

(No Model.)

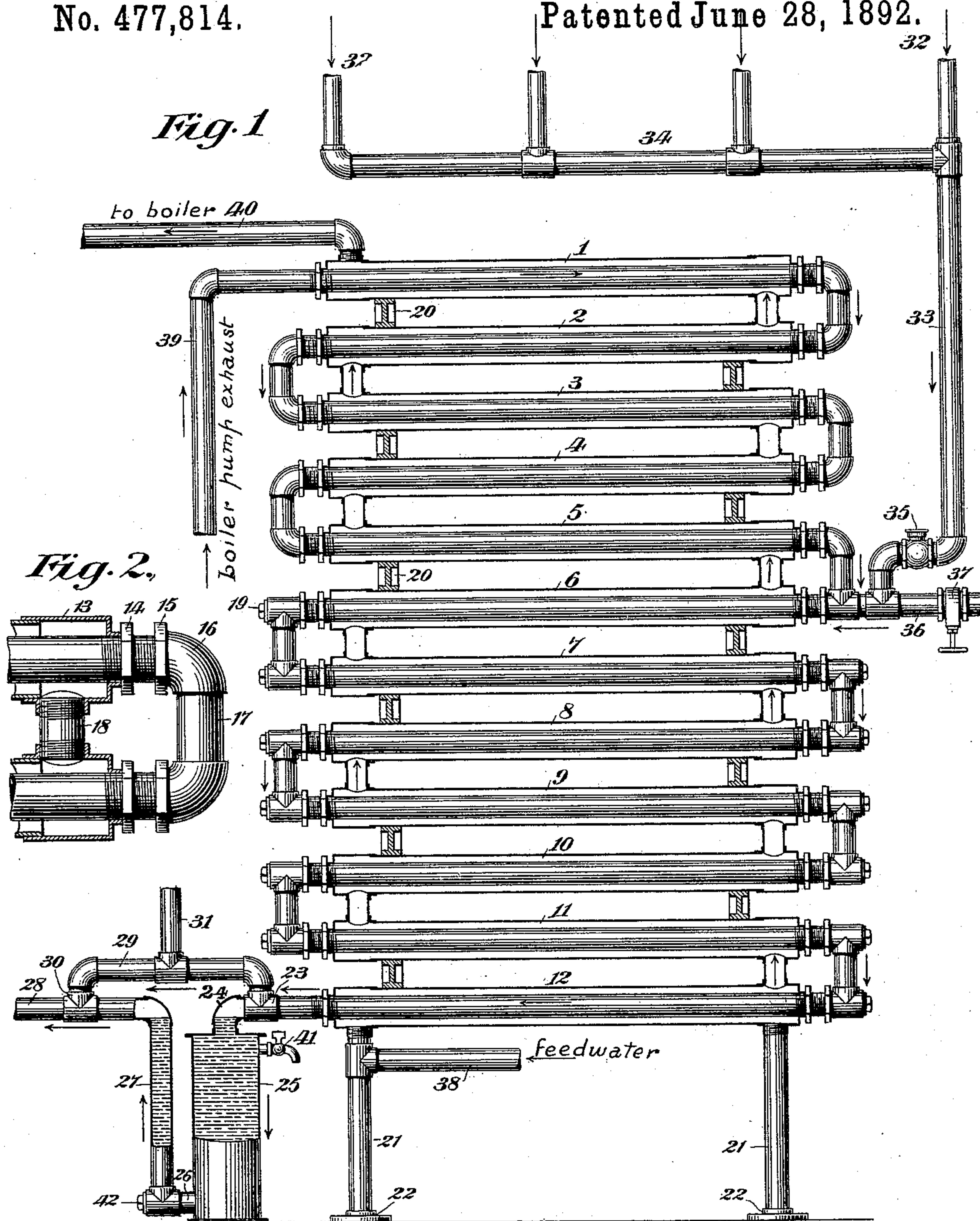
2 Sheets—Sheet 1.

E. NELSON.

FEED WATER HEATER AND CONDENSER.

No. 477,814.

Patented June 28, 1892.



