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STEAM DRIER AND SEPARATOR

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Fig. 1.

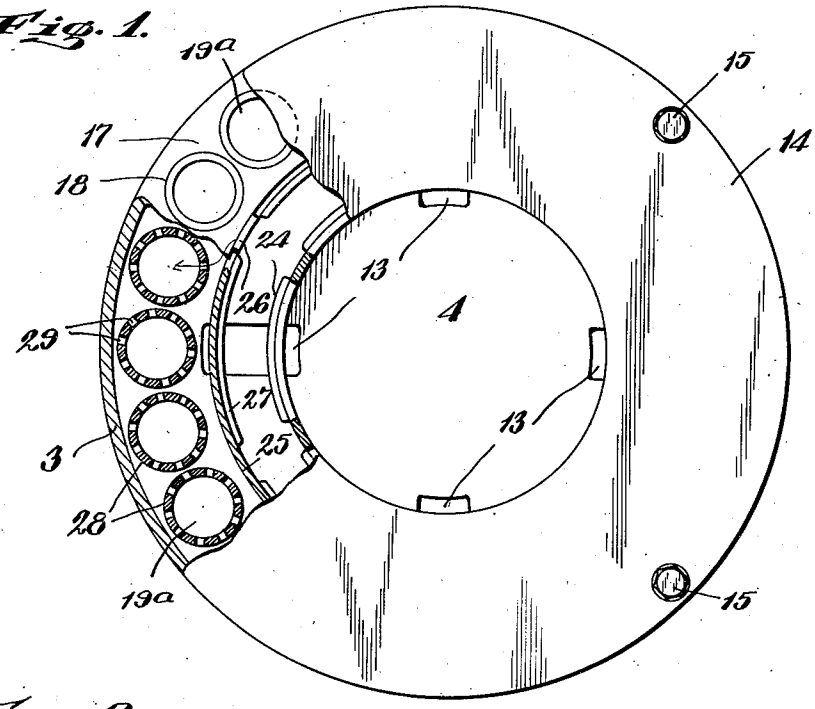
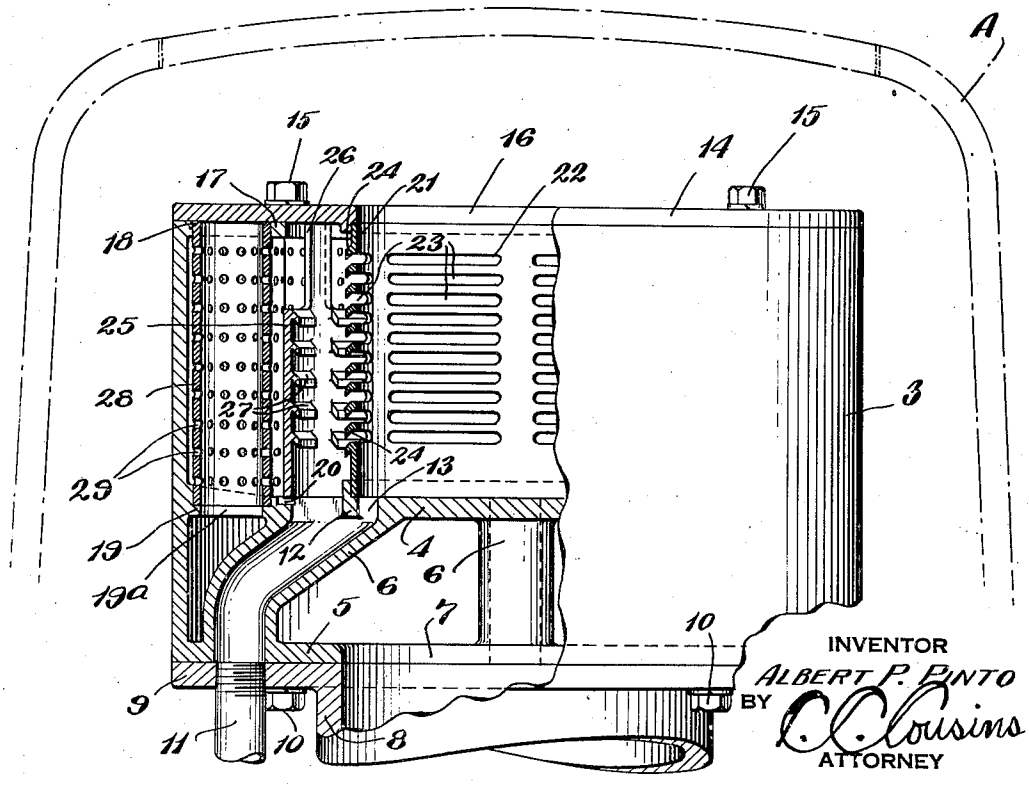


Fig. 2.



