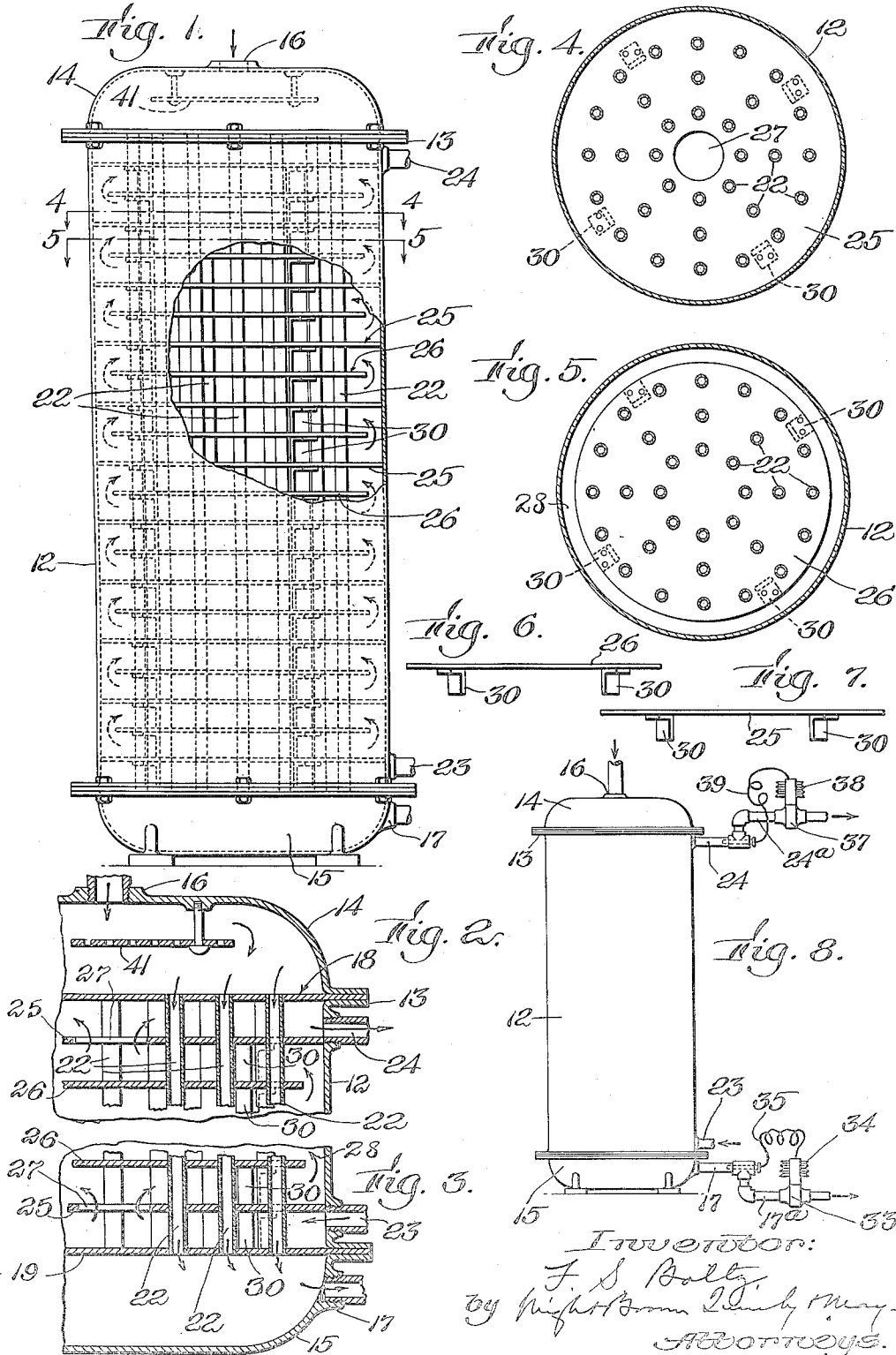


F. S. BOLTZ.
HEAT ECONOMIZING APPARATUS.
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Inventor:
F. S. Boltz
by *Wightman & Co.*
ATTORNEYS.

UNITED STATES PATENT OFFICE.

FRED S. BOLTZ, OF CAMBRIDGE, MASSACHUSETTS.

HEAT-ECONOMIZING APPARATUS.

1,226,299.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, FRED S. BOLTZ, a citizen of the United States, residing at Cambridge, in the county of Middlesex and State of Massachusetts, have invented new and useful Improvements in Heat-Economizing Apparatus, of which the following is a specification.

