

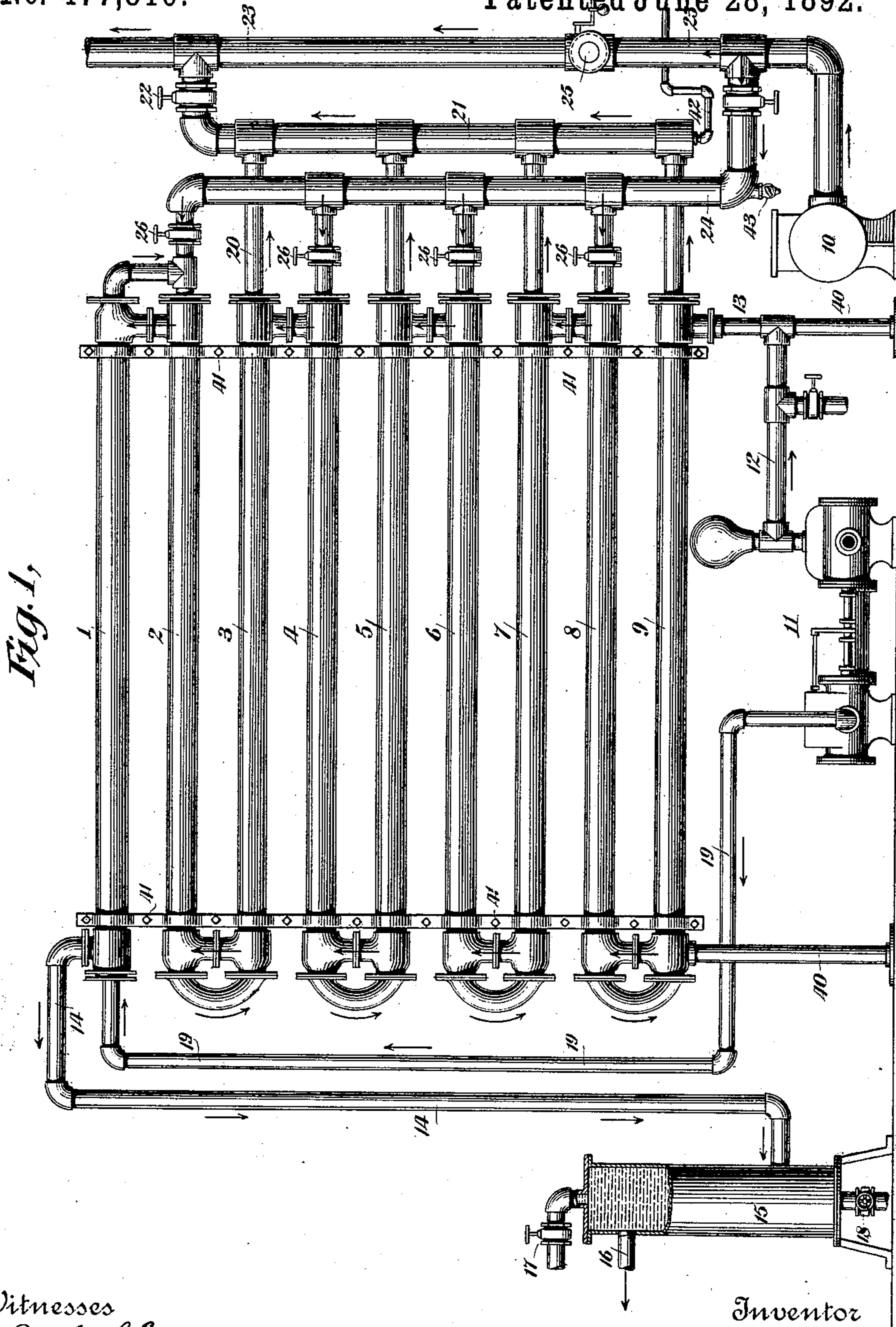
(No Model.)

3 Sheets—Sheet 1.

E. NELSON.  
SECTIONAL FEED WATER HEATER.

No. 477,816.