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STEAM DRIER AND SEPARATOR

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15 Claims. (Cl. 183—107)

This invention relates to a steam drying and separating device.

The object of the invention is to produce a compact assembly of parts, the entire assembly being of such size that it does not exceed in height and diameter what has been found in steam engineering practice to be most desirable. It has been found that it is highly desirable to increase the capacity and efficiency of an engine to which the device is intended to be attached, but that the height of its steam dome may not be materially increased.

More broadly, the object of the invention is to provide a highly efficient construction for thoroughly drying steam and separating the water and solid contents thereof before the steam is actually applied to work.

A further, more specific object is to provide a construction which may be cheaply made largely of cast parts so as to eliminate a large percent of labor costs, and the parts of which may be readily assembled or replaced.

A further, more specific object is to provide a construction in which the proportion of wall space is very high compared to the total area of the openings through which the steam passes so as to increase the efficiency of operation of the assembled parts.

The invention consists of the construction, combination and arrangement of parts, as herein illustrated, described and claimed.

In the accompanying drawing, forming part hereof, is illustrated a form of embodiment of the invention, in which drawing similar reference characters designate corresponding parts, and in which:

Figure 1 is a plan view, partly broken away, and partly in section; and,

Figure 2 is a vertical section, partly broken away, to show the interior construction.

Referring to the drawing, 3 designates a casing which is preferably cast in a single piece for cheapness of construction. The casing 3 is cast with an intermediate horizontal wall 4 and a lower wall 5 and a plurality of inclined ducts or passages 6 extending from the upper surface of the intermediate wall 4 through the lower wall 5 of the casing, thus forming a steam chamber below the intermediate wall 4, which may be readily cored in the casting operation.

The lower wall 5 of the casing 3 is provided with a steam outlet orifice 7 which coincides with the internal diameter of the steam outlet pipe 8, the flange 9 of which may be secured to the lower end of the casing 3 by the usual lag bolts 10. To do an efficient job it is necessary only to rough-dress the lower face of the lower wall 5 in order that a steam-tight joint may be made.

Suitable drain pipes 11 are screw-threaded to the ducts 6, and cast with the wall of the casing 3 above the ducts 6 is a flange 12, for the purposes hereinafter described.

At intervals through the intermediate wall 4 of the casing 3 there are provided a plurality of openings 13 to permit the passage of the water of condensation to the ducts 6, so that the water may be drawn off through the outlet pipes 11.

The casing 3 is closed by a top cap 14 secured in position by lag bolts 15 and the top cap is provided with an inlet orifice 16. The top cap 14 is provided with a plurality of depending retainer flanges 17. The outer wall of the casing 3 is provided with an interiorly extending retainer flange 18 at the top thereof for cooperation with flanges 17. The intermediate wall 4 of casing 3 is provided with a plurality of openings or ducts 20 to permit the passage of the water of condensation.

Disposed around the center of the casing and within the walls thereof is an annular wall 21 which is cast separate from the casing. The annular wall 21 has cast therein sections of spaced, horizontal ribs 22 providing slots 23 therebetween. Formed on the outer surface of the wall 21 and ribs 22 are external, downwardly extending fins 24 which partly overlie the slots 23 and deflect downwardly the steam admitted through the orifice 16.

Disposed within the casing 3 and spaced from the wall 21 is an annular wall 25, the upper end of which is formed with a plurality of prongs 26, leaving spaces or openings therebetween for the passage of steam, it being understood that the passages 20 are disposed and pass under the lower end of the wall 25. The wall 25 is provided with a plurality of downwardly projecting fins 27.

