Dec. 27, 1932. C. F. SHADLE 1,892,081

APPARATUS FOR CONDITIONING AIR

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FIG. 3

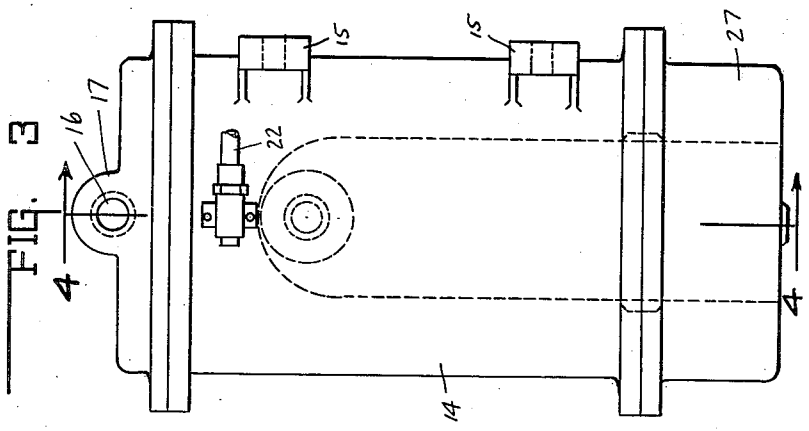


FIG. 2

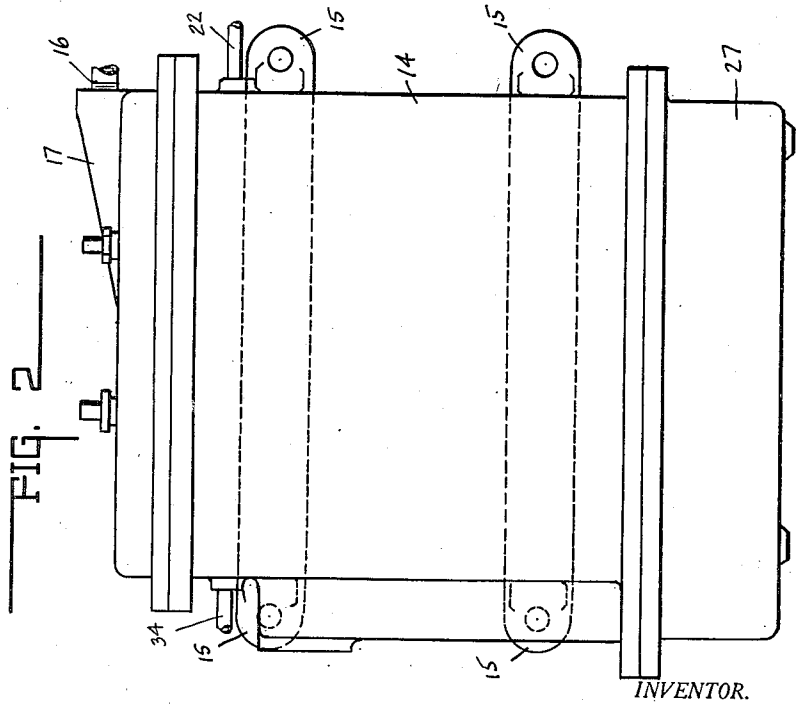
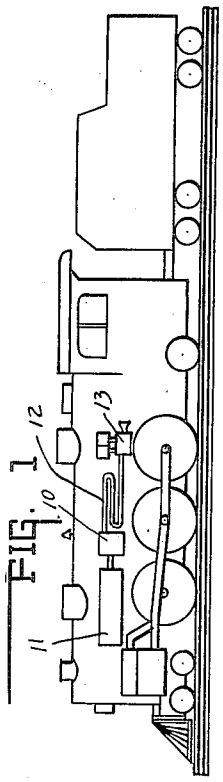