Patented June 28, 1892.



Witnesses  
C. E. Ashley  
S. J. Macpeak

Inventor  
Elihu Nelson  
By his Attorney  
C. H. Stockbridge

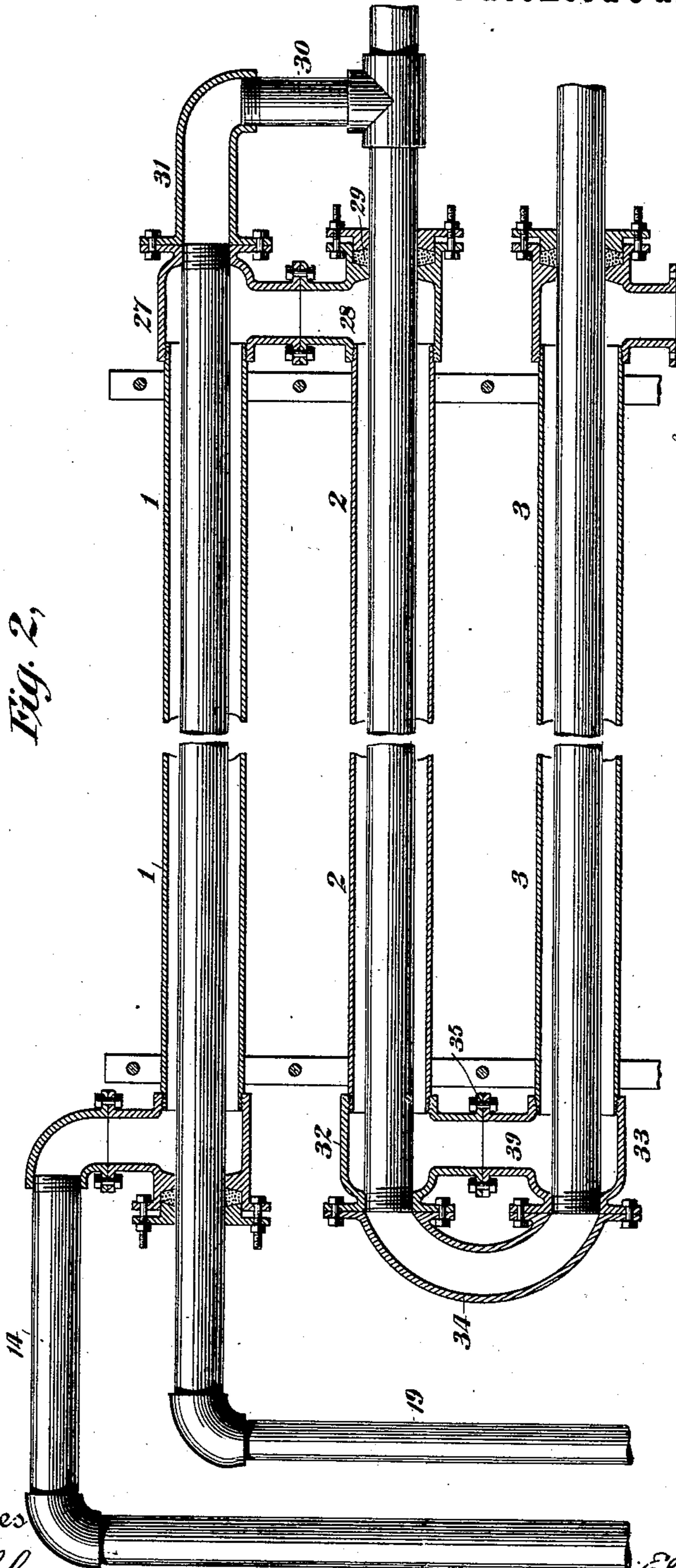
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3 Sheets—Sheet 3.