This invention has for its object to provide an apparatus for utilizing the heat of a heated fluid, such as dirty hot water which has performed its function in a laundry, dye-house, wool scouring plant, or elsewhere, and commonly runs to waste while hot.

The invention is embodied in the improvements hereinafter described and claimed in a conduit structure comprising a ramified descending conduit having an inlet at its upper end and an outlet at its lower end, and adapted to ramify a stream of dirty hot water and conduct its ramifications downwardly while the water is running to waste, and a sinuous ascending conduit having an inlet at its lower end and an outlet at its upper end, and adapted to conduct clean cold water upwardly in a sinuous course across the ramifications of the descending conduit, the ascending clean water absorbing heat from the ramifications of the descending dirty hot water, so that the temperature of the ascending water is gradually raised for a useful purpose and that of the descending water gradually lowered, waste of heat being therefore eliminated or reduced to a minimum.

The invention is also embodied in the combination with the said conduit structure of thermostatic valves associated with the outlets of the two conduits and controlled by the heat of the streams of liquid, to either retard or accelerate the flow thereof, the flow of the descending current being retarded by a rise of temperature and accelerated by a decrease of temperature at the outlet, while the flow of the ascending current is accelerated by a rise of temperature and retarded by a decrease of temperature at the outlet.

Of the accompanying drawings forming a part of this specification:

Figure 1 represents a side elevation of a conduit structure embodying my invention, a part being broken away;

Figs. 2 and 3 represent fragmentary sec-

tional views of the upper and lower end portions of said structure;

Fig. 4 represents a section on line 4—4 of Fig. 1;

Fig. 5 represents a section on line 5—5 of Fig. 1;

Figs. 6 and 7 represent edge views of two of the baffle plates hereinafter described;

Fig. 8 represents a side elevation showing thermostatic valves associated with the outlets of the descending and ascending conduits.

The same reference characters indicate the same or similar parts in all the views.

In the preferred embodiment of my invention here shown the conduit structure includes a substantially vertical hollow body 12, preferably cylindrical and provided with flanges 13 at its upper and lower ends, said body having a large cross sectional area.

14 and 15 represent recessed flanged heads bolted to the flanges of the body, the upper head 14 being provided with an inlet 16 and the lower head 15 with an outlet 17 for dirty water, which enters while hot and is discharged relatively cold.

Between the said heads and the ends of the body are tube sheets 18 and 19, preferably clamped with suitable packing rings between the flanges of the body and heads, as shown by Figs. 2 and 3, said heads and tube sheets forming upper and lower dirty water chambers.

With the tube sheets 18 and 19 are engaged the opposite ends of a plurality of tubes 22 extending vertically through the body 12. The said chambers and tubes constitute a ramified descending conduit through which the dirty water passes downwardly in numerous ramifications from the inlet 16 to the outlet 17.

The body 12 is provided at its lower end with an inlet 23 and at its upper end with an outlet 24.

Between said inlet and outlet are disposed substantially horizontal spaced-apart baffle plates 25 and 26, which are apertured to receive the tubes 22, and are formed to guide clean water entering at 23 in a sinuous upward course to 24, the water flowing repeatedly across the tubes 22, and absorbing heat therefrom.

The plates 25 are preferably formed to have a sliding fit on the inner surface of the body 12, each being provided with a central

aperture 27. The plates 26 alternate with the plates 25, and are preferably of smaller diameter than the latter, so that annular spaces 28 are formed around the plates 26.

It will now be seen that the body 12, tube sheets 18 and 19, and baffle plates 25, 26, constitute an ascending conduit adapted to conduct the clean water upwardly in a sinuous course and cause it to flow effectively across the tubes 22. The tube-receiving orifices in the baffle plates preferably have a sliding fit on the tubes 22, and the larger baffle plates have a sliding fit in the body 12 so that in practice the parts may be assembled by first securing the tubes to one of the tube sheets, then sliding the baffle plates onto the tubes, then inserting the tubes in the body 12 and applying the engaged tube sheet to said body, and finally applying the other tube sheet to the body and engaging it with the tubes.

The baffle plates are provided with spacing means preferably embodied in legs or struts 30 projecting downwardly from their under sides. The legs of the lowest baffle plate may be supported by the lower tube sheet 19, said plate supporting the other baffle plates through the legs thereof.

41 represents a perforated baffle plate attached to the head 14 and adapted to distribute the water entering at 16 over the tube sheet 18.

To insure sufficiently prolonged contact of the ascending clean water with the tubes 22, I combine with the outlets 17 and 24 thermostic valves adapted to automatically regulate the flow of water through each outlet.

