

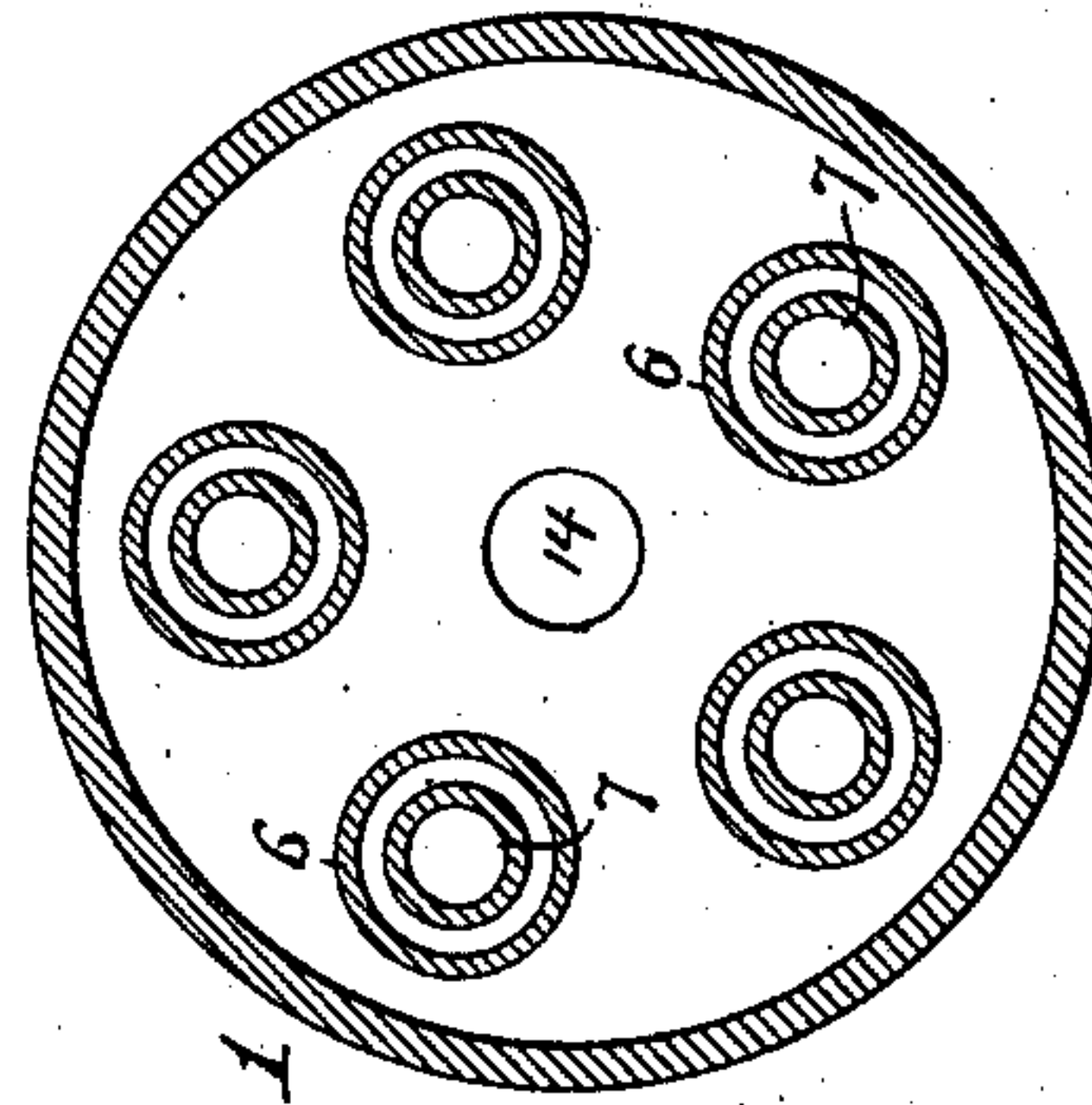
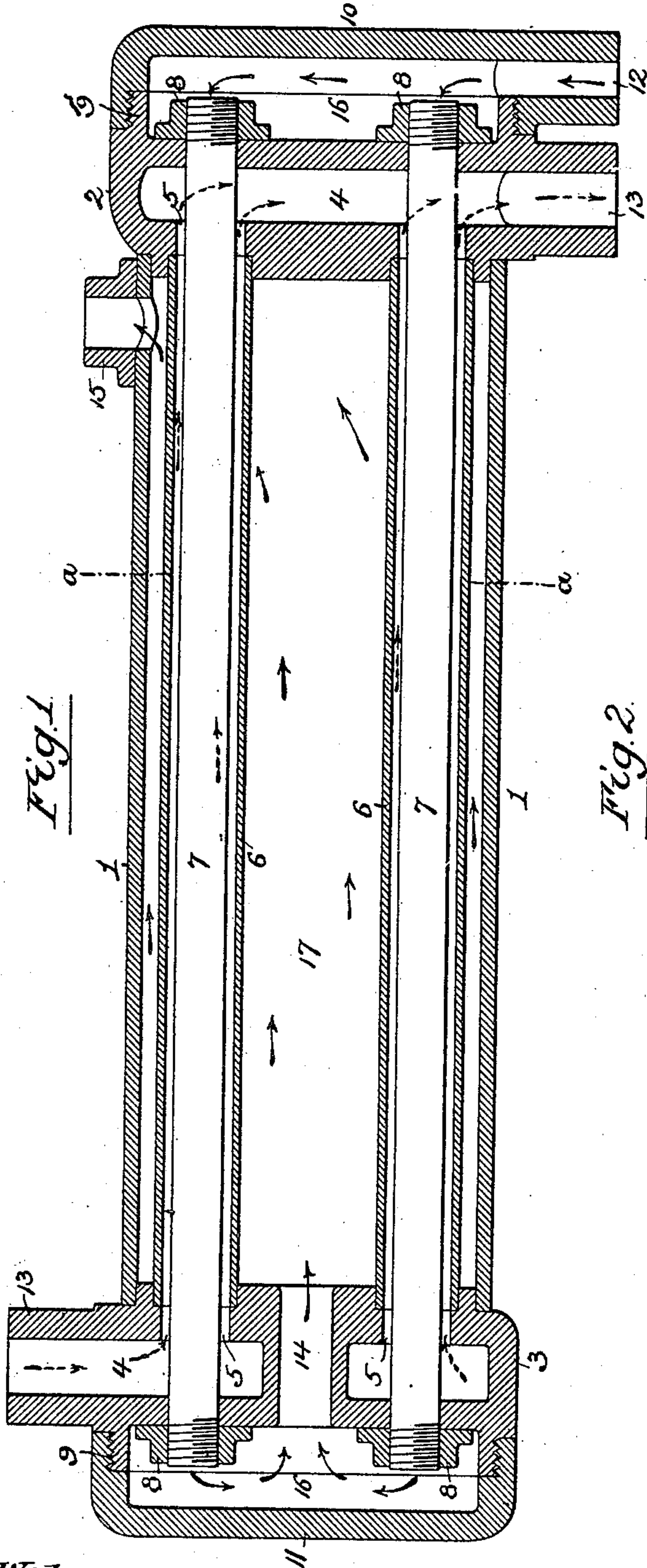
No. 704,454.