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Fig. 3,

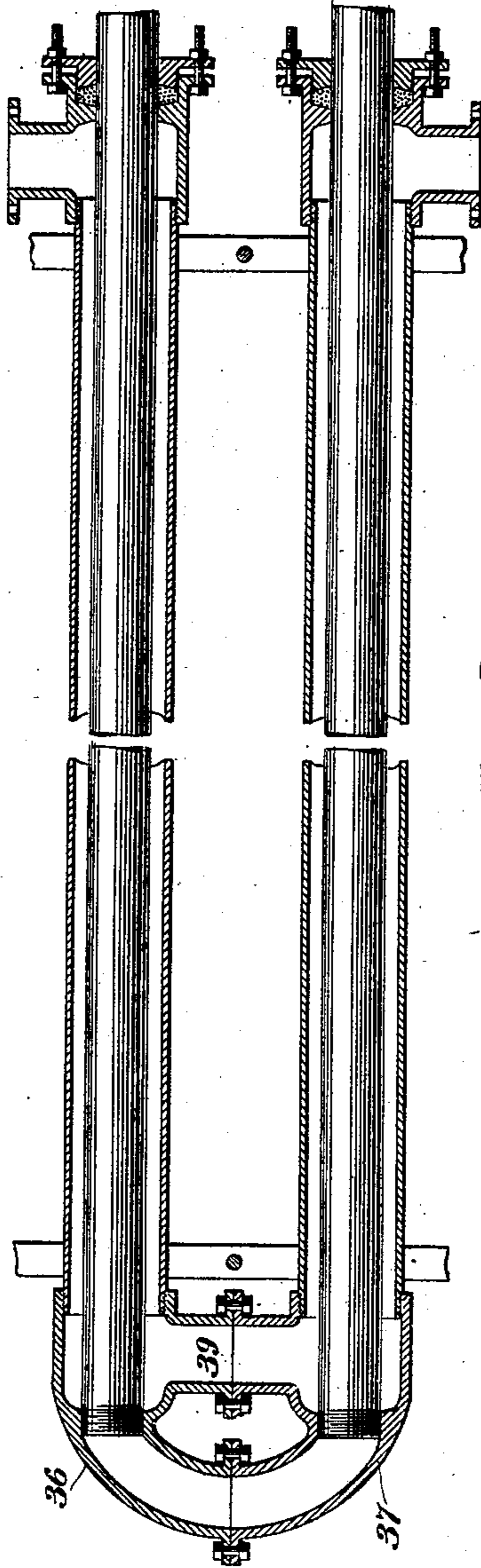
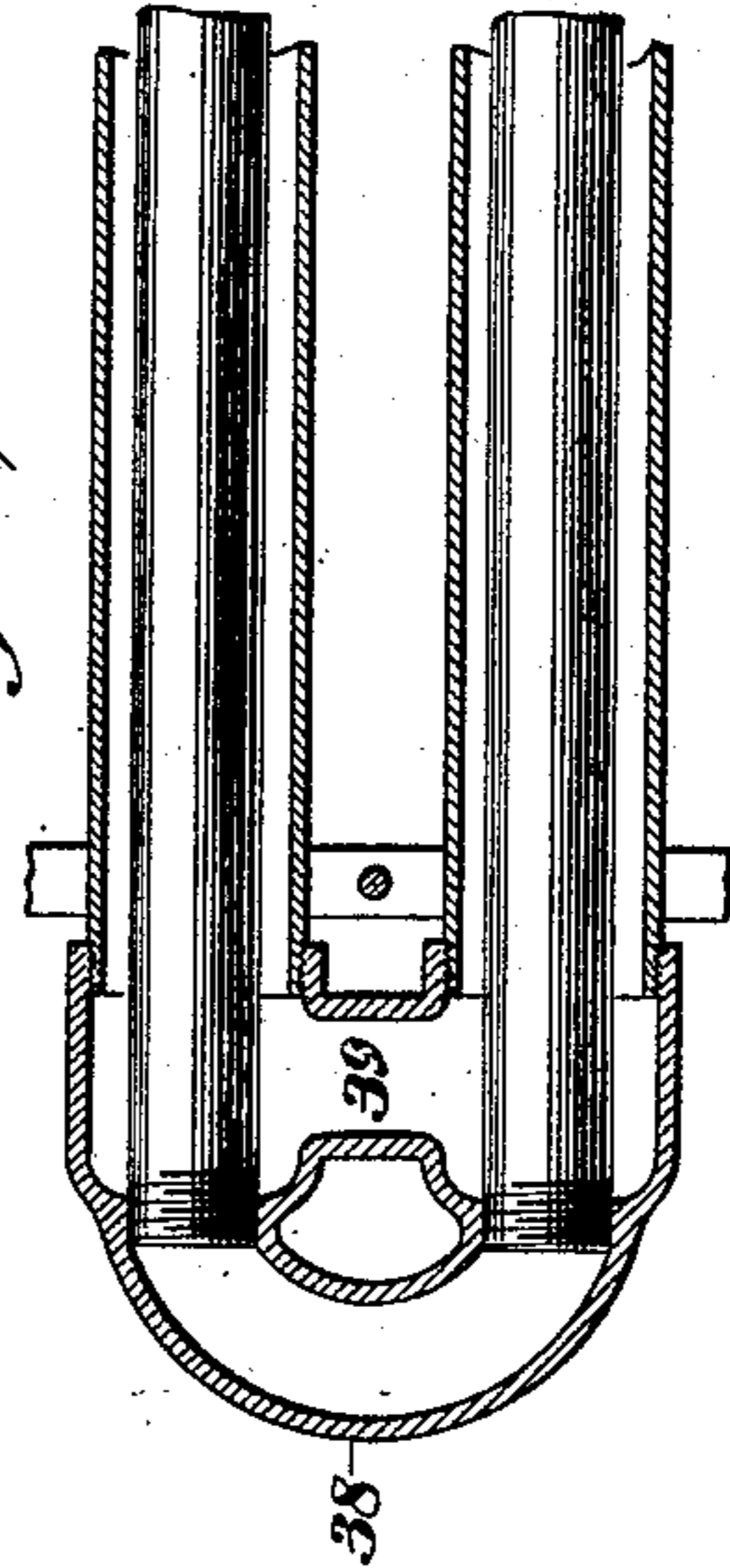