The outlet 17 has an extension 17^a in which is a valve casing 33, the movable valve member of which has its stem connected with a flexible bellows 34 which receives through a flexible tube 35 an expansible liquid contained in a bulb within the outlet 17. When the water is relatively hot it acts to expand the liquid in said bulb, tube, and bellows and move the valve member toward its closed position, thus retarding or stopping the flow of water through the outlet 17. When the water is relatively cold the bellows contracts and opens the valve member, thus accelerating the flow of water.

The outlet 24 has an extension 24^a in which is a valve casing 37, the movable valve member of which has its stem connected with a flexible bellows 38 which receives through a flexible tube 39 an expansible liquid contained in a bulb within the outlet 24. When the water is relatively hot it acts to expand the liquid in said bulb, tube, and bellows, and move the valve member toward its open position, thus accelerating the flow of water through the outlet 24. When the water is relatively cold the contraction of the bellows moves the valve member to or toward its

closed position, thus retarding or stopping the flow of water.

Provision is therefore made for preventing loss of thermal efficiency by the discharge through the outlet 17 of hot dirty water, and to regulate the discharge through the outlet 24 of clean hot water.

Thermostatic valves of the character briefly described above are well known, so that a detailed description and illustration of the same are not deemed necessary.

While I prefer to arrange the two conduits so that liquid will descend through one and ascend through the other, I do not limit myself to this arrangement, and may so arrange the conduits that the dirty hot water will flow in an approximately vertical direction, and the clean water will flow in a generally horizontal direction, although sinuously, force being employed to impel both streams.

Believing myself to be the first to provide a conduit structure comprising two involved conduits, one adapted to conduct hot dirty water in a predetermined path, and the other to conduct clean relatively cold water in a different path and cause its impingement on the hot water conduit, and the transference of heat from one conduit to the other, I do not limit myself to the specific embodiment of my invention shown by the drawings except as otherwise required in certain of the more limited claims.

Having described my invention, I claim:

1. An apparatus of the character stated, comprising a hollow body forming a conduit portion of large cross sectional area having a fluid inlet at one end and a fluid outlet at its opposite end, recessed heads attached to the ends of said body, the one head having a fluid inlet and the other head a fluid outlet, tube sheets between the said heads and the ends of the body, said heads and tube sheets forming chambers at the ends of the body, parallel tubes engaged with said tube sheets and extending through the body, a series of baffle plates apertured to receive and slide to place on said tubes and adapted to slide to place in said body, and means for supporting said plates in spaced relation to each other, the said chambers and tubes constituting a ramified conduit adapted to conduct a heated fluid from one chamber to the other, and the said body, tube sheets and baffle plates forming a sinuous conduit inclosing said tubes, adapted to receive a relatively cold fluid at its inlet, and conduct the fluid in a sinuous course crosswise of said tubes to its outlet.

2. An apparatus of the character stated, comprising a hollow body forming a conduit portion of large cross sectional area, having a fluid inlet at one end and a fluid outlet at its opposite end, recessed heads attached to the ends of said body, the one

head having a fluid inlet and the other head
a fluid outlet, tube sheets between said heads
and the ends of the body, said sheets and
heads forming end chambers, tubes engaged
5 with said tube sheets and extending through
the body, and a series of baffle plates aper-
tured to receive said tubes and provided
with spacing means, supporting means be-
ing provided for the plate at one end of the
10 series, and the other plates of the series be-
ing supported by the said plate.

3. An apparatus of the character stated,
comprising a hollow body forming a con-
duit portion of large cross sectional area,
15 having a fluid inlet at one end and a fluid
outlet at its opposite end, recessed heads
attached to the ends of said body, one head
having a fluid inlet and the other head a
fluid outlet, tube sheets between said heads
20 and the ends of the body, said sheets and
heads forming end chambers, tubes engaged
with said tube sheets and extending through
the body, and a series of baffle plates aper-
tured to receive said tubes and provided
25 with spacing means, the spacing means of

the plate at one end of the series bearing on
one of the tube sheets, and the other plates
of the series being supported by the said
plate.

4. In combination, a conduit structure 30
comprising a ramified conduit having an
inlet at one end and an outlet at its opposite
end, and adapted to ramify and conduct a
heated fluid, and a sinuous conduit having
an inlet at one end and an outlet at its op- 35
posite end, and adapted to conduct a rela-
tively cold fluid in a sinuous course across
the ramifications of the ramified conduit, a
thermostatic valve associated with the outlet
of the ramified conduit and adapted to be 40
opened by a decrease of temperature and
closed by a rise of temperature, and a ther-
mostatic valve associated with the outlet of
the sinuous conduit and adapted to be opened
45 by a rise of temperature and closed by a de-
crease of temperature.

In testimony whereof I have affixed my
signature.

FRED S. BOLTZ.