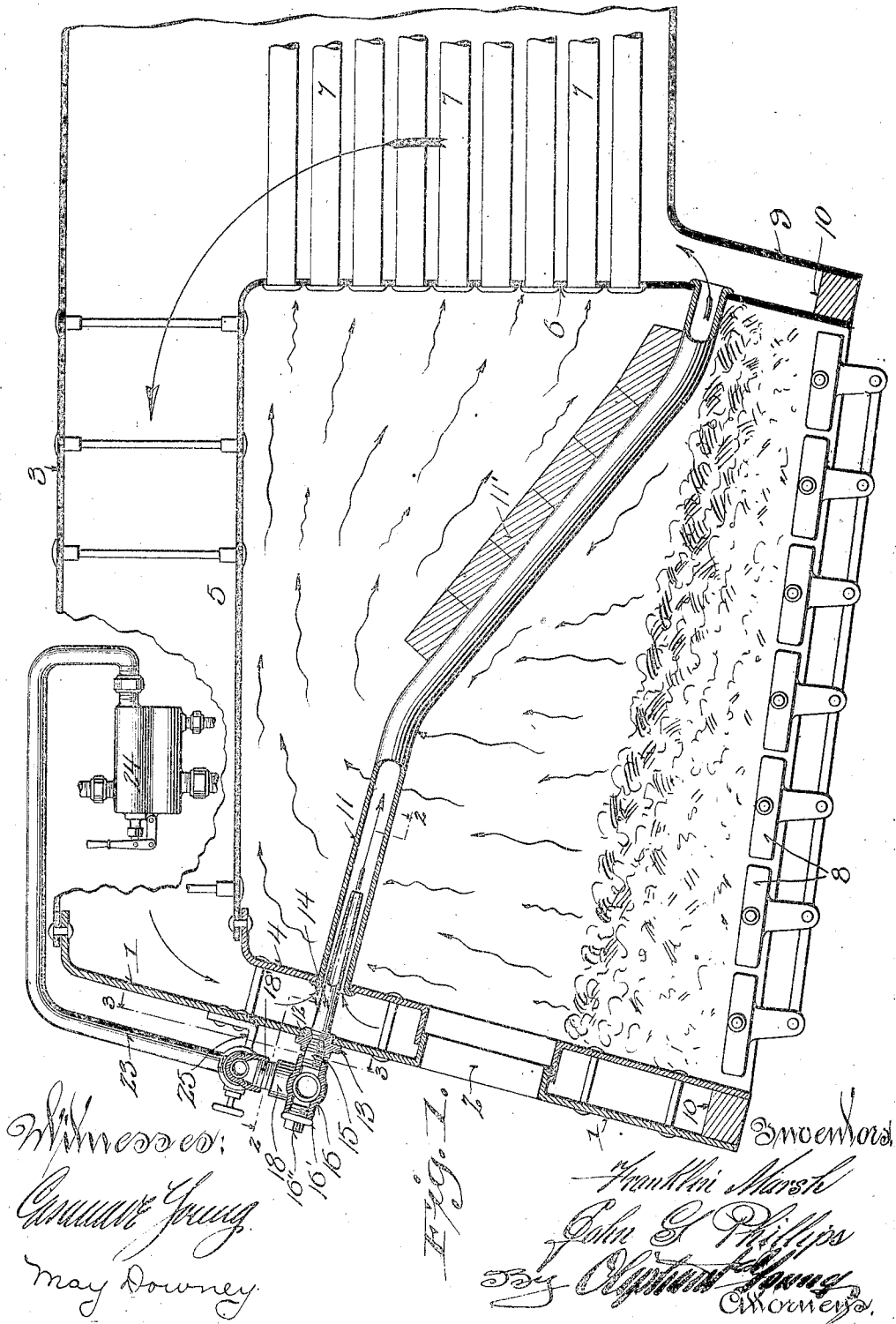


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 APPLICATION FILED MAY 24, 1912.

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2 SHEETS—SHEET 1.

