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STEAM PURIFIER

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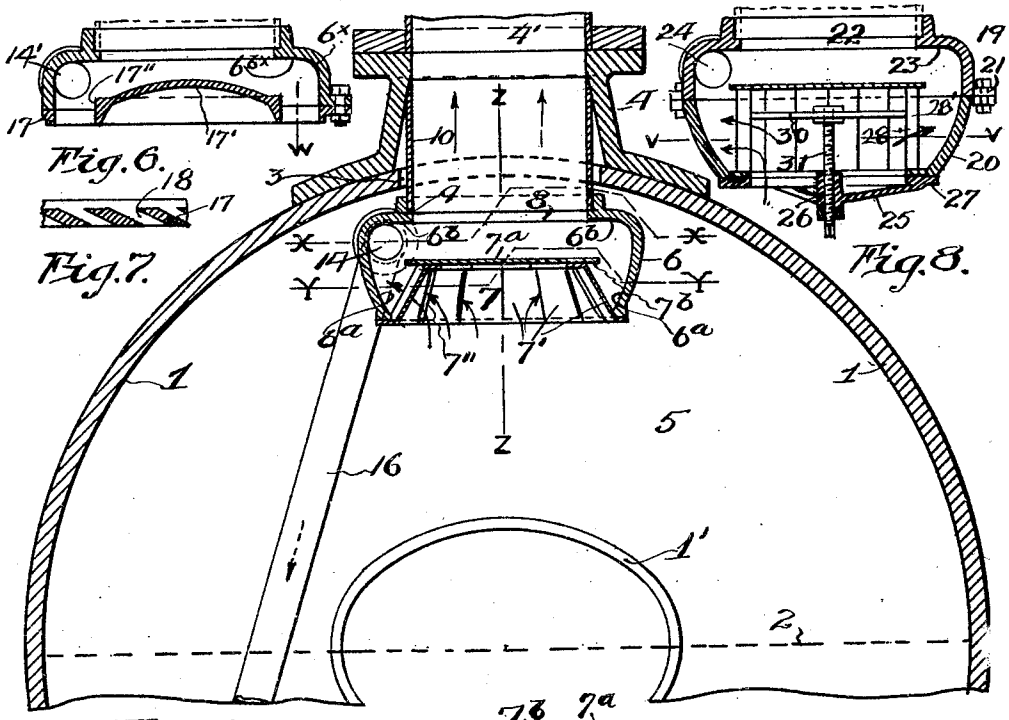

Fig. 1.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 5.

Fig. 3.

Fig. 2.

Fig. 9.

Fig. 4.

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STEAM PURIFIER

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In operating steam boilers and in like processes of evaporation and distillation, it is assumed and desired that the steam or other vapor evolved shall leave the steam or vapor drum in a pure state, that is, free from globules of liquid and particles of solid matter. As a rule the conditions controlling and modifying the operation in at least some measure defeat this primary expectation of purpose with the result that the vapor leaves the drum in an impure state. The present invention comprises a rotation imparting device; that is, a device that does not itself move or rotate, but nevertheless induces a strong centrifugal action within the stream of escaping steam or other vapor, whereby the foreign substances are removed from the fluid to be later returned to the body of liquid undergoing evaporation or discharged externally if it is desired to rid the boiler or evaporator of such substances.

The objects of the invention are to perfect such processes of purification and to provide a simple and reliable device or apparatus for the performance of the perfected process. These objects and the specific character of the invention will presently appear in further detail.

The invention will be readily understood on reference to the drawings that form part of this specification, in which:

Fig. 1 is a vertical cross-section of a steam boiler drum, or the like, equipped with steam purifying device embodying this invention. Fig. 2 is a horizontal section substantially on the line x—x of Fig. 1. Fig. 3 is a horizontal section on the line y—y of Fig. 1. Fig. 4 is a longitudinal elevation of the device with the boiler shell shown in section as on the line z—z of Fig. 1. Fig. 5 is an enlarged sectional detail taken from Fig. 1. Fig. 6 illustrates a simplified form of the device. Fig. 7 is a sectional detail taken from the line w— of Fig. 6. Fig. 8 illustrates a further modified form of the invention, and Fig. 9 is a horizontal section of the tuyère member, as on the line v—v of Fig. 8.

Referring to Fig. 1, 1 represents the pressure drum, 2 the liquid level therein, 3 the outlet opening and 4 the nozzle proper. It will be understood that the offtake pipe 4′ joins the nozzle. The end of the drum contains the usual manhole 1′ with its cover plate. But for the presence of the novel apparatus comprising this invention, the fluid or vapor leaving the steam or other space 5 would pass directly to the nozzle 4. Instead, this novel apparatus, though composed of parts all of which are stationary, that is, non-rotative, subjects the escaping fluid to a rapid whirling action. In consequence of this rapid whirling action substances heavier than the fluid are effectively separated therefrom, and, those remaining just before the fluid leaves the outlet, are completely separated therefrom.

