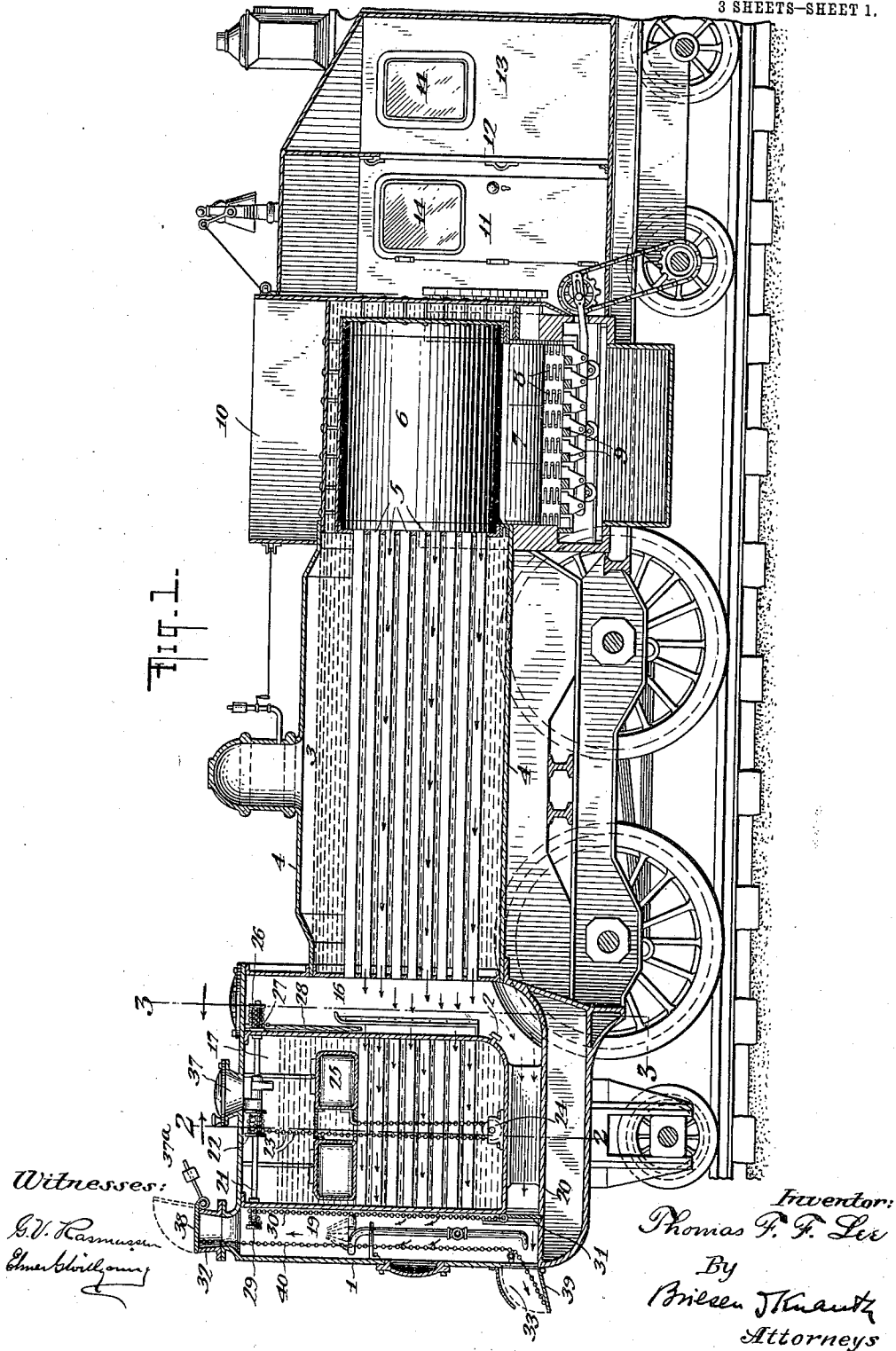


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LOCOMOTIVE FEED WATER HEATER.  
APPLICATION FILED DEC. 18, 1909.

1,043,848.

Patented Nov. 12, 1912.

