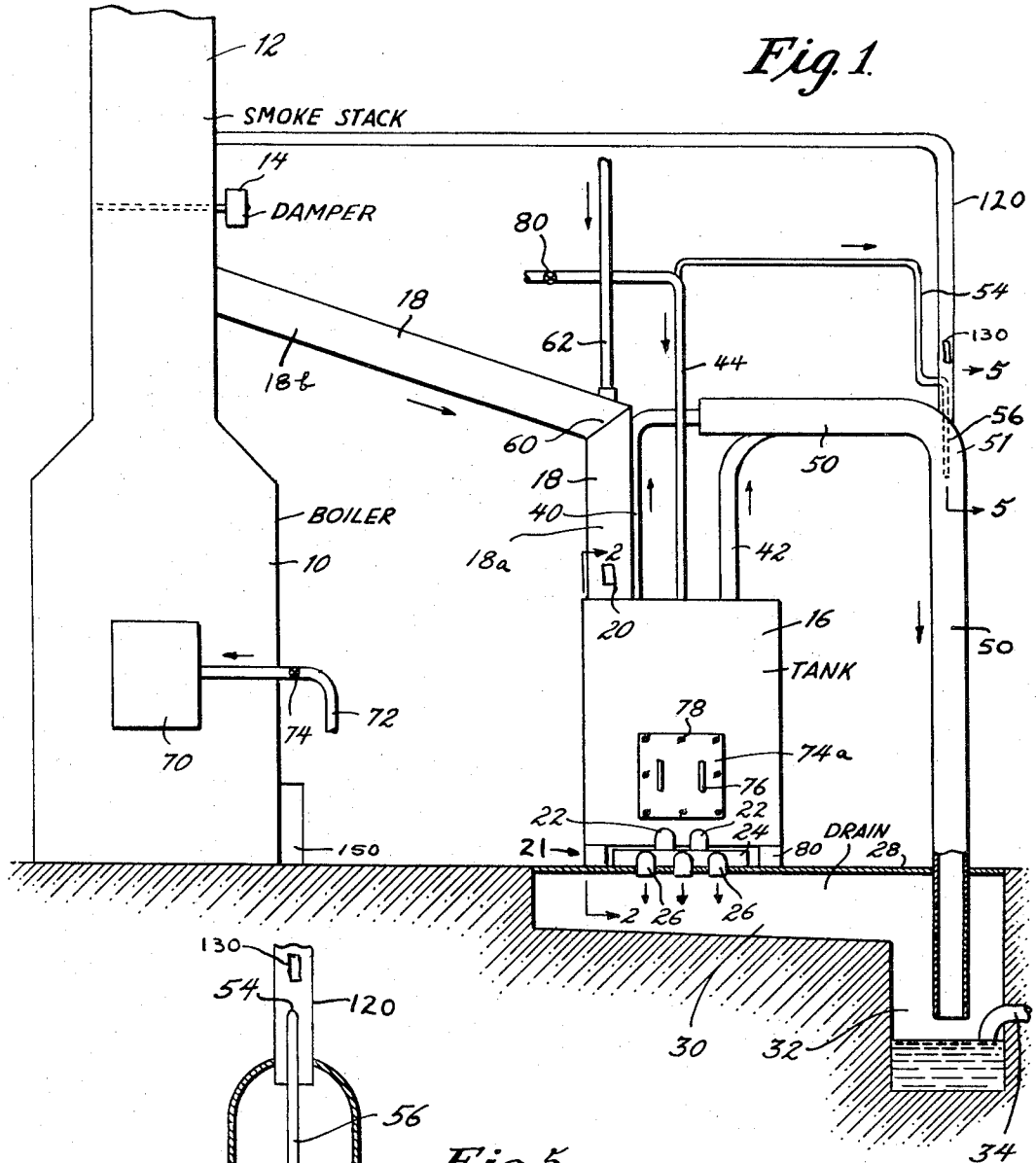
Dec. 10, 1968 J. REALE 3,415,231

METHOD FOR REMOVING SOOT FROM BOILER TUBES AND APPARATUS THEREFOR

Filed Jan. 3, 1968 3 Sheets-Sheet 1

Fig. 1.



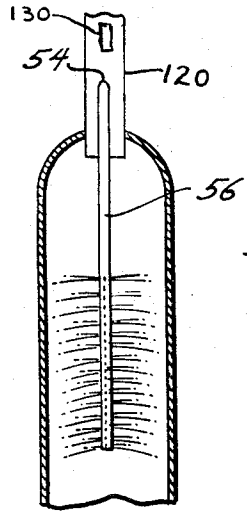


Fig. 5.