Fig. 4,



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# UNITED STATES PATENT OFFICE.

ELIHU NELSON, OF NEW YORK, N. Y.

## SECTIONAL FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 477,816, dated June 28, 1892.

Application filed February 4, 1892. Serial No. 420,321. (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 Sectional Feed-Water Heaters; 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.

My invention relates to improvements in sectional feed-water heaters; and it consists, broadly, in connecting up with the different sections of the said heater or with groups of the said sections the exhaust from the boiler-pump and a branch of the exhaust from the engine, the connection being such that the sections or groups of sections are in multiple between the said branch exhaust-pipe and the main exhaust-pipe from the engine. By the arrangement indicated I bring it about that the steam which is used for heating the feed-water is applied to small portions of the feed-water while the steam is at a great heat, and that in this way the greatest efficiency is secured. Moreover, by passing the steam after utilization in the heater out at the main exhaust-pipe I insure a free exit and guard against clogging or backing in the apparatus. As a matter of fact, a vacuum is created in the main exhaust-pipe, or rather in an intermediate pipe connected thereto, which vacuum greatly facilitates the action.

My invention will be fully understood by reference to the accompanying drawings, in which—

Figure 1 is an elevation of my feed-water heater. Fig. 2 is a detail view, partly sectional, showing a form of coupling which I use with my heater and which forms a part of my invention. Fig. 3 illustrates still another form of coupling by a similar view, and Fig. 4 shows a modified form of coupling.

Referring to the drawings, 1, 2, 3, 4, 5, 6, 7, 8, and 9 are sections united in series and forming all together the body of my feed-water heater. Each section consists of a pipe within a pipe, the interior pipe conveying the steam and the exterior pipe the feed-water. The pipes are connected from section to section by

suitable couplings, which will be described in detail further on.