Outside of the line formed by the wall 25 and disposed peripherally around the casing 3 and inside of its wall is a plurality of tubes 28 provided with numerous lines of perforations 29. It will be noted that the tubes 28 are retained in place by cooperation of the flanges 17 and 18, and the shoulders 19 so that they may be readily set in position without the employment of skilled labor. It will also be noted that the wall 4 at its periphery is slightly inclined so that the water of condensation readily runs down through the ducts 20 and the conduit 6.

The horizontal wall 4 is provided with a line of orifices 19a arranged peripherally in the cas-

ing 3. The orifices 19a coincide with lower ends of the tubes 28 and through them the dried steam passes below the horizontal wall 4 and through the orifice 7 to the pipe 8.

In the manufacture of the parts the casing 3 and its integral parts are cast as are the annular elements 21 and 25 together with their fins 22, 24 and 27 and slots 23 and prongs 26. A slight rough surfacing by simple machining is all that is required for the meeting or contacting parts. The tubes 28 are cut to proper lengths from stock of greater length and are perforated as shown to leave a large proportion of wall space as compared to the total area of the openings, which is also true of the annular elements 21 and 25.

In assembly the casing is first finished, the annular elements 21 and 25, and the tubes 28 are set in place and the top cap 14 is secured on by the lag bolts 15, so that the parts are held in position. It is obvious that any part may be removed or replaced very quickly and simply by removing the cap 14.

In operation, after the parts are assembled, the entire assemblage may be installed in the ordinary steam dome, indicated by broken lines and the numeral A. Steam being admitted to the dome A passes through the orifice 16 and into the annular element 21 striking the ribs 22 which help to separate particles of entrained liquid which collect, on the ribs 22 and the wall 21, and runs downward through the openings 13 in the horizontal wall 4 and thence through the ducts 6 and drain pipes 11.

The partially dried steam then passes through the slots 23 and is deflected downward by the ribs or flanges 24 into the annular space between annular elements 21 and 25. The downwardly flowing steam is caused to undergo sharp reversals in this space as it impinges upon the downwardly directed flanges 27, thus separating additional particles of liquid therefrom, the separated liquid passing by gravity through the orifices 13 and to the drain 11.

The partly dried steam passes upward between the prongs 26 and impinges against the perforated tubes 28 whereby further separation of particles of moisture remaining in the steam is obtained, the separated liquid being carried to the ducts 6 through the openings 20. The then practically dried steam passes through openings 29 of the tubes and is conducted below the wall 4 and to the outlet pipe 8.

It will be noted that in the event of a water surge that the water entering the inlet 16 will be drained off and the drying efficiency of the device is but slightly affected.

Having thus fully described the invention, what is claimed as new and desired to be secured by Letters Patent of the United States is:

1. In a steam separator and drier, the combination comprising a casing having inlet and outlet openings, a plurality of concentric walls disposed in the casing, said walls being provided with steam openings to communicate with the inlet and outlet openings and projecting portions for baffling the steam flowing therethrough, and a plurality of perforated tubes disposed in the casing, intermediate of the walls and the outlet of the casing.

2. In a steam separator and drier, the combination comprising a casing having inlet and outlet openings, a plurality of concentric walls disposed in the casing and provided with baffles and steam openings to communicate with the inlet and outlet openings, and a plurality of perforated tubes disposed in the casing through which the steam passes to the outlet opening of the casing.

3. In a steam separator and drier, the combination comprising a casing having inlet and outlet openings, a plurality of concentric steam and liquid separating walls disposed in the casing, said walls being provided with openings for the passage of steam, and a plurality of perforated tubes arranged annularly adjacent said walls and constituting a part of the passage between said outlet and inlet openings.

4. In a steam separator and drier, the combination comprising a casing having inlet and outlet openings, a plurality of concentric steam and liquid separating walls disposed in spaced relation in said casing, said walls being provided with openings for the passage of steam, and a plurality of perforated tubes arranged annularly about the outer of said walls and constituting a part of the passage between said outlet and inlet openings.

5. In a steam separator and drier, the combination comprising a casing having inlet and outlet orifices, a plurality of concentric walls disposed in the casing and provided with baffles and openings communicating with the inlet orifice and a plurality of perforated tubes disposed peripherally in the casing outside of the line of the outside concentric wall in communication with the outlet orifice of the casing.

