E. H. CONKLIN.

STEAM DEHYDRATER.

APPLICATION FILED DEC. 5, 1912.

1,120,691.

Patented Dec. 15, 1914.

2 SHEETS—SHEET 1.

Fig. 1.

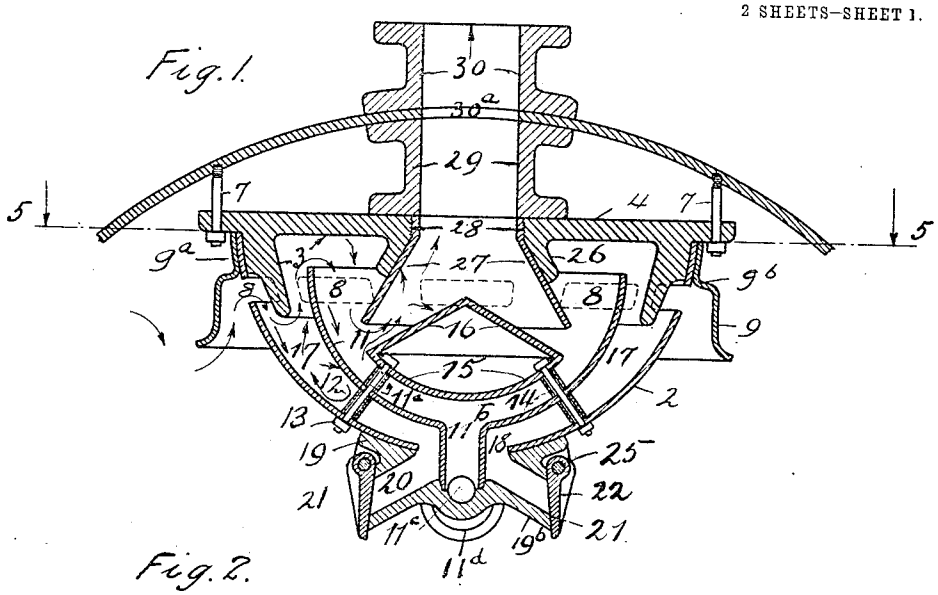


Fig. 2.

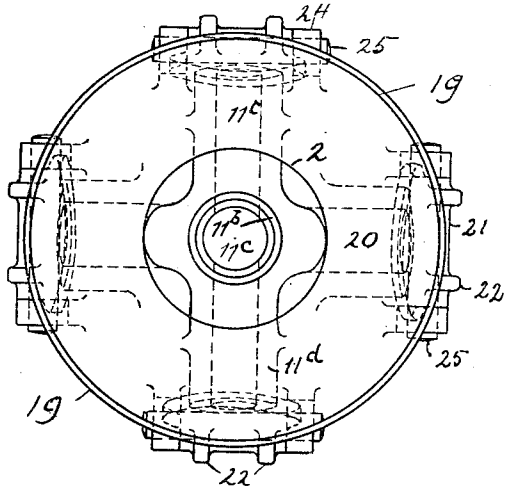
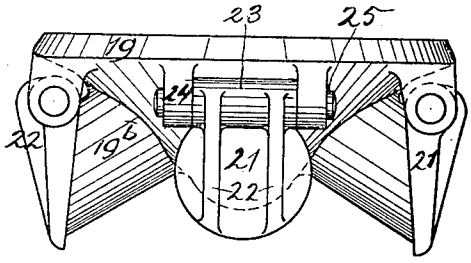


Fig. 3.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 4.

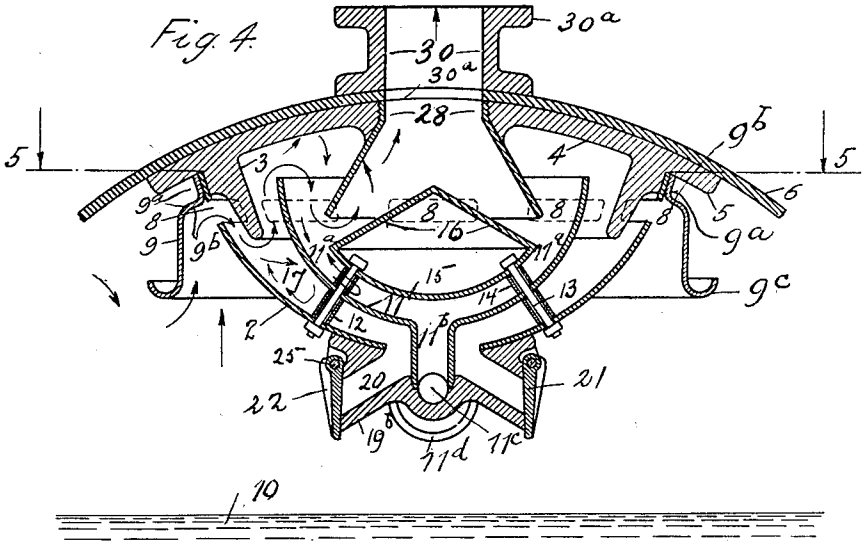
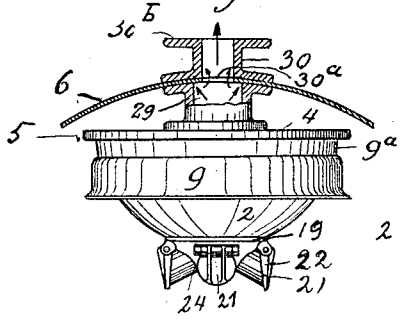


