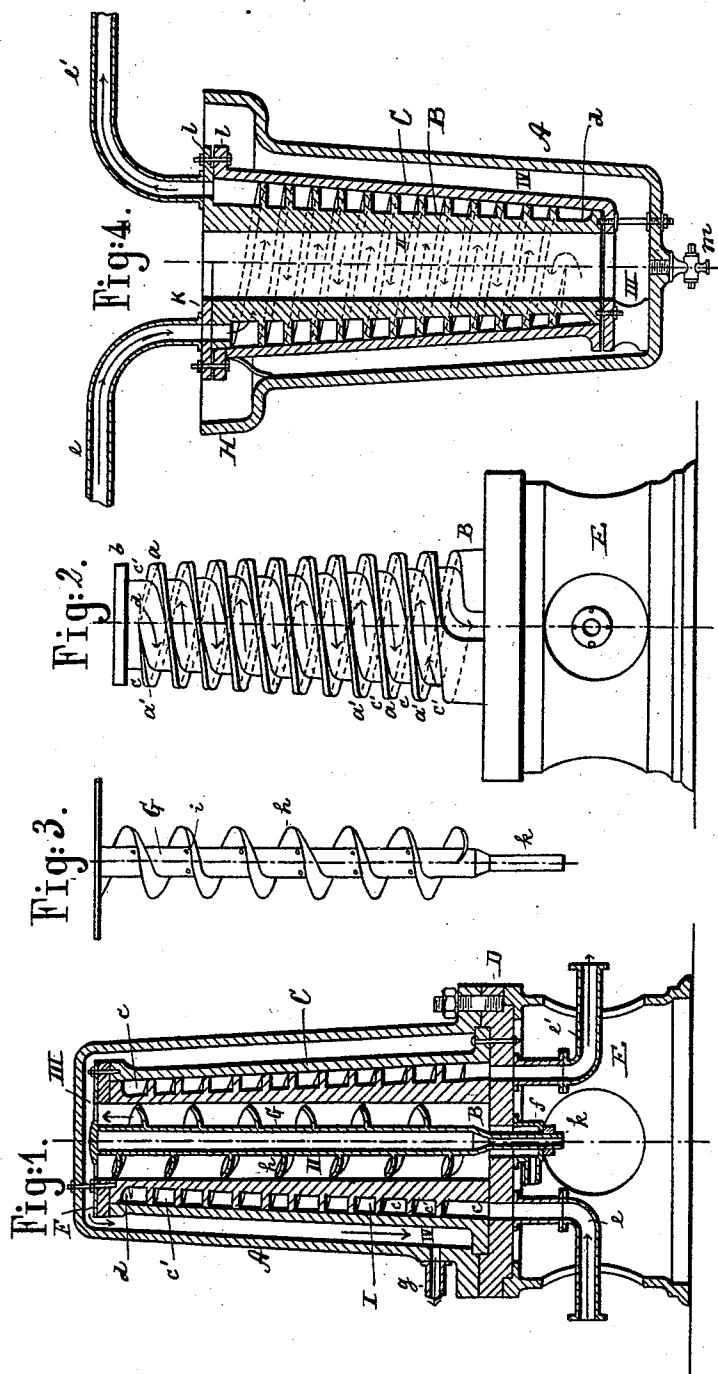


(No Model.)

H. KOHL.
FEED WATER HEATER

No. 536,354.

Patented Mar. 26, 1895.



Witnesses
William Schulz
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UNITED STATES PATENT OFFICE.

HUGO KOHL, OF EUSKIRCHEN, GERMANY.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 536,354, dated March 23, 1895.

Application filed February 8, 1894. Serial No. 499,532. (No model.)

To all whom it may concern:

Be it known that I, HUGO KOHL, machine master, a subject of the King of Prussia, and a resident of Euskirchen, in Rhenish Prussia, Germany, have invented certain new and useful Improvements in Feed-Water Heaters, of which the following is a specification, reference being had therein to the accompanying drawings.

10 The heater is drawn in Figure 1 in longitudinal section, while Figs. 2 and 3 show different parts in front view, and Fig. 4 a modification of the apparatus for a special purpose in longitudinal section.

15 The apparatus consists of three chief parts, the outer pot A, the inner tube B and the casing C, situated between the two. In the arrangement as in Fig. 1, these three parts are fitted on a common bottom-plate D, which in its turn rests on a raised support, either as in the drawings, a cast-iron ring E, or masonry, or wooden blocks or wrought-iron feet, or a kind of tripod. The parts B and C are connected with each other at the top by an air-tight ring F. Indeed, all surfaces where A B C D and F touch each other are well turned and fit closely together.