Patented July 8, 1902.

H. A. FERGUSON.  
FEED WATER HEATER AND CONDENSER.

(Application filed June 18, 1900.)

(No Model.)



Witnesses:-

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# UNITED STATES PATENT OFFICE.

HENRY A. FERGUSON, OF WILLIAMSPORT, PENNSYLVANIA.

## FEED-WATER HEATER AND CONDENSER.

SPECIFICATION forming part of Letters Patent No. 704,454, dated July 8, 1902.

Application filed June 18, 1900. Serial No. 20,697. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY A. FERGUSON, a citizen of the United States, and a resident of Williamsport, Pennsylvania, have invented certain Improvements in Feed-Water Heaters and Condensers, of which the following is a specification.

The object of my invention is to construct a cheap and simple form of combined water heater and condenser presenting a maximum of heating or condensing surface with which the steam is brought intimately into contact in order to effect the rapid heating of the water and the equally rapid condensation of the steam.

My invention is also applicable to cooling or condensing apparatus.

In the accompanying drawings, Figure 1 is a longitudinal sectional view of a combined water heater and condenser constructed in accordance with my invention, and Fig. 2 is a transverse sectional view of the same on the line *a a*, Fig. 1.

The casing of the device consists of a tube 1, seated at each end upon the flanged inner portions of opposite headers 2 and 3, each of these headers containing a steam-chamber 4 and each being provided in its inner web or wall with a series of openings 5, countersunk for the reception of the ends of a series of tubes 6, which are firmly seated therein.

In the back wall or web of each header 2, in line with the openings 4, are other openings for the reception of tubes 7, which are externally of somewhat less diameter than the internal diameter of the tubes 6, said tubes 7 passing through the tubes 6 and through the outer walls of the headers 2 and 3 and having these projecting portions threaded for the reception of nuts 8, which bear upon said outer walls of the headers and when tightened serve to force the headers tightly against the ends of the tubes 1 and 6, so as to form tight joints therewith, suitable packing-rings or gaskets being interposed between the ends of the tubes and their seats on the headers, if desired.