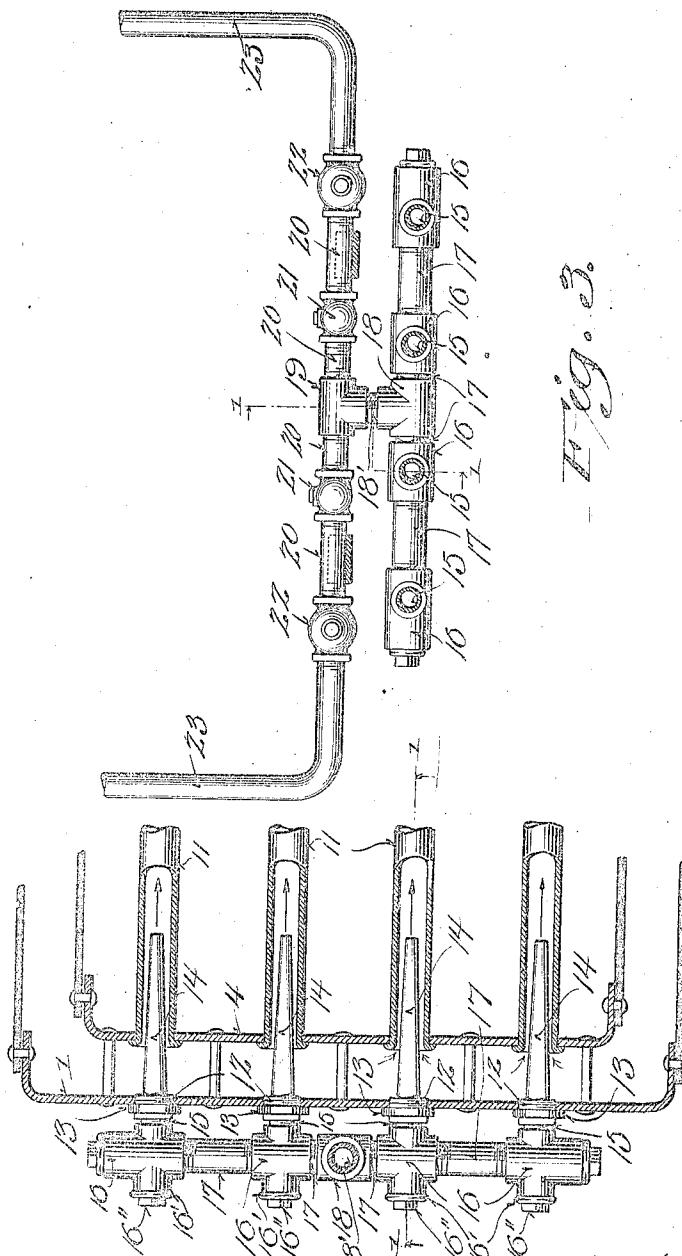


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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

FRANKLIN MARSH, OF MILWAUKEE, AND JOHN G. PHILLIPS, OF GREEN BAY,
WISCONSIN.

FEED-WATER-CIRCULATING SYSTEM FOR BOILERS.

1,057,566.

Specification of Letters Patent.

Patented Apr. 1, 1913.

Application filed May 24, 1912. Serial No. 699,435.

To all whom it may concern:

Be it known that we, FRANKLIN MARSH and JOHN G. PHILLIPS, both citizens of the United States, and residents of Milwaukee, in the county of Milwaukee and State of Wisconsin, and of Green Bay, in the county of Brown and State of Wisconsin, respectively, have invented certain new and useful Improvements in Feed-Water-Circulating Systems for Boilers; and we do hereby declare that the following is a full, clear, and exact description thereof.

Our invention refers to feed-water heaters and has for its object to provide simple, economical and effective feed-water heaters to be utilized in conjunction with the arch-tubes of a boiler fire-box.

