

July 6, 1943.

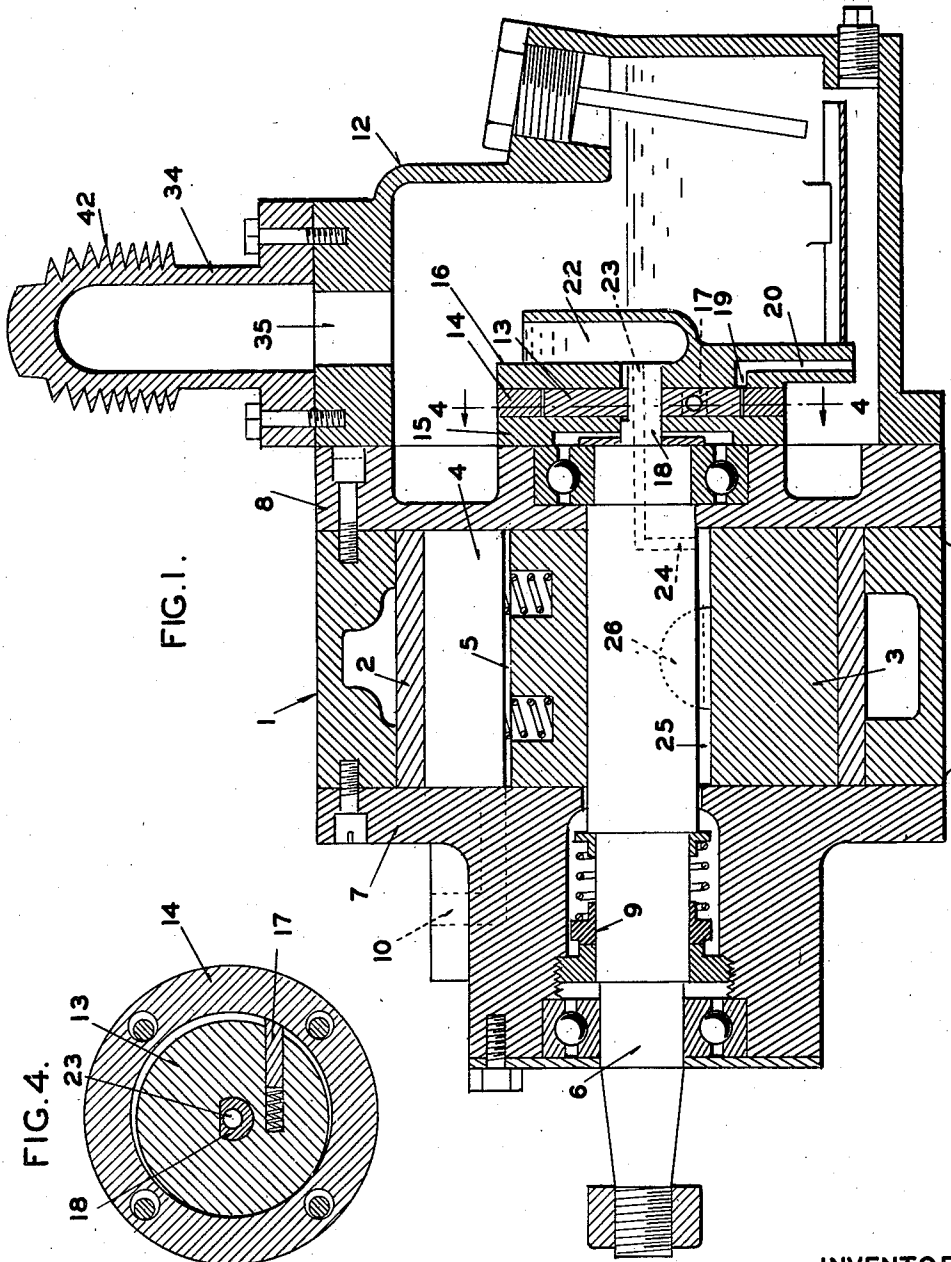
B. DICK ET AL

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LUBRICATING AND OIL SEPARATING SYSTEM FOR COMPRESSORS

Filed June 22, 1939

2 Sheets-Sheet 1



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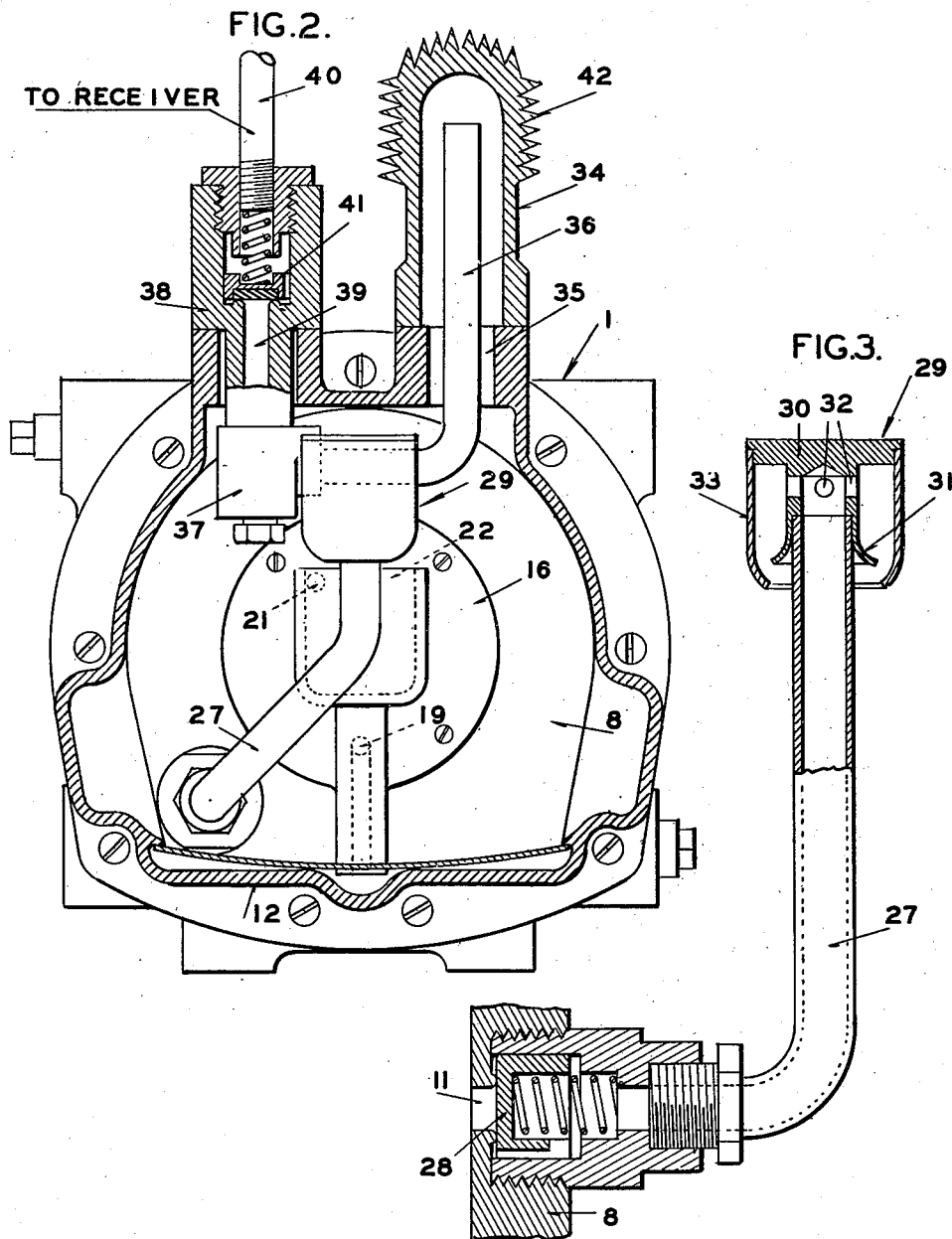
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LUBRICATING AND OIL SEPARATING SYSTEM FOR COMPRESSORS

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Application June 22, 1939, Serial No. 280,492

2 Claims. (Cl. 230—207)

Our invention relates to compressors and more particularly to a lubricating system therefor and to means for removing lubricant carried by the compressed fluid discharged by the compressor.

One of the objects of our invention is to provide an improved lubricating system for a compressor which will supply the proper amount of lubricant to the moving parts thereof at all times.

Another object of our invention is to provide means associated with the lubricating system of a compressor for efficiently separating lubricant from the compressed fluid, which lubricant is carried thereby in the form of particles in varying sizes, the smaller of which is in the form of a very fine mist, and returning this separated lubricant to the lubricating system for re-use.