In the form illustrated in Figs. 1 to 4, the device or apparatus comprises two main portions, to-wit: the top member or inverted bowl 6, and the bottom member or tuyère 7. The member 6 is of a size which allows it to be inserted through the manhole. In its top it has an opening 8, preferably of the same size as the nozzle 4 and offtake pipe 4′. Above the opening is an annular seat 9, which receives the lower end of the nipple 10. The latter has its upper end scarfed. Obviously the nipple completes the steam connection between the member 6, the nozzle 4 and the offtake pipe 4′. By way of support the member or bowl 6 is provided with oppositely extending brackets or arms, 11. See Figs. 2 and 4. The two bolts 12, 12 hang from the top of the boiler shell 1, passing through the slotted arms 11, 11, and are provided with the nuts 12′. As will be apparent, the tightening of the nuts 12′ serves to raise the bowl 6 and drive the nipple 10 upward into the nozzle 4. A connection which is both rigid and tight is thus established between the steam purifying device and the offtake pipe.

The bottom of the member 6 contains an opening which preferably is considerably larger than the opening 8, and this opening admits the upstanding tuyère 7. The latter preferably has its tuyère blades 7′ arranged in inclined positions. As will be obvious from Fig. 3, the tuyère blades 7′ are arranged tangentially with respect to the annulus as a whole, thereby providing the plurality of tangential tuyère openings 7″. The top

of the member 7 is formed by the circular plate or disk 7*a*. As will be noted, the disk is of greater diameter than the top of the conical tuyère, so that its edges 7*b* considerably overhang the bladed portion of the tuyère. The purpose of this will presently be described.

The shape of the interior of the member 6 is of moment. In particular, it is provided with upwardly and outwardly swelling walls 6*a*, which terminate in the overhanging and relatively flat top 6*b*. At its largest diameter the member 6 is provided with tangential discharge nozzle 14, arranged within the offset or boss 13. By preference a pipe nipple 15 is cast into the part 13, as a continuation of the tangential nozzle 14.

As well shown in Fig. 4, a drain or waste pipe 16 is connected to the nozzle nipple 15 by a union 16′. The waste pipe 16 may lead downward and terminate with an open end beneath the water level 2 or, as is the rule, the waste pipe is carried out through the end of the steam drum and is there joined to an automatic discharge trap. Such a trap is not shown, as both its construction and operation is well known, and it suffices to state that the function of the discharge trap is to get rid of the waste water from the steam purifying device and yet prevent the loss of steam through the waste pipe.

An added feature of construction is represented in Fig. 5, and comprises a plurality of slug dump holes 7*c* at the base of the tuyère 7. Incidentally, Fig. 5 shows how the tuyère is attached to the bottom of the bowl 6.

It should be noted that the bowl 6 is of such depth that the annular opening between the periphery of the disk 7*a* and the overhanging top 6*b* equals or is of slightly greater area than the area or cross sectional capacity of the opening 8. Likewise, the opening between the periphery of the disk or tuyère top 7*a* and the adjacent wall of the member 6 (the wall 6*a* of the member 6) is of generous capacity. Thereby a drop of pressure is avoided.

The steam from the space 5 enters the interior of the tuyère member and its direct passage being opposed by the tuyère top 7*a*, the steam of necessity enters the member 6 through the many angular or tangential tuyère openings 7″. The overhanging top 7*b* serves to deflect the streams horizontally. And thus the many tangentially entering streams are caused to impinge the inner surface 6*a* of the bowl. In this manner the heavier substances are first deposited on the wall 6*a* and then, due to the whirling action of the steam, are spirally carried upward thereon, caught beneath the overhanging part 6*b* and peripherally ejected through the nozzle 14 and into the waste pipe 16. The steam thus ridded of the heavier substances (moisture, globules and solids), escapes across the top 7*a* and rising through the opening 8, passes on or upward into the offtake pipe of the boiler. In this simple manner and by this simple device the steam or other vapor is very effectively purified.

A desirable incident of the structure shown in Figs. 1 to 4 resides in the performance of the slug dump holes 7*c* at the base of the tuyère. When a heavy burden of moisture enters the bowl 6 through the tuyère it is for the most part thrown back into the boiler through the opening 7*c*, the burden being too great to be lifted by the upward whirling body of steam within the bowl.

A simplified structure is illustrated in Fig. 6. In that case the inverted bowl or race ring 6*x* is shallower. Its whole bottom is open, and that bottom is closed by a simple casting 17, containing an annular series or row of angularly positioned tuyères 18. See Figs. 6 and 7. The middle portion 17′ of the casting is characterized chiefly by the upstanding annular shoulder 17″ at the inner margin of the annular series of rotation-imparting tuyères. The relation of the overhanging portion 6*bx* to the tuyères and the upward whirling action of the steam, remains as before described. The center 17′ of the bottom member 17 may be bowed upwardly if desired, to further hinder the tendency of the moisture to sweep inward towards the axis of the device along with the steam. As before, the peripheral discharge 14′ is placed directly beneath an annular overhanging shoulder portion 6*bx*.

