April 16, 1929. N. M. LOWER 1,709,533

LOCOMOTIVE BOILER FEED APPARATUS

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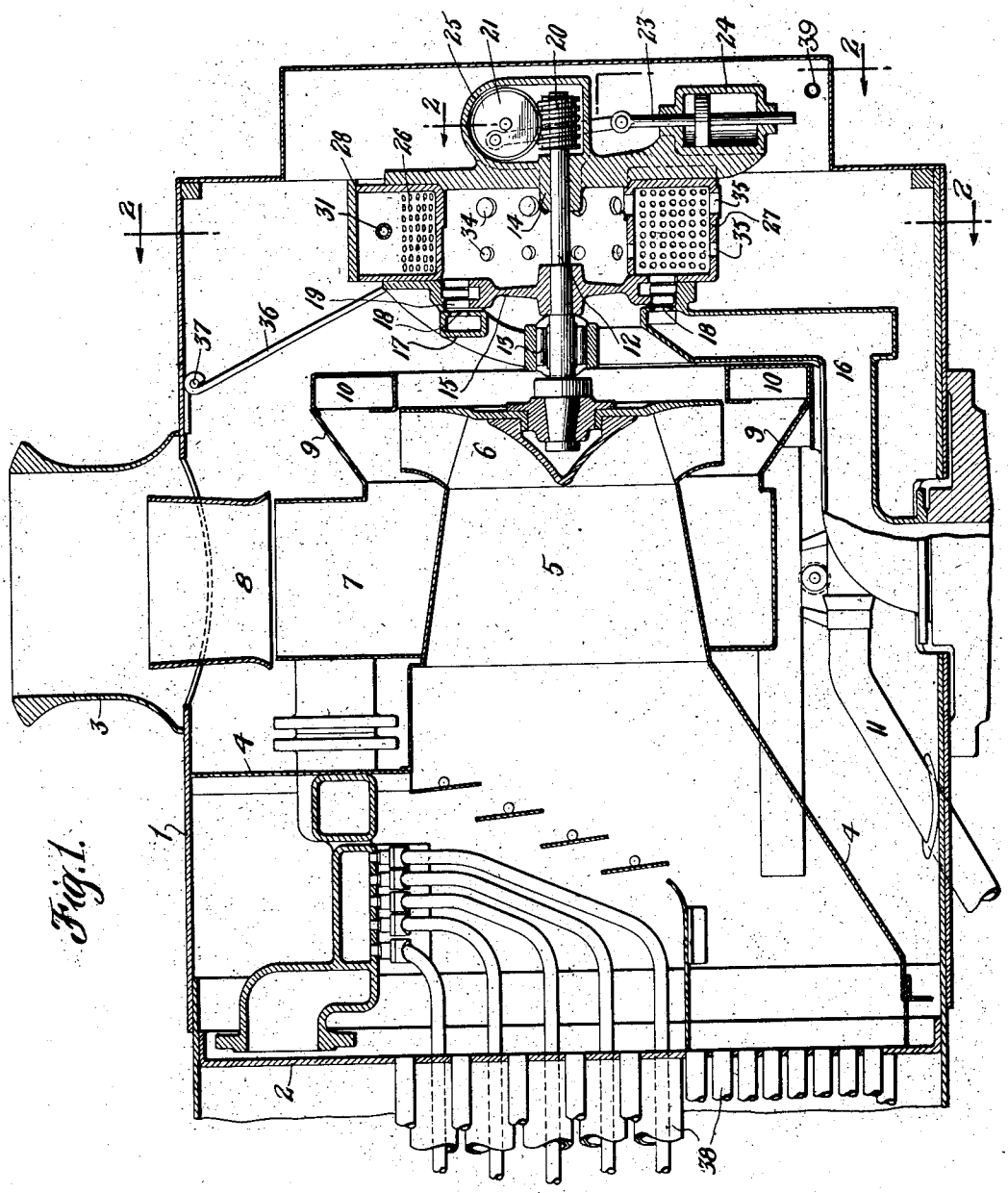


Fig. 1.

WITNESS.
Gustav Henglinger.

