Dec. 6, 1932. C. C. THOMAS 1,889,938

STEAM SEPARATOR

Filed Dec. 1, 1931 2 Sheets-Sheet 1

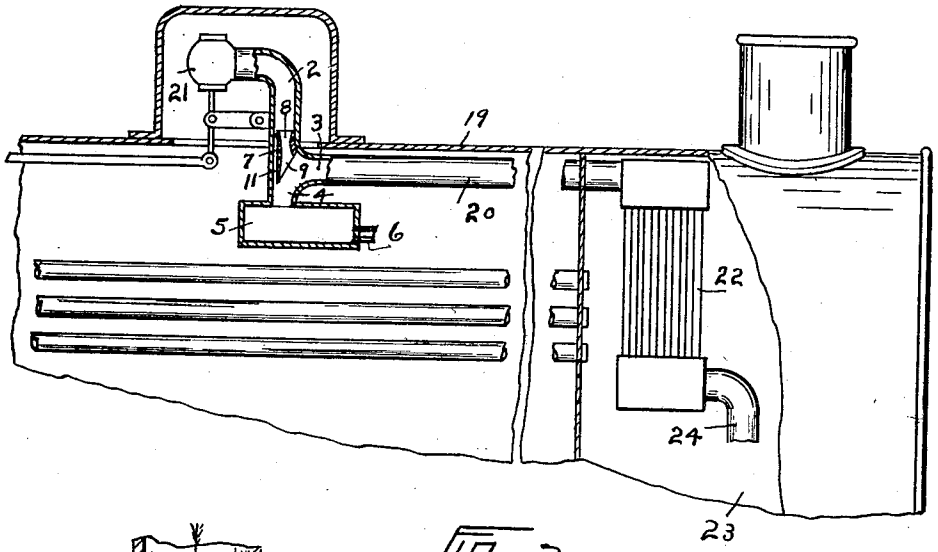



Fig. 3.

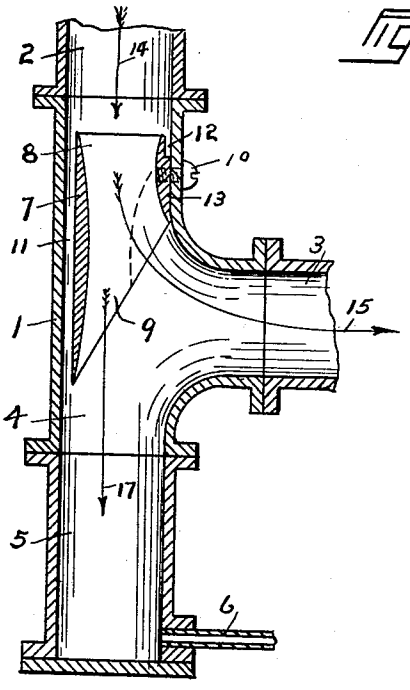



Fig. 1.

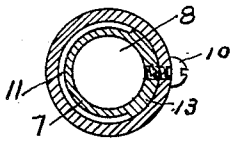



Fig. 2.

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Filed Dec. 1, 1931 2 Sheets-Sheet 2

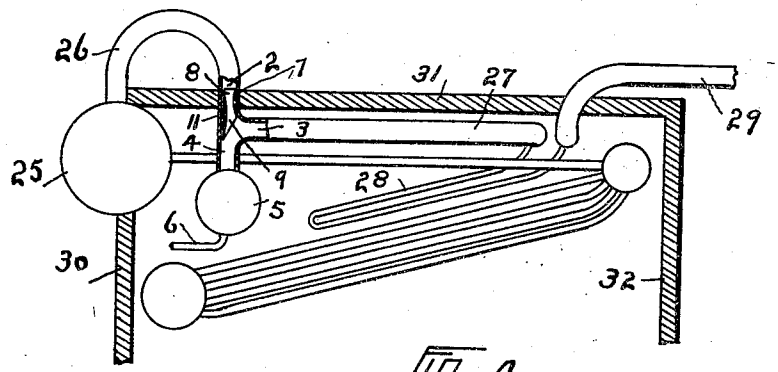



Fig. 4.

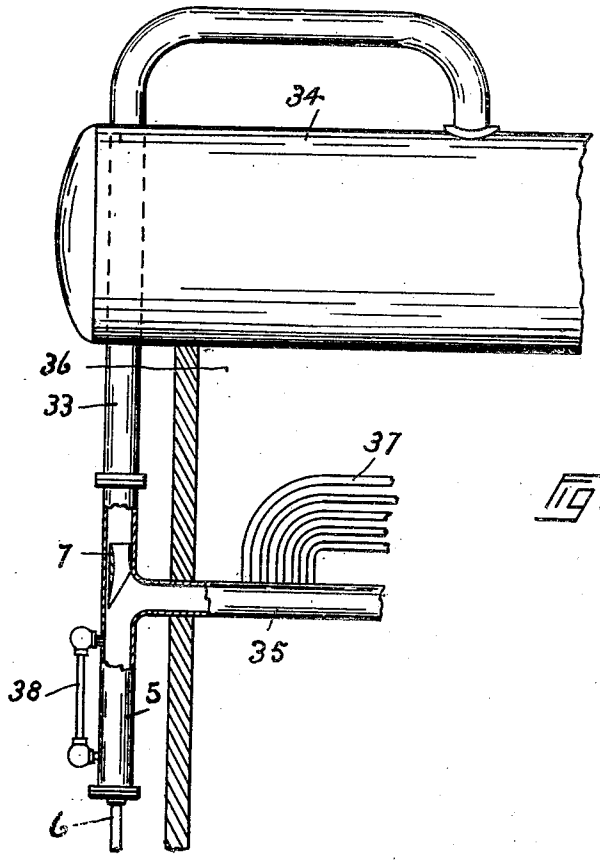



Fig. 5.

