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ELECTROSTATIC VAPOR CONDENSER

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1 Claim. (Cl. 183—7)

This invention relates to air conditioning apparatus, and more particularly to an electrostatic precipitator operative to remove oil and water vapor from fluid under pressure delivered by a compressor.

A compressor of the commercial type employed in supplying fluid under pressure for use in a fluid pressure control system, such as an air brake equipment, may be expected to pass more or less oil and water vapor with the fluid compressed during operation under certain conditions. In order to prevent particles of oil and water from being carried along with the fluid under pressure delivered by the compressor into valves and other operating devices of the control system, it has been proposed to provide filters, condensing reservoirs, and the like, which are designed to function in a mechanical way to trap and remove from the compressed fluid as much of the undesired oil and moisture as possible. Such equipment may be rather bulky and often occupies more space than is justified by its relatively low efficiency.

The principal object of my invention is to provide an improved vapor condensing apparatus constructed and arranged to precipitate and remove substantially all particles of oil and water from air compressed by a compressor.

Another object of the invention is to provide a vapor condensing equipment of the above type which can be compacted into relatively small space and thus rendered suitable for installation on a locomotive.

It is another object of the invention to provide an improved vapor condenser comprising electrostatic means operative to impress an electric charge on particles of oil and water vapor suspended in fluid compressed by a compressor, so that the particles will adhere to an associated surface having an opposite charge, and means for collecting and removing the precipitated oil and water.

Other objects and advantages of the invention will appear in the following more detailed description thereof, taken in connection with the accompanying drawing, in which

The single figure is a diagrammatic elevational view, partly in section, of a portion of a fluid pressure system embodying an improved vapor condenser constructed in accordance with the invention.

The apparatus illustrated in the accompanying drawing comprises a motor driven compressor 10, a discharge cooling pipe 11, a receiving reservoir 12, a power-pack 13, and an electrostatic

vapor condenser associated therewith and designated generally by the reference character 14. The compressor 10 may be of any suitable construction, and as illustrated consists of a motor driven unit operative to supply compressed air or other fluid through the cooling pipe 11 and conduit 21 forming part of the electrostatic condenser 14, hereinafter described, to the receiving reservoir 12.

The high voltage power-pack 13 is illustrated in outline only, but it will be understood that this unit comprises means for generating electrostatic power involving uni-directional high voltage, which in practice may be in the neighborhood of 13,000 volts. The power-pack 13 may be of any suitable construction, and may include the usual transformer, rectifier tubes, and condensers, the details of which form no part of the present invention.

It will be understood that the power-pack is operable to convert electrical energy which may be delivered thereto by way of conductors 18, into the necessary high potential D. C. power, for creating a corona discharge or electrostatic field in the ionizing chamber of the condenser device 14. One high potential terminal of the power-pack 13 may be connected to a grounded conductor 19, while the other high potential terminal is connected to a conductor 20 leading to the condenser device 14.

According to the invention, the electrostatic vapor condenser 14 comprises the substantially vertically disposed tubular casing or conduit 21, the lower portion of which is welded or otherwise secured to a mounting plate 22 that is in turn welded to the receiving reservoir 12. The upper end of the conduit 21 is connected to the cooling pipe 11. The lowermost portion of the conduit 21 projects into the interior of the reservoir 12, and supports a tubular extension member 25, the diameter of which is smaller than that of the conduit 21. The upper end of the extension member 25 is disposed in telescoping relation within the conduit 21 and is held in place by means of suitable lugs 26 welded to both members, it being noted that drainage space is left between the outer surface of the member 25 and the inner wall of the conduit. The extension member 25 terminates in an elbow 27 having its opening disposed closely adjacent a baffle wall 28 carried by the reservoir 12. It will be understood that fluid delivered by the compressor 10 is thus conducted to the receiving reservoir 12 by way of the cooling pipe 11, passage 21a within the

conduit 21 and passage 25a within the extension member 25 and elbow 27 thereof.