3 SHEETS—SHEET 1.



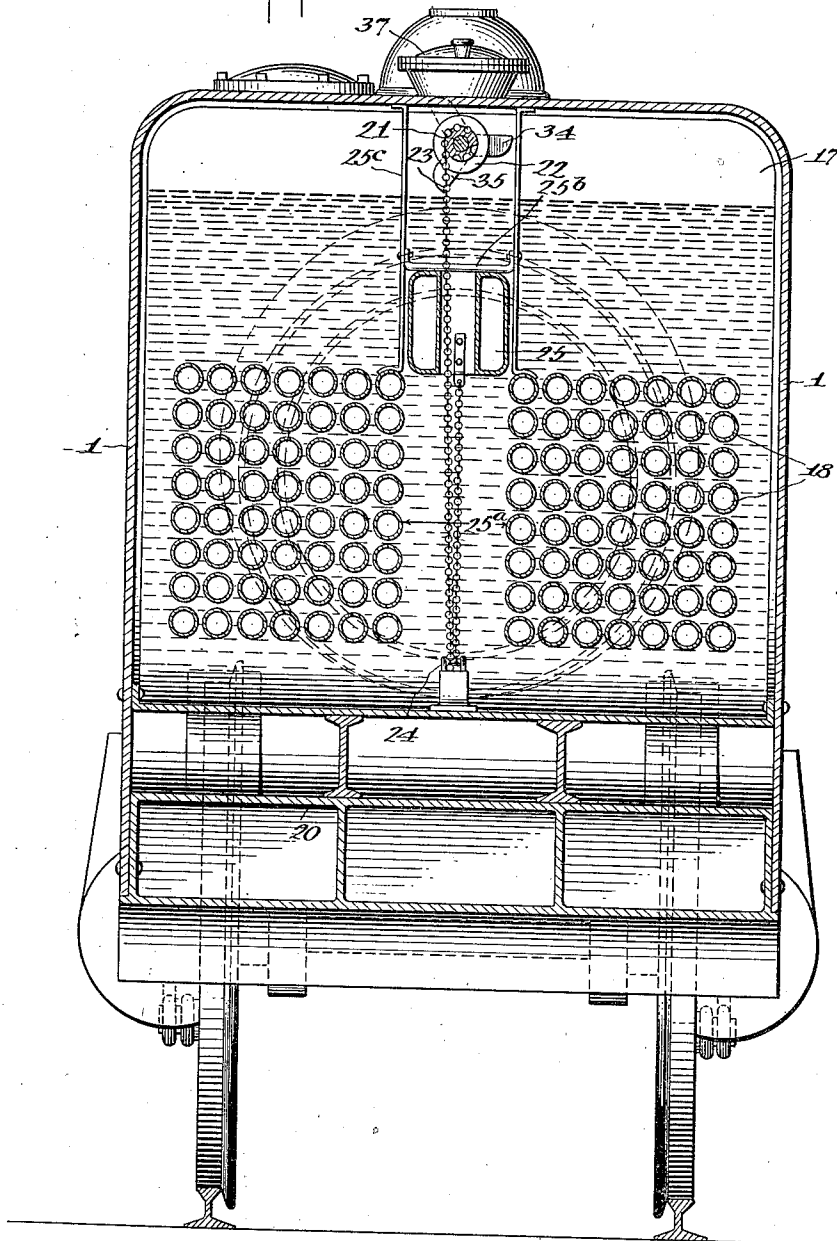
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3 SHEETS-SHEET 2.

Fig. 2.



