

**No. 754,726.**

PATENTED MAR. 15, 1904.

J. WATERHOUSE.

AIR HEATER.

APPLICATION FILED OCT. 1, 1902.

NO MODEL.

*Fig. 1.*

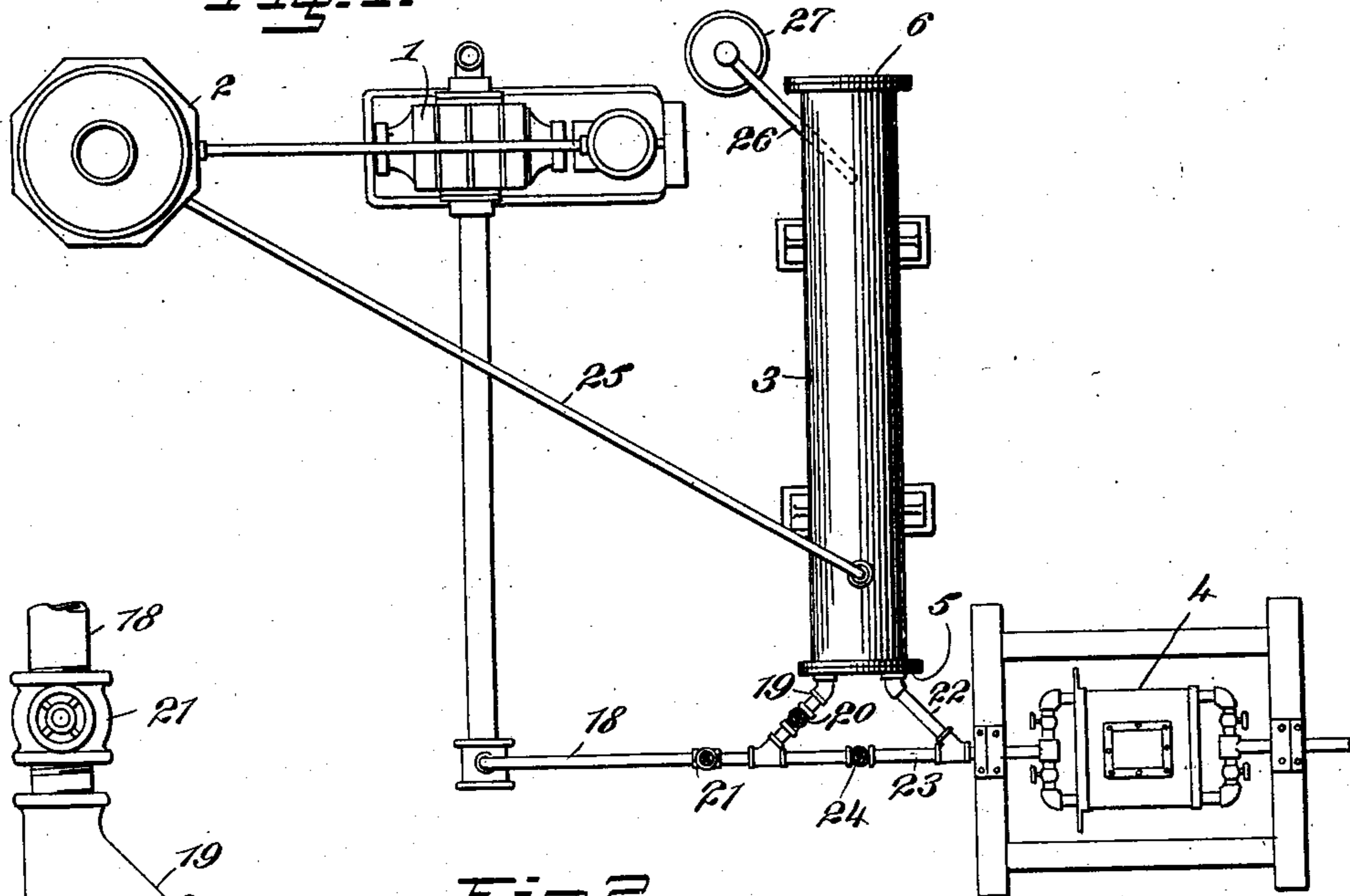


Fig. 2.