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Patented Dec. 6, 1932 1,889,938

# UNITED STATES PATENT OFFICE

CARL C. THOMAS, OF PASADENA, CALIFORNIA

## STEAM SEPARATOR

Application filed December 1, 1931. Serial No. 578,291.

This invention relates to improvements in a device for separating water from steam moving in a conduit without interfering to any serious extent with the flow of steam. An embodiment of this invention was disclosed by me, but not claimed as a separate invention, in my application for Letters Patent of the United States filed July 13, 1931, Serial Number 550,516.

In the present embodiment, the invention is shown more in detail and its use in practice as applied to steam pipes in three types of boilers, in each case in conjunction with super-heating devices, and which will be more fully explained in the following specifications.

An object of this invention is to separate water from steam moving in pipes by making use of the inertia of the moving globules of water. Another object is to collect at the same time any water which may be residual in or entrained on the inside of the steam pipe, and another object is to provide means for removing from the immediate pipe the water thus separated and collected.

In the accompanying drawings, I have shown three types of boilers, a locomotive boiler, a typical water tube boiler, and one in which my invention is installed outside the boiler placement, but the superheater disposed within the heated chamber. In each case the separator is in advance of the superheater. I have found this arrangement more satisfactory than placing the separator after the superheater, though I do not limit my invention or its application to any specific arrangement of the boiler parts. Better results can be obtained, however, by separating the water before superheating the steam, because less energy will be required to heat the comparatively dry steam than would be required to heat the steam and water to a temperature where the water would evaporate.

Another object within the contemplation of the present invention is to provide a device which is compact and easily installed, simple and inexpensive in construction, and that will not seriously interfere with the free passage of steam.

Other objects and advantages of my invention will become more apparent from the following specifications when considered in connection with the accompanying drawings, in which:

Fig. 1 is a sectional view of a steam conduit showing an arrangement of my invention and parts in section,

Fig. 2 is a section at 2—2 of Fig. 1, showing more clearly the arrangement of a by-pass, and other parts,

Fig. 3 is a partially diagrammatic, sectional elevation of that portion of a locomotive boiler including the internally arranged steam pipe, and showing my invention as applied to that type of boiler, some parts being cut away,

Fig. 4 is a partially diagrammatic illustration of a part of a water tube boiler showing the application of my invention to that type of boiler, and

Fig. 5 is an illustration of my invention as applied externally of the boiler placement.

Referring to the drawings with more particularity, the steam conduit 1 consists preferably of a steam pipe having a section 2 leading from the source of steam supply, and from which a section 3 continues at an angle to the section of pipe 2. Approximately in line with the section of pipe 2, a portion 4 continues to a water chamber 5 having an outlet 6. Within the pipe section 2 and disposed closely adjacent to the opening into section 3, I affix a separator 7 having a restricted passage 8 therethrough and an angular opening 9 preferably disposed in a position opposite the opening into section 3 of the steam pipe, the restricted passage 8 being, preferably, less in sectional area than the sectional area of the pipe section 3. The separator 7 is attached to the wall of the conduit as by screws 10, a portion of the separator 7 being cut away to provide an open by-pass 11 between a portion of the separator and the wall of the conduit. This by-pass is for the purpose of providing a means whereby any water entrained upon the walls of the conduit may pass the separator without passing through the restricted passage 8 and thus continue downwardly along the wall of the pipe 4 into the water chamber 5 without being disturbed by

the motion of the stream. When the separator is to be disposed in a vertical position as in Fig. 1, it is important to arrange that the water entrained upon the walls of the pipe does not enter the restricted passage 8. For this purpose, I provide a space 12 surrounding the upper end of the separator and communicating with the by-pass 11. The portion of the separator which abuts the wall of the pipe forms a boss 13 which is so shaped as to prevent water from passing along the wall of the pipe adjacent the opening into the pipe 3, and to lead the water to the far side of the pipe and through the by-pass 11.

The steam enters through the section of pipe 2, as indicated by the arrow 14, passes through the restricted passage 8 and out of the restricted passage through the angular opening 9, and turns into the pipe section 3, as indicated by the arrow 15. The steam in passing through the restricted passage 8, will travel at increased speed, due to the restriction. The water carried by the steam will also move at increased speed for the same reason, and because of the fact that it will be impelled by the steam. When the steam enters the larger, unrestricted pipe section 3, it will move more slowly and have little effect in carrying with it any globules of water. In the meantime, the globules being heavier per unit volume than is the steam will tend to travel in a straight line, there being no influence to turn them from a straight line, except the friction of the steam. The water globules will pass the opening into the pipe section 3 and continue into the water chamber 5, as indicated by arrow 17 where it will remain to be drawn off in any suitable manner through the outlet 6, or otherwise disposed of. Such water as may be entrained on the walls of the section of pipe 2 will pass through the by-pass 11 and continue into the water chamber 5 undisturbed.