Witnesses:  
G. V. Rasmussen  
E. M. Shollyoung

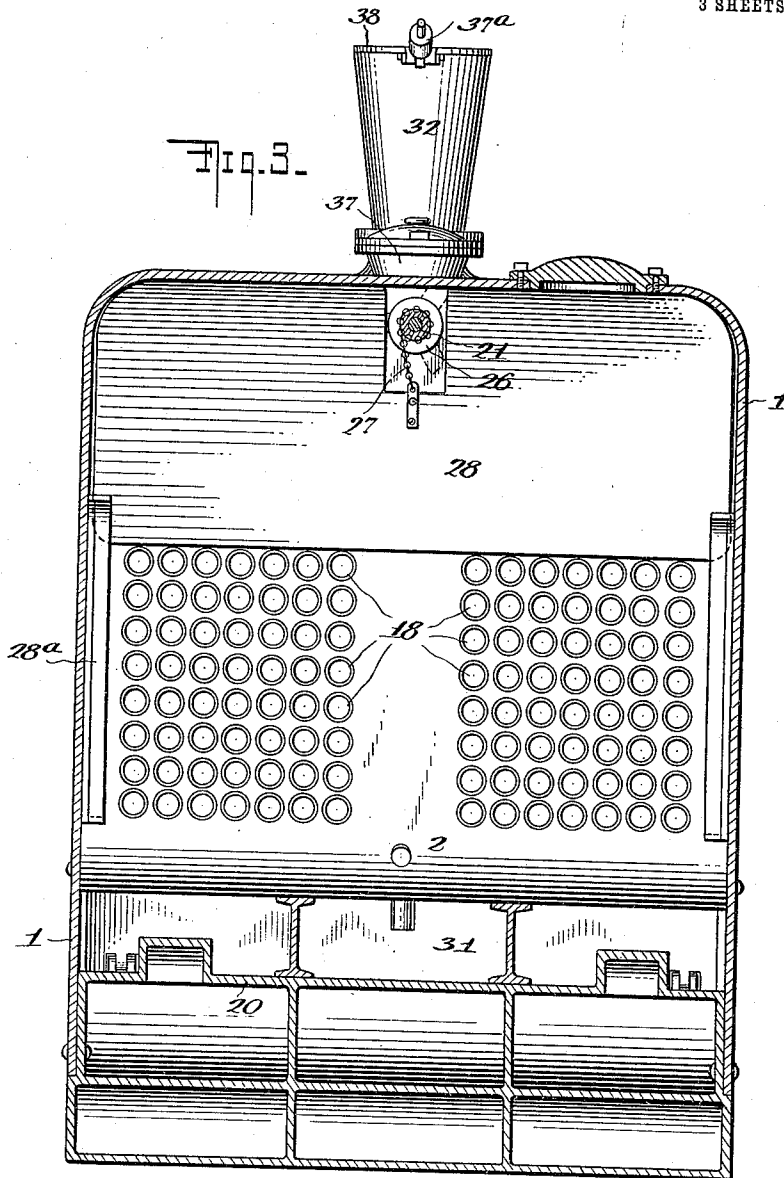
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3 SHEETS-SHEET 3.



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# UNITED STATES PATENT OFFICE.

THOMAS FRANCIS FITZHUGH LEE, OF NEW YORK, N. Y.

LOCOMOTIVE FEED-WATER HEATER.

1,043,848.

Specification of Letters Patent.

Patented Nov. 12, 1912.

Application filed December 18, 1909. Serial No. 533,940.

*To all whom it may concern:*

Be it known that I, THOMAS F. F. LEE, a citizen of the United States, and resident of the borough of Brooklyn, city, county, and State of New York, have invented certain new and useful Improvements in Locomotive Feed-Water Heaters, of which the following is a specification.

This invention has for its object to combine with the locomotive structure proper, the water tender and coal receptacle therefor and to utilize in such structure the gases after their passage through the boiler flues for the preliminary heating of the water in the storage tender before their final discharge.

My invention is an improvement upon my pending application for United States Letters Patent, Serial No. 487,516, filed April 2, 1909.

In the accompanying drawings Figure 1 is a longitudinal section of my improved structure, Fig. 2 is a rear elevation taken in section on line 2—2 of Fig. 1; Fig. 3 is a sectional view taken on line 3—3 of Fig. 1, looking in the direction of the arrow of Fig. 1.

In practising my invention, I provide a water tender 1 which forms a part of the locomotive structure at the rear of the locomotive boiler. This water tender by means of a pipe 2 has communication with the boiler 3 formed of the usual boiler shell 4 containing flues 5 which are surrounded by water, suitable pumping mechanism being provided for pumping the water from the storage tank into the boiler, such mechanism having been omitted for the sake of clearness. The boiler shell is forward of the water tender. To the front of the flues 5, I provide a heat chamber 6 which communicates with said flues 5 and which is formed within the boiler shell and has communication at its bottom with the combustion chamber 7 by means of an opening in the wall of said heat chamber 6, and in the boiler shell, the combustion chamber 7 comprising rocking side and bottom grates 8 and 9 respectively. The arrangement of these grates is fully described in my pending application, Serial No. 485,223, filed March 23, 1909. The boiler shell at its sides is surrounded by inclined grates rising upwardly from the bottom grate and constituting a portion of the combustion chamber. Fuel is supplied to these grates by means of a bin 10 leading

thereto. This construction likewise is explained and set forth in my pending application, Serial No. 440,727, filed June 27, 1908.