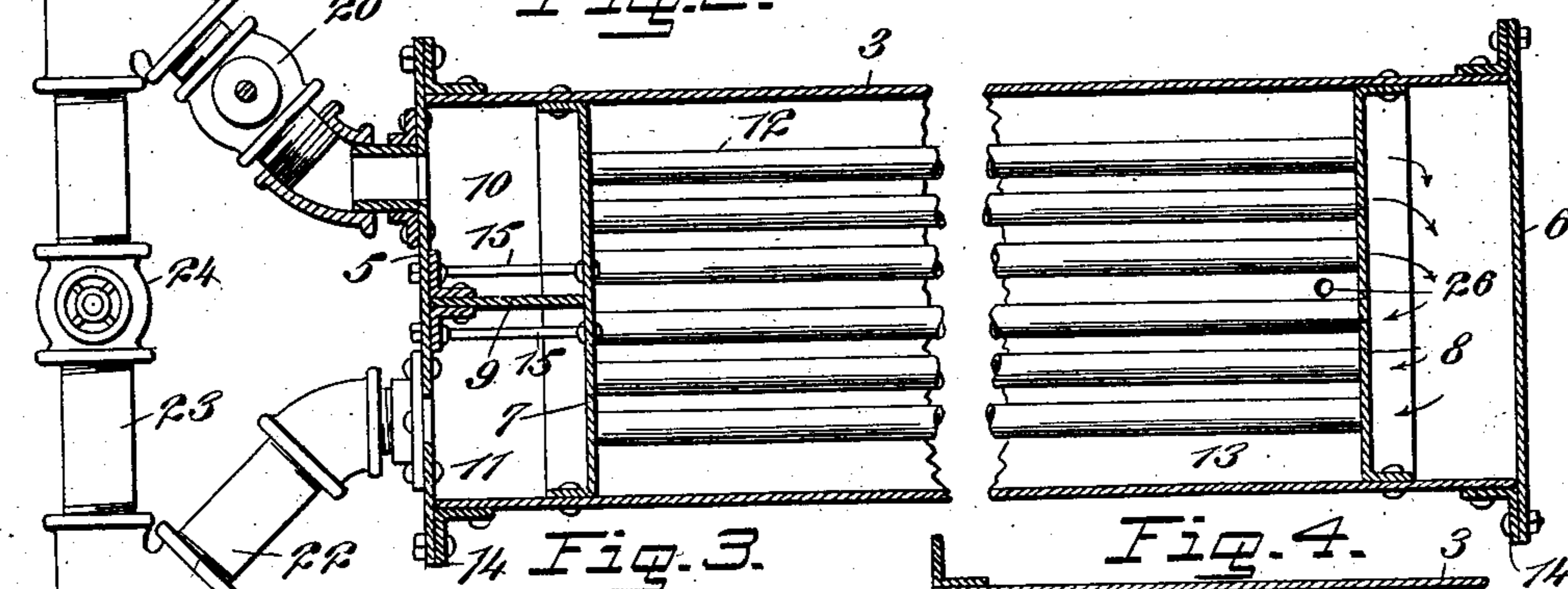


Fig. 3.