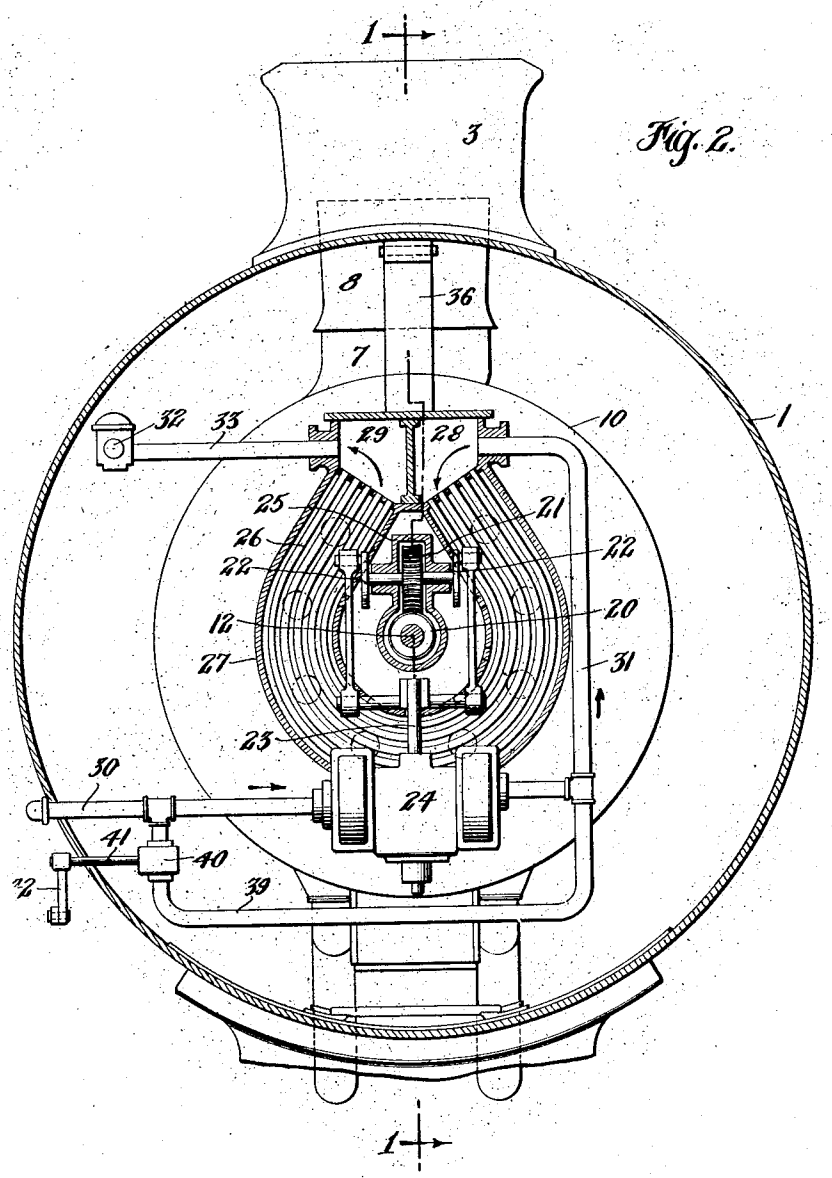
INVENTOR.
Nathan M. Lower
BY Bynnestvedt & Lechner
ATTORNEYS.

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Fig. 2.




WITNESS.
Gustav Genglinger.

INVENTOR.
Nathan M. Lower
BY Bynnestvedt & Lechner
ATTORNEYS.

Patented Apr. 16, 1929. 1,709,533

# UNITED STATES PATENT OFFICE.

NATHAN M. LOWER, OF BELLEVUE, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE STANDARD STOKER COMPANY INC., OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

## LOCOMOTIVE-BOILER-FEED APPARATUS.

Application filed December 20, 1920. Serial No. 431,893.

This invention relates to the means for supplying the feed water to the boilers of steam generating equipment and is particularly useful in connection with locomotive practice.

The primary object of my invention is to provide means of the character specified which will automatically supply the feed water at all times to the boiler substantially in proportion to the demand of the working conditions obtaining.

I have developed my invention in connection with a locomotive in which the draft is created by means of a turbine operated exhaust fan located in the smoke box and in the accompanying drawings I have illustrated it in such association.

Other objects of the invention relate to the provision of a boiler feed pump with suitable motor means therefor actuated by exhaust steam from the main cylinders of the locomotive, and to the provision of a suitable feed water heater which utilizes the steam exhausted from said motor means.

In addition to the foregoing objects and in connection with an exhausting mechanism of the character above described, my invention contemplates the provision of a boiler feed pump which is actuated by the motor means which is provided for driving the exhausting fan.

Stated in other words my invention has for its object the provision of a boiler feed apparatus by means of which I am enabled to automatically deliver the feed water to the boiler substantially in proportion to the demand of the working conditions obtaining as evidenced or registered by the exhaust from the main cylinders.

These together with such other objects as may hereinafter appear or are incident to my invention I obtain by means of a construction illustrated in the accompanying drawings in a preferred form and as embodied in a locomotive. Of the drawings Figure 1 is a longitudinal vertical section through the forward end of a locomotive on line 1—1 of Figure 2 and Figure 2 is a somewhat irregular section and partial elevation transversely of the structure illustrated in Figure 1 taken as indicated on Figure 1.

