

(No Model.)

F. GOODFELLOW.  
FEED WATER HEATER AND PURIFIER.

No. 491,547.

Patented Feb. 14, 1893.

Fig. 2.

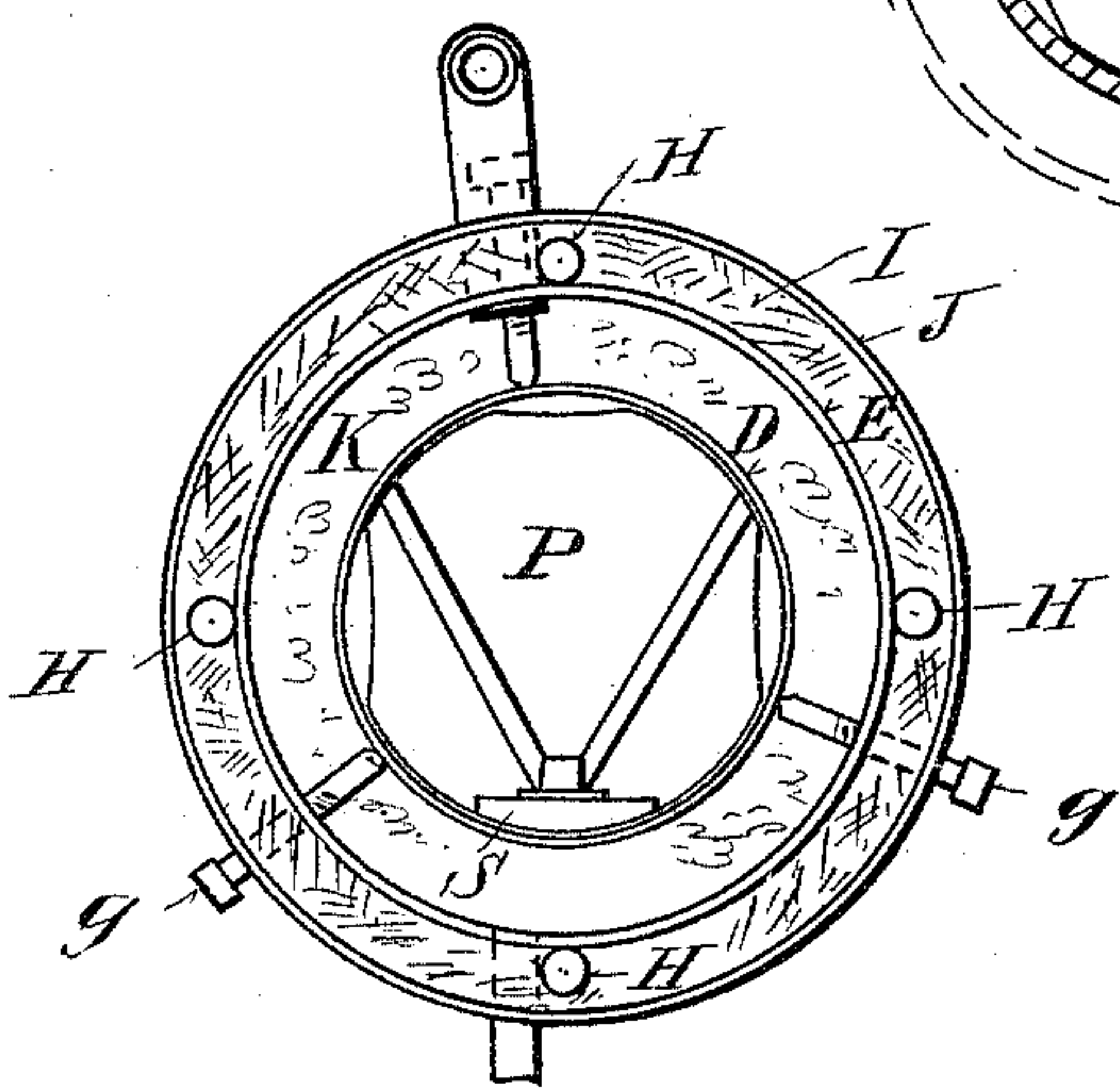


Fig. 4.