Other objects of our invention will become apparent from the following description taken in connection with the accompanying drawings in which Figure 1 is a longitudinal cross-sectional view of a rotary air compressor showing my improved lubricating and oil separating system associated therewith; Figure 2 is an end view showing the oil separating portion of the system, parts being shown in section; Figure 3 is a cross-sectional view of the discharge conduit of the compressor and the oil separator associated therewith; and Figure 4 is a cross-sectional view taken on the line 4—4 of Figure 1, showing the oil pump.

Referring to the drawings in detail, there is shown a rotary compressor 1 comprising a stator 2 and an eccentrically mounted rotor 3 carrying a plurality of blades 4 slidably mounted in slots 5. The rotor is keyed to a drive shaft 6 which is journaled by suitable bearings in end plates 7 and 8. A seal 9 is associated with the end plate 7 and the shaft 6 to prevent leakage at the shaft. The end plate 7 is provided with an inlet passage 10 for admitting air to the compressor to be compressed and the end plate 8 is provided with an outlet passage 11 (Figure 3).

The end plate 8 of the compressor has secured thereto a housing 12 forming an oil reservoir for the lubricant employed to lubricate the compressor. Also mounted on this end plate is a rotary oil pump comprising a rotor 13 and a stator 14 mounted between two end members 15 and 16. The rotor and the single blade 17 thereof are driven from the main drive shaft 6 by an extension 18. The inlet port 19 of the oil pump is in communication with the bottom of the reservoir 12 by means of a passage 20 in the lower part of the end member 16. The discharge port 21 (Figure 2) communicates with a well 22

formed integral with the end member. The reduced end 18 of shaft 6 extends to the well and oil is fed through shaft passages 23 and 24 to the interior of the compressor, the passage 24 entering into the keyway 25 of the shaft, the key 26 being grooved to permit the fluid to flow to the remote end of the keyway.

From the above described structure it is seen that when the compressor is operating, the oil pump will cause well 22 to be continuously filled with oil and this oil will be free to flow into the compressor and lubricate all the moving parts thereof. The flow of oil from the well into the compressor will be under the action of gravity and also the differential pressure resulting from fluid under pressure in the oil reservoir and a lower pressure in parts of the compressor. Part of the oil which is fed to the compressor is picked up by the compressed air and carried out of the discharge opening 11 of the compressor, this oil being in the form of particles of varying sizes, the smaller of which are a very fine mist. In order to prevent the discharged compressed air from passing through the oil in the reservoir and causing this oil to assume a foam state, a conduit 27 is employed to conduct the discharged compressed air into the upper part of the reservoir. A check valve 28 (Figure 3) is also provided at the outlet of the compressor for preventing return flow of fluid to the compressor.

If the oil carried out of the compressor with the compressed air is permitted to remain in the air which is employed in a mechanism operated by the compressed air, there will soon result a continuous loss of lubricant from the reservoir and the compressor would not be adequately lubricated unless oil were continuously added to the reservoir which, of course, would involve waste and be costly. For efficient operation it is desired to extract substantially all the oil being carried by the discharged compressed air and return this oil to the reservoir, a small amount of the oil, however, being allowed to remain in the air to be used to lubricate any movable elements of the mechanism operated by the compressed air.

In accordance with our invention, we remove substantially all the oil carried by the compressed air by means of a separator and a condenser, the former removing the larger particles of the oil by causing the air to impinge successively on a plurality of surfaces and the latter removing the smaller particles in the form of a mist by causing the air to be cooled whereby these smaller particles are condensed.

As shown in Figures 2 and 3, there is mounted upon the upper end of the discharge conduit 27, an oil separator 29 which comprises a member 30 having a downwardly extending bell-shaped portion 31 for receiving the end of the pipe. Openings 32 in the extension permit the discharged air to flow radially outwardly and against the wall of a cylindrical member 33 which is carried by the member 30 and spaced from the extension 31. The air striking the surface of member 33 is directed back against the lower curved surface of the extension 31 which, in turn, will re-direct the air against the wall of the cylindrical member 33. The lower end of this cylindrical member is curved inwardly below the end of the projection 31 and this curved end will cause the air to be redirected against the pipe 27. The construction of the separator thus causes the compressed air to impinge successively upon a plurality of surfaces and because of this, the larger particles of oil will be precipitated and collect upon the various surfaces where the oil will be free to run back into the body of oil in the bottom of the reservoir.

