March 23, 1943. L. H. SMITH 2,314,667

CIRCULATING UNIT

Filed May 9, 1940

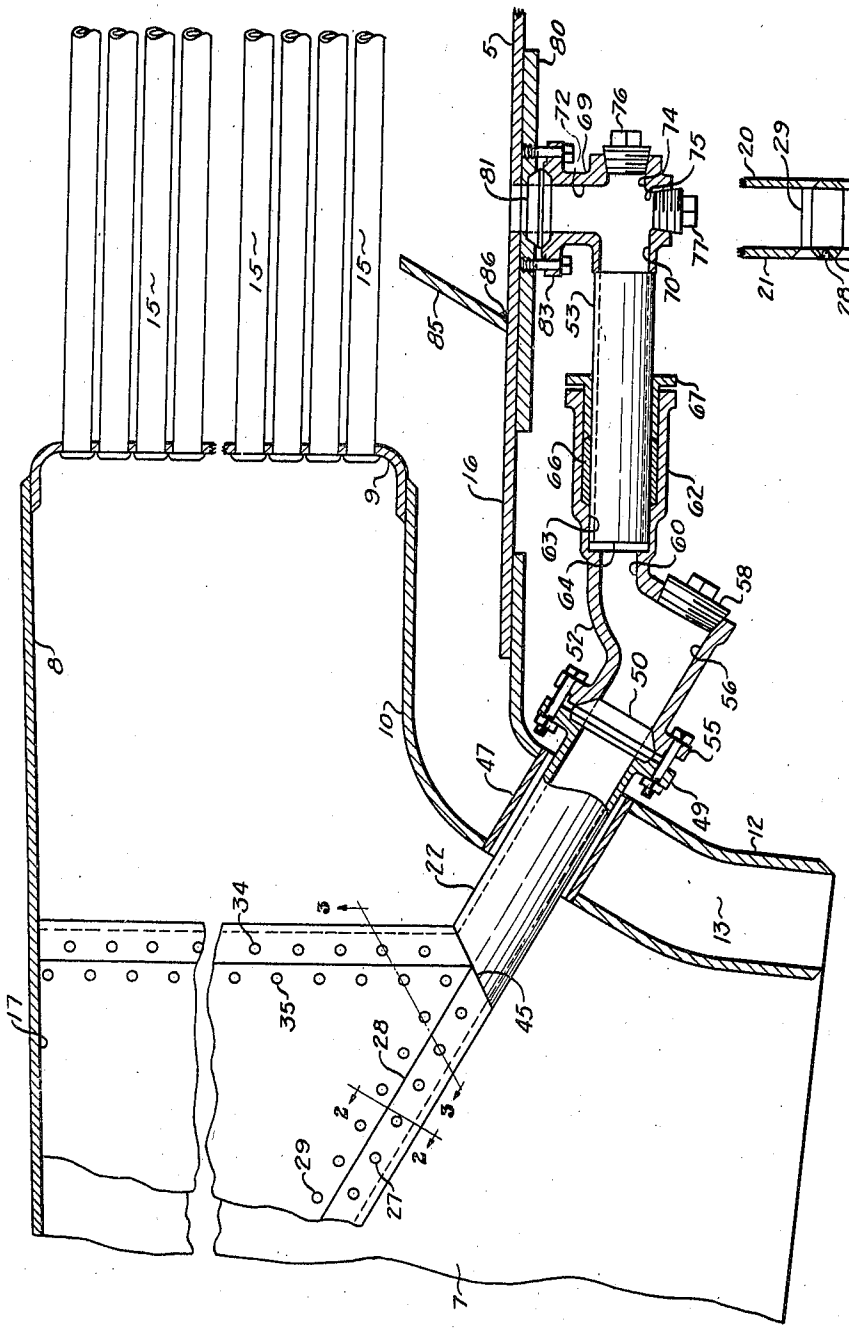


Fig. 1

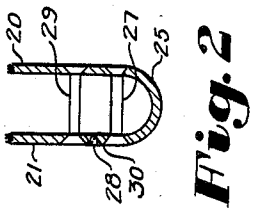


Fig. 2

INVENTOR.
LEWIS H. SMITH

BY Fay, Golwick, Williams & Fay
ATTORNEYS.

Patented Mar. 23, 1943 2,314,667

UNITED STATES PATENT OFFICE

2,314,667

CIRCULATING UNIT

Lewis H. Smith, Cleveland, Ohio, assignor to H. H. Pinney, Shaker Heights, Ohio

Application May 9, 1940, Serial No. 334,225

4 Claims. (Cl. 122—68)

This invention relates generally as indicated to a circulating unit and has reference more particularly to a unit for circulating the water of a locomotive boiler.