Fig. 6.



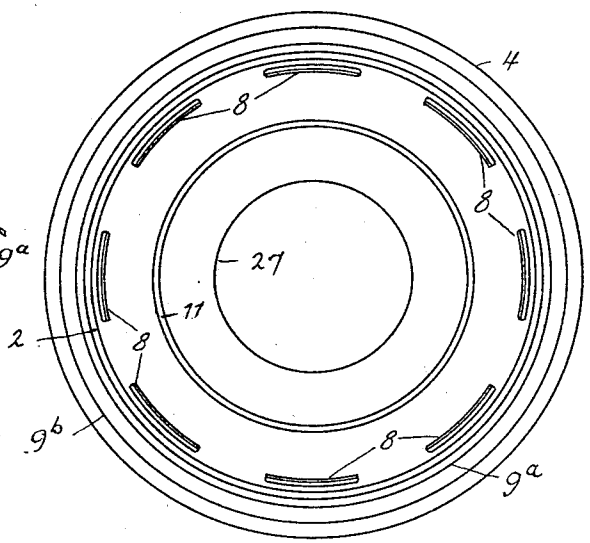


Fig. 5.

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UNITED STATES PATENT OFFICE.

ELMER H. CONKLIN, OF CHICAGO, ILLINOIS.

STEAM-DEHYDRATER.

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To all whom it may concern:

Be it known that I, ELMER H. CONKLIN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Steam-Dehydraters, of which the following is a specification.

My invention relates to an apparatus fitted within the steam space of a boiler in such a manner that all the steam issuing from the boiler will pass through the device and will there be deprived of all entrained water, by the special arrangement and disposition of the parts within and pertaining to the apparatus.

To accomplish its purpose of removing or abstracting all the water from the steam passing out of the boiler to the engine or other means of utilization, the de-hydrater is designed to take advantage of the fact that water has a specific gravity very many times greater than that of steam, hence a very much greater momentum and inertia. Owing to this difference of momentum, whenever a stream of steam entraining a large percentage of water in the form of minute globules is made to impinge against any surface placed in its normal path, so that its inherent direction will be changed, the mobile, dry steam will immediately take up the new course, while the vastly greater inertia of the particles of water entrained by the steam will cause them to persist in the original direction, so that they will be left behind by the steam, to fall by gravity. This feature is put to practical use in the present invention by so interposing a number of surfaces in the path of the steam on its way from the steam space to the point of its utilization, that the direction of flow will be changed a number of times, while appropriate channels are so disposed below the deflecting surfaces, as to conduct back to the water space of the boiler the water thus wrung from the steam.

My invention supplies a second method of utilizing the relatively great mass of water as compared to that of steam, to dehydrate the latter by causing the stream lines of water-laden steam to travel in paths which are arcs of circles, whereby a centrifugal effect is brought into play, which causes the relatively heavy particles of water to be hurled from out of the steam against the outer walls of the confined curved channels, to drain thence back to the water space of the boiler.

One of the objects of the invention is to provide means for automatically allowing the water shed by the steam within the dehydrater to drain back into the water space of the boiler, while preventing the inrush of steam through the drainage channels into the interior of the apparatus.

Another object of the invention is to so screen the inlets of the de-hydrater, as to prevent the entrance of water which may have crawled along the inside of the shell of the boiler to said inlet, and to so arrange the screening means that they will form, partly in themselves, and partly in coöperation with the outer shell of the apparatus, a first means for shedding the water from out of the steam prior to the entrance of the steam into the de-hydrater proper.

