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1,948,355

LIQUID BOILER

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Fig. 1.

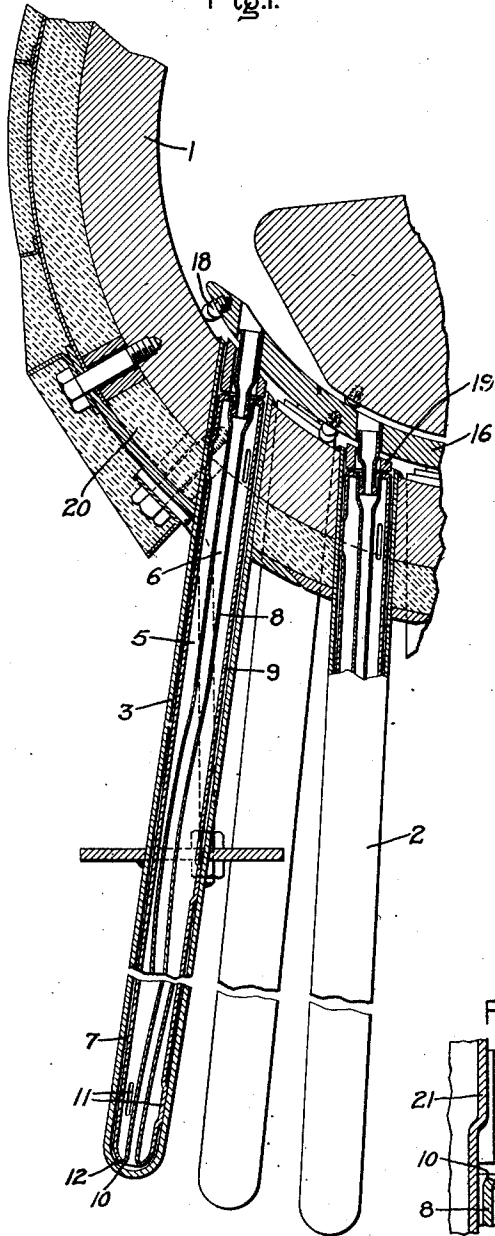


Fig. 2.

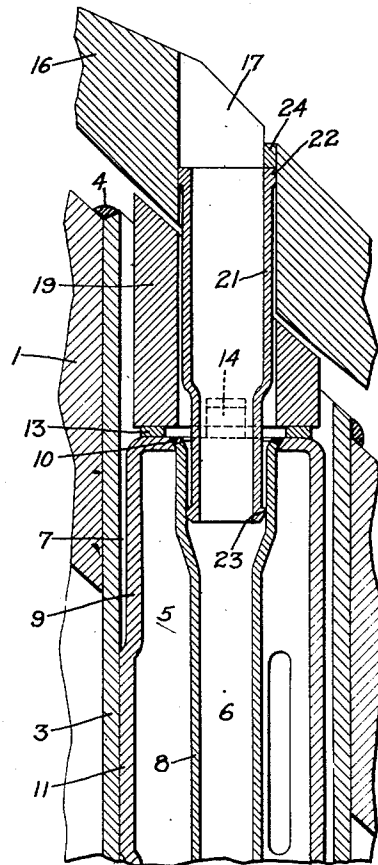
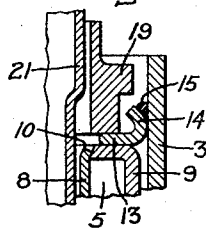


Fig. 3.



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UNITED STATES PATENT OFFICE

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LIQUID BOILER

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Serial No. 306,467

4 Claims. (Cl. 122-312)

The present invention relates to boilers for generating vapor from liquid and especially to boilers intended for vaporizing a liquid having a high boiling point as compared with water and which may be comparatively heavy. Such a liquid is mercury, mercury vapor now being utilized for driving elastic fluid turbines and for other purposes, such as a heating agent in connection with industrial processes.