INVENTOR.
JOSEPH REALE
BY Denny and Denny
HIS ATTORNEYS

Dec. 10, 1968 J. REALE 3,415,231

METHOD FOR REMOVING SOOT FROM BOILER TUBES AND APPARATUS THEREFOR

Filed Jan. 3, 1968 3 Sheets-Sheet 2

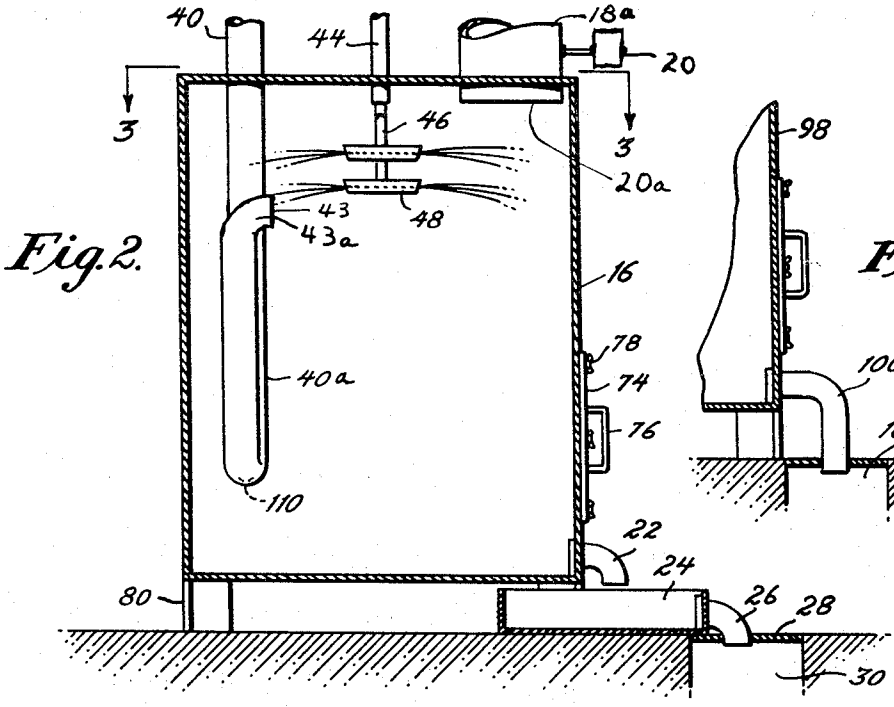


Fig. 2.

Fig. 6.

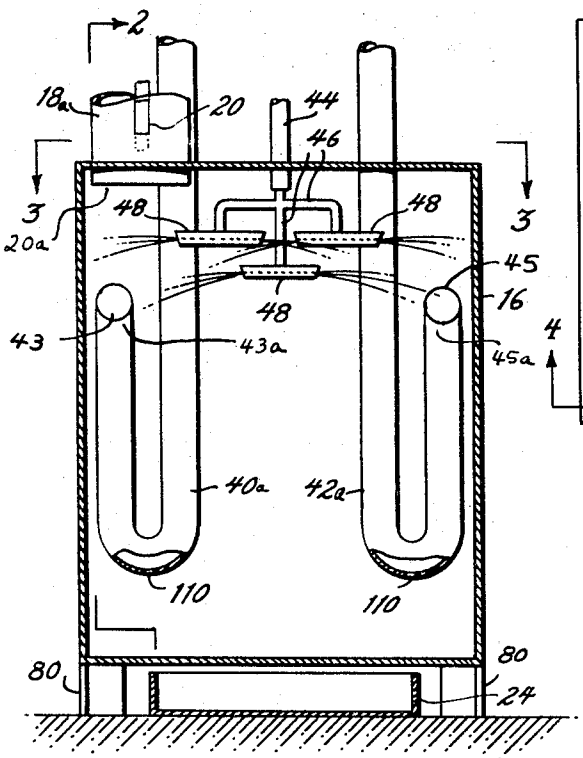


Fig. 4.

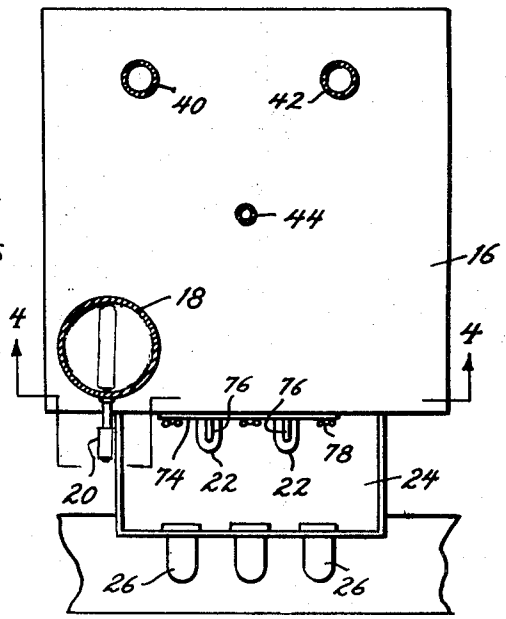


Fig. 3.