A special advantage of my invention is that it enables dry-pipes, steam-domes, steam drums and other similar excrescences and adjuncts of boilers to be dispensed with, and that it permits the water level to be carried very high in the boiler, at the expense of the steam space, without thereby causing water to be carried over into the cylinders of the engine in excessive amounts.

Other advantages will appear in the course of the following description and will be specifically set forth in the claims.

These objects are attained by the special construction and arrangement hereinafter described, and illustrated in the accompanying drawings, in which:

Figure 1 is a vertical, transverse section through a de-hydrater incorporating my invention, together with a part of the boiler shell, showing the means of attaching the device to the inside of the boiler and of connecting its discharge orifice with the main steam pipe; Fig. 2, a top plan view on an enlarged scale of the casting containing the discharge nozzles; Fig. 3, a front elevation of said discharge nozzle casting, showing the automatic, non-return, discharge valves in front and side elevation; Fig. 4, a vertical, transverse section of a modified form of my improved steam de-hydrater, adapted to be fitted directly against the inside of the boiler shell; Fig. 5, a top plan view of all of my de-hydrater that lies below a horizontal

plane through line 5—5 of Figs. 1 and 4; and Fig. 6 is a front elevation of the preferred form of my steam de-hydrater, showing the discharge sleeve, a part of the boiler shell and the flanged nozzle for attaching the boiler stop valve, all in section.

A shell 2 of approximately hemispherical shape, which may be of cast iron, but is preferably made of sheet iron or sheet steel dished out to the required shape, forms the body as well as the inclosing vessel of the de-hydrating apparatus. All around its upper edge this sheet is jointed by rivets, tap-bolts or any suitable known means, to a bearing face on the outside of an annular rib 3 depending integrally from the cover 4, which may be a flat plate, as in Figs. 1 and 6, or a convex plate concentric with the shell of the boiler, as in Fig. 4, and has an overlap or flange 5 projecting beyond the root of rib 3 and the upper edge of shell 2.

For purposes of general application I prefer to make cover 4 square, in which case it is hung from the boiler shell 6 by a tap-bolt 7 passing upward through each corner of the cover, and tapped into the shell, as shown in Fig. 1. In special cases, especially where the steam space is very limited vertically, the cover is preferably made to conform to the curvature of the boiler-shell, as shown in Fig. 4, in which case it is secured directly to the inside of the shell by any suitable known means (not shown). At a short distance below its upper edge, shell 2 is pierced by a number of apertures 8, preferably horizontal and of rectangular shape, extending at appropriate intervals entirely around the shell in a horizontal row. An annular hood 9, having a vertical body portion flaring outwardly at its lower end, is secured to the root or base of rib 3, or to the upper part of shell 2, by any suitable fastening means (not shown) passing through the upper part 9^a of the hood, shaped to conform to the curvature of the shell, and joined to the body portion of the hood by an offset 9^b. The function of the hood is to prevent water, which has a tendency to creep upward along the boiler shell, from being entrained into the interior of the de-hydrater by the stream rushing into the apertures 8. In addition to keeping the up-creeping water globules and films within the boiler, the hood also provides a first separative surface by its outwardly curving body portion, and especially by its offset portion 9^b, which lies squarely in the path of the vertical streams of the up-rising stream. As these streams impinge against the sides of the annular channel between hood 9 and the side of shell 2, and especially against the offset 9^b, they are deflected at right angles, to pass through apertures 8, and in the impinging as well as in the deflecting, the particles of water, moving with relatively far greater inertia than the steam, lag behind the latter and are cast back toward the water space of the boiler.

From the level of the upper edges of apertures 8 downward the depending rib 3 has an outward cut-away portion, forming with the straight inwardly inclined, inner face of the rib an annular projection curved to conform approximately to the curvature of the shell opposite to it, and extending below the level of the bottoms of inlet orifices (see Figs, 1 and 4).

While I have shown the shell to be of approximately hemispherical shape in the drawings, this is not a pre-requisite of the invention, as any figure of revolution having curved sides and coming to a point at its lowest end may be used to advantage, the shell being formed of the shape of such figure cut transversely at right angles to the axis, excepting in the special case illustrated in Fig. 4, in which the cover 4 is made convex to fit snugly against the inside of the wall inclosing the steam space in which the de-hydrater is hung. Ordinarily this steam space will be confined between the shell proper of the boiler and the surface of the body of water 10 within the boiler, but it may be within a drum or steam dome, especially in the case of many types of water tubular boilers.

