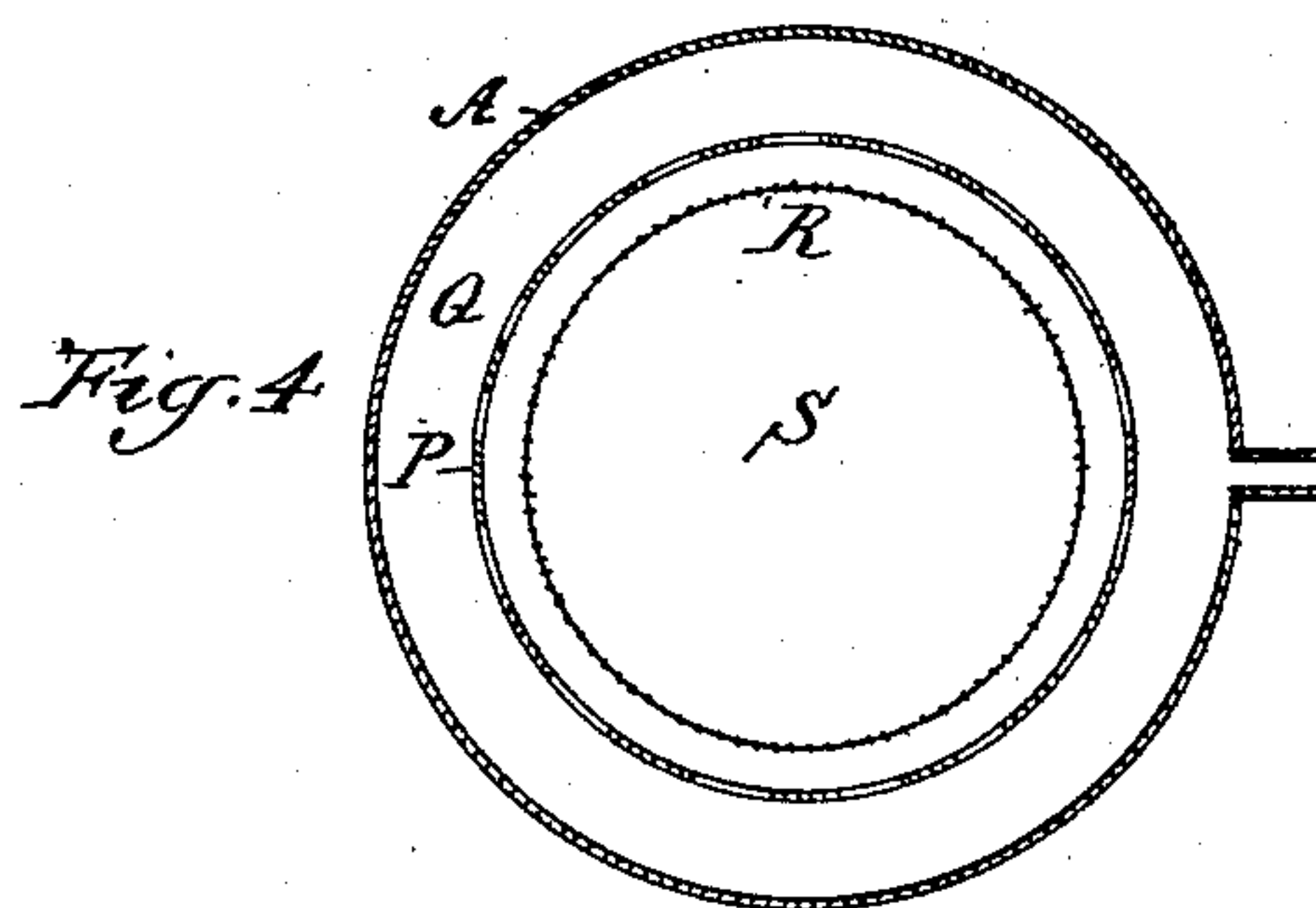