The invention is especially applicable to locomotive fire-boxes of the above type and embodies a header having a series of discharge nozzles, one of which extends into the mouth of each arch-tube, water to the header being supplied by the usual pair of injectors, which injectors in this instance have their delivery pipes coupled in the form of a loop to opposite ends of a valve-controlled feed-pipe having a branch in communication with a header. By the above arrangement it is apparent that the jets of feed-water traveling through the arch-tubes will be heated to a high temperature and be discharged into the lower portion of the boiler adjacent to the mud ring at approximately the same temperature as the water contained in the boiler. Thus uneven expansion of the tube-sheets and its consequent leakage of tubes due to the variation in temperature is avoided, whereby the life of the boiler is materially increased. Furthermore the water-jets being discharged into the mouths of the arch-tubes at comparatively low temperature will create a current or circulation of water from the bottom of the boiler upwardly adjacent to the fire-box back-tube sheet, over the crown-sheet and down through the water-space between the back head and back-sheet of the fire-box, this continuous flow serving to prevent burning out of the crown-sheet due to the fact that mud deposits thereon will be continually agitated whereby the crown-sheet is kept clear.

Specific objects of our invention are to provide a simple and convenient means of attaching the header nozzles to the back-

head of the boiler whereby said nozzles may be quickly removed for repairs or for the purpose of cleaning out the arch-tubes; to provide clean-out apertures in connection with the header in alinement with the nozzles, and to provide simple and effective means for connecting a valve-controlled feed-pipe to the header, which feed-pipe in conjunction with the injector delivery pipes forms a loop.

With the above and other objects in view the invention consists in certain peculiarities of construction and combination of parts as set forth hereinafter with reference to the accompanying drawings and subsequently claimed.

In the drawings Figure 1 represents a sectional elevation through the fire-box of a locomotive boiler, the arch-tubes of said fire-box being equipped with a feed water heating appliance embodying the features of our invention; Fig. 2, a detailed sectional plan view of the feed-water mechanism, the section being indicated by line 2—2 of Fig. 1, and Fig. 3, a vertical sectional view of the same, the section being indicated by line 3—3 of Fig. 1.

Referring by characters to the drawings, 1 represents the back head of a boiler provided with a fire-box opening 2, and 3 the roof-sheet of said boiler that is connected to the back-head in the usual manner. Secured to the back-head by suitable stay-bolts and spaced therefrom is the usual back-sheet 4 of the fire-box having connected thereto a crown-sheet 5 that is suspended from the roof-sheet by the ordinary stay-bolts. The crown-sheet is also connected to the back tube-sheet 6 which carries the usual tubes 7 that are beaded therein. The ash-pit mouth of the fire-box also carries the usual grate-bars 8 and the water-space between the throat sheet 9 and lower portion of the back-tube sheet 6 is closed by a mud ring 10, which mud ring also serves as a closure for the water space between the bottom edges of the back-head 1 and back-sheet 4 of the fire-box. A series of longitudinally disposed arch-tubes 11 are arranged within the fire-box, the inlet and discharge mouths of which tubes communicate with the boiler and are respectively beaded into the back-sheet 4 of said fire-box and back-tube sheet 6 thereof. The arch-tubes also serve as supports for a brick arch 11', it being understood that all

of the before mentioned construction is of the ordinary boiler type and forms no part of our invention.

The back-head 1 is provided with a series of threaded apertures 12 for the reception of similarly threaded plugs 13, which plugs are provided with internally threaded apertures for the reception of threaded ends of water discharge nozzles 14, the ends of the same being extended into the arch-tubes a predetermined distance, said nozzles being of lesser diameter than the inner diameter of the tubes whereby a water space is formed thereabout. Nipples 15 are also in threaded union with the threaded apertures of the plugs 13, the outer ends of which nipples are fitted with crosses 16 that are connected by pipe sections 17 to form a header. The branches 16' of the crosses are alined with the nipples 15 and nozzles 14 and said branches are closed by threaded plugs 16'', which plugs are adapted to be removed and access had to the nozzles for cleaning purposes. The center pipe section 17 of the header is broken and connected to a T 18 that carries a nipple 18' which in turn is coupled to a T 19 of a feed-water pipe 20, the nipple 18' constituting a branch connection from the feed-water pipe to the header. The feed-water pipe is also provided with a pair of inwardly opening check-valves 21 and globe-valves 22, whereby the water supply is controlled. While we have shown the globe valves at the end of the feed water pipe it is understood that without departing from the spirit of our invention we may place the same in the intermediate position assumed by the check-valves in which instance the position of said check-valves and globe valves would be reversed. It should also be understood that in some instances we may provide a slightly yielding coupling connection between the pipe section 17 and crosses 16 whereby the parts may be more readily alined with the back-head apertures 12 and while we have shown and described screw-plugs in threaded union with the apertures 12 we may, without departing from the spirit of our invention, in some instances dispense with the same and head the discharge nozzles 14 directly in said apertures. The ends of the feed-pipe 20 are each connected to one end of an injector delivery pipe 23, the opposite end of said delivery pipe being in communication with an injector 24 whereby water is delivered to the nozzles. As shown we may in some instances employ brackets 25 for the support of the feed-water pipe whereby strain of the pipe connections is relieved from the joints.