Adjacent to the forward end of the boiler 3 is located the fireman's cab 11 through which access may be had by suitable doors 12 at either side of the locomotive. Forward of the fireman's cab and communicating therewith by sliding doors, the engineer's cab 13 is located which preferably forms the foremost part of the locomotive and which may have side and front windows. The boiler flues 5 extend rearwardly in the boiler shell and lead into a chamber 16 which is formed by the rearward plate of the boiler 3 and the forward plate of a tank 17, having flues 18, said flues opening at their forward ends into the chamber 16 and at their rearward ends into the outlet channel 19, whence the heated gases will finally escape. As shown, the water tank 17 is spaced from the rear flue head of the boiler 3 and from the bottom plate 20, so that it is surrounded by a passageway leading from the rear of the boiler flues around the tank 1 to the outlet channel 19.

Journaled near the top of, and running through the forward and rearward plates forming the front and rear walls of the water tank, I provide a shaft 21, having at about its center a fixed drum 22, to which is secured a chain 23 extending downwardly to and around a pulley 24, secured to the bottom of the tank, thence upwardly to a float 25, the end of the chain 23 being fastened to said float. The flues 18 being arranged in two banks with a central space 25<sup>a</sup> between them, the float 25 will descend between the banks of flues as the water in the tank grows lower. The float 25 is prevented from rising to the top of the water tank by stops or abutments 25<sup>b</sup> and begins to descend only after the water in the tank is approximately on a level with the lowermost portions of the float. The float may be guided in its downward course by vertical rods 25<sup>c</sup> suitably fixed in position.

At the forward end of the shaft 21, which extends through the forward plate of the water tank 17, I provide a fixed drum 26 to which is secured one end of a chain 27 while the other end is connected with a screen 28 of a height and width sufficient to cover the entire series of flues 18 in the water tank but which, when the tank is full, is maintained above the banks, of flues 18.

The screen 28 travels in vertical guides 28<sup>a</sup>. Secured to the rear end of shaft 21 is a fixed drum 29 to which is secured one end of a chain 30, while the other depending end is  
 5 secured to a gravity damper 31 disposed near the lower end of outlet channel 19. This damper 31, when the tank is full, is in position to close channel 19 at or about its lowermost portion.

10 I shall now describe the operation of my device: When the water tank 1 is full the float 25 is positioned as indicated in Fig. 1, that is to say, in the upper portion of the water tank 17. The screen 28, is also in its  
 15 raised position as indicated in Fig. 1, while the damper 31 is in its lowered position thereby closing the channel 19 at its lower end. The heated gases pass from combustion chamber 7, into the inner heat cham-  
 20 ber 6, from the inner heat chamber 6 into and through the flues 5 within the boiler shell; thence they travel into the chamber 16, thence into and through the flues 18 in the water tank 19 and finally pass out  
 25 through the stack 32 of the outlet channel 19 or through the outlet 33 located near the lower portion of said outlet channel.

When a quantity of water has been pumped from the tank into the boiler, so  
 30 that the water in the tank 17 is approximately on a level with the bottom of float 25, the float begins to descend with the descent of the water level by continued withdrawal of water. The screen 28 by gravity  
 35 gradually drops, through its chain connection 27, revolving the shaft 21, thereby taking up the slack in the float chain 23 by winding it upon its drum 22, and winding the damper chain 30 upon its drum 29. In  
 40 this manner, the damper 31 gradually rises and opens the channel 19 near its inner lower portion. The screen 28 in its progress downwardly covers the flues 18 in the tank whereby, as the water recedes, the flues are  
 45 successively closed and the combustion gases passing from the boiler flues are diverted into the lower flues still covered by the water and into the outlet channel 19, whose damper 31 increasingly opens to allow the excess  
 50 of gases to escape.

It will be understood from the foregoing description that in the specific form shown the chains 23, 30 and 37 are so secured to the shaft 21 that the unwinding of chain  
 55 27 will result in winding up chains 23 and 30 while the unwinding of chains 23 and 30 will result in winding up chain 27.

When the tank 17 is practically exhausted the float and screen have reached their low-  
 60 ermost positions while the damper 31 has reached its uppermost position. Upon re-filling the tank the float will rise until in contact with stops 25<sup>b</sup>, thereby revolving shaft 21 and carrying the screen 28 to raised  
 65 position while permitting the damper 31 to

drop to lowered position, by means of their chain connections with the shaft. If it be desired a series of water paddles 34, 35 may be disposed about the shaft 21 beneath the water inlet 37 whereby the influx of water  
 70 will assist in revolving the shaft to restore the parts.