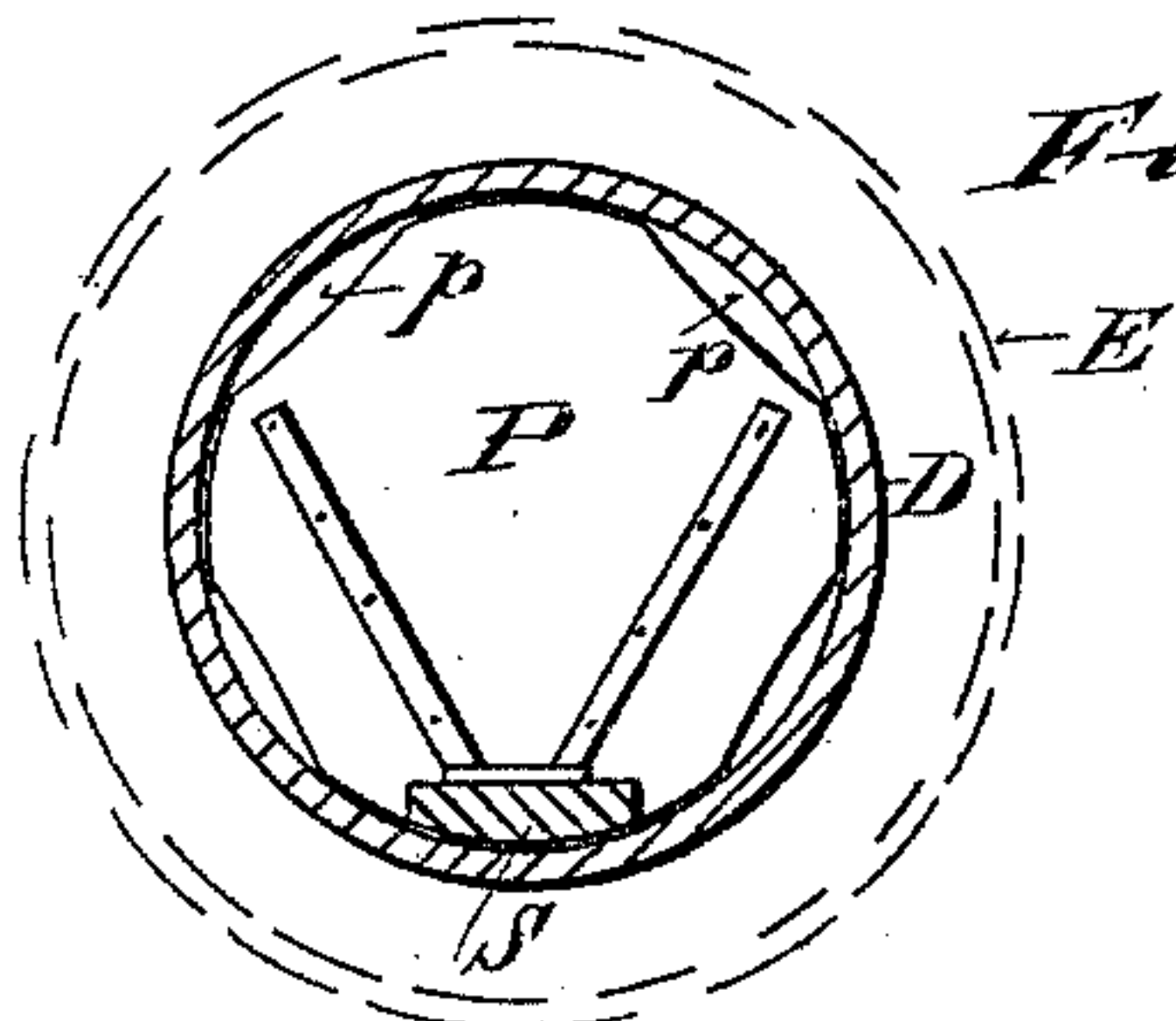


Fig. 3.