Locomotive boilers generally comprise a barrel, the rear portion of which has incorporated therein a firebox provided with a crown sheet, a flue sheet and water legs. It is well known that due to variations of temperature of one part of a boiler as compared to another part thereof and due to road jars, the various parts of a boiler have slight relative movement. When a relatively rigid element is introduced into the boiler, the parts which it interconnects are not as free to move as are the other parts and consequently such interconnected parts are subject to greater and more frequent stresses which result in fractures, thus putting the boiler out of commission. Such a relatively rigid element frequently takes the form of a syphon which interconnects the throat or front leg with the crown sheet.

Such a syphon comprises a substantially triangularly shaped water steaming and circulating pocket with the top thereof opening through the crown sheet and the neck thereof secured to the throat of the boiler. The neck portion, being one of the weakest parts of the syphon, is subject to the stresses which are set up by relative movement between the crown sheet and the throat and frequently becomes fractured.

The intake of the neck usually draws water from the throat, but since the throat is of relatively restricted volume, the drawing of water therefrom might result in inadequate supply of water to the side water legs. According to this invention, the intake of the syphon is supplied with water by a conduit which communicates with the rear portion of the barrel at a point forwardly of the firebox flue sheet so that the conduit has a tendency to draw or syphon water out of or away from the water legs. The result, if such tendency were not counteracted, would be very undesirable and consequently we have provided a counteracter. Thus a saving in the length of conduit is appreciated because by means of this invention a conduit, shorter than conduits heretofore used at a sacrifice of safety, can now be safely employed.

The conduit and the entire syphon itself, if maximum efficiency is to be appreciated, must be maintained relatively free from water impurity precipitates. These precipitates form a layer on the walls of the liquid container, thus setting up a strata of insulation, and have a deteriorating effect on such walls. Frequent flushing does not completely remove such precipitates and for a more thorough removal thereof means hereinafter described are provided.

One of the objects of this invention has been to provide a device of the character described which is relatively unaffected by the movement of the various parts of a boiler.

Another object of this invention has been to provide a relatively economically constructed syphon.

Still another object of this invention has been to provide structure which permits safe usage of a relatively short syphon inlet conduit which draws water at a point so located with respect to a firebox water leg that without such structure the conduit would, to an unsafe extent, adversely affect the syphonic action of such water leg.

A further object of this invention has been to provide means auxiliary to flushing whereby precipitates from the water may be readily removed.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims; the annexed drawing and the following description setting forth in detail certain structure embodying the invention, such disclosed structure constituting, however, but one of various structural forms in which the principle of the invention may be used.

In said annexed drawing:

Fig. 1 is a fragmentary longitudinal sectional view of a circulating unit incorporating this invention;

Fig. 2 is a section taken on the line 2—2 of Fig. 1.

As is above noted, this invention relates to a circulating unit which is particularly adapted for use in conjunction with a locomotive boiler. Sufficient parts of such a boiler to adequately disclose this invention are seen in Fig. 1. Such a boiler in general comprises a barrel 5, only the lower portion of which is shown, which has incorporated into the rear portion thereof a firebox indicated generally at 7. The firebox is provided with a crown sheet 8, a flue sheet 9 and a throat sheet 10. The barrel extends, as at 12, below the throat sheet and the space 13 therebetween is known as the throat or the front water leg. A large number of fire tubes 15 open through the flue sheet 9 at the rear of the boiler and through a front flue sheet (not shown) at the front of the boiler wherefrom the flues are discharged by a suitable chimney. The water level is preferably maintained above the crown sheet so as to submerge the same and the fire tubes, whereby to prevent detrimental overheating. The sides of the firebox are bounded by side sheets which are spaced from the barrel so as to provide side water legs in communication with the throat.

The side water legs, being considerably warmer at the upper than at the lower portion thereof produce a syphonic action of their own. That is to say, they suck or draw water from the throat and due to syphonic action such water is forced upwardly through the side water legs and steamed off above the crown sheet. As is known

to those acquainted with locomotive boilers and as seen in Fig. 1, the throat or front water leg is of relatively restricted dimensions and consequently in order to supply adequate water to the side water legs, the water passing through the throat frequently attains a relatively high velocity. This high velocity causes the water to sweep past the lower fire tube and the lower portion 16 of the barrel which merges with the throat. This sweeping action will be hereinafter more fully enlarged upon.

One part of a circulating unit embodying this invention is a syphon which, as is above indicated, in general is a flat hollow triangular element.

As is seen in Fig. 1 and by way of illustration rather than limitation, when viewed from the side the syphon is substantially right triangular. The crown sheet is provided with a longitudinally extending slot which serves as an exit for the syphon. To this end the edges 17 of one of the bases of the syphon are secured to the crown sheet so that the interior of the syphon communicates with the slot. Hence the syphon opens through and is secured to the crown sheet.

