

No. 718,819.

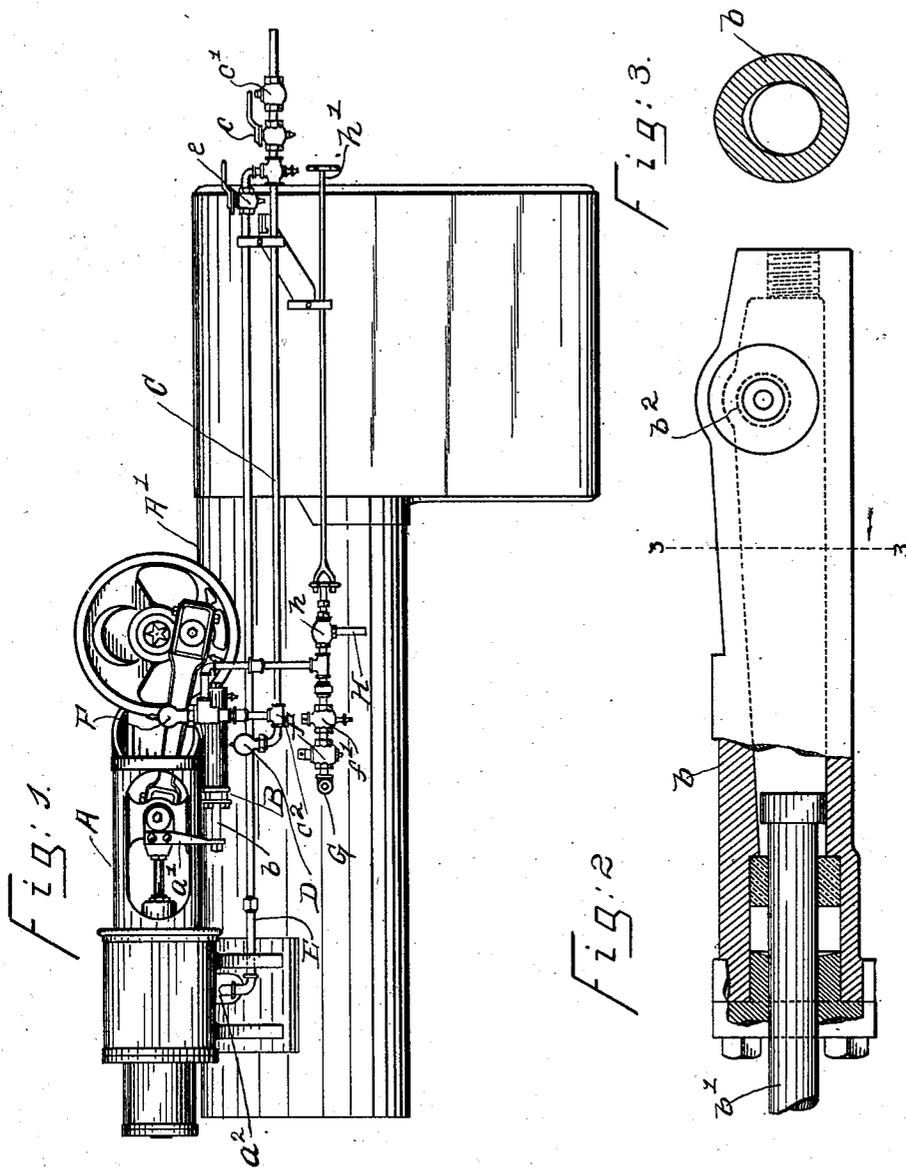
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G. F. CONNER.

FEED WATER HEATER.

APPLICATION FILED MAY 15, 1902.

NO MODEL.



WITNESSES.  
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# UNITED STATES PATENT OFFICE.

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## FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 718,819, dated January 20, 1903.

Application filed May 15, 1902. Serial No. 107,426. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE F. CONNER, a citizen of the United States of America, residing at the city of Port Huron, in the county of St. Clair and State of Michigan, have invented new and useful Improvements in Feed-Water Heaters, of which the following is a full, clear, and exact specification.

This invention relates to feed-water heaters of the type wherein the temperature of the water is raised before it passes through the feed-pump, and especially to means whereby the exhaust-steam of the engine may be utilized by direct condensation and whereby the difficulty arising from the collecting of gas and air in the feed-pump and its connections is obviated.

The invention consists in the matters hereinafter set forth and more particularly pointed out in the appended claims.

The invention is hereinafter shown and described as adapted for use with a portable engine. It may be used in connection with any type of engine.

In the drawings, Figure 1 is a view in elevation, showing an engine and boiler fitted with a feed-pump and connections embodying the features of the invention. Fig. 2 is a view in longitudinal section through the barrel of the pump. Fig. 3 is a view in cross-section on line 3 3 of Fig. 2.

Referring to the drawings, A represents a horizontal engine of the usual portable type, mounted upon a boiler A' in the customary manner. A single-acting horizontal pump B is suitably secured to the engine-frame or the boiler, its piston *b'* being operatively connected to the cross-head of the engine by a rigid arm *a'*. A suction-pipe C leads from the feed-water tank or other source of supply to the outboard end of the pump-cylinder through a controlling stop-cock *c* and check-valve *c'*. As herein indicated, said pipe is carried back to the fire-box end of the boiler, so that the controlling-valves are within easy reach of the engine-driver. Said pipe C is not carried in a right line from the stop-cocks to the pump, but is provided with a T *c<sup>2</sup>*, to the outer end of which an air-chamber D is connected. An exhaust-steam pipe E leads from the steam-chest *a<sup>2</sup>* of the engine, through a controlling-valve *e*, to the suction-pipe C,

which it enters between the air-chamber D and the controlling-cock *c*. The pump discharges through a pressure-chamber F of the usual type and a check-valve *f* into a pipe G, which enters the boiler. A stop-cock *f'* is provided in this pipe to control the flow. The usual overflow-pipe H, with its controlling-valve *h*, is connected to this discharge-pipe, and, as shown herein, a long stem *h'*, provided at its outer end with a handle, permits the manipulation of the valve from the driver's station. The overflow-pipe H performs the usual office of relieving the pump when the engine is first started up.