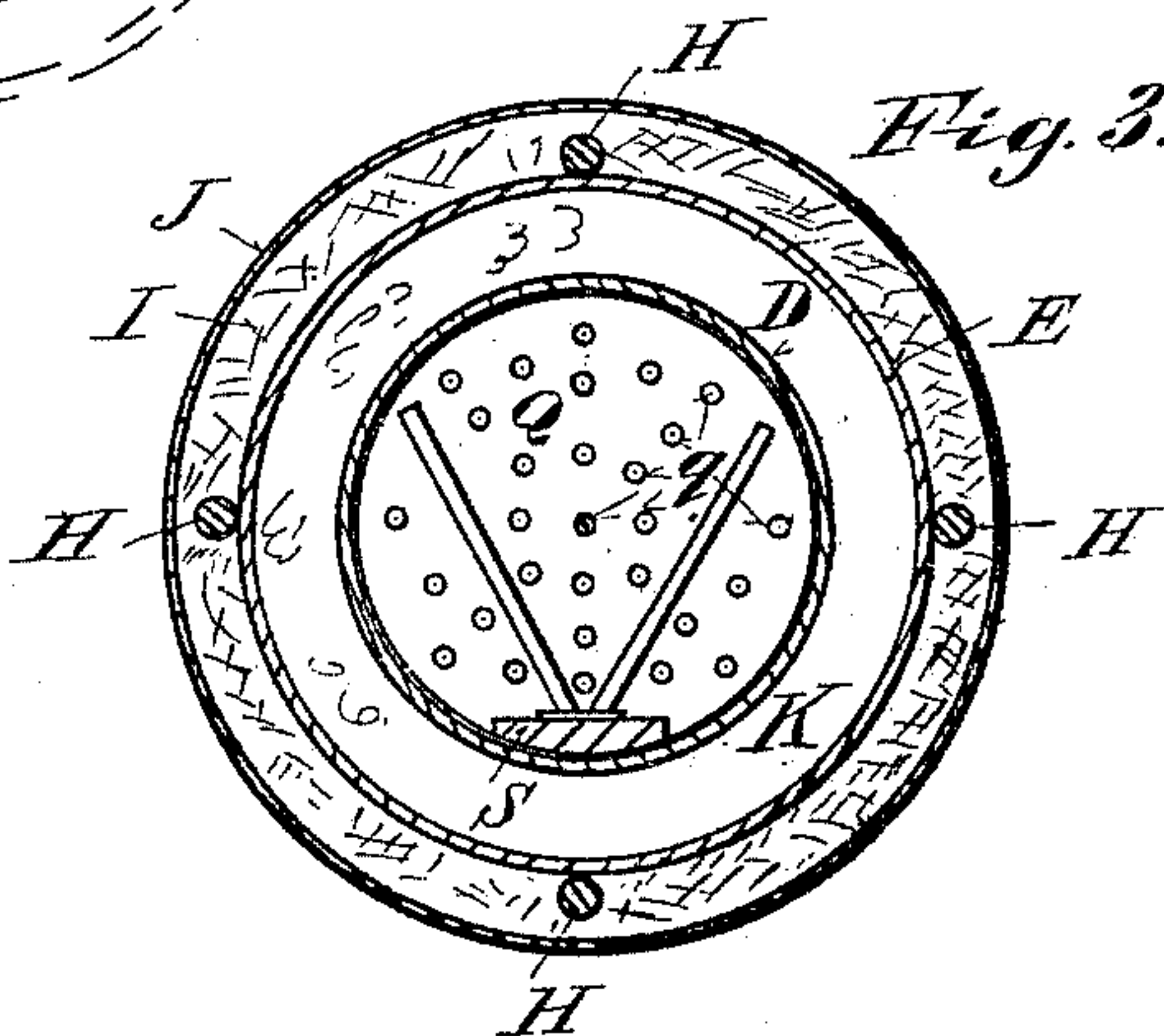
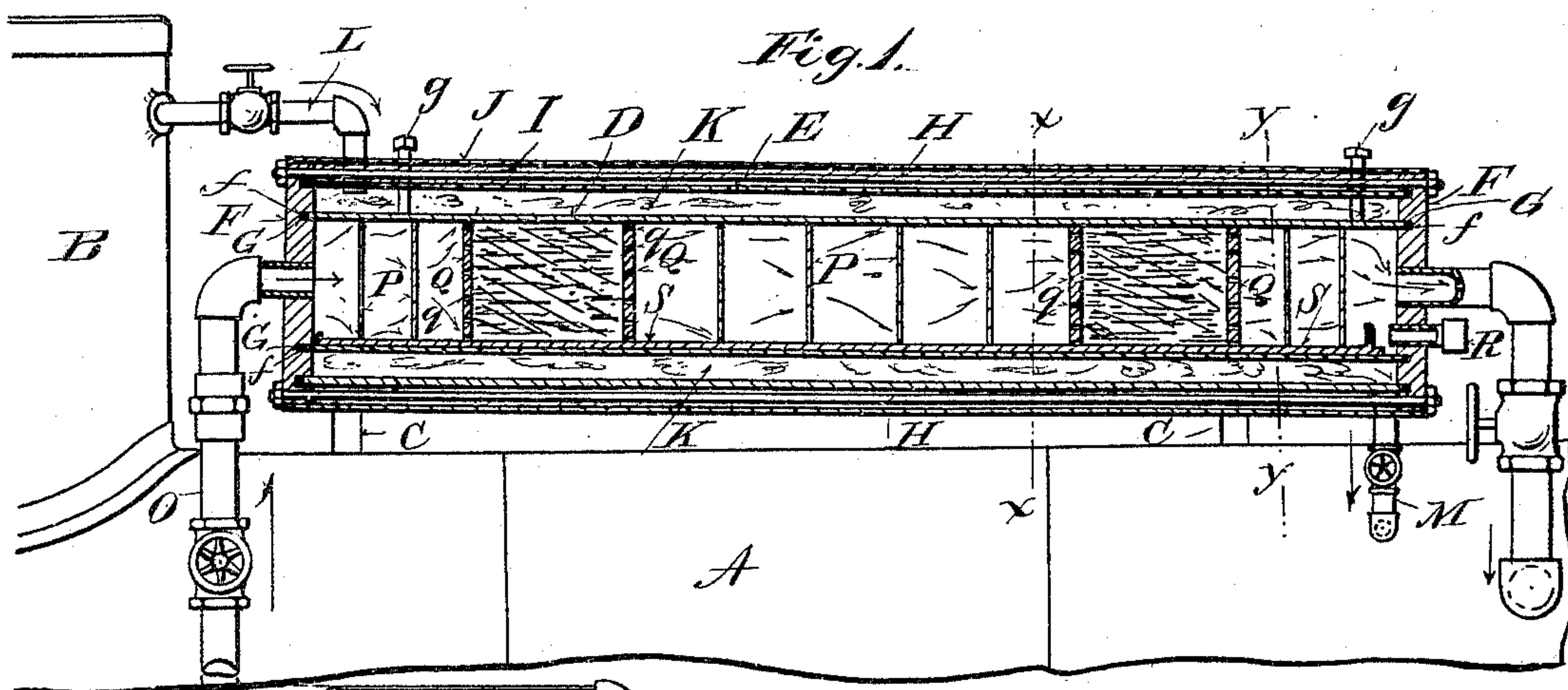