FIG. 1



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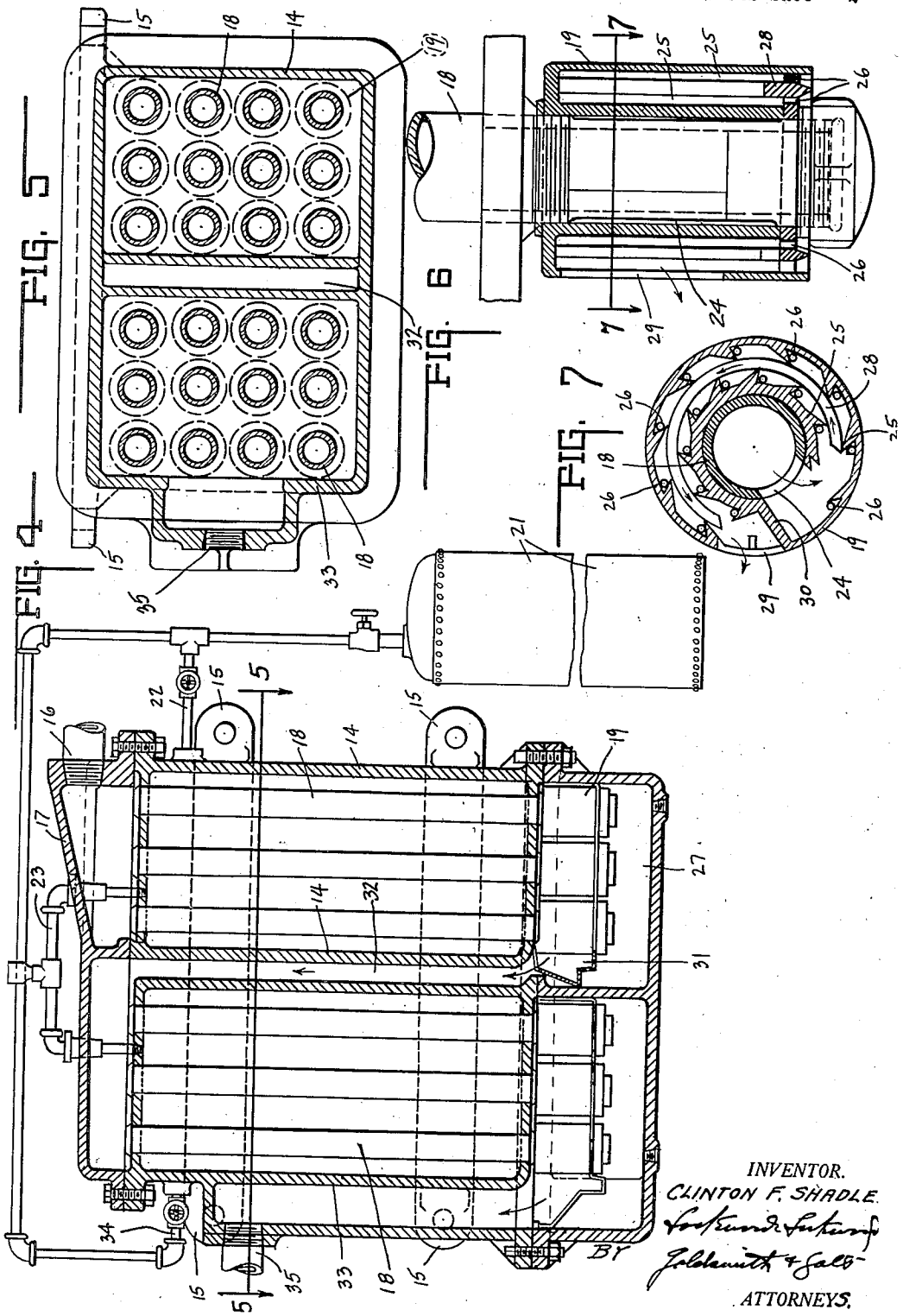


FIG. 4

FIG. 5

FIG. 6

FIG. 7

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UNITED STATES PATENT OFFICE

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APPARATUS FOR CONDITIONING AIR

Application filed February 1, 1929. Serial No. 336,871.

This invention relates to a two-stage condenser particularly adapted for use in removing the moisture from air wherein it is desired to use the air in connection with air brake systems, tool service or the like, as heretofore set forth and described in the copending application, Serial No. 189,534, filed May 7, 1927, entitled Process and apparatus for conditioning air.