INVENTOR.
JOSEPH REALE

BY Denny and Denny
ATTORNEY

Dec. 10, 1968 J. REALE 3,415,231

METHOD FOR REMOVING SOOT FROM BOILER TUBES AND APPARATUS THEREFOR

Filed Jan. 3, 1968 3 Sheets-Sheet 3

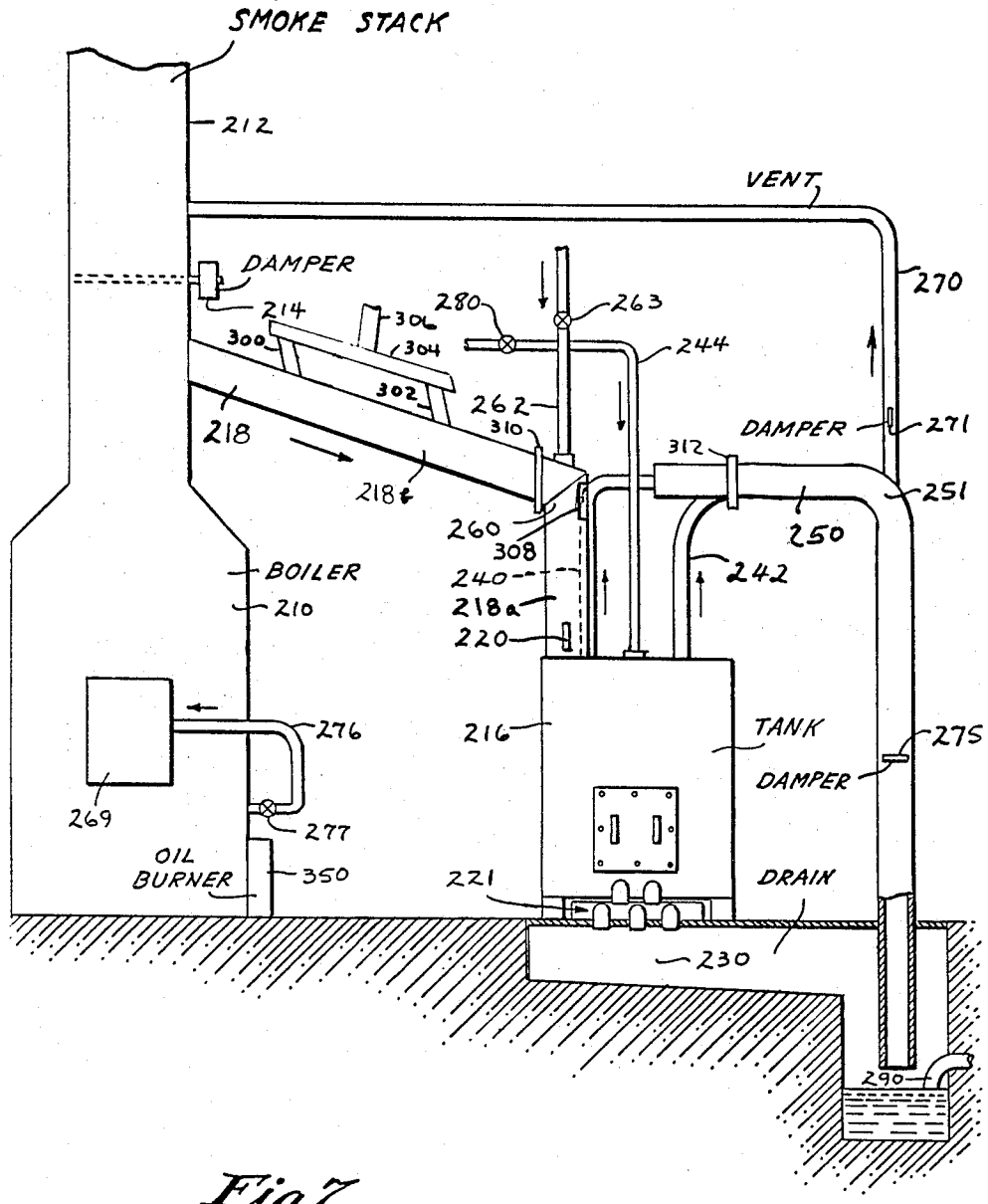


Fig. 7.

INVENTOR.
JOSEPH REALE
BY Denny and Denny
HIS ATTORNEYS.

United States Patent Office 3,415,231
Patented Dec. 10, 1968

3,415,231

METHOD FOR REMOVING SOOT FROM BOILER TUBES AND APPARATUS THEREFOR

Joseph Reale, 1425 S. Broad St.,
Philadelphia, Pa. 19147

Filed Jan. 3, 1968, Ser. No. 695,413
11 Claims. (Cl. 122—379)

ABSTRACT OF THE DISCLOSURE

This invention relates to minimizing air pollution by reducing to a minimum the escape, into the atmosphere, of soot from a boiler during the removal of the soot from the boiler tubes when a fluid is injected into a boiler to clean the tubes of soot. The fluid carries the soot to a tank where the soot is substantially removed from the fluid. The tank is connected by a pipe to the smoke stack to vent the cleaned fluid to the atmosphere. The soot is removed in the tank by a liquid which carries the soot to a suitable drain.