Each of the headers 2 has an outwardly-projecting flange 9, and upon these flanges are screwed caps 10 and 11, the cap 10 having a projecting tubular branch 12. The headers 2 and 3 also have projecting tubular branches 13, communicating with their chambers 4,

and the header 3 also has a central opening 14 extending through it, but having no communication with the chamber 4 of said header.

At one end of the tubular casing 1 is a tubular branch 15. The tubular branch 13 of the header 3 is connected to the pipe for supplying steam, and the tubular branch 13 of the header 2 is connected to the pipe for carrying off the water of condensation, the water to be heated entering through the tubular branch 12 of the end cap 10 and the heated water escaping through the tubular branch 15 of the casing 1. The water follows the course indicated by the solid-line arrows, Fig. 1—that is to say, it passes from the chamber 16 within the cap 10 through the inner tubes 7, thence backwardly through the opening 14 in the opposite header 3, and through the chamber 17 within the casing 1 to the outlet 15. The steam follows the course indicated by the broken-line arrows in Fig. 1—that is to say, it enters the tubular branch of the header 3, passes from the chamber 4 of the same through the contracted annular spaces between the tubes 6 and 7, and is condensed by contact with the outer surfaces of the tubes 7 and inner surfaces of the tubes 6, the water of condensation entering the chamber 4 of the header 2 and escaping through the tubular branch 13 of the same. By thus circulating the steam through the contracted annular passages presenting both inner and outer condensing-surfaces intimate contact of the steam with said condensing-surfaces is insured, and there is a resultant rapid condensation of the steam, as well as an equally rapid heating of the water, which circulates through the tubes 7 and around the tubes 6.

It will be noted that the tubes 7 constitute stay-bolts for securing together the opposite end portions of the structure and confining them to the central portion of the same, the aim of my invention having been to produce a water heater and condenser which while simple in construction would be compact in size and light in weight in proportion to its heating and condensing capacity, being therefore especially adapted for use in connection with motor-vehicles.

Although I have described my invention as a feed-water heater and condenser, it will be evident that it may be used, if desired, for



cooling or condensing purposes only. For instance, water or other cooling agent may follow the course indicated for the steam, and air, gas, or other fluid to be treated may follow the course indicated for the water, or vice versa. Hence in the claims I have adopted the term "fluid" instead of the terms "steam" or "water."

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

1. A heater or condenser comprising opposite hollow headers, one having an inlet for fluid and the other an outlet for the same, a tubular casing seated upon and confined between said headers, a series of tubes contained within said casing and likewise seated upon and confined between the headers, said tubes communicating with the chambers within the headers, an inlet for another volume of fluid, an outlet for the same, and a second set of tubes passing through the headers and through the tubes which communicate with the chambers in said headers, said internal tubes having end fastening devices bearing upon the outer faces of the headers and serving as tubular stay-bolts to confine the headers to the said casing, substantially as specified.

2. A heater or condenser consisting of opposite hollow headers one having a fluid-inlet and the other an outlet for the said fluid, a tubular casing seated upon and confined between said headers and having an outlet for another volume of fluid, a series of tubes contained within said casing and likewise seated upon and confined between the headers and communicating with the chambers within said headers, other tubes passing through the headers and through the tubes which connect the chambers of said headers, fastening de-

vices secured to the ends of said inner tubes, and bearing upon the outer faces of the headers, and caps secured to the headers and inclosing chambers with which said internal tubes communicate, one of said caps having an inlet branch for the second volume of fluid and the opposite header having a passage leading from the chamber of its cap to the chamber within the central tubular casing, substantially as specified.

3. A heater or condenser consisting of opposite hollow headers, one having an inlet for fluid and the other having an outlet for the same, a tubular casing seated upon and confined between said headers and having an outlet for another volume of fluid, a series of tubes contained within said casing and likewise seated upon and confined between the opposite headers, said tubes communicating with the chambers within the headers, other tubes passing through the headers and through said connecting-tubes and having fastening devices bearing upon the outer faces of the headers and serving to secure the latter to the central structure, threaded flanges projecting outwardly from each header, and caps screwed upon said flanges, one of said caps having an inlet for the second volume of fluid, and the opposite header having a passage providing a communication between the chamber within its cap and the chamber within the central tubular casing, substantially as specified.

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

HENRY A. FERGUSON.

Witnesses:

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C. C. MITCHELL.