The vapor condenser 14 further comprises electrostatic means operative to effect ionization of fluid carrying particles of oil or water vapor through the passageways 21a and 25a. As illustrated, the electrostatic means may comprise a relatively fine wire 30 which extends vertically and centrally through the cylindrical casing 21 and extension conduit 25, one end of the wire 30 being soldered or otherwise attached to a conductor 31 embedded in an insulating element 32 mounted in a lateral projection 33 of the casing, and the other end of the wire being anchored in an insulating block 34 secured in the lower end of the extension member 25. Mounted within an annular insulating member 37 at the open end of the elbow 27 is a wire screen 38, which is connected by means of a wire 39 to the lower portion of the main wire 30.

It will be noted that the conductor 31 is connected to the conductor 20 leading to one of the high voltage terminals of the high voltage power-pack 13, while the conduit 21 and extension member 25 enclosing the wire 30 are connected to the ground by way of a ground connection 40, which is connected to reservoir 12.

When the power-pack 13 is operated to impress a high direct current voltage on the wires 30 and 39 and on the connected wire screen 38, an electrostatic field or corona discharge is set up between the charged conductors and the grounded conduit 21 and extension member 25, and also between the screen 38 and the grounded baffle wall 28. The charge impressed by the power-pack 13 on the wire conductors is preferably of a negative potential, and results in rapid streaming of electrons from the wires toward the adjacent grounded conducting surfaces.

Fluid under pressure meanwhile discharged by the compressor 10 is initially cooled as it passes through the cooling pipe 11, so that any water vapor contained therein will begin to condense into the form of mist or spray, and will be carried along with particles of oil also ejected from the compressor into the vertically disposed conduit 21, where such particles of oil and mist become charged during passage through the electrostatic field emanating from the wire 30. Such particles of oil and water as receive a sufficiently strong charge within the conduit 21 are then attracted to the walls thereof, from which accumulated drops of liquid are free to flow downwardly past the spaced lugs 26 and into the reservoir 12, at the bottom of which is formed a depression 12a for collecting the condensate.

Oil and water vapor particles not deposited in the conduit 21 are carried into the concentrated electrostatic field maintained within the extension member 25 and between the screen 38 and baffle wall 28, where such particles accumulate further electrical charges tending to insure final precipitation thereof on the surface of one of those grounded elements, from which drops of oil or water can travel to the bottom of the reservoir 12. A drain cock 41 may be provided to enable removal of the condensate from the bottom of the reservoir from time to time.

It will thus be seen that with the electrostatic vapor condenser 14 constructed in accordance with the invention, as just described, and interposed between a compressor discharge cooling pipe and the usual receiving reservoir, fluid compressed by the compressor and carrying particles of oil and water is conducted through an electrostatic field of sufficient extent to cause the particles to become charged and drawn to the collecting surfaces of the apparatus, without in any way impeding flow of the fluid under pressure. It will be understood that the amount of electrical energy required for effecting efficient removal of the oil and water particles from the compressed fluid will be quite small, since only a limited current flow will be needed to produce the corona discharge between the negatively charged wire and the grounded conduit and reservoir members.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

The combination with a compressor and a receiving reservoir therefor, of a conduit communicating with the outlet of said compressor and opening downwardly into said reservoir, an extension pipe having its upper end disposed in spaced telescoping relation in said conduit and its lower end opening into said reservoir, a baffle portion of said reservoir disposed adjacent said open end of the extension pipe, discharge electrode means mounted within said conduit and pipe and terminating in close proximity to said baffle portion, and a voltage producing power-pack constructed and arranged to impress high unidirectional voltage on said discharge electrode means for generating a corona discharge field between said means and said conduit, pipe, and baffle portion, whereby particles of liquid suspended in the fluid under pressure delivered by said compressor may be precipitated on the walls of said elements.

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