This application relates to subject matter disclosed and claimed in my copending patent application Ser. No. 625,464, filed Mar. 23, 1967, the latter being a continuation-in-part of Ser. No. 606,302, filed Dec. 30, 1967, now abandoned.

Background of the invention

This invention is directed to the field of air pollution control which, with the passing of each day, is becoming of more and more concern in all urban areas.

The effects of air pollution are fairly well known, as it has been reported to kill and sicken people and to destroy property.

One source of air pollution in industrial areas, is the soot which is emitted from smoke stacks when boiler tubes are cleaned. As is known, for maximum boiler efficiency, the boiler tubes should be cleaned periodically, for instance once a day. One common device for doing this is a steam spray device which sprays steam into the boiler, at the tubes, to dislodge the soot. The steam and the thus dislodged soot has heretofore normally been permitted to escape up the smoke stack and into the atmosphere.

Brief summary of the invention

It is an object of my invention to provide a method and apparatus for the cleaning of soot from the boiler tubes while substantially preventing or minimizing the escape into the atmosphere of the dislodged soot.

In my preferred method, the smoke stack damper is closed and a fluid is sprayed into the boiler to remove the soot from the tubes. This fluid and the removed soot is substantially prevented from escaping up the smoke stack by the closed damper and instead flows into a tank where substantially all of the soot is made to flow into a drain.

The apparatus I provide to accomplish this method comprises a main pipe connected between the boiler and the smoke stack damper at one end and at the other end to a substantially closed tank. The tank is provided with a liquid spray means to spray cooling liquid into the fluid, to wet the soot, remove it from the fluid, and carry it out into a drain.

The foregoing and other objects of my invention, the principles of the invention, and the best modes in which I have contemplated applying such principles will more fully appear from the following description and accompanying drawings in illustration thereof.

Brief description of the views

In the drawings:

FIG. 1 is a front elevation, but mostly diagrammatic view, illustrating a boiler, a smoke stack in part, a tank, connecting pipes, and a drain;

FIG. 2 is a cross-sectional side view of the tank illustrated in FIG. 1, but showing the pipes connected thereto and the liquid spray device in side elevation;

FIG. 3 is a top view of the tank taken along the line 3—3 in FIG. 2;

FIG. 4 is a cross-sectional front view of the tank illustrated in FIG. 1, but showing the pipes connected thereto and the liquid spray device in front elevation;

FIG. 5 is a sectional view of a part of the top vent pipe showing the interior liquid spray pipe;

FIG. 6 is a partial view similar to the lower right hand portion of FIG. 2, but showing a modification wherein the lower part of the tank is connected directly in the drain, and

FIG. 7 is a front elevation, but mostly diagrammatic view, illustrating a boiler, a smoke stack in part, a tank, connecting pipes, and a drain, similar to FIG. 1, but showing my preferred embodiment.

Description

Referring to the drawings, and in particular to FIG. 1, a boiler **10** is shown (diagrammatically) connected to a suitable smoke stack **12**, the latter including a damper **14**. Spaced from the boiler **10** is a closed tank **16** connected to the smoke stack **12** by a main pipe **18** which generally inclines upwardly to the smoke stack, as shown. The pipe **18** is connected at the left hand end to the smoke stack **12** between the damper **14** and the boiler **10** and on the right hand end is connected to the top of the tank **16** at the front, left portion thereof. As shown in FIGS. 1 and 4, the pipe **18** has a damper **20** near the top of the tank **16**, to close communication between the pipe **18** and the tank **16**, when desired.

The bottom of the tank **16** is provided with drain means **21** comprising two elbow-shaped pipes **22** connected to the tank **16** at the bottom of its front wall, the bottom pipes **22** emptying into an open-top pan **24** having three elbow-shaped pipes **26** extending through a cover **28** of a drain **30**, the drain **30** having a deeper well **32** into which a sewer pipe **34** extends.

The top of the tank **16** is further vented by two pipes **40** and **42** secured to the top (FIGS. 2 and 4) of the tank **16** and extending within the tank **16** as pipes **40***a* and **42***a* having a tortuous or U-shape, as shown. The pipes **40***a* and **42***a* have open ends **43** and **45**, respectively, facing to the front, as shown in FIG. 2, and formed by terminal elbows **43***a* and **45***a*. The U-shape pipes **40***a* and **42***b* are placed adjacent the rear wall of the tank, FIG. 2, and the entry elbows **43***a* and **45***a* are placed adjacent the left hand and the right hand side walls, respectively, of the tank **16**, i.e., the elbows are close to the nearest side wall. Thus, the entry elbows **43***a* and **45***a* are spaced from the outlet **20***a* (of the pipe **18***a*) within the tank **16** to afford the required time for condensing most of the steam within the tank **16** before it attempts to leave the tank, and for sufficiently wetting the soot so that it will drop down and flow out of the bottom of the tank **16**.