Witnesses

C. E. Ashley  
H. W. Lloyd.

Inventor

Elihu Nelson.  
By his Attorney  
G. H. Stockbridge

(No Model.)

2 Sheets—Sheet 2.

E. NELSON.

FEED WATER HEATER AND CONDENSER.

No. 477,814.

Patented June 28, 1892.

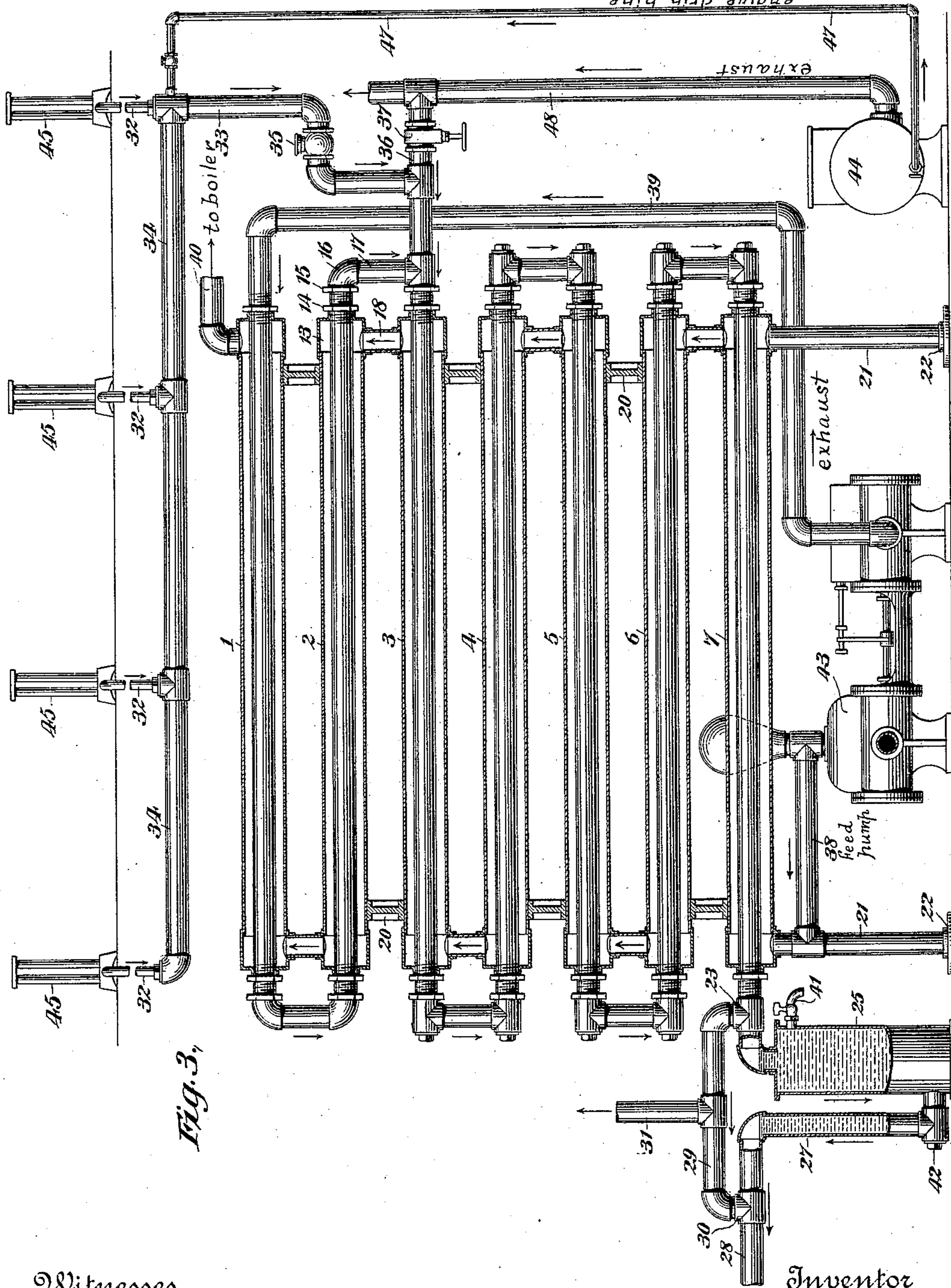


Fig. 3.