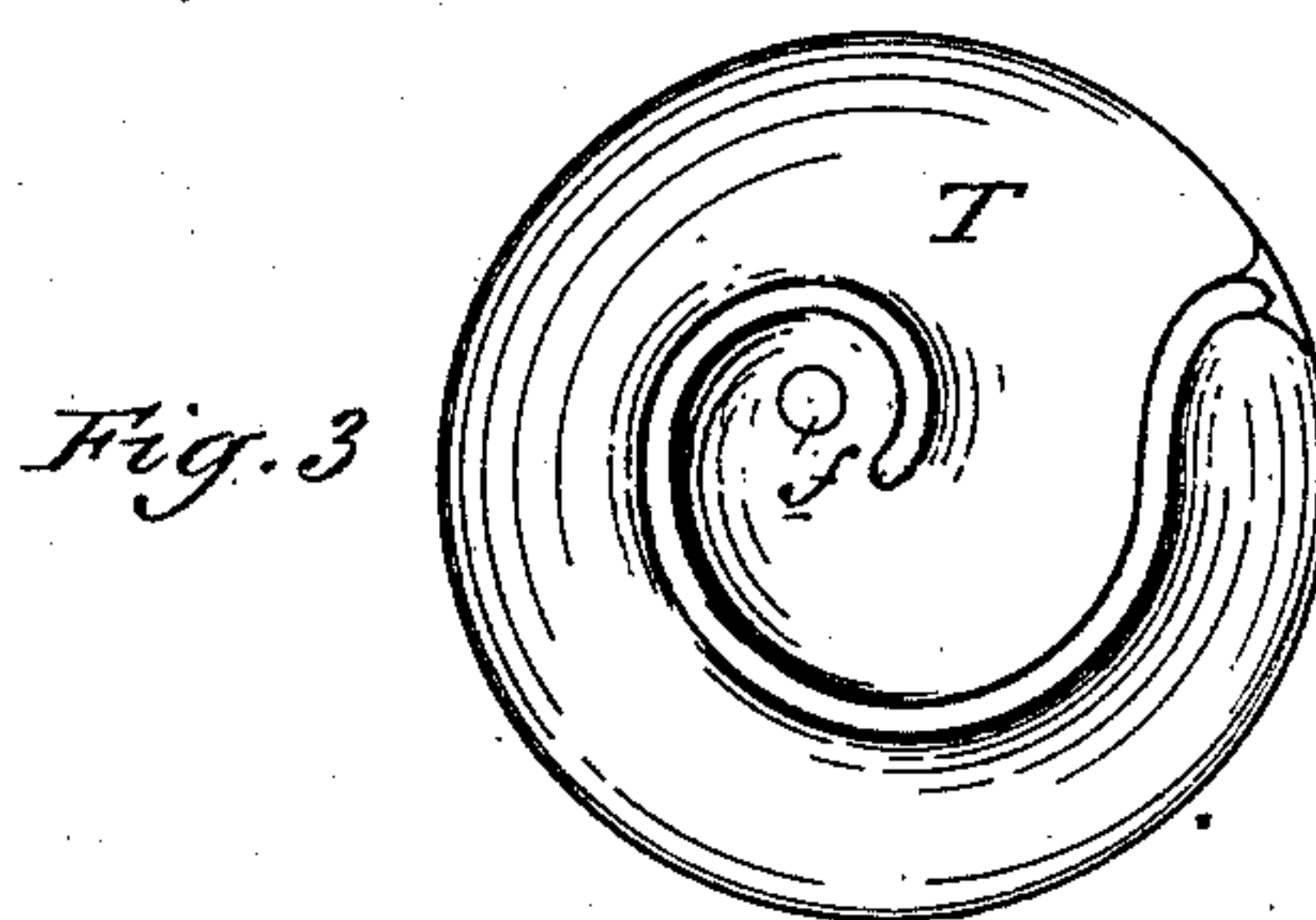
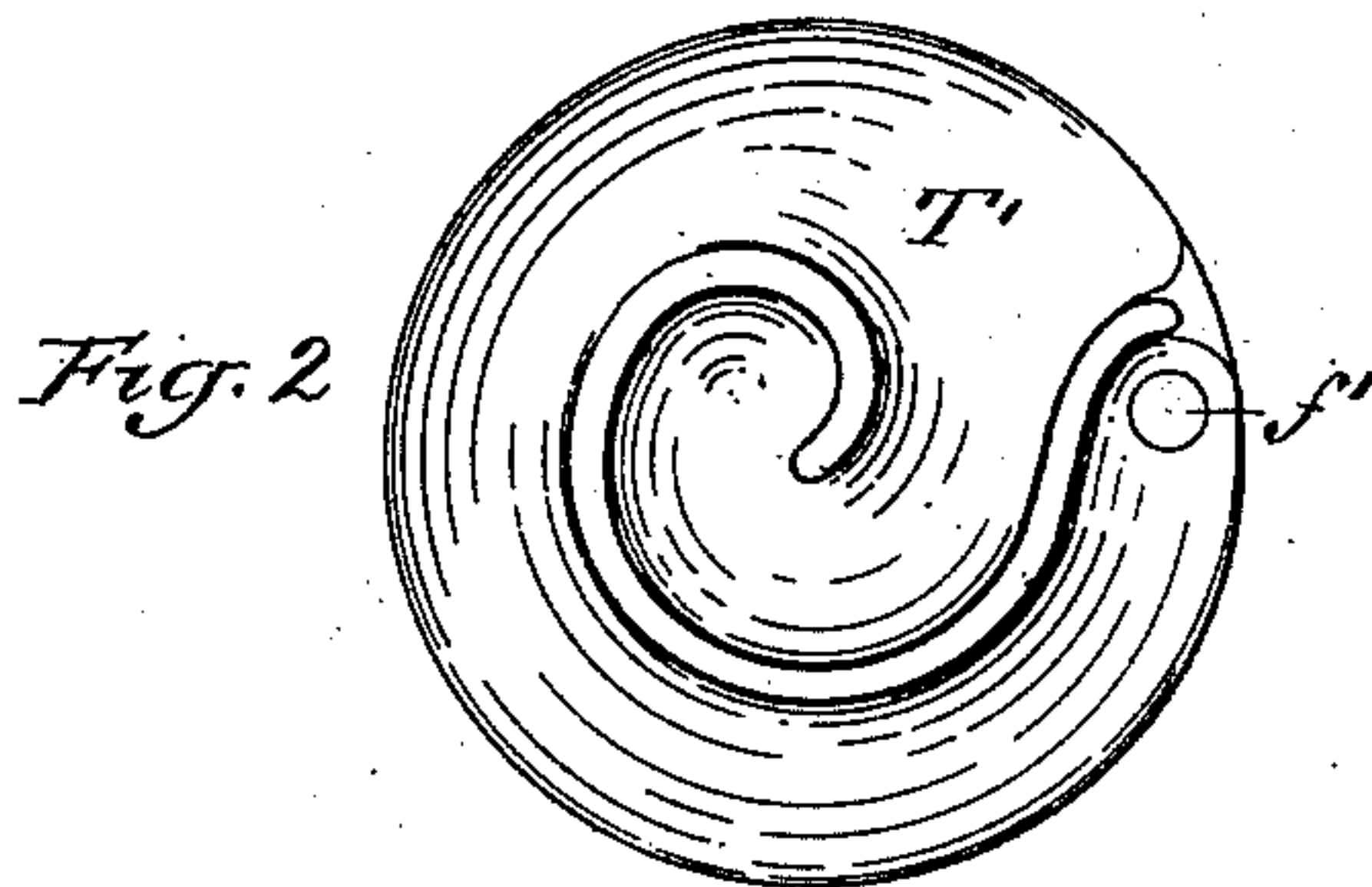