10 is the engine, and 11 the boiler-pump. The latter pumps the water through the pipes 12 and 13 into the outer pipe of section 9, and so through the whole series. The water issues from section 1 by way of the pipe 14 and passes to a purifier 15 and out at the pipe 16. The purifier is simply a vertical receiver through which the heated feed-water passes, and it is provided with a surface blow-off 17 at the top and with a vertical pipe 18 at the bottom, through which the sediment in the bottom of the purifier can be drawn off as often as may be found necessary. A pipe 19, forming the exhaust-pipe from the boiler-pump, leads to the inner pipe of section 1 and carries the steam-exhaust from the boiler to the said inner pipe, whence it passes through the inner pipes of sections 1, 2, and 3. Beyond the last-named section it enters, through the pipe 20, a pipe 21, which is joined through a valve 22 to the main exhaust-pipe 23, running from the engine 10. At 24 I show a branch exhaust-pipe from the engine and this branch pipe is itself branched, so as to form multiple paths through the inner pipes of succeeding sections or groups of sections. In the present instance I so arrange the branches that the steam from the exhaust-pipe 24 passes off at various points through two sections of the feed-water heater, as shown. Referring to Fig. 1, it will be seen that the branch most remote from the engine passes through sections 2 and 3, the next branch passes through sections 4 and 5, the next branch through sections 6 and 7, and the next branch through sections 8 and 9. All the branches referred to are joined to the pipe 21, leading the main exhaust-pipe 23. In the said main exhaust-pipe beyond the point of branching is an automatic or adjustable valve 25, which regulates the amount of exhaust-steam that shall pass through the main exhaust-pipe, and consequently regulates the flow through the branch pipe 24. There are also valves 26 26 26 26 in the branches leading from the pipe 24. These valves can be opened or closed at will, according to the temperature to which it is desired to raise the feed-water. If all the valves 26 are open,

it is evident that the feed-water will be subjected to more and more heat and that the water will be raised to a higher temperature.

It is obvious that the system which I have here illustrated and described is calculated to give the maximum of efficiency to apparatus of this class. There is a free passage of exhaust-steam through different sections of the apparatus, the hottest steam from the engine first coming in contact with the feed-water when it is coolest. However, there is practically little difference in the temperature of the steam which acts upon the different sections, as the amount of condensation which the steam undergoes in passing the entire length of the pipe 24 is inconsiderable. In section 1, which is the last section through which the feed-water passes, it is met by the exhaust-steam from the boiler-pump and receives there its final increase of temperature. I have said that there is a free passage for the exhaust-steam from the engine, because it will be seen that the steam from the pipe 20, passing through the upper part of the pipe 21, will tend to create a vacuum, and thereby increase the facility with which the steam behind it passes through the said pipe 21. Aside from section 1 of my feed-water heater the sections are connected up in multiple between the pipes 24 and 21, or practically between the branch and the main exhaust-pipe from the engine. It is obvious that I may cause the pipe 19 to be joined at 26 directly to the inner pipe of the section here marked 2 without passing through section 1 at all—that is to say, section 1 may be dispensed with, if desired.

The means for coupling successive sections of my feed water-heater form, also, a part of the present invention. These means will best be understood by reference to Figs. 2, 3, and 4. Referring to Fig. 2, it will be seen that the outer pipe of section 1 is joined to the outer pipe of section 2 by means of T's 27 and 28, screwed, respectively, to the outer ends of the said pipes and joined to each other by a flanged joint. Connected with the T 28, where it surrounds the inner pipe of section 2, I have a stuffing-box 29 to prevent leakage. The inner pipes of the section referred to are joined through the medium of a T 30 on the inner pipe of section 2 and an L 31, bolted or secured by a flanged joint to the T 27. My special attention has, however, been directed to the coupling which joins the sections 2 and 3, and this in Fig. 2 consists of three parts 32, 33, and 34. The parts 32 and 33 are counterparts in the form of T's, having internal screw-threads for receiving both the outer and the inner pipes of their respective sections and flanges for coupling to their co-operating parts. They are secured together by flanged joints at 35, and are similarly secured to the opposite ends of the goose-neck 34. The three parts 32, 33, and 34 constitute, when joined together as described, an end coupling for succeeding sections of my feed-water

heater. In Fig. 3 I show a similar coupling made up of only two parts 36 and 37, bolted together, as shown in the drawings. In Fig. 4 a similar coupling is shown in a single casting 38. In all three of the forms illustrated the part which corresponds to the goose-neck 34 in Fig. 2 is the part with which the inner pipe is connected, and in all three forms there is a passage 39 for allowing the water to pass from outer pipe to outer pipe of succeeding sections.