Witnesses  
C. E. Ashley  
H. W. Lloyd.

Inventor  
Elihu Nelson  
By his Attorney  
G. H. Stockbridge



# UNITED STATES PATENT OFFICE.

ELIHU NELSON, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO WILLIAM  
M. MACBEAN, OF SAME PLACE.

## FEED-WATER HEATER AND CONDENSER.

SPECIFICATION forming part of Letters Patent No. 477,814, dated June 28, 1892.

Application filed August 31, 1891. Serial No. 404,173. (No model.)

*To all whom it may concern:*

Be it known that I, ELIHU NELSON, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Feed-Water Heaters and Condensers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The object of my invention is to do away with the waste which is now so common in the use of engines in buildings where the steam is utilized for heating purposes, for running the elevators, and so on. In operating such engine it is now customary to let the drips from the engine and the returns from the radiators pass off without being utilized. Moreover, the exhaust from the boiler-pump is usually carried off to the open air, its heat being in this way allowed to go to waste. I obviate the waste thus occasioned by providing an apparatus wherein the heat of the exhaust-steam from the boiler-pump is utilized in raising the temperature of the feed-water, and also the heat of the engine-drips and the radiator-returns I make use of for the same purpose. Moreover, in buildings which are heated by the exhaust-steam of the engine there is a considerable amount of oil passing through the radiators along with the exhaust, and for this reason the returns from the radiators are ordinarily passed into the sewer, the oil making them unfit for use in the boiler. In my apparatus these returns are carried to the feed-water heater and the heat is transferred to the feed-water, as already indicated; but after it emerges from the heater I pass it into a separator to separate the oil from the water, so that the latter can be passed into the sewer or wherever desired. In doing this I pass the heating-water in an opposite direction from that taken by the feed-water, the result being that the heating-water when it passes out into the sewer or elsewhere is comparatively cool and in such condition that it will not give rise to the noxious vapors which are the cause of much trouble when the sewers are traversed by water at a high temperature. On the other hand,

the arrangement described serves to carry the feed-water to the boiler hot, inasmuch as this water meets the drips and radiators, returns after they have become somewhat cool, and, taking up some of their heat, passes constantly along a course which is gradually hotter and hotter until it comes to the point where the drips and returns enter the condenser. Beyond this point I arrange to have the feed-water met by the exhaust-steam from the boiler-pump, (this steam also traveling in a direction opposite to that of the feed-water,) so that the feed-water passes into the boiler at a very high temperature.

The oil-separator, as such, does not form a part of the present invention, nor have I claimed it in combination with the other parts of the apparatus.

From the description which follows it will be seen that, owing to the arrangement of the different parts, it is impossible that any water should be carried to the boiler without being first heated by the exhaust-steam from the boiler-pump.

I have illustrated my invention in the accompanying drawings, in which—

Figure 1 is an elevation of my apparatus, the oil-separator being shown partly in sections. Fig. 2 is a detail view; and Fig. 3 is an elevation of a slightly-different form of apparatus, showing the connections to the engines and the boiler-pump.

Referring to the drawings by letter, I show in Fig. 1 a series of sections 1 2 3 4 5 6 7 8 9 10 11 12, making up my condenser and feed-water heater. Each section consists of two pipes, one within the other, the central pipe forming a chamber for the exhaust-steam from the boiler-pump or for the engine-drips and radiator-returns, as the case may be. The two pipes are connected together, as shown in Fig. 2, by T's 13, which screw up on both pipes, the latter being provided for this purpose with screws of similar pitch. Outside the T's are put on lock-nuts 14 and 15, the former of which screw up tight against the ends of the T's 13 and the latter of which are screwed against the ends of L's 16, which are screwed upon the ends of the inner pipes. The L's 16 are joined by vertical pipes 17 and the T's 13 by vertical pipes 18, the said



L's and T's being joined in pairs from section to section, as will be readily understood. It thus appears that each section forms a double chamber, one of which—the central one—is cylindrical in shape and the other annular. Moreover, it is apparent that the central chambers are connected continuously to form, practically, one passage for the steam, and also that the annular chambers are similarly connected to form a passage for the feed-water. The feed-water, being passed through annular chambers, as described, will present a large amount of surface in proportion to its volume, and, consequently, will take up heat with great comparative rapidity and be heated to the proper degree so much the sooner. To facilitate this process the sizes of the pipes may be graduated in such a manner as to leave the feed-water very thin outside the inner pipe.