Within the smoke box 1 and located between the tube sheet 2 and the stack 3 I have provided the transverse partition or chamber structure 4 suitably shaped to conform to the adjacent structure and provided with a funnel shaped outlet 5 at its forward end. A suction exhaust fan 6 is mounted immediately adjacent the outlet 5 and the products of combustion are thrown outwardly therefrom in a manner well known in the art and discharged to the stack through the annular casing or housing 7 and the petticoat pipe 8. The cinders are thrown by the force of their impact against the inclined surfaces 9 into the annular chamber 10 from which they are discharged through the piping 11. The shaft 12 for revolving the fan projects forwardly therefrom and is journalled in suitable bearings 13 and 14 which latter are mounted in a structure now to be described. The rotary element 15 of a turbine is mounted on the shaft 12 intermediate the bearings 13 and 14 and exhaust steam from the main cylinders of the locomotive is delivered through the casting 16 which has an annular portion 17 arranged immediately adjacent the rotor 15. Openings 18 admit the steam to the blades 19.

The outer end of the shaft 12 is provided with a worm 20 which is adapted to drive a gear 21 carrying a crank arm 22 at each side thereof. These crank arms are suitably connected to the piston rod 23 of a reciprocating pump within the housing 24. A housing 25 encloses the gear and the worm. Between the turbine and the pumping unit are arranged a plurality of water tubes 26 within a steam casing or housing 27. The tubes and the housing which contains them are bent in a U shape, the ends of the tubes communicating with a water inlet header 28 at one side and with a water outlet header 29 at the other side. Feed water from any suitable source of supply is delivered through the pipe 30 to the feed water pump 24 which forces it through the pipe 31 to the inlet header 28 from whence it passes through the tubes and out through the outlet header 29 to the boiler check valve 32 through the pipe 33. As shown, turbine, shaft bearings 13, 14, annular feedwater heater 26, 27, and feed pump 24 are combined in a unitary structure ahead of the chamber structure 4, 7, around the fan shaft 12. The turbine and its steam supply chamber 13 are mounted at the rear of the feedwater heater casing 26, and the pump 24 on its front side.

The steam which was delivered to the turbine through the openings 18 enters the space within the tube casing 27 through a plurality of openings 34. From the heater casing the steam passes out through another series of openings 35 into the smoke box from which it escapes through the stack. The structure is braced by means of the tie plate 36 which is pivoted at its outer end upon the pin 37 to the shell of the smoke box.

The operation of the device is as follows: When the engine is working, exhaust steam from the main cylinders of the locomotive (not shown) is delivered through the hollow casting 16 to the actuating motor which in this instance is shown as being a turbine. The fan is thereby revolved and acts to exhaust the products of combustion through the flues 38 in the manner well known in the art. The pump actuating mechanism being arranged on the same shaft with the fan and the turbine, it will be seen that it is possible to operate the pump at a speed which is proportionate to the demand of the working conditions obtaining. The harder the locomotive is working the more exhaust steam will be delivered to the turbine and the faster will the exhausting fan and the feed water pump be operated. By proper experiment the turbine, the fan and the pump can be so proportioned with respect to one another as to enable the pump to deliver feed water to the boiler substantially in proportion to the demand of the working conditions obtaining.

There may be occasions when it is desirable or necessary to render the feed water pump partially or even wholly ineffective and to this end I have provided the by-pass pipe 39, see Figure 2 particularly. A valve 40 interposed in this pipe 39 is manually controlled from the cab through the shaft 41 and crank arm 42, the latter being connected to a suitable reach rod not shown. When the valve 40 is opened the pump 24 will produce a circulation around through the pipe 39 instead of up through the pipe 31 and into the boiler through the check valve 32. Such action will take place by reason of the resistance which is encountered in the pipe 31 due to the high boiler pressure.

In the embodiment of my invention herein illustrated to operate the feed water pump from the same shaft upon which the turbine rotates was exceptionally convenient, but it will, of course, be understood that other arrangements might be employed.

I claim:

1. The combination with a steam locomotive smoke box and a draft fan therein receiving gases from boiler flues and discharging to the stack, of a turbine on the fan shaft operated by the locomotive exhaust steam, a feedwater heater for the locomotive around the shaft receiving the turbine exhaust; and a feed pump for the locomotive in front of said feedwater heater driven by the shaft.

2. The combination with a steam locomotive smoke box, a chamber structure therein receiving gases from boiler flues and discharging to the stack, and a fan at the forward end of said structure for passing the gases therethrough as aforesaid; of a structure in the smoke box, ahead of said first mentioned structure, comprising a feedwater heater around the fan shaft, a turbine on said shaft operated by the locomotive exhaust steam and discharging into said feedwater heater from one side thereof, and a feed pump for the locomotive at the other side of said feedwater heater, driven from said shaft.

3. The combination with a steam locomotive smoke box, a chamber structure therein receiving gases from boiler flues and discharging to the stack, and a fan at the forward end of said structure for passing the gases therethrough as aforesaid; of a structure in the smoke box, ahead of said first mentioned structure, comprising an annular feed water heater around the fan shaft, and a turbine on said shaft operated by the locomotive exhaust steam and discharging into said feedwater heater.

In testimony whereof, I have hereunto signed my name.

NATHAN M. LOWER.