantage as liquefied chlorin gas is generally shipped in metal containers which, especially when the liquefied gas is permitted to remain in them for a relatively great length of time, are injuriously affected by the action of the gas on the metal.

The main advantages in forming the upper end of the piston and the underside of the cylinder, as shown, are that instead of flooding the entire top of the piston, as would be the case where the piston-head is flat, in order that the desired amount of lubricant be carried up in contact with the walls of the cylinder, a relatively small portion of the piston only is covered, namely around its marginal edge, thus reducing the amount of lubricant carried up with each stroke of the piston and preventing pounding or knocking; and the discharge of all of the gas undergoing compression is facilitated and the egress from the cylinder of the excess lubricant, instead of being abrupt as in the case with flat pistons, is gradual.

While I have disclosed a certain embodiment of my invention, I do not wish to be understood as limiting it thereto, it being my intention to claim my invention as fully

and completely as the prior state of the art will permit.

What I claim as new and desire to secure by Letters Patent is—

1. In the art of lubrication, the method which consists in lubricating contacting surfaces, one or both of which is movable with relation to the other, by interposing a lubricant between the same consisting of comparatively dry sulfuric acid under conditions excluding outside moisture.

2. In the art of lubricating contacting surfaces of a gas compressor for compressing chlorin gas, one or both of which is movable with relation to the other and contacted by the gas, the method which consists in interposing a lubricant between the said contacting surfaces consisting of comparatively dry sulfuric acid and from which moisture is excluded other than that derived from the gas.

3. In the art of lubricating contacting surfaces of a gas compressor for compressing chlorin gas, one or both of which is movable with relation to the other and contacted by the gas, the method which consists in interposing between the said contacting surfaces a lubricating material from which moisture is excluded other than that derived from the gas and of such properties that its lubricating property will not be injuriously affected by subjection to chlorin gas.

4. In the art of lubricating contacting surfaces of a gas compressor for compressing chlorin gas, one or both of which is movable with relation to the other and contacted by the gas, the method which consists in interposing a lubricant between the said contacting surfaces consisting of comparatively dry sulfuric acid from which moisture is excluded other than that derived from the gas.

5. In the art of lubricating contacting surfaces of a gas compressor for compressing chlorin gas, one or both of which is movable with relation to the other and contacted by the gas and absorbing the moisture from the gas, the method which consists in interposing between the said contacting surfaces a lubricant material from which moisture is excluded other than that derived from the gas and of such properties that its lubricating property will not be injuriously affected by subjection to chlorin gas and moisture in the gas will be absorbed by the lubricating material.

6. In the art of lubricating contacting surfaces of a gas compressor for compressing chlorin gas, one or both of which is movable with relation to the other and contacted by the gas and absorbing the moisture from the gas, the method which consists in interposing between the said contacting surfaces a lubricant consisting of comparatively dry sulfuric acid under conditions excluding outside moisture.

7. In the art of lubricating contacting surfaces of a gas compressor for compressing gas, which in wet condition affects the metal of the compressor, one or both of which surfaces is movable with relation to the other and contacted by the gas and absorbing the moisture from the gas, the method which consists in interposing between the said contacting surfaces a lubricating material under conditions excluding all moisture other than that derived from the gas of such properties that it will not appreciably injure the metal of the compressor, its lubricating property will not be injuriously affected by subjection to a gas of the character above stated, and moisture in the gas will be absorbed by the lubricating material.

8. In the compression of a gas which when wet attacks the metal of the compressor, the method of interposing between contacting surfaces of the compressor, one or both of which is movable relative to the other, of a lubricating and moisture absorbing medium consisting of comparatively dry sulfuric acid and from which moisture is excluded other than that derived from the gas.

9. In the lubrication of compressors for chlorin gas or substances having similar properties, the method which consists in lubricating the parts thereof from a body of comparatively dry sulfuric acid excluded from moisture other than that derived from the gas, and discharging the gas through the body of such lubricant to absorb the moisture from the gas.

WILLIAM M. JEWELL.