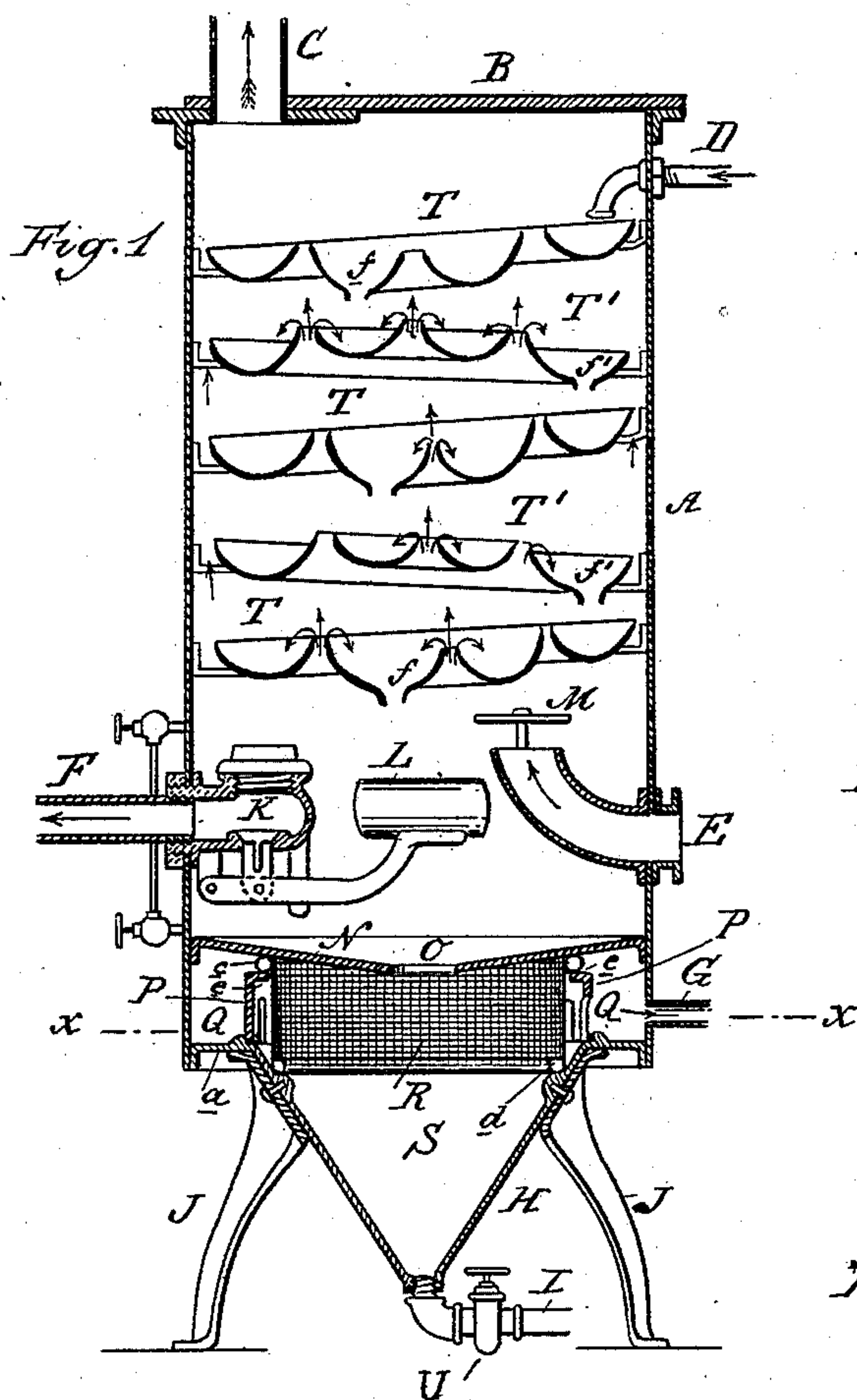