A further modification of the structure, and in some particulars a better construction, is illustrated in Fig. 8. By reason of somewhat increased depth the bowl is made in upper and lower halves 19 and 20. These are fastened together by a plurality of bolts 21. The part 19 contains the now familiar central opening 22, the overhanging annular portion 23, and the tangential nozzle opening 24. The lower part contains a larger opening, and in this is situated the spider 25, having a central hub 26 and the peripheral ring portion 27. Obviously, ample steam openings are presented between the arms of the spider. On the ring 27, I erect the substantially cylindrical tuyère member 28. The blades 28′ parallel the axis of the member. They are positioned tangentially and may overlap one another as shown in Fig. 9, forming the many distinct tangential tuyère openings 28″. The top of the tuyère member is closed by the now familiar disk. The combined area of the tuyères 28″ somewhat exceeds the area of the opening 22. Nevertheless the incoming steam is effectively whirled outward against the inner walls of the members 20 and 19, and the heavier substances being caught beneath the annular overhang 23, are ejected through the opening 24.

It is not always that the flow of steam

through the outlet 22 is sufficient to engender a velocity through the tuyères adequate to completely effect a separation of the heavier from the lighter substances. An example may be observed in the case of a boiler of much greater capacity than required to serve the engine or other apparatus to which it is connected. In that instance, the offtake pipe of the boiler is obviously of greater size than needed, and the movement of steam through the boiler nozzle is relatively slow. This presents a difficulty in separation which must be obviated. To this end I equip the tuyère with an adjustable member 30. This is illustrated in Fig. 8, and may be mounted on the central stem 31, held in the hub 26. The disk or member 30 reaches from side to side of the tuyère, and by moving it up or down the effective or active length of the tuyères 28″ may be varied. In that manner, it becomes possible to quickly adjust a steam purifying device of necessarily fixed size and make it suit the peculiar load demands on the boiler.

Not every construction of my invention can be illustrated herein, and as other constructions will immediately become obvious to those skilled in the art, it is to be understood that the invention is not limited to those herein shown.

Having thus described my invention, I claim as new, and desire to secure by Letters Patent:—

1. A centrifugal fluid purifying device comprising an inverted bowl having a central outlet opening in its top, also a peripheral discharge nozzle, in combination with a multiple tangential tuyère member rising within said bowl and having a fluid admission opening in its bottom and adapted to whirlingly direct all of the fluid outwardly within the bottom of said bowl.

2. A centrifugal fluid purifying device comprising an inverted bowl having a smaller central outlet opening in its top, also a peripheral discharge nozzle, in combination with a multiple tangential tuyère member of smaller diameter than the bowl and rising within and from the bottom of said bowl, said member having a fluid admission opening in its bottom and being closed at the top, and thus adapted to direct the fluid outwardly within said bowl and toward said nozzle.

3. A centrifugal fluid purifying device comprising an inverted bowl having a smaller central outlet opening in its top, also a peripheral discharge nozzle, in combination with a multiple tangential tuyère member rising within said bowl and of smaller diameter than the bowl, said member having a central fluid admission opening in its bottom, while topped by an overhanging deflecting plate, said tuyère rising from the bottom of said bowl and adapted to whirlingly direct the fluid into the same.

4. A centrifugal steam purifying device comprising an inverted bowl having a small central outlet opening in its top and a peripheral discharge nozzle, in combination with a multiple tangential tuyère member having a central fluid member, an adjustable top for said member, and means for adjusting said top.

5. A centrifugal steam purifying device comprising an inverted bowl having a central steam outlet in its top and provided with a peripheral discharge nozzle directly below said outlet, in combination with an annular series of inclined blades forming tuyères positioned at and rising within the bottom of said bowl and serving to direct the steam whirlingly outward within said bowl, and means at the top of said tuyères preventing the passage of steam axially through said bowl from bottom to top.

6. A centrifugal steam purifying device comprising an inverted bowl having a smaller central steam outlet in its top and provided with a peripheral discharge nozzle directly below said outlet, in combination with an annular series of inclined blades forming tuyères positioned at the bottom of said bowl and serving to direct the steam whirlingly outward within said bowl, means at the top of said tuyères preventing the passage of steam axially through said bowl from bottom to top, and the lower part of the device being provided with slug dump openings at the outer periphery of the annular series of blades.

In testimony whereof, I have hereunto set my hand this 1st day of December, A. D. 1924.

CHARLES GILBERT HAWLEY.