It will be observed that, beginning with section 6, the ends of the inner section-pipe are capped with T's instead of L's, and that these T's are provided with plugs 19. The object of this is to admit of cleaning the inner pipes, the plugs being removable for this purpose. The reason why this construction begins with section 6 is because it is at this section that the returns from the radiators enter, carrying oil, which necessitates the cleansing process.

The connecting-pipes 17 and 18 for the inner and outer chambers, respectively, are sufficient to brace succeeding sections at one end; but at the opposite ends I supply a separate brace 20, as shown. To support the whole structure I supply legs or standards 21, which are set in bases 22 at the bottom. On the end of the inner pipe of the last section I secure a T 23, and I couple this with a pipe or L 24, leading to the cap of my oil-separator 25. Near the bottom of the separator a pipe 26 leads off, which is joined by a T with a vertical pipe 27, connected to the exit-pipe 28. A by-pass 29 leads from the T 23 to a T 30, connected with the pipe 28. I may provide a vent-pipe 31 for the pipe 29; or I may dispense with the same.

At 32 I show pipes for the engine-drips and radiator-returns.

At 33 I show the main drip-pipe, and at 34 a branch drip-pipe. The pipe 33 is connected through a check-valve 35 and suitable L's and T's with the central pipe of section 6. This pipe also has an extension 36 leading to the exhaust of the engine. In the latter pipe is a valve 37. The pipe 38 is the inlet-pipe for the feed-water, the pipe 39 is the inlet for the exhaust-steam from the boiler-pump, and the pipe 40 is the pipe leading to the boiler.

Such being the construction and arrangement of the parts, I will now describe the mode of operation of the apparatus taken as a whole. The valve 37 will, when the radiators are in use—that is, in the winter season—be either wholly or partially closed, according to what is found necessary. If it is not

needful to draw on the exhaust-steam from the engine, this valve will be completely closed. Otherwise it may be opened completely or partially.

It will be understood the engine-drips pass into section 6 both summer and winter; but the radiator-returns only during the cold season when the radiators are in use. In either case heated water or condensed steam will pass into this section from the pipe 33, and will take a downward course toward the lower section. Gradually becoming cool, it will, in the lower section, meet the feed-water while it is cold and part with the greater portion of its remaining heat, thus passing into the oil-separator comparatively cool. On the other hand, the feed-water will gradually become more heated and will constantly meet a portion of the heating medium, which is less cooled by condensation. In this way both the feed-water and the heating medium act with the highest possible degree of efficiency, the former exerting its greatest possible condensing effect and the latter its greatest possible heating effect. When the feed-water passes in its upward course beyond the sixth section, it is met by the exhaust-steam of the boiler-pump and heated to a still higher degree, so that it passes into the boiler at a very high temperature. It is largely for this purpose (so that the feed-water may be subjected to higher and higher degrees of temperature) that I have caused the main drip-pipe to be connected at about the middle section, and have caused the currents for heating and for condensing to flow in opposite directions; but the arrangement also serves the purpose of preventing the choking and back-pressure on the boiler-pump which would take place if the pipes 33 and 36 were led into the first section.

Returning now to the waters of condensation which pass out from the lower section into the separator it will be seen that they pass through the same into the pipe 27, which is so arranged as to form a trap for the water in the separator. If there are any vapors carried along with the water, they will pass through the by-pass 29 and out at the exit 28 or at the vent-pipe 31. As has already been stated, the waters themselves have become cooled sufficiently so that they can be passed out into the sewer or elsewhere without danger. The oil will be kept at the top of the separator and can be drawn off at intervals through the cock 41; but for the by-pass 29 the vapors might carry some of the oil through the water to the exit, but this is now prevented.