10 The invention relates particularly to boilers of the type such as that disclosed in the application of Emmet and Coulson, Sr. No. 306,486, filed of even date herewith and has for its object to provide an improved construction and arrangement in a boiler of this type.

15 For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

20 In the drawing Fig. 1 is a sectional view of a boiler structure embodying my invention, and Figs. 2 and 3 are detail sectional views on a larger scale.

Referring to the drawing, 1 indicates a boiler drum or casing and 2 indicates boiler tubes depending from the lower portion thereof. Each boiler tube 2 comprises an outer tube 3 which at its upper end is fixed in an opening in drum 1 and is welded thereto as is indicated at 4, and a core 5 which is located inside tube 3 and provides a central passage 6 through which the liquid to be vaporized flows to the bottom of the tube, and an annular passage 7 through which the liquid flows upward and in which it is vaporized. Core 5 may be formed from an inner tube 8 and an outer tube 9 welded together at their upper and lower ends as is indicated at 10. The space between tubes 8 and 9 being filled with air preferably, which forms a heat-insulating medium to prevent transfer of heat to the liquid to be vaporized as it flows downward through core passage 6. The core 5 is held in spaced relation to tube 3 to define annular passage 7 by means of short, longitudinally-extending projections 11 which may be formed by forcing outwardly portions of the wall of core tube 9. At its lower end the core is held in spaced relation with tube 3 by a suitable projection 12. Core 5 is held down in tube 3 by means of a washer 13 which engages the top of the core and is provided with ears 14 which are welded to the adjacent inner surface of the tube 3 as is indicated at 15.

Inside drum or casing 1 and located in spaced relation thereto, is a baffle plate 16 provided with opening 17 through which a liquid to be vapor-

ized is supplied to core passages 6. Baffle plate 16 is held in spaced relation to the adjacent surface of drum 1 by projections 18 which may be in the form of heads on studs threaded into the baffle plate. Associated with the boiler structure are filler blocks 19 which serve to occupy spaces within the drum so as to decrease the volume which is required to be filled with the liquid to be vaporized. 20 indicates lagging for the boiler structure, which lagging may be fixed in position in any suitable manner.

The structure so far described is more fully illustrated and described in the above-referred application of Emmet and Coulson and is to be taken as representing a specific type of construction to which my invention may be applied. In connection with a boiler of the type so far described, the liquid mercury is fed through baffle plate passages 17 to core passages 6 and the vapor generated in boiler tubes 2 flows from the annular passages 7 at the tops of outer tube 3.

In connection with the operation of such a boiler, it is important that the flow of liquid through the baffle plate passages to the core passages be continuous and uninterrupted, for should an interruption in the flow to a core passage occur, it may result in burning out of the tube. For manufacturing reasons, and because of the effect of heat upon the structure, it is not practical to form a rigid connection between the upper ends of the cores and the baffle plate openings 17.

Specifically, the object of my invention is to provide an improved connection between the baffle plate passages 17 and the core passages 6 for conveying the liquid to be vaporized from passages 17 to passages 6.

According to my invention, I connect each baffle plate passage 17 to the corresponding core passage 6 by means of a sleeve 21, the connection between the sleeve and the passages being of a character such that there is provided a yieldable connection between the parts whereby they may move angularly and preferably axially also relatively to each other to a limited extent while still maintaining a fluid-tight connection. To this end sleeve 21 in the present instance is made somewhat smaller in diameter than the diameters of passages 17 and 6 and at its two ends it is provided with flanges or collars 22 and 23 which have flat surfaces of limited extent in an axial direction which engage the surfaces of the passages 17 and 6. This forms, in substance, a sort of universal joint. With this arrangement, a tube 2 may assume a slightly angular position relatively to a passage 17 without affect-

ing adversely the tightness of the connection with the sleeve, a turning movement taking place around one or both flanges at the ends of the sleeve. A limited axial movement of the core 5 may also take place relative to baffle 16 and with the joint as arranged the necessary tightness is maintained. It will thus be seen that warping of the tubes or baffle plate or slight misalignments or other relative movements which 10 may take place while the boiler is in operation will not disrupt the connection between the passages 17 and the core passages 6. With this arrangement, also, passages 17 and the tube passages 6 need not be accurately aligned initially 15 insofar as the connection of them by means of the sleeves 21 is concerned.