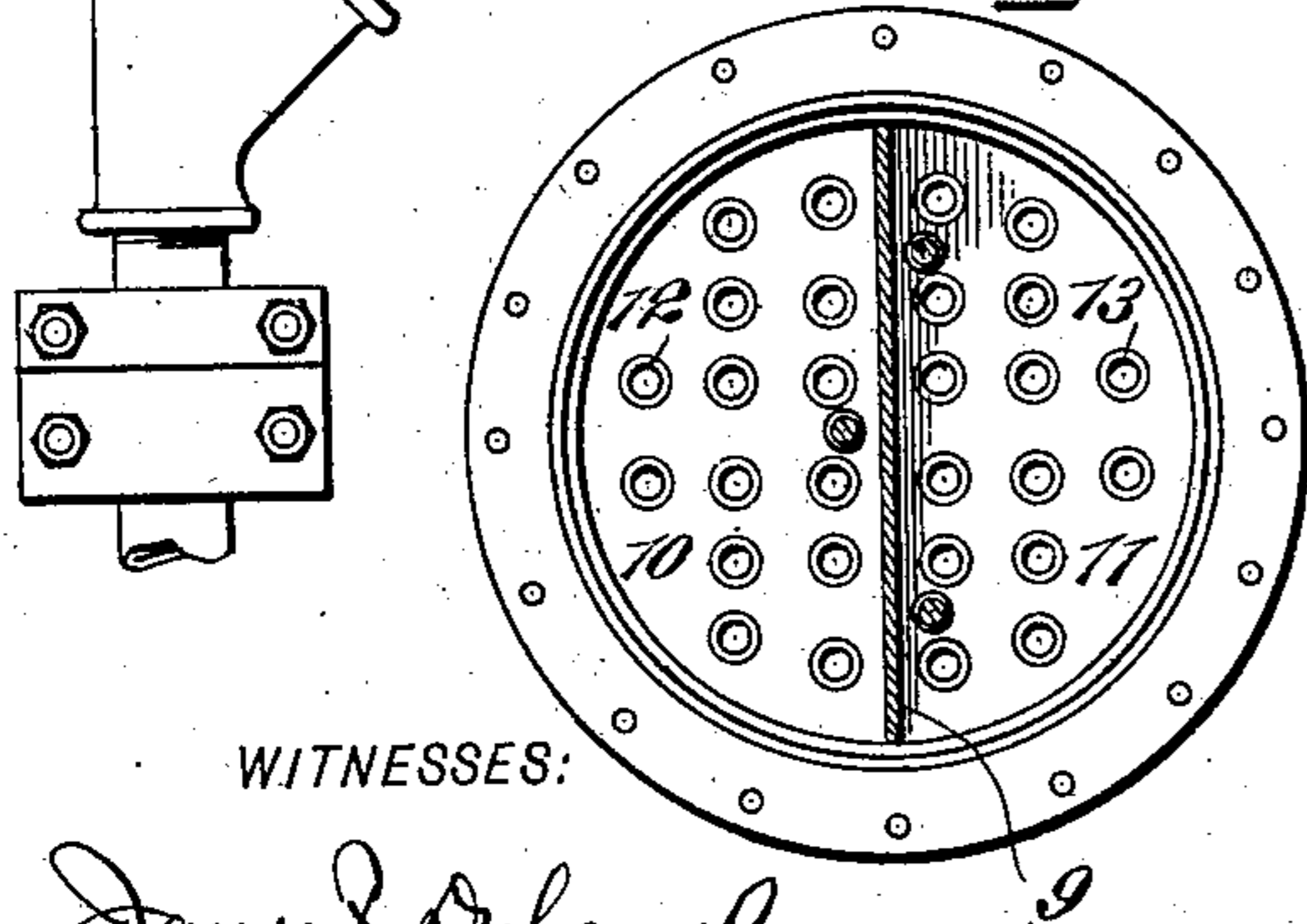
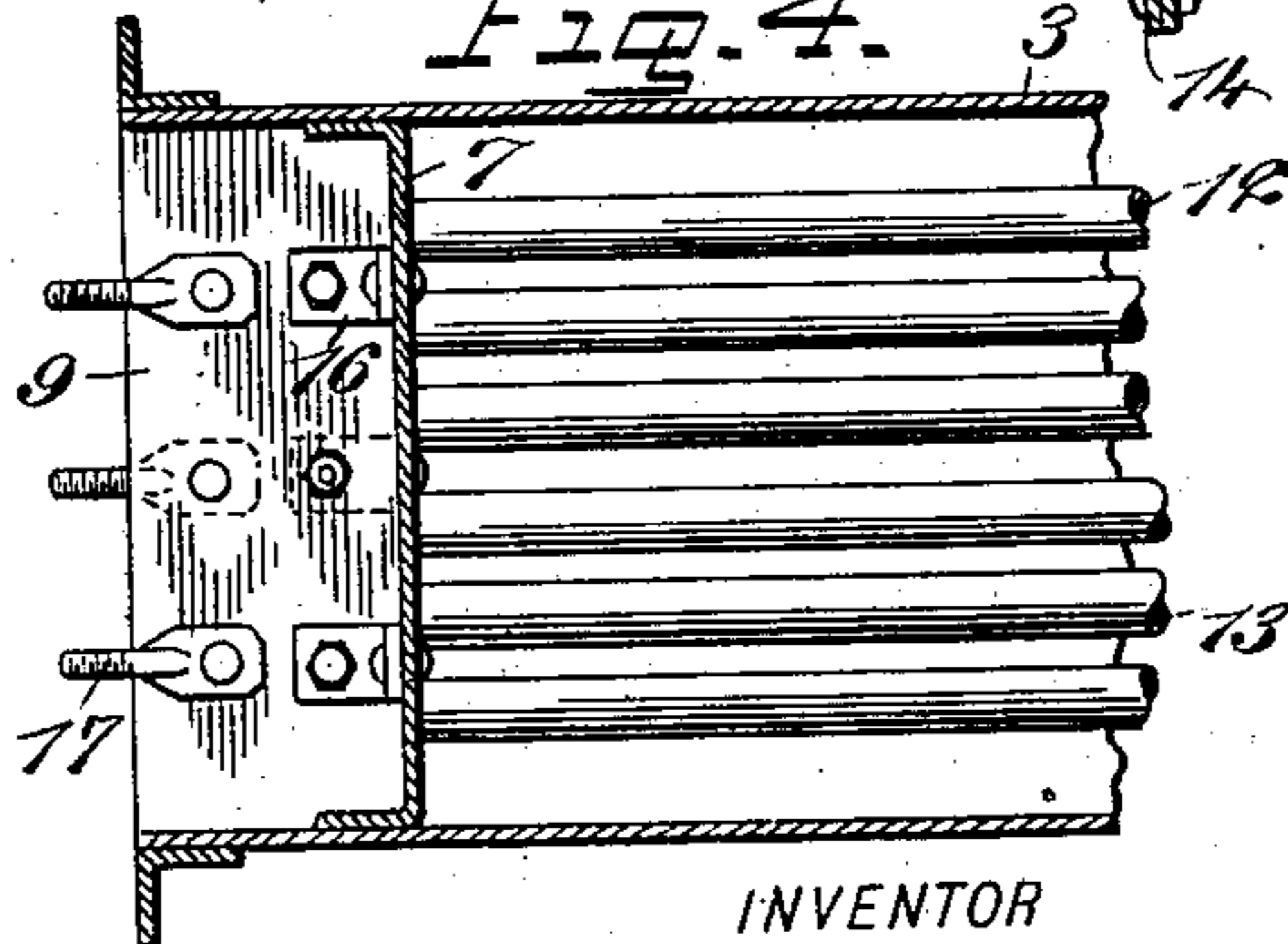