It will be observed that this kind of coupling is used at only one end of the sections, the coupling at the other end being sufficiently clear from the drawings, taken in connection with the description which I have given of the parts 27, 28, and 29.

I prefer the form shown in Fig. 4; but I do not wish to limit myself to the use of that form alone.

It will be seen that my feed-water heater is supported upon suitable standards (which may be pipes) 40 40 and that it is stayed by suitable straps 41 41. The part 42 is a trap for letting off the waters of condensation, and 43 is a drip-cock, the function of which need not be described.

What I claim is—

1. In a sectional feed-water heater, a steam-pipe, a pipe exhausting to the air, and a series of sections connected up in multiple between the two pipes aforesaid, as and for the purpose set forth.
2. In a sectional feed-water heater, an exhaust-pipe from the engine, a second pipe exhausting to the air, and a series of sections connected up in multiple between the two pipes aforesaid, as and for the purpose set forth.
3. In a sectional feed-water heater, a main exhaust-pipe from the engine opening to the air, a branch exhaust-pipe from the engine, and a series of sections connected up in multiple between the two pipes aforesaid, as and for the purpose set forth.
4. In a sectional feed-water heater, a steam-pipe, a pipe exhausting to the air, and a series of sections connected up in multiple between the two pipes aforesaid, all in combination with a boiler-pump and an exhaust-pipe therefrom joined to the last section or sections of the feed-water heater, as and for the purpose set forth.
5. In a sectional feed-water heater, an exhaust-pipe from the engine, a second pipe exhausting to the air, and a series of sections connected up in multiple between the two pipes aforesaid, all in combination with a boiler-pump and an exhaust-pipe therefrom joined to the last section or sections of the feed-water heater, as and for the purpose set forth.
6. In a sectional feed-water heater, a main exhaust-pipe from the engine opening to the air, a branch exhaust-pipe from the engine, and a series of sections connected up in multiple between the two pipes aforesaid, all in

combination with a boiler-pump and an exhaust-pipe therefrom joined to the last section or sections of the feed-water heater, as and for the purpose set forth.

5 7. In a sectional feed-water heater, a main exhaust-pipe from the engine opening to the air, a branch exhaust-pipe from the engine, an adjustable valve in the main exhaust-pipe beyond the branching point, and a series of  
10 sections connected up in multiple between the two pipes aforesaid, as and for the purpose set forth.

15 8. In a sectional feed-water heater, a main exhaust-pipe from the engine opening to the air, a branch exhaust-pipe from the engine, an adjustable valve in the main exhaust-pipe beyond the branching point, and a series of sections connected up in multiple between the  
20 two pipes aforesaid, all in combination with a boiler-pump and an exhaust-pipe therefrom joined to the last section or sections of the feed-water heater, as and for the purpose set forth.

9. In a sectional feed-water heater, a series of sections, each consisting of a pipe within a pipe, and a coupling for joining two succeeding sections, consisting of a return-bend having internally-screw-threaded openings for receiving the ends of the pipes, a goose-neck joining the ends of the interior pipes, and an internal passage joining the ends of the outer  
25 pipes, as and for the purpose set forth.

10. A pipe-coupling having internal screw-threads for receiving pipes of different diameters and provided with flanges in planes at right angles to each other, as and for the purpose set forth.  
35

In testimony whereof I have signed my name, in the presence of two witnesses, this 3d day of February, A. D. 1892.

ELIHU NELSON.

Witnesses:

J. B. CONKLING,  
G. H. STOCKBRIDGE.