6. In a steam separator and drier, the combination comprising a casing having inlet and outlet orifices and a horizontal wall intermediate of its height provided with water drain and steam outlets, a plurality of concentric walls disposed in the casing and provided with steam separating baffled openings and a plurality of peripherally arranged perforated tubes set in the casing, to communicate with the water and steam outlets.

7. In a steam separator and drier, the combination comprising an open-ended casing having an intermediate horizontal wall provided with steam and water orifices, an orificed upper cap disposed on the casing, a plurailty of baffled concentric walls disposed in the casing from its cap to its horizontal wall and provided with openings communicating with the orifice in said cap, and a plurality of perforated steam separating tubes set peripherally in the casing and communicating with its steam and water outlets.

8. In a steam separator and drier, a casing having a steam inlet centrally of the upper side thereof, a wall spaced therefrom and defining the bottom of the separating chamber, said wall having steam openings communicating with a steam outlet, a plurality of spaced vertically extending walls disposed above said bottom wall, said walls being provided with baffles projecting radially and downwardly therefrom and a plurality of openings communicating with said inlet, said bottom wall being provided with liquid drain passages communicating with the spaces formed within said casing by said vertically extending walls, and a plurality of perforated tubes arranged annularly within said casing in communication with the steam openings in said bottom wall and disposed intermediate the side walls of said casing and said vertically extending walls.

9. In a steam separator and drier, a casing having a steam inlet orifice and water and steam outlet orifices, a central annular wall set in the casing having orifices in alignment with the steam inlet orifice and provided with steam sep-

arating means, a second annular wall set in the casing surrounding the central annular wall and provided with fins and steam ports, and a series of perforated tubes set in the casing outside of the second annular wall, the tubes establishing communication between said steam ports and the outlets in the casing.

10. In a steam separator and drier, a casing having a steam inlet centrally of the upper side thereof and a horizontal wall spaced therefrom and provided with a steam outlet and liquid draining means, and a plurality of spaced, concentrically arranged, vertically extending perforate steam and liquid separating elements disposed in said casing in communication with said steam inlet and outlet, said liquid draining means being in communication with the spaces between said steam and liquid separating elements.

11. In a steam separator and drier, a casing having a removable cap plate and a fixed bottom wall, said cap plate being provided with positioning elements and a steam inlet, said bottom wall being provided with positioning elements and separate steam and liquid outlets, and a plurality of perforate steam and liquid separating elements arranged concentrically in spaced relation about said inlet with the ends thereof abutting said positioning elements, the outer of said separating elements communicating with said steam outlet and the spaces between said separating elements being in communication with said liquid outlet.

12. In a steam separator and drier, a casing having a steam inlet and outlet and a horizontal wall provided with steam and water outlet orifices, the wall and casing being provided with positioning elements, and a plurality of steam separating elements concentrically arranged to abut the positioning elements and to provide a passage for steam from the steam inlet to the outlet and a passage for water to the water outlet, the outer circle of said separating elements comprising perforated tubes.

13. In a steam separator and drier an annular casing having a steam inlet and outlet and a horizontal wall provided with steam and water outlet orifices, the wall and casing being provided with positioning elements, and a plurality of steam separating elements concentrically arranged to abut the positioning elements and to provide a passage for steam from the steam inlet to the outlet and a passage for water to the water outlet, the outer circle of said separating elements comprising perforated tubes arranged in spaced relation to each other and the inner wall of the casing.

14. In a steam separator and drier, a casing having a horizontal wall provided with steam orifices and water drainage ducts, a cover for the casing having a steam inlet, a plurality of annular walls disposed concentrically in the casing and provided with steam separating means and passages therefor and a plurality of separating tubes disposed in a concentric ring around said walls in the casing and in communication with the steam outlet orifices in the horizontal wall.

15. In a steam separator and drier, a casing having a removable cap plate and a fixed bottom wall, said cap plate being provided with positioning elements and a steam inlet, said bottom wall being provided with positioning elements and separate steam and liquid outlets, means defining an annular chamber in said casing, and a plurality of perforate steam and liquid separating elements arranged concentrically in spaced relation in said annular chamber adjacent said steam inlet with the ends thereof abutting said positioning elements, and so positioned between said steam inlet and said steam outlet that steam in passing through said elements must pass through the perforations therein before reaching the steam outlet and the spaces between said separating elements being in communication with said liquid outlet.

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