I have shown the outlet channel 19 as provided with a stack 32 at its upper end and with an opening 33 at its lower outer end.  
 75 The stack is provided with a swinging cover 38 to which is secured a counter weight 37<sup>a</sup> tending to maintain the cover in opened position. Attached to this cover 38 is a chain 40 secured to a flap damper 39 jour-  
 80 naled to the truck near its lower outer end and adapted to open and close channel 19. When the stack cover is closed the flap damper 39 is in its opened position while when the stack cover is opened the flap damper 39 will,  
 85 through chain 40, be drawn to its closed position. The movement of the locomotive against the air will close the stack cover whereby the flap damper 39 will automatically become opened. These covers may  
 90 moreover be actuated in any other suitable manner.

While I have shown my invention in a particular form it is to be understood that I do not confine myself to the specific con-  
 95 struction shown, since the same may obviously be practised in various equivalent forms and in different structures.

The advantages of my invention will be readily apparent from my foregoing de-  
 100 scription. The water in the storage tank will be subjected to a very effective preliminary heating before being pumped into the boiler. The descent of the float will automatically effect the protection of the tank  
 105 flues against the combustion gases when no longer surrounded by water. Simultaneously a damper is operated to permit the escape of excess of combustion gases. The outlet 33 located at the rear end of the en-  
 110 gine will accelerate the progress of combustion by reason of the suction produced by the forward movement of the engine. Moreover this outlet will divert any unburnt particles of fuel downwardly onto the road bed,  
 115 thereby overcoming the objections of projecting such particles upwardly and over the cars attached behind the locomotive. When the locomotive is at rest the counterweight 37<sup>a</sup> will automatically open flap damper 38  
 120 and draw closed the flap damper 39 by its chain connection 40 therewith. When the locomotive is in motion the impact of the flap damper 38 with the air will automati-  
 125 cally close the same and correspondingly open the lower damper 39.

Having thus described my invention, what I claim and desire to secure by Letters Pat-  
 ent, is:

1. In a locomotive, the combination of a 130

boiler, a storage tank provided with flues adapted to carry combustion gases from the boiler to the outlet, and means controlled by the volume of water within said tank for opening and closing said flues as said volume is increased or decreased.

2. In a locomotive, the combination of a boiler, a storage tank provided with flues adapted to carry combustion gases from the boiler to the outlet, and means actuated by the variation of water level for closing or opening said flues according as they may be above or below said level.

3. In a locomotive, the combination of a boiler, a storage tank provided with flues adapted to carry combustion gases from the boiler to the outlet, a float within said tank and means actuated by said float for closing and opening said flues.

4. In a locomotive, the combination of a flue boiler therefor, a storage tank having flues in communication with the flues in the boiler and leading to the outlet, a float in the storage tank and means connected with said float for diverting the flow of gas from given flues to a separate passage when the water level falls below said flues.

5. In a locomotive the combination of a flue boiler therefor, a storage tank having flues in communication with the flues in the boiler and leading to the outlet, means for mechanically closing the flues in the storage tank, walls forming a passage-way for the combustion gases about the outside of the storage tank, means for closing said passage-way and mechanism for operating said means to open said passage-way simultaneously with the closing of the storage tank flues.

6. In a locomotive, the combination of a

flue boiler therefor, a storage tank having flues in communication with the flues in the boiler and leading to the outlet, a float in the storage tank and means connected with said float for closing the flues in the storage tank.

7. In a locomotive the combination of a flue boiler therefor, a storage tank having flues in communication with the flues in the boiler and leading to the outlet, a float in the storage tank and means connected with said float for closing the flues in the storage tank and opening a damper for the escape of the combustion gases.

8. The combination of a boiler provided with flues, a storage tank spaced from said boiler, flues in said storage tank arranged to communicate with the boiler flues, a device for cutting off the communication between said flues, means controlled by the water in said storage tank and rotary mechanism connected with said device and with said means, respectively, said mechanism being operated by said means and operating said device.

9. The combination of a boiler, a storage tank spaced therefrom and having communication with said boiler for the gases of combustion and having a water inlet, a device for cutting off such communication, means controlled by the water in said tank for operating said device and mechanism operated by the water entering the inlet for restoring said device and said means to their initial position.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

THOMAS FRANCIS FITZHUGH LEE.

Witnesses:

EUGENE EBLE,

EDWARD HARTUNG.