Extending through the top wall of the tank **16** is a pipe **44** for cooling water, the pipe **44** being connected by branch pipes **46** to three water heads **48** which spray water into the tank **16** to cool and condense most of the steam which enters the tank **16** through the pipe **18**. While circular spray heads **48** have been illustrated, an array of stacked straight pipes have been found satisfactory, and other shaped pipes, with suitable holes through which water may be sprayed, could also be used.

The pipes **40** and **42** extend upwardly from the top wall of the tank **16**, as shown, the pipe **40** making a right angle turn and being connected to the left end of a larger pipe **50**, the pipe **42** extending straight upwardly and curving to the right, as shown, and being connected to a cylindrical horizontal portion of the pipe **50** near the left end thereof. The pipe **50** continues to the right, as shown, to an elbow **51** where it turns downwardly at approximately a 90° angle, and the lower, vertical end of the pipe **50** extends, through the cover **28**, into the drain well **32**. To the elbow **51** is connected a branch water pipe **54** which has a forward spray head **56** extending into the elbow **51** and down into the vertical part of the pipe **50**, the spray head **56** having sufficient holes to provide a water spray of cooling water to condense substantially all of the steam which is vented through the pipes **40** and **42**, if desired.

As shown, the main pipe **18** is connected to the tank **16** by a substantially vertical portion **18***a* and to the smoke stack **12** by a sloping portion **18***b*, these two pipe portions meeting to form an angular joint **60**, as shown in FIG. 1. A steam pipe **62** is connected to the angular joint **60** to inject steam at high velocity into the joint **60** and down into the vertical portion **18***a*, the steam from the pipe **62** assisting the flow of the steam from the boiler to the tank. If desired, the steam pipe **62** may be connected to a steam injector (not shown) disposed within the joint **60** to assist the flow of steam from the boiler **10** (and smoke stack **12**) to the tank **16**.

Mounted on the boiler **10** is a steam spray device **70** for spraying steam within the boiler **10** during cleaning of the boiler tubes (not shown) by dislodging the soot which accumulates on them during normal operation of the boiler. Steam is supplied to the steam spray device **70** by a steam pipe **72** having a valve **74** which is closed during normal operation of the boiler **10** and opened when the cleaning operation is to be performed. The steam spray device **70** is of a well known type having means (not illustrated) for manually rotating the steam spray within the boiler so as to better dislodge the soot from the tubes.

The front wall of the tank **16** is provided with an access opening which is normally closed by a door **74***a* having suitable handles **76**, the door being bolted into place by suitable studs and nuts **78** and the tank **16** rests upon suitable feet **80**.

When it is desired to clean the boiler tubes, the normally open smoke stack damper **14** is now closed, and the normally closed damper **20** in the pipe **18***a* is now opened to provide communication between the boiler **10** and the tank **16**. The water valve **80** is opened to supply water to the spray head devices **48** and **56**.

Steam is then supplied through the pipe **62** to the pipe joint **60** and the valve **74** is opened to supply steam to the steam spray device **70**. (If the pipe **62** is connected to the pipe **72** between the valve **74** and the steam spray device **70**, the same valve, i.e., valve **74**, will then control the flow of steam to both the steam spray device **70** and the steam pipe **62**, but this is not illustrated.)

As the steam flows from the steam spray device **70** into the boiler **10**, it dislodges the soot from the boiler tubes. This steam and soot would normally flow up to smoke stack and out into the atmosphere. However, since the damper **14** is closed at this time, some pressure buildup takes place within the boiler and the part of the stack below the damper **14**, and this steam, and the soot which it carries along, flows under this pressure into the pipe **18** and is assisted in flowing into the tank **16** by the action of the steam injected at the joint **60**. Thus, the steam and the soot flows forcefully, under pressure, out of the pipe opening **20***a* into the front of the tank **16**, i.e., the lower left hand corner in FIG. 3, and is directed vertically downwardly, FIG. 4, due to the vertical disposition of the pipe **18***a*, toward the bottom of the tank **16**.

The U-shaped pipes **40***a* and **42***a* are located, adjacent opposite corners, at the rear of the tank **16**, the top in FIG. 3, i.e., remote from the portion of the tank in which the steam and soot enter from the pipe **18***a*, so that the steam entering the tank **16** tends to first flow down and then up towards the open ends of the elbows **43***a* and **45***a*, the U-shaped pipes **40***a* and **42***a* and the elbows providing tortuous paths helping to muffle and expend the energy of the steam.

Between the U-shaped pipes **40***a* and **42***a* and the outlet **20***a* of the pipe **18***b* are placed the water spray devices **48**, as shown in FIG. 2, the devices **48** being approximately centrally located near the top of the tank so as to tend to spray water on the steam as it first enters the tank **16**, and as it is about to leave through the open ends of the elbows.