The principal feature of this invention resides in the construction and arrangement of the apparatus such as to reduce the horsepower necessary for operating the same over that heretofore required, and obtaining more compact apparatus for installation purposes.

The reduction in volume incident to compression reduces the weight of moisture which will remain in the vapor stage at any given temperature, so that the compression assists the condensation of moisture.

Another feature and advantage of the invention resides in the construction of the apparatus wherein it is adapted to be practically used on a locomotive in connection with the air brake service by mounting the same thereon intermediate the compressor pump carried by the locomotive and the main air reservoir.

A still further advantage of the invention resides in the fact that the desired refrigerant can be obtained by expansion of any suitable liquefied gas as delivered directly from well known commercial tanks containing the gas under a pressure of approximately one hundred fifty atmospheres. This makes the apparatus desirable and practical for commercial use by reason of its adaptability to convenient refrigeration.

Other advantages and features of the invention will be hereinafter more fully set forth and described.

The full nature of the invention will be more clearly understood from the accompanying drawings and the following description and claims.

Fig. 1 is a diagrammatical illustration of a portion of a locomotive showing the position of the condenser in the air compressing system. Fig. 2 is a front elevation of the condenser. Fig. 3 is an end elevation thereof. Fig. 4 is a section taken on the line 4—4 of Fig. 3. Fig. 5 is a section taken on the line 5—5 of Fig. 4. Fig. 6 is a central vertical section through one of the separators. Fig. 7 is a section taken on the line 7—7 of Fig. 6.

In the drawings there is shown a condenser 10 mounted on a locomotive intermediate the main air reservoir 11 and the cooling manifold 12 leading from the compressor pump 13. The compression and subsequent partial removal of the heat of compression results in the precipitation of some moisture from the air. The air thus highly compressed and partially separated from the moisture, is forced through the cooling manifold 12 into the condenser 10.

The condenser unit comprises a casing shell or housing 14 which is secured in place on the locomotive by the ears 15. Said condenser is divided into two stages as will hereinafter be described. The air is forced into the first stage through the inlet 16 to the first stage expansion chamber 17, and passes downwardly therefrom through a plurality of tubes 18 parallel to the separators 19. The lower end of each of the tubes 18 is in communication with its respective separator 19. Surrounding the tubes 18 within the casing or housing 14 there is a refrigerating medium. The refrigerating medium may be preferably carbon dioxide or the like stored in suitable tanks, and may be obtained in any well known manner such as from a tank 21 communicating with the interior of the first stage unit through the pipe 22. The gas is removed through the discharge outlet 23.

The air, as it passes downwardly through the tubes 18, is highly cooled thereby to a temperature of approximately thirty degrees so as to cause a precipitation of the moisture contained therein. It passes into the separator as shown in Figs. 6 and 7 through the opening 24 and is directed about the separator between the outer wall and the tube. In this passage there are provided water separators or baffles 25 which are shown herein in the form of saw toothed members. The face of each tooth acts as a baffle against which the air impacts and releases a portion

of the moisture which drops down along the face thereof and passes through the openings or perforations 26 in the bottom thereof to the water sump 27. Extending partially about the bottom of the separator intermediate the opposed water separators or baffles 25 there is an upwardly extending false bottom strip 28 which acts to maintain air in its circulation about the separator above the bottom thereof. Adjacent the opening 24 there is an air discharge outlet 29 separated therefrom by the wall 30 which permits the discharge of the air, after having been relieved to a large extent of the moisture contained thereby, into the chamber 31 from which it is forced upwardly by the pressure thereon through the passage 32 which extends between the first stage unit and the second stage unit and is separated thereby by the walls 14 of the respective units.

The second stage unit, which is indicated by the numeral 33, is similar in every respect to the first stage unit and need not be described in detail other than to state that the cooling medium entering the second stage unit through the intake pipe 34 is brought to a lower degree of temperature or about 5° F. After the air has been further cooled thereby, there is caused a final precipitation of such moisture as escapes precipitation in the first unit, and passes outwardly through the discharge opening 35 into the main reservoir 11.