20 The inner-tube B—in Fig. 2 drawn in front-view—is provided on its outer surface with two screw-threads *a* and *a'* running between each other and terminating at the top below the end-flange *b* diametrically opposite each other, so that the spiral-shaped passages C C' formed between the two screw-threads are connected at the top by a ring-passage *d*. The lower ends of the passages C C' are carried vertically downward diametrically opposite each other and have their outlet through the plate D into pipes that are placed there. The casing C lies close on the screw-threads *a a'*. Thus in the interior of the apparatus there are two spaces formed, separated from each other, namely, between plate D, tube B, casing C and ring F, space I forming two passages winding in the shape of a screw and running between each other, but connected at the top with each other, and between plate D and tube B a cylindrical space II which is connected by means of the free space III remaining between ring F and the bottom of the pot A with the outer ring-shaped space IV, formed between pot A and casing C. Water

or steam can be conducted, according as desired, through space I, when steam or water correspondingly passes through the other spaces.

In Fig. 1, it is taken for granted that the water passes through space I and is heated by the steam circulating in the other space. The cold water enters by the tube *e* into the spiral shaped passage *c*, ascends in it through the ring-passage *d*, and then descends again in the spiral-shaped passage *c'* and flows out in a heated state through the tube *e'*. The steam enters by an upright tube *f* in the center of the plate D into the space II, ascends in it through the space III into the space IV and descends in the latter, till it finds an outlet at *g*. In order now, on the one hand, to carry away the waste water, formed more especially in the space III by the contact of the hot steam with the cold water, and on the other hand to better press the steam against the walls of the tube B and to force it to completely give off its heat by pressing against it on as long a way as possible, there is another tube G placed from above in the space II which is specially drawn in Fig. 3. This tube has on its circumference a spiral-shaped groove *h*, lying with its exterior edge on the tube B. Along the groove in the tube G there are fine holes *i* made, which allow the waste water collected in the groove to enter into the interior of the tube. The tube is drawn out into a narrow point *k*, which passes into the steam-inlet-pipe *f*, and reaches through its lower wall so as to be able to be connected here with a tube for carrying away the wastewater. The steam, that has entered through *f*, is thus forced to ascend, following the thread of the groove *h* and thus passing round the tube G, and in doing this, it thoroughly heats the walls of the tube B in all its parts, and gives off its waste water to the groove *h* and through the holes *i* to the tube G, whence it flows off below.

Fig. 4 shows the application of the apparatus with a slight modification, to the heating of fluids by exhaust-steam, which are not continuously to flow through, but are to be heated for a lengthened time in fixed quantities. In this case the juice of sugar in sugar-refineries is taken as an example. The juice foams to a great extent and therefore the ves-

sel in question must be open at the top and not quite full and have a protecting rim to prevent the foaming over. This is attained in Fig. 4, by the apparatus drawn in Fig. 1
 5 being placed on its head, *i. e.*, on the bottom of the pot A, the plate D taken away and the casing of A being provided with the margin-
 10 ring H. The lower end of casing C is in this modification supported upon the base of shell
 15 A, and at a distance therefrom, by means of upright bolts. The inner or spiral tube B rests directly upon the flanged lower end of casing C. The parts B and C should be closely
 20 connected with each other by a ring K at the upper end, where the plate D is now missing and which was formerly the lower end; but the connection can also be made directly by
 25 flanges *l*, as well above as below, as is shown in the right-half of Fig. 4. In this case, as
 30 represented in Fig. 4, the steam entering at *e* and passing out at *e'* goes through space I, while the other spaces of the apparatus are filled with the fluid (sugar-juice), which is let in above and finally flows out below through
 35 a cock *m*. The waste water formed in space I is collected in the ring-space *d* and carried from here sidewise through the casing of A.

The chief advantage of this heater over the others that exist, is in the double spiral,
 30 which causes the water and the steam to travel a very long way in opposite directions, thereby effecting the most complete utilization of the heat of the steam, as well as a very uniform distribution of heat in all parts of the water,

the descending hotter layers of water either 35 passing between the ascending colder ones, or the descending colder steam between the ascending hotter steam and vice versa. Practical experiments have proved that in such an apparatus the well-water heated by the
 40 exhaust-steam of a steam-engine flowed off in almost a boiling state.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a feed water heater, the combination 45 of a tube having an external double thread, with an intermediate casing snugly fitting over said thread, whereby an ascending and descending steam or water way is formed, an
 50 outer casing and connections between the tube and casings, substantially as specified.

2. In a feed water heater, the combination of a tube having an external double thread, with an intermediate casing snugly fitting 55 over said thread, whereby an ascending and descending water way is formed, an outer casing, connections between the tube and casings, and with a perforated stem and a surrounding spiral within the tube, substan-
 60 tially as specified.

In testimony whereof I have signed this specification in the presence of two subscrib-
 60 ing witnesses.

HUGO KOHL.

Witnesses:

FRIEDR. KOTTHAUS,
 EVA HAUSEN.