Most of the steam which enters the tank condenses and with the water sprayed through the spray devices **48** flows out near the bottom of the tank through the elbow-shaped pipes **22**, into the pan **24**, and in doing so carries with it the soot that has been removed from the boiler tubes.

The water and soot in the pan **24** then flows through the elbow pipes **26** into the drain **30** and eventually into the sewer pipe **34**.

The open top pan **24** is provided merely as a convenience to visually inspect the water as it flows out of the tank **16** so that one can see that the water is, in fact, carrying along with it the soot removed from the boiler tubes. As a practical matter, the lower portion of the tank **98** may be connected, as shown in the modification illustrated by FIG. 6, by suitable pipes **100** directly to the drain **102**.

To remove any water that may accumulate in the U-shaped pipes **40***a* and **42***a*, holes **110** are placed at the bottom of the U from which the accumulated water drains into the bottom of the tank **16**.

If a sufficiently large cooling means is used to condense the steam entering the tank **16**, the vents provided by the pipes **40** and **42** would probably not be required, but the provision of these pipes adds a safety feature preventing an excessive pressure increase within the tank **16**.

Further, while U-shaped pipes **40***a* and **42***a* have been shown with terminal elbows **43***a* and **45***a*, it will be understood that the device would be operative if the U-shaped pipes **40***a* and **42***a* and the terminal elbows **43***a* and **45***a* were omitted, i.e., the pipes **40** and **42** could only be connected to openings in the top of the tank **16**.

Also, to vent the sulphuric and other noxious gases that may be carried along by the steam, a vent pipe **120** is connected at one end to the elbow **51** and at the other end to the smoke stack **12** above the damper **14**, as illustrated in FIG. 1.

The water pipe **54** is of smaller diameter than the vent pipe **120** and extends into the vent pipe **120**, as shown, and down into the elbow **51** and the vertical part of the pipe **50**.

Preferably a damper **130** is provided in the vent pipe **120**, adjacent and above the water spray pipe **56**, the damper **130** being open during cleaning of the boiler tubes and shut otherwise.

Thus, I have provided a tank **16** which retains the steam carrying soot and the sulphuric and other noxious gases for a long enough time period to permit the soot to be wetted sufficiently to flow to the bottom of the tank and out thereof with the cooling water and condensed steam. The flow of cooling water has to be adjusted properly relative to the flow of steam. If too much water flows into the tank **16**, it tends to choke the system, in which event the steam carrying soot backs up, and tends to come out of the boiler openings, i.e., around the boiler doors and other leak spaces in the boiler, into the

boiler room, which is, of course, objectionable. If too little water flows into the tank **16**, the soot will not get wet enough and not enough steam will condense, resulting in soot laden steam being vented either into the atmosphere through pipe **120** or into the drain through pipe **50**.

Another feature of my invention is that a certain amount of the sulphuric and other noxious gases become trapped in the cooling water and the condensed steam and the gases are carried thereby into the drain instead of being vented to the atmosphere.

While in the foregoing method I have stated that the smokestack damper **14** is closed during removal of the soot, because it increases the flow to the tank **16** and reduces the air pollution to a minimum, and hence is preferable, some of the soot dislodging steam from the boiler would flow into the pipe **18** and the tank **16** even if the damper **14** were kept open assuming, of course, that the damper **20** in the pipe **18** is open at such time.

However, if the damper **14** is kept open during the soot removal, the diameter of the pipe **62** should be increased and the flow of steam should be increased so as to increase the assistance provided at the joint **60**, whereby the amount of steam carrying soot entering the pipe **18** will approach the amount which would enter it if the damper **14** were closed at such time.

Referring to FIG. 7, the preferred embodiment of my invention is illustrated. The apparatus shown in FIG. 7 is generally similar to that shown in connection with FIGS. 1 to 5 and includes a boiler **210** having a smoke stack **212** with a damper **214**, the smokestack **212** being connected by a pipe **218** to a tank **216** the bottom of which is connected to a drain **230** by drain means **221**.

The pipe **218** is provided with a damper **220** adjacent the top of the tank **216** and steam is supplied through a pipe **262** to the joint **260**, the flow of steam being controlled by a valve **263**, to assist the flow of the steam from the boiler to the tank, as described in connection with the previous embodiment.

A cooling liquid, such as water, is supplied to the top of the tank **216** by a pipe **244** and the top of the tank **216** is vented by pipes **240** and **242** which are connected to the larger pipe **250**, as shown.

The vent pipe **250** has generally horizontal and vertical portions, as shown, and a connecting elbow **251** therebetween. Secured to the connecting elbow **251** is a vent shown, above the damper **214**. The vent pipe **270** includes pipe **270** which communicates with the smokestack, as a damper **271** adjacent the elbow **251**.

The vertical portion of the vent pipe **250** extends into the drain **230**, as illustrated, and is provided with a damper **275** adjacent the portion of the pipe which enters the drain.

The boiler **210** is provided with a steam control device **269** which receives steam from the boiler through a pipe **276**, the flow of steam being controlled by a valve **277**.