The syphon per se is made up of three main parts, namely, two side sheets 20 and 21 and a neck 22. In making the syphon, the lower portion 25 of one of the side sheets, such as sheet 20, is bent so that what was the edge of the lower portion is spaced from the body thereof. In finished form the lower portion 25 is arcuate for at least 90° and preferably for 180° or more, as is seen in Fig. 2. Suitable stay bolting 27 may be employed for maintaining the edge of the side sheet 20 spaced from the body thereof. Suitably secured as by welding 23 to the edge 30 of the sheet 20 is the bottom edge of the side plate 21. Suitable stay bolting 29 interconnects the two side sheets to maintain them in parallel relationship and spaced in accordance with the spacing of the edge 30 from the body portion of side sheet 20.

For securing the side plates 20 and 21 together at the front edge of the syphon, means similar to those disclosed in Fig. 2 may be employed. The forward edge portion of the side sheet 20 is bent in a similar manner to the bottom portion 25 thereof so as to provide an edge disposed similarly to the edge 30. Suitable stay bolting 34 and 35, similar respectively to stay bolting 27 and 29 may be employed. When this construction is employed, the portions 25 and 31 are first bent into position and then the side sheet 21 is welded in place. It is to be noted that the side sheet 21 in such a construction is truly triangular and thus a considerable saving is appreciated in cutting it to size.

The neck 22 of the syphon preferably takes the form of a piece of conventional pipe which is suitably secured as by an annular weld 45 to the body of the syphon. As is clearly seen in Fig. 1, the neck extends from and in alignment with the bottom of the syphon.

For a detailed description of the syphon per se, reference in made to our copending application Ser. No. 371,131 filed December 21, 1940, and entitled "Syphon and method of making same."

As is above indicated, the syphon is supplied with water by a conduit which opens into the boiler at a point in advance of the flue sheet. To this end a sleeve 47 of inner diameter greater than the outer diameter of the neck is welded to and provides a passageway through the throat or front water leg. For securing the above said conduit to the neck, the latter has welded thereto a flange 49 which is provided with a recess for accommodating a suitable flexible packing washer 50.

It has hereinbefore been indicated that the neck of the syphon will move with respect to the throat of the boiler and consequently the conduit, which will now be described, is provided with means for compensating or absorbing such movement.

The conduit in general comprises two sections 52 and 53. The section 52 is connected to the neck, the section 53 is connected to the boiler and the sections are interconnected by a slip joint.

The end of the section 52 which is connected to the neck is provided with a flange 55 which has a recess for accommodating the washer 50, the washer being of such size that when the flanges 49 and 55 are assembled the washer is compressed to form a seal. Suitable means such as bolts and nuts may be employed for maintaining the flanges and washer in assembled relation, but the flanges do not contact each other and may move with respect to each other without breaking the seal. This section is also provided with a hollow interior 56 which is aligned with and of substantially the same diameter as the inner diameter of the neck and is further provided with an opening for cleanout purposes adapted to be closed by a plug 58. This opening is aligned with and of substantially the same diameter as the neck so that, when the plug is removed, a suitable precipitate or sediment removing tool may be inserted through the opening for cleaning the neck and the body of the syphon. The opening is made of the size indicated because if it were smaller, the insertion therethrough of a tool would be impossible or greatly hindered.

For communication with the section 53 the section 52 is provided with another hollow interior 60 which communicates with the hollow interior 56 and which is substantially horizontally disposed. The end of the section 52 which is remote from the flange 55 is enlarged as at 62 and bored as at 63 in alignment with the hollow interior 60 for slidingly accommodating one end 64 of the section 53. Suitable packing 65 is compressed against each of the sections by means of a suitable nut 67, the latter being threadedly engaged by one of the sections.

The forward end of the section 53 is provided with an elbow 69. This section is provided with a hollow interior 70 which is aligned with the hollow interior 60 of the section 52 and with a hollow interior 72 which extends upwardly and communicates with the boiler and with the hollow interior 70. For cleaning the sections in a manner similar to that used for cleaning the neck, the elbow is provided with an opening 74 aligned with and of substantially the same diameter as the hollow interior 70. The elbow is further provided with an opening 75 of substantially the same diameter as and in alignment with the hollow interior 72. Respective plugs 76 and 77 are provided for plugging the openings 74 and 75.

For maintaining the hollow interior 72 in communication with the boiler, surrounding the point of communication and secured to the bottom of the boiler is a plate 80 which is provided with an annular groove for accommodating washer 81, the latter being similar to the washer 50. The elbow is provided with a flange 83 which is similar to the flange 55, the latter being secured to

the plate 80 in a manner similar to that in which the flanges 49 and 55 are connected.