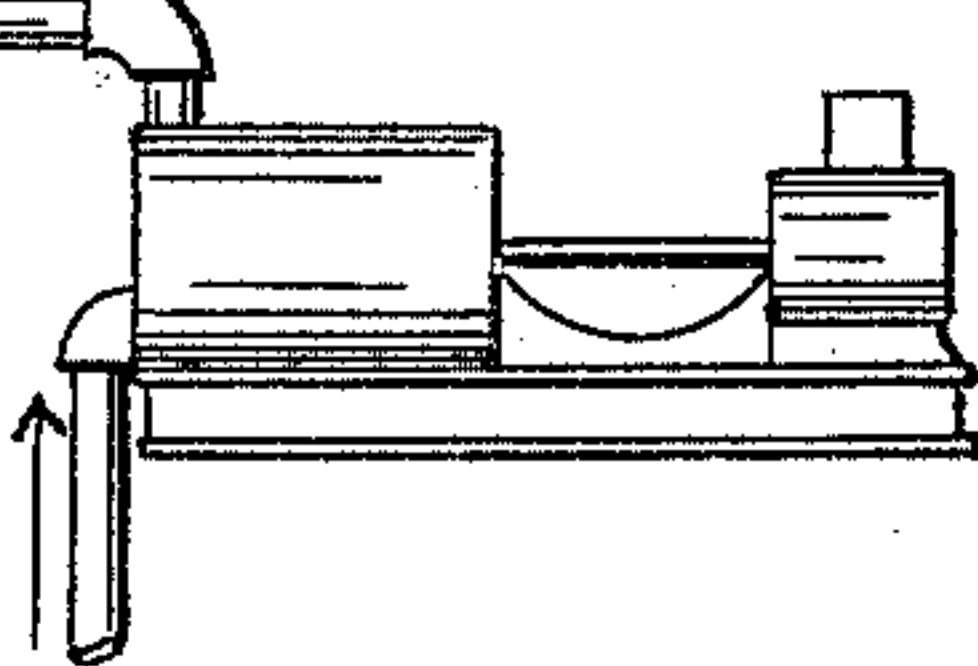