Referring now especially to the construction of the pump, the latter comprises a pump-barrel *b*, in which the piston *b'* reciprocates in unison with the cross-head of the engine. Said piston *b'* is cylindrical, while the bore of the pump-barrel is shaped in cross-section, as indicated. This arrangement provides an air-space in the cylinder above the piston. The vertical diameter of the pump-bore is gradually increased in length from either end of the cylinder until the discharge-aperture *b<sup>2</sup>* is reached. Here the vertical diameter reaches its greatest length, and a gland or upward swelling in the cylinder itself carries the wall at this point still farther away from the piston. As a result of this construction in the pump any air which may enter through the suction-pipe collects in the top of the cylinder and readily escapes through the discharge-port of the pump without interfering in any manner with the vacuum of the pump—that is to say, by the collection of the air in this upper chamber and its constant passage therethrough at each outstroke of the pump the degree of exhaust in the barrel is practically constant and as a result the water is forced out of the pump at a constant head.

The operation of the device is as follows: After starting the pump through the open overflow the latter is closed, and the exhaust-steam from the engine is then introduced through the regulating-cock into the suction-pump. Through the synchronous action of the engine and pump the exhaust-steam enters the cylinder of the pump at each outstroke of the cylinder, so as to thoroughly heat the body of water therein, the steam itself condensing, while the gas and air accom-

panying it collect in the chamber above the piston, as already shown, and are carried out through the pressure-chamber of the pump. Of course the vacuum in the pump-cylinder  
 5 is never perfect, but is constant, and as a result the pump is easily adjusted to take care of the air and gas brought into its barrel and does not "check" or "jump," as it otherwise might do. The air-chamber D, connected to  
 10 the T in the feed-water pipe, also serves as a collecting-chamber to the air and aids in cushioning the pipe and preventing to a large extent the formation of a water-hammer therein, due to the sudden condensation of the  
 15 steam after striking the cold body of water, the air in the chamber returning into the pipe and effectually eliminating the formation of a vacuum therein.

The details of construction may of course  
 20 be varied to adapt the apparatus to different forms of engines, and the inventor does not limit himself to any particular forms of construction except as set forth in the appended claims.

25 I claim as my invention—

1. In a feed-water heater, the combination with a steam-engine and feed-pump operated thereby, having a recess extending longitudinally along the inner face of its cylinder  
 30 above the path of travel of the piston, of a suction-pipe discharging into the pump-cylinder, a steam-pipe leading from the exhaust of the engine into the suction-pipe, and a discharge-pipe leading from the pump to the engine-boiler.  
 35

2. In a feed-water heater, the combination with a steam-engine and feed-pump operated thereby, having a recess extending longitudinally along the inner face of the cylinder  
 40 above the path of travel of the piston, of a suction-pipe discharging into the pump-cylinder, a check-valve in said pipe, an air-chamber opening into said pipe between said  
 45 check-valve and the pump, a steam-pipe leading from the exhaust of the engine discharging into the suction-pipe between the check-valve and pump, and a discharge-pipe leading from the pump-outlet to the boiler.

3. In a feed-water heater, the combination  
 50 with a steam-engine and feed-pump operated

thereby, having a recess extending longitudinally along the inner face of its cylinder above the path of travel of the piston, whose height reaches its maximum at the discharge-  
 55 port of the cylinder, of a suction-pipe discharging into the pump-cylinder, a steam-pipe leading from the exhaust of the engine into the suction-pipe, and a discharge-pipe leading from the pump to the engine-boiler.

4. In a feed-water heater, the combination  
 60 with a steam-engine and feed-pump operated thereby, having a recess extending longitudinally along the inner face of the cylinder above the path of travel of the piston, whose height reaches its maximum at the discharge-  
 65 port of the cylinder, of a suction-pipe discharging into the pump-cylinder, a check-valve in said pipe, an air-chamber opening into said pipe between said check-valve and the pump, a steam-pipe leading from the ex-  
 70 haust of the engine, discharging into the suction-pipe between the check-valve and the pump, and a discharge-pipe leading from the pump-outlet to the boiler.

5. In a feed-water heater for the boiler of  
 75 a horizontal engine, a single-acting feed-pump comprising a horizontal cylinder having a recess extending longitudinally along the inner face of the cylinder, above the piston, whose height reaches its maximum at the discharge-  
 80 port of said cylinder, a piston whose stem is operatively connected to the engine, a feed-pipe leading from the discharge of said pump to the boiler, a pressure-chamber opening into said pipe, a suction-pipe discharging into said  
 85 pump-cylinder, a check-valve in said suction-pipe, a pressure-chamber opening into said suction-pipe between said check-valve and said cylinder, a steam-pipe leading from the  
 90 exhaust of said engine and discharging into said suction-pipe between said check-valve and air-chamber, and a check-valve in said steam-pipe.

In testimony whereof I have signed my name to this specification in the presence of  
 95 two subscribing witnesses.

GEORGE F. CONNER.

Witnesses:

D. E. PURDY,  
 H. E. HALL.