In the operation of a boiler of this type, the vapors generated flow rapidly from the upper end of annular spaces 7 and are directed outward beneath the bottom of the baffle plate 16 20 while the liquid to be vaporized flows continuously through the baffle plate passages 17 to the core passages. It is of utmost importance to prevent the flow of vapor from the upper ends of the annular passages 7 from interfering in any 25 way with the flow of liquid through the passages 17 to the core passages 6. In a boiler with a large number of tubes this interference may be cumulative with the performance of the boiler seriously hampered. By my invention, the possibility of this occurring is, for all practical purposes, eliminated. 30

The sleeves 21 are held in the baffle plate passages 17 by means of keys 24 located in slots in 35 the wall or drum. Ordinarily the tubes are arranged in rows lengthwise of the drum and keys 24 may be in the form of strips laid in a continuous slot apertinent to all the sleeves of a row of tubes. Also, ordinarily, the baffle plate 16 will 40 be made in sections of suitable length a number of the tubes of each row of tubes being connected to each baffle plate section.

By the use of my invention, it will be seen that in constructing the boiler, the boiler tubes may 45 be assembled in the drum or casing 1 and welded in position after which a baffle plate section 16 may be put in place and fastened in a suitable manner and then sleeves 21 inserted one after another through the baffle plate openings 17 into 50 the core passages 6, the holding keys then being put in position. Since sleeves 21 may assume a slightly angular position, it is not essential that the passages 17 be aligned accurately with core passages 6. And in fact from a practical manufacturing standpoint, this would be a very difficult 55 result to accomplish. The use of the sleeves 21 serves to render practicable manufacture and

assembly without difficulty of a boiler structure of this type. The arrangement has substantial advantages also from a practical standpoint in that it permits of the ready dismantling of the boiler structure for repairs and makes it possible 80 readily to replace one or more tubes should it become necessary. In addition to the foregoing, the arrangement is one which can be manufactured and assembled at low cost.

In accordance with the provisions of the patent 85 statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative 90 and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a boiler structure, the combination of a 95 casing, boiler tubes connected to the casing, a baffle plate in the casing provided with passages for the flow of liquid to the boiler tubes, and conduit means connecting said passages to the boiler tubes, said conduit means having at one end a 100 universal and slip joint with the adjacent wall.

2. In a boiler structure, the combination of a casing, boiler tubes connected to the casing, a baffle plate in the casing provided with passages 105 for the flow of liquid to the boiler tubes, and conduit means connecting said passages to the boiler tubes, said conduit means having at least at one end a universal joint connection with the adjacent wall.

3. In a boiler structure, the combination of a 110 casing, boiler tubes connected to the casing, a baffle plate in the casing provided with passages for the flow of liquid to the boiler tubes, and sleeves connecting said passages to the boiler tubes, said sleeves having outturned flanges of 115 small axial length which engage the walls of the adjacent passages with a sliding fit whereby there are provided universal joint connections between the sleeves and the passages.

4. In a boiler structure, the combination of 120 a casing, boiler tubes connected to the casing, said boiler tubes being provided with tubular cores, a baffle plate in the casing provided with passages for the flow of liquid, sleeves detachably mounted in said passages and projecting into 125 the cores for conveying liquid from above the baffle plate to the cores, said sleeves having outturned flanges of small axial length at their lower ends which engage walls of the cores with a sliding fit whereby there are provided universal joint 130 connections between the sleeves and the passages.

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