An inner basin or shell 11, which may be any figure of revolution having curved sides and coming to a point if its sides or walls are continued to the lowest end, and which is cut transversely to its axis, is supported from the shell 2 by thimbles 12 held in place by bolts 13, each of which is threaded through a second thimble 14 which supports the curved bottom 15 of a central core-member preferably formed by a double figure of revolution having a common horizontal base. In the incorporation of my invention illustrated in the drawings, the central core-member has its lower part formed by a segment of a sphere taken at right angles to a vertical radius thereof, while its upper part is a cone 16, which will be further described later on. Any suitable, known securing means may be used in place of the thimbles 12, 14 and the bolts 13, but I have found that method of fastening to be the most convenient for practical erection of the apparatus. In the drawings the inner bowl 11 is shown as a hemisphere approximately concentric with the shell 2 but of a materially smaller radius and mounted so that its open top is about on a level with the upper edges of inlet orifices 8 and under any circumstances extends well above the bottom of rib 3. A chamber 17 between shell 2 and bowl 11 has a curved vertical, transverse section, sloping downward and inward toward the lowest point of the shell, and narrowing gradually toward its lower end,

where it opens at 18 into a drainage channel or duct 20. The latter is fitted within a spout leading downward and outward so that it will discharge water separated from the steam and collected within chamber 17, toward the bottom of the space in which the de-hydrater is mounted, which, in most cases, will be the water space of the steam generator. At its lowest part the inner basin 11 has, preferably integral with its sides, which are made of sheet metal, a vertically extending spout or nozzle 11^b. This nozzle drains the water from chamber 11^a, intercepted between the inner side of the bowl and the curved bottom 15 of the core-member mentioned above. Nozzle 11^b discharges into a channel or duct 11^c running axially through a spout 11^d extending downward and outward, and discharging toward the bottom of the space in which the apparatus is mounted. As the duct 11^b divides the chamber into two equal spaces, a separate discharge channel 20 and spout 19^b is required for each half of chamber 17. Similarly a separate discharge duct 11^c and spout 11^d is used for draining each end of duct 11^b. In my preferred construction I make these four spouts in one, integral casting 19 fastened by any suitable, known means to the bottom of the lowest part of shell 2, the four spouts forming the arms of a cross. Each of the spouts has its end faced off on an inclination of about 8 degrees to the vertical, sloping outward from the top of the face down. A flap-valve 21 of metal, having one or more heavy, integral ribs 22 is hinged at its upper end to lugs 24 projecting from the casting 19 above each spout, by a hinge-bolt 25. The weight of the valves, aided by the inclination of the faced end of each spout, is sufficient to keep the valve against its seat at all times except when the water has risen high enough in chambers 17 and 11^a to give it head required for lifting the valve to allow the excess of water to be discharged. Immediately after the valve has discharged it is returned to its seat automatically by gravity, so that there is no possibility that steam will enter the de-hydrater through the drains.

It is clear from above construction that while shell 2 and casting 19 are preferably made in two separate parts of different materials, they may be made integral, and are structurally a single piece to all intents and purposes.

It is difficult to lay down any hard and fast rule for determining how far the bottom of bowl 11 should be spaced from the inside of the shell, as this amount varies with the size of the apparatus, the amount of steam passing through the de-hydrater, and especially the amount of steam space allowed the boiler under working conditions. In practice I have found it preferable to make this distance not less than one-sixth of the radius of the shell in the narrowest part of the chamber, and to use about the same spacing distance between the inside of the basin and the curved bottom 15 of the central core-member.

A circular opening 28 is provided in the middle of the cover 4 for the outlet of the steam from the apparatus. I prefer to cast a short, inwardly projecting, conical nozzle 26 around the edges of said opening, to receive a conical eduction nozzle 27, which has a short, cylindrical sleeve at its upper end, that is threaded to engage a thread on the straight part of aperture 28. The flaring eduction nozzle 27 is extended to well below the level of the top of bowl 11, preferably to about the level of the lower edges of inlet-orifices 8, and the cone 16 of the central core-member is carried up to above this level, its slant sides forming with the mouth of the eduction nozzle an eduction passage for the steam, having an annular horizontal section, and flaring in its vertical, axial sections, from the bottom upward.