All the sections of the feed-water heater are of the same dimensions; but they may be made long or short to suit the space which the heater is to occupy. If the sections are made longer, a smaller number will be required to do the same work.

The object of the check-valve 35 is to keep the exhaust-steam from backing up into the main drip-pipe and its branches.



In the T which connects pipes 26 and 27 I place a plug 42, which can be removed for emptying the oil-separator whenever it is desired.

5 In Fig. 3 I show seven long sections replacing the twelve short sections in Fig. 1. The boiler-pump is shown at 43, the engine at 44, and the radiators at 45 45 45 45. The drip-pipe appears at 47, and the exhaust-pipe from  
10 the engine at 48.

I claim as my invention—

1. The combination, with an engine, a boiler-pump, and one or more radiators, of a feed-water-heating apparatus consisting of a series of sections intermediate between the said engine and the said boiler-pump and radiator or radiators, the said boiler-pump having its exhaust joined to the first section, and the said radiator or radiators having its or their  
20 returns joined to an intermediate section of the said heating apparatus, as and for the purpose set forth.

2. The combination, with an engine, a boiler-pump, and one or more radiators and one or  
25 more engine-drips, of a feed-water-heating apparatus, consisting of a series of sections intermediate between the said engine, the said radiator or radiators, and the said engine drip or drips, the said boiler-pump having its  
30 exhaust joined to the first section, and the said radiator or radiators and the said drip or drips having their returns joined to an intermediate section of the said heating apparatus, and the exhaust from the engine being  
35 also joined to an intermediate section, while the inlet for the feed-water is at the last section of the said heating apparatus, as and for the purpose set forth.

3. The combination, with an engine, a boiler-pump, and one or more radiators, of a sectional feed-water-heating apparatus, the said boiler-pump having its exhaust joined to the first section of the said heating apparatus and the said radiator or radiators having its  
45 or their returns joined to an intermediate section of the said heating apparatus, and the inlet-pipe for the feed-water being joined to the last section of the said heating apparatus, as and for the purpose set forth.

50 4. The combination, with an engine and with radiators, of an intermediate sectional feed-water heater, the inlet-pipe for the feed-water being joined to the last section of the

said heater, and the returns from the radiators being joined to an antecedent section of the said heater, as and for the purpose set forth. 55

5. The combination, with an engine, a boiler-pump and radiators and engine-drips, of a sectional feed-water-heating apparatus, the first section thereof being joined to the exhaust-pipe from the boiler-pump and an intermediate section thereof being joined both to the drips and returns and to the exhaust-pipes from the engine, a valve in the connecting-pipe, and a check-valve in the pipe joining the returns to the intermediate section, the inlet-pipe for the feed-water being joined to the last section of the said heating apparatus, as and for the purpose set forth. 60 65 70

6. The combination, with an engine and a boiler-pump, of an intermediate sectional feed-water heater, each section consisting of a double-chambered pipe forming an interior cylindrical and outer annular chamber, the first section of the said heater being joined through its inner pipe to the exhaust from the boiler-pump, and the last section of the said heater being joined through its outer pipe to the inlet-pipe for the feed-water, as and for the purpose set forth. 75 80

7. In a feed-water heater consisting of a series of sections, the main drip-pipe 33, in combination with the branches 32 32 32 32 and 34, the said main drip being connected to one of the intermediate sections through a check-valve, the same intermediate section being joined to the exhaust-pipe from the engine, as and for the purpose set forth. 85

8. In a sectional feed-water heater, the main drip-pipe 33, in combination with the branch pipes 32 32 32 32 and 34, the said main drip-pipe being connected to one of the intermediate sections, in combination with a boiler-pump joined to the first section, all the sections beyond the said intermediate section being provided with removal plugs, as and for the purpose set forth. 90 95

In testimony whereof I have signed my name, in the presence of two witnesses, this 29th day of August, A. D. 1891. 100

ELIHU NELSON.

Witnesses:

GEO. R. BLODGETT,  
G. H. STOCKBRIDGE.