Referring to Fig. 3 which discloses an embodiment of my invention as applied to a locomotive boiler, parts are numbered to correspond to similar parts in Fig. 1, and the invention is of similar construction. Within the steam dome 18 and the boiler 19, the dry pipe 20 with a valve 21 is disposed in a manner usual in boilers of this type. Within the section of pipe immediately after the valve, and preferably within the dome, the separator 7 is disposed within the pipe. The section of pipe 3 leads into the dry pipe 20. A water chamber 5 of suitable design, is suitably disposed below the separator 7 and provision made for disposing of the accumulated water through the outlet 6. Any water coming through the valve 21 will be separated and deposited in the chamber 5 while the comparatively water free steam will turn into the dry pipe 20 and through it to the superheater 22 which is usually disposed within the smoke box 23. The superheated steam passes out of the superheater 22 through the pipe 24 and to the engine, as in the usual manner.

It is not the intention of applicant to disclose all details of boiler construction or parts, but sufficient to make the application of the present invention to a boiler clear to one skilled in this art.

In Fig. 4 an arrangement is shown in which the present invention is installed in a boiler of the water tube type, in which 25 is a steam drum with a pipe 26 leading therefrom. In this case the valve is omitted and may or may not be placed before or after the separator. The section containing the separator 7 is connected to the steam pipe 26 by the section 2, and steam passing through the separator enters the main steam pipe 27 through the section 3, and thus to the superheater 28, and out through the pipe 29 to the engine. The separated water, and that passing through the by-pass 11, passes into a suitable water chamber 5 from which it is drawn off in a suitable manner through the outlet 6.

In Fig. 4, I have shown the water chamber 5 as disposed within the furnace which is enclosed by the emplacement walls 30, 31 and 32, by which arrangement the separated water may be heated before being returned to the boiler or sufficiently heated to cause it to evaporate.

Fig. 5 illustrates an embodiment of my invention as arranged in connection with a boiler of still a different type, in which the steam pipe 33 carries the steam from the steam drum 34, but lies outside the boiler and the boiler emplacement. The steam separator 7 is disposed at a convenient place in the steam pipe 33 from which the pipe 35 may turn at an angle to the pipe 33 and enter the heating chamber 36, where the steam may pass through a suitable superheater 37 before being conducted to the engine. This arrangement provides a convenient and accessible location for the separator and water chamber, which latter may be arranged as a water leg to the steam pipe. The water which may accumulate in the water chamber may be observed by means of a water gauge glass 38, or other suitable means, arranged and connected with the water chamber. By this means the operator may more intelligently adjust the means for evacuating the water chamber of water, and observe any variation in amount of water entering the water chamber.

It is understood that various changes and modifications may be made in the construction and arrangement of the parts without departing from the spirit or sacrificing any of the advantages of the invention as set forth in the specifications and appended claims.

What I claim is:—

1. A steam separator comprising, a steam conduit, a reducing means within said conduit, said reducing means having an angular

opening and a by-pass between said means and the wall of said conduit.

2. A steam separator, comprising a steam conduit, a reducing means within said conduit, said reducing means having a passage therethrough and a by-pass between said reducing means and the wall of said conduit, and a portion of said conduit disposed at an angle to said passage.

3. A steam separator having a reduced passage therethrough, an angular opening from said passage, a by-pass parallel to said passage, and a steam conduit having a portion disposed at an angle to said passage and a water chamber.

4. In a steam separator, a steam conduit having a reduced passage therein, through which the steam moving in said conduit may pass, a by-pass against the wall of said conduit through which water may pass, a portion of said conduit disposed at an angle, and a portion continuing substantially in line with the axis of said reduced passage.

5. In a steam separator, a steam conduit, a reducing means therein having a reduced passage through which the steam may pass, a by-pass between said reducing means and the wall of said conduit through which water entrained on the walls of said conduit may pass without entering said reduced passage, a channel about the end of said reducing means to trap water entrained upon the walls of said conduit and direct it into said by-pass, an angular opening from said passage through which the steam may leave the passage at an angle, and a water chamber substantially in line with the axis of said passage to provide means whereby water globules leaving said passage with the steam may continue substantially in the line of the axis of said passage.

6. In a steam separator, a steam conduit, a reducing means therein having a reduced passage through which the steam may pass, a by-pass between said reducing means and the wall of said conduit through which water entrained on the walls of said conduit may pass without entering said reduced passage, a boss on said reducing means abutting on the wall of said conduit, a channel about the end of said reducing means communicating with said by-pass, an angular opening from said passage through which the steam may leave the passage at an angle, and a water chamber substantially in the line of the axis of said passage.

CARL C. THOMAS.