Fig. 4.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

JOHN WATERHOUSE, OF NEW YORK, N. Y.

## AIR-HEATER.

SPECIFICATION forming part of Letters Patent No. 754,726, dated March 15, 1904.

Application filed October 1, 1902. Serial No. 125,470. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN WATERHOUSE, a citizen of the United States, and a resident of the city of New York, borough of Manhattan, in the county and State of New York, have invented new and useful Improvements in Air-Heaters, of which the following is a full, clear, and exact description.

This invention relates to improvements in machines for heating or reheating compressed air to be used in drying material in machines—such, for instance, as shown in patents granted to me under date of May 8, 1900, No. 649,376, and May 14, 1901, No. 674,309—although the invention is not confined to the devices shown in the patents, the object being to provide a heater of simple construction, in which the heat may be easily regulated to the desired temperature for the material under treatment.

I will describe an air-heater embodying my invention and then point out the novel features in the appended claims.

Reference is to had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a general plan view of a heater embodying my invention and the connections thereof. Fig. 2 is a longitudinal section of the heater. Fig. 3 is a transverse section thereof, and Fig. 4 is a sectional detail showing a modification in the heater construction.

Referring to the drawings, 1 designates a high-pressure blower operated by steam from the steam-boiler 2, and 3 indicates the heater, while 4 shows a drying-tumbler, such as shown in my patents above mentioned.