The vent pipes **240** and **242** extend into the tank **216** with the parts within the tank having the configurations illustrated and described in connection with FIGS. 1 to 5.

The cooling water pipe **244** extends into the tank **216** and has spray devices as illustrated and described in connection with FIGS. 2 and 4.

In operation, when it is desired to remove the soot from the tubes of the boiler **210**, the damper **214** is closed and the damper **220** is opened to place the tank **216** in communication with the smokestack **212** downdraft of the damper **214**. The damper **275** is closed which closes the communicating passage between the tank **216** and the drain **230** provided by the pipe **250**. The damper **271** is opened to place the smoke stack in communication with the pipe **250** at the elbow **251**.

Water is then admitted to the tank **216** through the pipe **244** by opening the valve **280**. The valve **263** is then opened and steam flows into the joint **260** and down into the tank **216**. Also, the valve **277** is opened admitting steam into the steam control device **269** to dislodge the soot from the boiler tubes.

At such time, the steam from the steam control device **269** dislodges the soot from the boiler tubes (not illustrated) and due to the closed damper **214** some pressure buildup takes place within the boiler **212**, aiding the flow of soot laden steam into the pipe **218** toward the tank **216**. The steam flowing through the pipe **262** into the joint **260** also aids the flow of the soot laden steam. The soot laden steam enters the tank **216** and most of the steam condensed by the cooling water flowing through the pipe **244** into the tank **216**, the condensed steam, water and soot dropping to the bottom of the tank and flowing through the drain means **221** into the drain **230** and out into the sewer pipe **290**.

Any part of the steam which is not condensed, together with the sulphuric and other gases which are not trapped in the condensed steam or the cooling water, are vented upwardly through the pipes **240**, **242**, **250** and **270** to the atmosphere through the portion of the smoke stack above the damper **214**, the closed damper **275** preventing the uncondensed steam and the sulphuric and other gases from entering the drain. The damper **275** is provided so as to vent the steam and gases to the atmosphere rather than having them enter the boiler room as tends to happen when they are flowing to the drain, because of the tendency of the gases to escape into the boiler room at the loose connection between the pipe **250** and the cover of the drain **230**. Thus, it is seen that the pipe **250** could be terminated and closed immediately downstream of its connection to the vent pipe **270**, rather than having it extending down into the drain.

However, the generally vertical portion of the pipe **250** which extends into the drain does serve a useful demonstration purpose. That is, to show how little steam remains uncondensed, the damper **271** may be closed and the damper **275** opened. If then the cover of the drain **230** is removed, or if the hole in the cover of the drain through which the pipe **250** extends is slightly larger than the pipe, the steam passing down through the vertical part of the pipe **250** will tend to rise into the boiler room, providing a visual observation of the small quantity that actually remains uncondensed.

Thus, relative to the embodiment illustrated in FIGS. 1 to 5 in the embodiment of FIG. 7 the part of the pipe **250** leading to the drain has been provided with a damper **275** adjacent the drain so as in effect to close off the pipe **250** between the elbow **251** and the drain and the water which was previously injected into the joint **251** has been omitted.

As discussed in connection with the embodiment of FIGS. 1 to 5, the embodiment shown in FIG. 7 can also be operated with the smoke stack damper **214** open.

Also, as discussed in connection with the embodiment of FIGS. 1 to 5, while it is preferred to have pipes within the tank **216** similar to the pipes **40***a* and **42***a* shown in FIGS. 2 and 4, the system would be operative without such U-shaped pipes within the tank **216**, i.e., the pipes **240** and **242** would merely provide a communication with the top of the tank **216** and the pipe **250**.

In FIG. 7 the pipe **276** has been shown connected to the boiler **210** to receive its steam and the pipe **263** may also receive its steam from the boiler **210**.

This invention has been embodied in a boiler having an oil burner **150** (FIG. 1) or **350** (FIG. 7); but it is seen that this invention is not limited to a particular type of boiler or fuel.

While the pipe **18***b* has been shown (FIG. 2) extending below the top of the tank **16**, to form an outlet **20***a*, this has been shown for purposes of clarity, whereas in practice the pipe **18***b* is connected to the top of the tank **16** without extending into the tank.

Further, while only the injection of steam in the pipe joint **60** to assist the flow of steam from the boiler **10** to the tank **16** has been discussed, it is seen that other assist-

ing means could be provided in the pipe **18**, such as water flowing through a Venturi tube (not illustrated) this water tending to also condense the steam to create a further vacuum, in addition to that created by the Venturi tube.

In the embodiment of this invention, the soot removing method is performed once a day, when the demand for steam from the boiler is substantially reduced, i.e., during the noon lunch hour.

Further, the apparatus has been illustrated in the drawings primarily diagrammatically, because the various flanges and welded connections which may be used, but are not shown, may easily be provided by those skilled in the art.

Although direct water sprays have been shown to condense the steam it will be understood that other means for cooling and condensing the steam could also be provided.