Fig. 1.



WITNESSES:

Wm. Plaisted.  
F. B. Ernest



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# UNITED STATES PATENT OFFICE.

FRANK GOODFELLOW, OF SPRINGFIELD, OHIO.

## FEED-WATER HEATER AND PURIFIER.

SPECIFICATION forming part of Letters Patent No. 491,547, dated February 14, 1893.

Application filed July 19, 1892. Serial No. 440,446. (No model.)

*To all whom it may concern:*

Be it known that I, FRANK GOODFELLOW, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Feed-Water Heaters and Purifiers, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to certain new and useful improvements in feed water heaters and purifiers, the peculiarities of which will be hereinafter fully described in the specification and particularly pointed out in the claims.

My heater and purifier belongs to that class in which the water is directed in thin sheets against a highly heated surface, is agitated or directed back and forth within the conducting passage between the heating operations, in order to thoroughly commingle the currents and render uniform the temperature of the mass; and during the said heating action, a purifying or filtering effect is given to the water, whereby particles in suspension, as well as in solution, are taken therefrom and deposited within the purifier.

In the accompanying drawings on which like reference letters indicate corresponding parts: Figure 1, represents a portion of a boiler, and my device mounted thereon, the latter being shown in section on the center line. Fig. 2, an end view of my device with one of the caps or end pieces removed. Fig. 3, a cross section on the line *xx* of Fig. 1, showing a perforated partition, and Fig. 4, a cross section on the line *yy* of Fig. 1, the outer casing being shown by dotted lines.

The letter A designates a boiler having a steam drum B. Upon the boiler, or adjacent thereto, is mounted by brackets C, or otherwise, a cylindrical device consisting of an inner tube D, an outer tube or casing E,—the tube and the casing being substantially the same in length, and closed at the ends by caps F, provided with annular recesses or grooves *f*, having gaskets G, preferably of copper, whereby a tight joint is effected between said tubes and caps, when the latter are brought together by means of the rods H, as shown in Figs. 1 and 2. A lagging I, of asbestos or other suitable material, surrounds the outer

tube, and is provided with a covering J, of iron or wood as may be convenient, whereby the tubes and the binding rods are all inclosed and protected from rust as well as loss of heat. The space between the outer and inner tubes constitutes a steam space, designated by K. This space connects with the steam drum B by a valve controlled pipe L. An outlet or drip pipe M at the opposite end of the cylinder communicates with the boiler and returns the drip thereto, as well as affording a circulation of live steam from one end of the casing to the other. The inner tube is thereby heated to a high temperature, and the feed water, being delivered through the valve-controlled pipe O from the feed pump, or other source of supply, enters at the center of the cap F at one end, as shown in Fig. 1. At the other end, a discharge pipe, also provided with a valve, delivers the water in its highly heated condition to the boiler. Within the inner tube are cross partitions P, nearly or quite touching the sides of the tube, but provided with cut away portions *p*, adapted to allow the passage of water between the edges of the partitions and the tube, in thin sheets only. In succeeding partitions, these cut away partitions, alternate with the ones in front, in order to form currents and commingle the thin sheets of heated water with the colder water between the partitions. In this way the water is quickly and thoroughly heated in its passage through the inner tube.

In order to purify the water, I provide partitions Q, between which hay or other suitable material is placed, through which the water passes by means of the perforations *q* in said partitions Q. Thus the water, when discharged from the inner tube, is raised practically to the same temperature as that of the live steam in the steam space K, and enters the boiler without causing a lowering of the temperature of the water within the same.