In the operation of our device the feed-water is discharged through the delivery pipe 23 from either injector into the feed-pipe 20 and from thence through the branch connection to the header, the water flowing

in either direction from said branch to the discharge nozzles in which the water is delivered in a fine jet to the arch-tubes and owing to their positions the water so delivered is in its travel downward heated to a high degree of temperature approximately equal to the body of the water within the boiler. The water after being heated in its downward travel is discharged at the bottom of the boiler adjacent to the throat sheet from which point it is distributed and owing to the injector effect caused by the water being discharged from the nozzles a circulation will be maintained whereby the water will travel in the direction of the arrows as indicated in Fig. 1, first upwardly adjacent to the back-tube sheet, over the crown-sheet and returning to the arch-tubes through the water space between the back-head 1 and back-sheet of the fire-box 4 to the intake mouths of the tubes. This current of water serves to clear the crown-sheet of any mud deposits and will thus prevent the same from burning and furthermore the current of water traveling through the arch-tubes will also materially increase the life of the latter, it being found in practice that where such arch-tubes are utilized that counter-currents of water will intercept each other within the tubes and block circulation to such an extent that the intense heat at points in the arch tubes would cause the latter to burn. Furthermore the water being heated to the degree stated before it is discharged into the bottom of the boiler will prevent uneven expansion whereby the tube-heads usually draw and loosen the flues. It is further observed that owing to the alinement of the apertures 12 of the back-head with the mouths of the arch-tubes that said arch-tubes can be readily accessible for renewal purposes. It is also apparent that while we have shown the boiler as being provided with a pair of injectors that in some instances one may be employed with efficiency and that while we have described the invention in connection with a locomotive boiler that said invention will operate with equal efficiency in conjunction with a stationary boiler. It is also apparent that the feed-water heating apparatus as shown and described can readily be attached to any type of arch-tube boiler without dismantling any of the parts and that said device can be cheaply constructed from standard fittings.

We claim:—

1. In a boiler having a fire-box comprising a back-head, a spaced back-sheet, back tube sheet and crown-sheet connecting the back-sheet and back tube sheet, and a series of arch-tubes constituting water channels connecting the fire-box back-sheet and back tube sheet, the back-head being provided with threaded apertures alined with the

mouths of the arch-tubes; the combination of a series of apertured plugs in threaded union with the back head apertures, the plugs being provided with interior threads, 5 a series of end threaded nozzles in connection with the threaded plug apertures, the discharge ends of the nozzles being extended into the mouths of the arch-tubes across the intervening space between the back-head 10 and back-sheet, nipples in threaded union with the threaded apertures of said plugs, the nipples being extended beyond the back-head, and a header in communication with said nipples.

15 2. A fitting for feed-water circulating systems comprising a sectional header pipe, the sections being connected by crosses, one series of branches of which crosses are pro-

vided with header nipples and the corresponding alined series of branches provided with end closures, a series of plugs having threaded apertures in union with the header nipples, a series of tapered discharge nozzles in threaded union with the apertured plugs, and a feed-pipe in communication 25 with the header.

In testimony that we claim the foregoing we have hereunto set our hands at Milwaukee in the county of Milwaukee and State of Wisconsin in the presence of two 30 witnesses.

FRANKLIN MARSH.
JOHN G. PHILLIPS.

Witnesses:

CASANAVE YOUNG,
MAY DOWNEY.