(No Model.)

A. F. WARD.
FEED WATER HEATER.

No. 279,848.

Patented June 19, 1883.



Attest:
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UNITED STATES PATENT OFFICE.

ALEXANDER F. WARD, OF DETROIT, MICHIGAN.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 279,848, dated June 19, 1883.

Application filed April 19, 1883. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER F. WARD, of Detroit, in the county of Wayne and State of Michigan, have invented new and useful Improvements in Feed-Water Heaters; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form a part of this specification.

This invention relates to a new and useful improvement in feed-water heaters; and it consists, first, in the peculiar construction and arrangement of a series of spiral troughs in which the feed-water is exposed to the action of the exhaust-steam within the heater; second, in the devices employed for freeing the feed-water from the solid precipitations before conducting it to the boiler; third, in the disposition and arrangement of the different parts within the heater-shell; fourth, in the constructive features of some of the operating parts.

In the drawings, Figure 1 is a vertical central section of my feed-water heater. Fig. 2 is a plan view of one of the spiral troughs with a peripheral discharge. Fig. 3 is a plan view of one of the spiral troughs with a central discharge. Fig. 4 is a cross-section on line X X.

A is the cylindrical shell of the heater, which is provided with a detachable cover, B, and a discharge-pipe, C, for the escape of air and non-condensed steam from the heater.

D is the inlet for the supply-water. E is the inlet for the exhaust-steam; F, the overflow-pipe, and G the feed-water-supply pipe. The lower end of the shell forms an inverted conical receptacle, H, provided with a bottom discharge-pipe, I.