It will be observed from the foregoing that the air is cooled in two stages for the reasons and purposes as more fully set forth in the above mentioned copending application. While the structure and apparatus shown and illustrated in the above mentioned application has certain advantages, and is designed to operate for certain purposes as successfully as the structure shown herein, this device is more applicable for certain purposes and uses by reason of its compactness and adaptability to the air brake system units as now mounted on locomotives.

The invention claimed is:

1. An apparatus of the character described, comprising a plurality of air conditioning units, each unit including a plurality of tubes extending therethrough, a refrigerating chamber surrounding said tubes, connections for passing a refrigerating medium through said chamber, means for forcing air under pressure through said tubes, and moisture separators, one associated with the discharge end of each tube.

2. An apparatus of the character described, comprising a plurality of air conditioning units connected for air-flow serially therethrough, each unit including a plurality of tubes extending therethrough, a manifold communicating with said tubes through which air is introduced, a refrigerating chamber surrounding said tubes, connections for passing a refrigerating medium through said chamber, means for forcing the air under pressure into said manifold and through said tubes, and moisture separators one associated with the discharge end of each tube.

3. An apparatus of the character described, comprising a plurality of air conditioning units connected for air-flow serially therethrough, each unit including a plurality of tubes in parallel arrangement, a refrigerating chamber surrounding said tubes, connections for passing a refrigerating medium through said chamber, means for forcing air under pressure through said tubes, and moisture separators, one associated with the discharge end of each tube, said separators including a curved passage and baffles.

4. An apparatus of the character described, comprising a plurality of air conditioning units connected for air-flow serially therethrough, each unit including a shell and a plurality of tubes extending therethrough, the shell forming a refrigerating chamber surrounding said tubes, connections for passing a refrigerating medium through said chamber, means for forcing air under pressure through said tubes in parallel, moisture separators associated with the discharge ends of said tubes, said separators having water drains, and a sump associated with said shell, remote from said chamber, and adapted to receive moisture draining from said separators.

5. An apparatus of the character described, comprising a plurality of air conditioning units connected for air-flow serially therethrough, each unit including a shell and a plurality of tubes extending therethrough, the shell forming a refrigerating chamber surrounding said tubes, connections for passing a refrigerating medium through said chamber, means for forcing air under pressure through said tubes in parallel, casings associated with the discharge ends of said tubes, and defining approximately circular discharge passages from the corresponding tubes, and water separating means in said circular discharge passages.

6. An apparatus of the character described, comprising a plurality of air conditioning units connected for air-flow serially therethrough, each unit including a shell and a plurality of tubes extending therethrough, the shell forming a refrigerating chamber surrounding said tubes, connections for passing a refrigerating medium through said chamber, means for forcing air under pressure through said tubes in parallel, a water collecting sump beneath the discharge ends of said tubes, and remote from said shell, casings associated with the discharge ends of said tubes and defining approximately circular discharge passages from corresponding tubes and baffles in said passages serving to arrest water drops and direct them to said sump.

7. An apparatus of the character described, comprising a plurality of air conditioning units connected for air-flow serially therethrough, each unit including a shell and a plurality of tubes extending therethrough, the shell forming a refrigerating chamber surrounding said tubes, connections for passing a refrigerating medium through said chamber, means for forcing air under pressure through said tubes in parallel, cylindrical casings associated with the discharge ends of said tubes and defining a narrow arcuate discharge path, and baffles projecting from opposite sides of said path to intercept water drops.

8. Apparatus of the character described, comprising in combination, a shell and a plurality of tubes extending therethrough, the shell enclosing a refrigerating chamber surrounding the tubes; connections for passing a refrigerating medium through said chamber; connections for forcing air under pressure through said tubes; a water collecting sump beneath the discharge ends of said tubes and remote from said shell; casings associated with the discharge ends of said tubes and defining substantially circular flow paths; and moisture arresting baffles in said circular flow paths.

In witness whereof, I have hereunto affixed my signature.

CLINTON F. SHADLE.