The shell, basin, central core-member and eduction nozzle are all preferably made of sheet iron or steel, rolled or dished to the desired shape, as the case may be. In mounting the square-topped form of the de-hydrater, adapted for general practice, I prefer to connect the outlet 28 with the shell of the boiler by a cast sleeve or filling-piece 29, having an axial bore equal to the hole 30^a passing through the shell of the boiler, and an upper flange curved to fit against the boiler shell, and a square-faced lower flange secured to the cover 4 by any suitable, known means. The nozzle 30 to which the boiler stop valve is usually connected by flanges, is riveted to the outside of the boiler shell, in continuation of sleeve 29 and opening 30^a. In the modified form shown in Fig. 4, the filling-in sleeve 29 is not required. In the modification illustrated in Fig. 6, the filling-in sleeve 29 is made with a bore larger in diameter than the orifice 30^a through the shell of the boiler and than the nozzle or sleeve 30 which connects by flange 30^b with the stop valve. This construction provides an annular shoulder projecting into the path of the steam rushing up out of sleeve 29, whereby a last deflection of the steam and consequent elimination of water are procured, the water falling back on the slant sides of the cone 16, whence it runs into the chamber 11^a.

In the type of de-hydrater that has its cover fitted directly against the boiler shell, I prefer to curl the extreme lower end of the hood 9 upward, making an annular gutter or trough 9^c, to prevent water from being carried into the de-hydrater by the in-rushing steam, after it has crept up

along the inside of the shell of the boiler and down along the outside of the hood, and would be dripping off the edge of the hood had it been retained in the uncurled form shown in Figs. 1 and 6.

The action of the apparatus on the steam passing through it is readily understood from the drawings in which the course of the steam is indicated by arrows. It will be observed that after passing through the inlet-orifices the steam strikes successively against rib 3, the inside of the shell and the bottom and sides of the basin, the inner, flat side of rib 3, the inside of cover 4, outside of eduction nozzle 27, slant sides of cone 16, inner wall of eduction nozzle and, in one modified form, against the inner side of the boiler shell. A part of the stream rushes along the curved inside of shell 2, shedding water on the way by the effect of centrifugal force. These streams are returned upward after striking the water line in chamber 17 or the vertical sides of duct 11^b. In chamber 11^a a similar action takes place with the difference that as there is no septum in the lowest part of the chamber, the streams rushing downward and inward from all points of the annular top of the chamber come together at the center, the consequent shock causing a great proportion of the still abiding water to be shaken from out of the steam. It will be noted that at each change of direction along the tortuous passage between the inlet-orifices and the boiler stop valve nozzle 30, the main deflecting surfaces are always normal to the path of the steam at the time of its coming up to each of the respective surfaces. The greatest part of the water is abstracted from the steam in and over chamber 17, for which reason the drainage ducts of that chamber are made appreciably larger than those of chamber 11^a, as is clearly shown in Figs. 2 and 3.

I claim:

1. A steam de-hydrater supported within a steam space of a steam generator, above the normal water level in said generator, having an outer, inclosing shell, a horizontally disposed series of apertures in the upper part of the walls of said shell, screening means offset from said shell along a circle above the level of said apertures, and depending to a level well beneath that of the bottom of said apertures.

2. A steam de-hydrater supported within a steam space of a steam generator, above the normal water level in said generator, having an outer, inclosing shell, a horizontally disposed series of apertures in the upper part of the walls of said shell, screening means offset from said shell along a circle above the level of said apertures, depending to a level well beneath that of the bottom of said apertures, and flaring outwardly at their lower end.

3. A steam de-hydrater supported within a steam space of a steam generator, above the normal water level in said generator, characterized by the combination of an outer shell having its sides sloping to a cusp or point at its lowest part, with means for draining said de-hydrater, leading directly from said lowest part of said shell and toward said water level, automatic, non-return means for controlling the passage through said drainage means; a horizontally disposed series of steam-inlet orifices piercing the upper part of said shell; and means within said shell for providing from time to time within said drainage means of hydrostatic pressure operating on said non-return means, sufficient to cause said means to open momentarily.

4. A steam de-hydrater supported within a steam space of a steam generator, above the normal water level in said generator, characterized by the combination of an outer shell having its sides sloping to a cusp or point at its lowest part, with means for draining said de-hydrater leading directly from said lowest part of said shell and toward said water level, automatic, non-return means for controlling the passage through said drainage means, a horizontally disposed series of steam-inlet orifices piercing the upper part of said shell; means within said shell for providing from time to time within said drainage means of hydrostatic pressure operating on said non-return means, sufficient to cause said means to open momentarily, screening means offset from said shell along a circle above the level of said apertures, depending to a level well beneath that of the bottom of said apertures, and flaring outwardly at their lower end.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."