A draw-off pipe R is provided at one end of the cylinder, but I provide means by my construction, to thoroughly and quickly clean the inner tube. The partitions P and Q are all connected by a longitudinal strip S to which they are suitably stayed or braced. One or both of the caps F may be removed from the tubes by unscrewing the nuts on the rods H and detaching the corresponding water pipe



from the valve connection. The end of the tubes then being open, the partitions may all be quickly drawn out in one piece, along with the deposits between them. The valves being closed, prevent the discharge of water and steam respectively. The inner tube is supported by set screws *g*, so as to maintain its central position and allow of readily replacing the detached cap after clearing the deposits from between the partitions and returning them to their proper place.

It has been found by practical experiment that this device works very efficiently in purifying and heating water and is especially adapted for treatment of feed water of fairly low temperature and combining more or less matter in suspension and solution. The size of the device is proportioned according to the amount of feed water necessary, and according to circumstances in which it may be placed and operated.

A certain amount of inclination is given to the device as seen in Fig. 1 in order to facilitate the return of drip to the boiler.

I have indicated in Fig. 1, a pump connected to the inlet pipe to force the water into the heater and purifier, from which it enters the boiler. It will be observed that the water is taken in its unheated, unpurified state by the pump, and delivered to the heater and purifier. In other words the heating and purifying means are located between the forcing means and the boiler. The advantage of this is that the water passes through the forcing means while cold instead of when in its highly heated condition, just previous to its entrance to the boiler, as is the case in other heaters and purifiers. The pump, or other forcing means, such as an injector, for instance, acts more readily on cold water than on the hot water, and it is well known that the forcing means sometimes refuses to work, from the highly heated condition of the water, passing through the same. I lay claim to this process of purifying and heating as will be hereinafter specified.

Having thus fully described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a feed water heater and purifier, the combination with an outer tube, an inner tube, suitable caps for the ends of said tubes, and steam and water pipes communicating with the space between the tubes and with the inner tube respectively, of a longitudinal strip, and disks carried thereby forming partitions in said inner tube, the said partitions leaving space between their edges and the tube for the passage of the water in sheet-like currents, for the purpose described.

2. In a feed water heater and purifier, the combination with an inner tube and an outer tube inclosing the former and constituting a steam space, of caps closing the ends of said

tubes, longitudinal rods to maintain said caps in position, a valve-controlled steam pipe to admit steam into said steam space, a steam and drip discharge pipe, a set of cross partitions mounted on a connecting strip and having cut-away portions at the sides to form sheet-like currents of the water passed through the inner tube, whereby the partitions may be readily removed for cleaning, and effect a thorough heating of the water, and inlet and outlet water pipes to and from said inner tube.

3. In a feed water heater and purifier, the combination with an outer and an inner tube, and closing end caps therefor suitably packed to constitute a steam space between the tube and a water space within the tube, inlet and outlet water pipes therefor through said caps, substantially as shown and described, cross partitions for said inner tube provided with alternately located cut-away portions, adapted to form the opposing water into thin sheet-like currents, and direct them against the walls of said inner tube, perforated partitions provided with an interposed purifying and filtering filling, all the partitions being mounted on a longitudinal strip and adapted to be withdrawn from the inner tube, together with the deposits from the feed water, and thus facilitate cleansing, and a suitable covering or wrapping about the outer tube to obstruct the said loss of heat from said steam chamber.

4. In a water heater and purifier, the combination with an inclosing tube adapted to receive and deliver water, and means to heat said tube, of cross partitions within said tube consisting of disks of nearly the diameter of the tube, and having cut-away portions to form the passing water into thin sheets adjacent to the sides of the tube, and a connecting strip on which said disks are mounted, the disks supporting themselves by contact with the tube and separated by the strip, whereby the strip-connected disks may be withdrawn from the tube for cleaning.

5. In a feed water heater and purifier, the combination with an inclosing tube, of the hereindescribed cross partitions, consisting of disks having cut-away portions near their edges adjacent to the tube, for the purpose described, the cut-away portions alternating in adjacent partitions, to commingle the water currents, and perforated partitions adapted to maintain a filtering filling in place, and a connecting strip for said partitions to preserve their relative positions when mounted within the tube, and allow of removing them therefrom, substantially as and for the purpose described.

In testimony whereof I affix my signature in presence of two witnesses.

FRANK GOODFELLOW.

Witnesses:

OLIVER H. MILLER,  
WARREN M. MCNAIR.