The heater consists of a cylinder 3, having the outer headers 5 6 at its opposite ends and the inner headers 7 8 spaced from the outer headers. The space between the headers 5 and 7 is divided by means of a partition 9 to form two chambers 10 and 11, and from the chamber 10 a series of pipes 12 lead from the inner header 7 through the inner header 8, and steam-conducting pipes or tubes 13 lead from the inner header 8 through the inner header 7 and into the chamber 11.

The outer headers are secured by means of

bolts to flanged rings 14, which are bolted to the cylinder, and the inner headers are also bolted to the cylinder. In Fig. 2 I have shown stay-bolts 15 as extending between the headers 5 and 7. A preferable construction, however, may be seen in Fig. 4. In this construction the partition 9 is secured to the inner header 7 by means of bolts passing through angle-plates 16. Secured to the partition are bolts 17, designed to pass through openings in the outer header. By this arrangement after removing the outer header the partition may be readily removed without first removing the inner header when it is desired to clean out the tubes or otherwise make repairs.

From the blower air is conducted to the heater through a pipe 18. From the pipe 18 a branch 19 leads into the chamber 10, and in this branch is a valve 20, and between this branch pipe and the blower the main pipe 18 is provided with a regulating-valve 21.

From the chamber 11 a branch pipe 22 leads to the tumbler. A by-pass pipe 23, provided with a valve 24, connects the branch pipes, and the object of this by-pass will more fully appear hereinafter.

From the boiler 2 a steam-pipe 25 leads into the heater between the inner headers and near one end at the top, while from the bottom at the opposite end between the headers an exhaust-pipe 26 leads to a trap 27, from which it may be discharged in the form of waste or may be returned to the boiler by any suitable means.

In operation the air to be heated is supplied by means of the high-pressure blower 1, or it may be drawn from any air-receiver in which compressed air is stored. The air passes through the pipe 18, where the flow may be regulated by means of the valve 21, and thence through the branch 19 into the chamber 10, it being understood that at this time the valve 24 may be closed. The air now passes through the pipes or tubes 12 to the chamber between the headers 6 and 8, and thence back through the pipes or tubes 13 to the chamber 11, from which it passes through the branch 22 to the tumbler. The tumbler is provided with a thermometer at each end, wherein the temperature of the interior may be noted. The heater

between the inner headers is supplied with live steam from the boiler through the pipe 25, and the condensation passes out through the pipe 26, as above indicated. By this arrangement the small air-tubes 12 and 13 are thoroughly and rapidly heated by live steam, which is a good absorbent of radiant heat, and this is further intensified by the pressure, while dry air is a poor absorbent of radiant heat and must be heated by contact, which is accomplished by forcing the air under a lower pressure through the small heated tubes, thus causing every particle of the air to come in contact with the heated surfaces, and so heating it to a maximum temperature of about 328° Fahrenheit under a gage-pressure of steam in the boiler of about one hundred pounds.

The flow of air to the tumbler is regulated by the valve 21, and its temperature is controlled by the valves 20 and 24—that is, in case the air is heated to too high a temperature in passing through the heater air of a low temperature or cold air may be mingled with the heated air before passing into the tumbler by opening the valve 24 and also opening the valve 20 to more or less degree.

As the valves 20 and 24 are close together and adjacent to the heater, an attendant may quickly adjust them to secure the desired temperature.

By observing the reading of the thermometers in the tumbler and properly adjusting the two valves 20 and 24 the temperature of

the air in the tumbler may be regulated to a nicety.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In combination with a drier and an air-compressor, a heater, an exhaust-trap having communication with the heater, a pipe leading from the compressor, a valve in said pipe, a branch leading from the pipe into one end of the heater, a valve in said branch, a branch leading from said heater to the drier, a by-pass connecting the two branches, and a valve in the by-pass, the said valve in the branch and the valve of the by-pass being directly in front of the heater and close together, and the said branch valve being between the other two valves.

2. A heater for the purpose described, comprising a cylinder, outer headers on the ends of said cylinder, inner headers arranged in the cylinder and spaced from the outer headers, a partition arranged in one of said spaces, angle-plates bolted to said partition and to the inner header, and bolts attached to said partition for passing through the outer header, substantially as specified.

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

JOHN WATERHOUSE.

Witnesses:

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