While the devices for removing the soot from the tubes have been indicated as steam spray devices **70** (FIG. 1) and **269** (FIG. 7), it is seen that a device injecting another fluid, such as high pressure compressed air, into the boiler would result in dislodging the soot from the tubes and carrying it into the tanks.

Also, while steam has been mentioned for use in the pipes **62** (FIG. 1) and **262** (FIG. 7) to assist the flow of the fluid (steam or air) from the boiler to the tank, it is seen that high pressure compressed air could also be injected in the pipe connecting the tank to the boiler for the purpose of assisting the flow.

Further, I have found that soot will accumulate in the pipe **218***b*. As illustrated, the pipe **218***b* slopes down from the smoke stack toward the tank. To clean the soot from the pipe **218***b*, pipes **300** and **302** are connected to the pipe **218***b* and high pressure compressed air is injected into the pipe **218***b* through the pipes **300** and **302** which are angled to direct the flow toward the pipe **218***a*, driving the accumulated soot into the pipe **218***a* and into the tank **216** from which it is removed by the water flowing through the tank. The pipes **300** and **302** are connected to a common pipe **304** and a supply pipe **306**, as shown. While air is preferred for cleaning the soot from the pipe **218***b*, steam and/or water could also be used. However, if water is used acids would tend to be formed which is undesirable, but if water is used, the slope of the pipe **218***b* causes it to flow into the tank. Further, if steam is used, some of the steam would condense in the pipe **218***b*, tending to produce the acids previously mentioned.

If desired, the cleaning of the pipe **218***b* may be done by hand and a suitable hole, in the joint **260** covered by plate **308**, and secured by suitable studs to the pipe **218***b* may be placed in the pipe **218***b*. The hole is so located in the joint **260** so that, when the plate **308** is removed, a suitable tool, preferably a long rod with a scrape plate at the far end, may be inserted into the pipe **218***b* to scrape the soot down toward the pipe **218***a*, the soot falling through the pipe **218***a* into the tank.

Referring to FIG. 7, to facilitate shipment of the tank **216** and the required pipes, the pipes **218** and **250** are provided with suitable flanges **310** and **312**. The tank **216** is preferably shipped by itself and thereafter the pipes **218***a* (to which may or may not have been preassembled the joint **260** and part of the flange **310**) the pipes **240**, **242**, **244** and **250** (which may or may not have been preassembled together with part of the flange **312**) and the pipe **262** are added to the tank on the site. The pipes **218***b*, **244**, **262** and **270**, and the pipe **250** to the right of the flange, are added to suit the particular location where the tank is placed relative to the boiler, smoke stack and drain.

The liquid supplied to the tanks to remove the soot may be an alkaline liquid which would tend to neutralize the acids which may be formed by the water and soot.

Having described my invention, what I claim is:

1. A method for removing soot from boilers while minimizing air pollution comprising discontinuing fuel combustion within the boiler, placing a fluid into said boiler for removing and carrying away said soot, taking the fluid carrying soot from the boiler into a tank, spraying a liquid into said fluid in said tank to wet said soot, and discharging said liquid and soot from said tank to a drain.

2. The method recited in claim **1** and further including assisting with a second fluid the flow of the first mentioned fluid from the boiler to the tank.

3. The method recited in claim **2** wherein the first mentioned fluid is steam and the second fluid is air.

4. The method recited in claim **2** wherein both fluids are air.

5. The method recited in claim **2** wherein the first mentioned fluid is air and the second fluid is steam.

6. The method recited in claim **2** wherein the first mentioned fluid is air and the second mentioned fluid is a liquid such as water.

7. The method recited in claim **1** wherein said liquid is alkaline.

8. The method recited in claim **1** and further including closing the damper of the smoke stack, taking the fluid carrying soot upstream of the damper so as to bypass the smoke stack, assisting the flow of fluid from said boiler to said tank, and venting the tank to the atmosphere by connecting it to the smoke stack downstream of said damper.

9. Apparatus for removing soot from boiler tubes comprising a boiler having tubes upon which soot collects, means connected to said boiler for placing a fluid into said boiler to remove said soot, a smoke stack connected to said boiler, a tank connected to said boiler to receive said fluid and soot, said tank having second means to dispense a liquid within the tank to remove said soot from said fluid, and third means for assisting the flow of said soot into said tank.

10. The structure recited in claim **9** and further including a pipe connecting said tank to said boiler and further means to clean said pipe of accumulated soot.

11. The structure recited in claim **9** and further including a vent pipe connected to said tank and connectable to a drain and/or to said smoke stack.

References Cited

UNITED STATES PATENTS

493,749	3/1893	Born et al.	261—17
604,551	5/1898	Thompson	122—391
1,103,304	7/1914	Lent	261—17 XR
2,530,018	11/1950	Marks	122—390
2,601,041	6/1952	Logan	122—390 XR

KENNETH W. SPRAGUE, *Primary Examiner.*

U.S. Cl. X.R.

122—390