J are the supporting-legs of the device.

K is an overflow-valve controlled by a float, L.

M is a spreader-disk over the discharge end of the steam-inlet pipe E.

N is a diaphragm, dished toward the center, which is provided with the opening O.

P is a short perforated cylinder of smaller diameter than the shell, and placed concentrically within the same, so as to form an annular water-chamber, Q, extending between the bottom *a* of the shell and the diaphragm N.

R is a cylindrical cage or screen, made of burlap or other suitable material, and secured

at the top and bottom to the rings or frames *c d*, respectively. The top frame, *c*, is supported upon the annular flange *e* of the perforated cylinder, and fits snugly into the interstice left between the latter and the diaphragm N, thereby forming an inclosed settling-chamber, S, to which the only access is through the opening O.

T T' are an alternating series of metal pans located in the upper part of the heater. As shown in the drawings, each of these pans represents a trough arranged in spiral form, with open interstices between the convolutions. In the pans T the trough forms a helix with the highest point in the periphery and the lowest in the center, which is there provided with a bottom discharge, *f*. The pans T' are formed similarly with the highest point of the trough, however, in the center, and the lowest point in the periphery, which is there provided with a bottom outlet, *f'*. These pans are supported, one below the other, in alternating series, in any convenient manner, upon each other, or upon lugs on the inside of the heater-shell, so that they may be easily removed and replaced again. They may be made, preferably, of cast-iron as thin as convenient, especially at the edges of the troughs, and when in position must leave an annular space between them and the shell of the heater.

In practice the water-supply is conducted through the inlet D upon the periphery of the top pan, and, following the convolutions of the trough, flows to the center of the pan, from where it is discharged upon the next lower pan, which conducts the water in the convolutions of the trough toward its periphery, from whence it is discharged again upon the next lower pan, and so on through all the remaining pans until it is discharged from the last one in a heated condition, owing to the action of the incoming exhaust-steam, which, on its passage from the steam-inlet E toward the discharge C, is obliged to part with most of its heat by being brought in contact with all the exposed surfaces of the pans. The spreader M, the peculiar shape and arrangement of the pan, the small contracting interstices between the convolutions of the troughs, and the thin edges thereof, all combine to make the steam in its upward passage permeate the whole space and part with its heat by direct and in-

direct contact with the supply-water carried down in the troughs. All the sediment from the water falls upon the dished diaphragm N, which discharges it through the opening O into the settling-chamber S, which collects it at the bottom thereof and allows the removal by opening the valve U in the pipe I. The peculiar construction of the settling-chamber S makes its action very effective, as no disturbing action can pass within.

The feed-water for the steam-generator is obtained from the water-chamber Q, and in order to pass to that chamber it has to pass first through the meshes of the vertical screen R, whereby all sediment is retained.

It will be seen that the arrangement and construction of all the parts are very favorable for self-cleaning and for the easy removal of all sediment; for convenience' sake, however, the device is also provided with hand-holes where deemed advisable.

What I claim as my invention is—

1. In a feed-water heater, a series of pans each provided with an open convolute water-way, the said pans being supported and arranged in alternating oppositely-inclined positions, with discharge-openings from each, alternating from center to circumference, all arranged and combined to form a continuous water-way through the whole series, and to form

steam-passages between the individual pairs and their convolute ways, substantially as herein set forth.

2. In a feed-water heater, an open spiral water way or trough whose open passages between its convolutions are contracted at the top, and in combination with the thin edges of the trough, whereby the steam passing through said passages is transformed into a jet, and after its passage partly deflected upon the contents of the trough, substantially as described and shown.

3. In a feed-water heater, an inverted conical settling-chamber formed at the bottom of the heater, in combination with the superimposed perforated cylinder P and centrally-perforated diaphragm N, forming the means of exit and entrance of the feed-water, substantially as and for the purpose described.

4. In a feed-water heater wherein a cylindrical mud-screen is placed at the top of an inverted conical settling-chamber, with the water-inlet centrally to it, and the water-chamber from which the supply is drawn circumferentially around it, substantially as and for the purposes specified.

ALEXANDER F. WARD.

Witnesses:

H. S. SPRAGUE,
E. W. ANDREWS.