From the foregoing it will be seen that water from the boiler is drawn into the section 53, passes through the section 52 to the neck 22 and from there upwardly through the water steaming and circulating syphon and is discharged through the crown sheet. It will also be seen that movement of the neck with respect to the throat is absorbed by the washers 50 and 81 and by the slip joint which connects the sections 52 and 53. It will be further seen that by removing any of the plugs 58, 76 and 77 and inserting a suitable tool that the circulating system can be thoroughly relieved of foreign matter.

As is aforesaid, the water from the boiler, due to the syphonic action of the side water legs of the firebox, is swept with great velocity into the throat. It is to be noted that the conduit communicates with the boiler slightly forwardly of the throat and of the flue sheet in such a manner that the point of communication can be described as adjacent the throat and flue sheet. Due to this adjacent relationship, water from the forward portion of the boiler in approaching the throat would be swept into the conduit so that an inadequate quantity of water would be drawn into the throat. Or if the syphonic action is sufficiently great, the conduit might draw water out of the throat causing water in the throat to flow forwardly.

For insuring an adequate supply of water to the conduit and to the throat, a flat upwardly directed transversely disposed baffle plate 85, which is interposed between the point of communication of the conduit and the boiler and the flue sheet and the throat, is welded to the bottom of the boiler as at 86. Due to the baffle plate water from the rearward portion of the boiler is drawn into the throat and water from the forward portion of the boiler is drawn into the conduit. If either the throat or the conduit were to have an inadequate supply or circulation of water then the side water legs or the syphon would be injuriously affected. The baffle plate augments the flow of water from the front lower portion of the boiler to the conduit, thus increasing the overall efficiency of the boiler.

Due to the simplicity of construction of the syphon, the same can be economically manufactured. The free passage of the neck through the throat, the washers 50 and 81 and the slip-joint cooperate in reducing maintenance costs. The baffle plate 85 increases the efficiency and insures an adequate supply of water to the throat and to the conduit. The plugs 58, 76 and 77 provide ready means for scraping and flushing the interior of the unit.

It will be understood that more than one syphon may be employed, in which case the other elements would be duplicated.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the structure herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:

1. A locomotive boiler provided at the rear thereof with a firebox having a crown and a throat sheet and side sheets providing a front and two side water legs communicating with each other, in combination with a flat hollow triangular water-steaming and circulating element disposed longitudinally of the firebox and having one edge thereof opening through and secured to said crown sheet and also having an intake, a conduit in communication with said intake and that portion of the boiler which is forwardly of and adjacent the front water leg, and an upwardly directed transversely extending baffle plate in the boiler between the forward portion of the firebox and said portion of the boiler whereby said conduit tends to draw from the forward portion of the boiler and said legs tend to draw from the rearward portion of the boiler.

2. A boiler having at the rear thereof a firebox including a crown sheet, a flue sheet and side and front water legs, in combination with a flat hollow water-steaming and circulating element one edge of which is secured to and in open communication with the crown sheet, said element having an intake neck projecting through and beyond said front water leg, a conduit communicating with said neck and with said boiler at a point forwardly of said flue sheet and adjacent said front water leg so that each tends to interfere with the syphonic action of the other and a substantially flat upwardly directed and transversely disposed baffle plate interposed between said point and said front water leg for counteracting said tendency whereby said water legs tend to draw from the rear of said baffle plate and said conduit tends to draw from the front of said baffle plate.

3. A boiler having at the rear thereof, a firebox including a crown sheet and side and front water legs, in combination with a flat hollow water steaming and circulating element one edge of which is secured to and in open communication with the crown sheet, said element having an intake neck projecting through said front water leg, a conduit communicating with said neck and with said boiler at a point such that said legs and said conduit interfere with the syphonic action of each other, and a substantially flat upwardly directed and transversely disposed baffle plate interposed between said point and said front water leg whereby said legs and said conduit are provided with an adequate supply of water.

4. A locomotive boiler having at the rear thereof a firebox and including a water leg having an intake opening disposed to induce a substantially horizontal flow of liquid thereinto by thermal syphonic action in combination with a water steaming and circulating element discharging into the upper water space of said boiler, an intake conduit communicating with said element and with said boiler at a point forwardly of the water-leg intake and below and transversely of the normal path of fluid flow into said water-leg intake so that said leg intake and said intake conduit would normally interfere with the thermal syphonic action of each other, and a transverse baffle interposed between said point and said water leg intake and projecting into the path of fluid flowing thereinto whereby said leg and said conduit are both provided with an adequate supply of water.

LEWIS H. SMITH.