The air, after passing through the separator, still carries an appreciable quantity of oil in the form of a very fine mist and, if this oil is not removed, a considerable waste of oil will be present. The structure we employ to remove this fine mist of oil from the compressed air comprises a dome-like member 34 mounted upon the top of the reservoir housing 12 and in constant communication with the top of the reservoir by a passage 35. Extending into the dome-like member is a tube 36 (Figure 2) which is of less diameter than passage 35. The lower end of this tube is connected by a fitting 37 to a member 38 attached to the top of the reservoir housing, this member being provided with a conduit 39 for connecting the tube to a conduit 40 leading to a receiver for storing the compressed air. A check valve 41 prevents fluid from the receiver from passing back into the reservoir.

The dome-like member 34 is preferably provided on its exterior surface with a plurality of cooling fins 42 so that heat may be conducted away from the inner wall surface of the dome and maintain it relatively cool. In order to facilitate the cooling of the dome-like member, a stream of air from any suitable fan may be caused to pass over the fins of the member. This fan may be the usual radiator cooling fan employed on internal combustion engines of a motor vehicle if the compressor is driven by such an engine.

It is thus seen from the structure just described that the air which has passed through the oil separator 29 and still carries an appreciable quantity of oil in the form of a fine mist, will flow upwardly through passage 35 and along the cool walls of the dome 42. This will cool the air and cause the small particles of oil to be condensed and then run back into the reservoir. The major portion of the condensing will take place before the air reaches the top of the dome 42 where it enters the tube 36 and then is conducted through the check valve 41 to the receiver. The open end of the tube 36 which extends into the dome is quite closely adjacent the top of the dome, thus insuring that the air which goes into the pipe will first have to pass along substantially the entire length of the cool walls of the dome-like member prior to entering the tube.

From the foregoing description of our lubricating and oil separating system, it is seen that

the compressor will be adequately lubricated as long as any oil is in the reservoir. The oil for lubricating the compressor is taken from the bottom of the reservoir by the oil pump and is then placed in a well from where it is free to enter the compressor. The oil which is carried from the compressor by the compressed air is removed from the air and returned to the reservoir prior to the air entering the receiver. The air carrying the oil is caused to successively pass through an oil separator and a condensing chamber, thus insuring that substantially the major portion of the oil carried by the air will be removed. The separator and the condensing chamber are so arranged that the oil removed from the air is free to flow back into the body of oil in the reservoir. By first removing the large particles of oil carried by the air by passing the air through the separator, the smaller particles in the form of mist remaining in the air are more efficiently removed by the condenser.

Being aware of the possibility of modifications in the particular structure herein described without departing from the fundamental principles of our invention, we do not intend that its scope be limited except as set forth by the appended claims.

Having fully described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. In apparatus of the class described, an oil separating means for removing oil in the form of both small particles and a fine mist from the discharged compressed fluid of a fluid compressor which has associated therewith an oil reservoir from which oil is fed to the compressor and through which the compressed discharged fluid passes to an outlet in the reservoir in order to place oil under pressure, an oil separator mounted in the oil reservoir above the oil level, a pipe connecting the compressor discharge port to the oil separator and through which all of the compressed fluid passes, said separator being so formed as to remove the small particles of oil from the compressed fluid so that said oil can return to the reservoir by causing the fluid to impinge successively upon a plurality of surfaces, means forming a cooling chamber above the reservoir and connected to said reservoir by a passage, a tube having one end directly connected to the outlet of the reservoir and its other end extending into the cooling chamber through the passage and to a point adjacent the top of the chamber whereby fluid will pass through the passage and along the walls of the cooling chamber before entering the tube to thus cause the oil in the form of fine mist to be condensed on said walls and return to the reservoir through the passage.

2. In apparatus of the class described, an oil separating means for removing oil in the form of a fine mist from the discharged compressed fluid of a fluid compressor which has associated therewith an oil reservoir from which oil is fed to the compressor and through which the compressed discharged fluid passes to an outlet in the upper part of the reservoir in order to place oil under pressure, conduit means for discharging the compressed fluid into the top of the reservoir above the oil level, means forming a detachable elongated cooling chamber positioned above and in communication with the oil reservoir by a passage and having the outer surface of its wall provided with heat radiating fins ex-

posed to atmosphere, a tube extending through the passage from the reservoir and having one end communicating with the top portion only of the chamber, said tube being of smaller diameter than the passage whereby fluid from the reservoir can enter the chamber and flow along the walls thereof to its upper end to thereby cause 5

the oil mist to condense on the walls and return to the reservoir through the passage, and means for directly connecting the other end of the tube to the outlet of the reservoir.

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