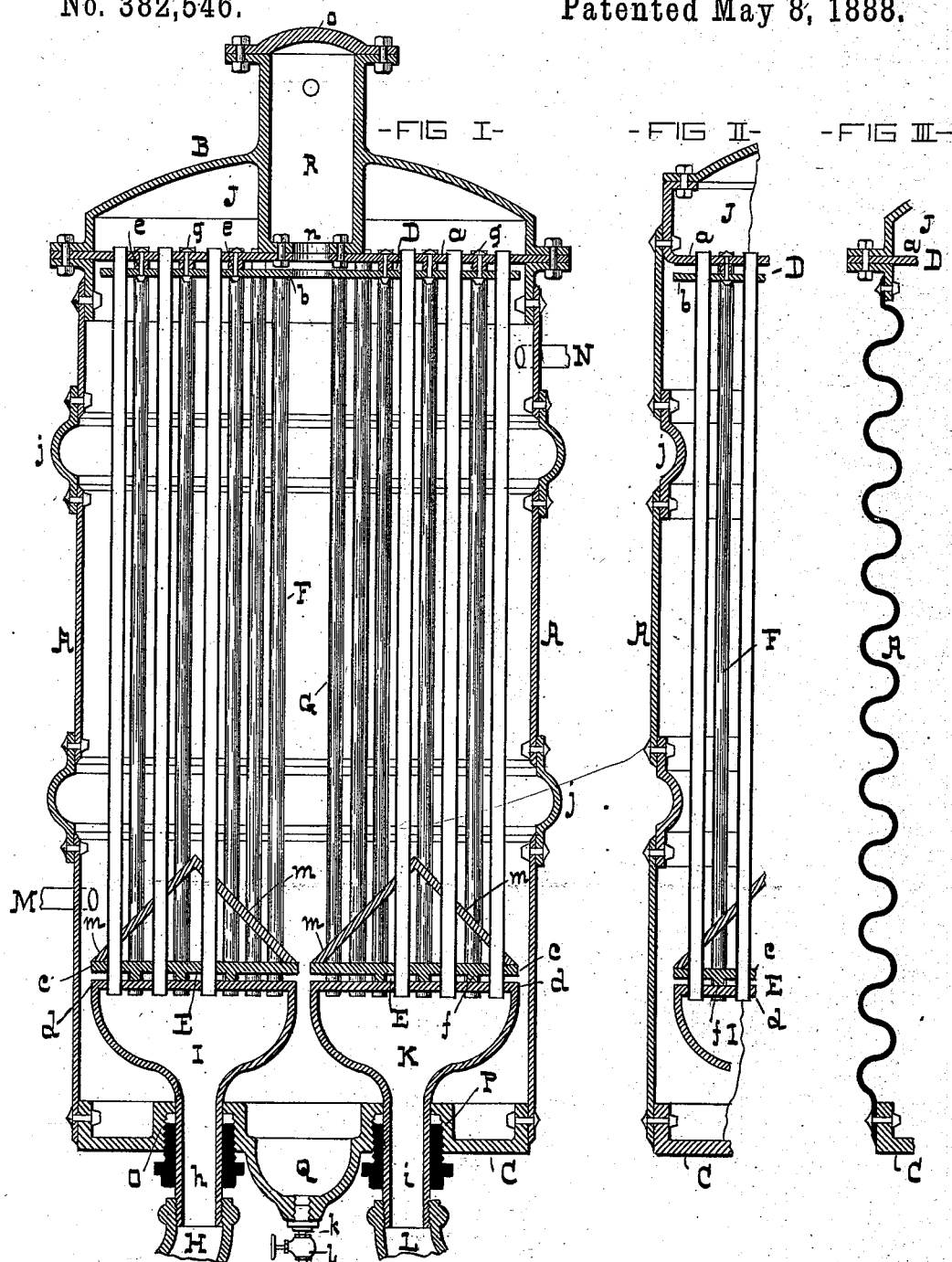


(No Model.)

E. J. MOORE.
FEED WATER HEATER.

No. 382,546.

Patented May 8, 1888.



-WITNESSES-

Daniel Fisher.

Frank Hodges.

-INVENTOR-

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UNITED STATES PATENT OFFICE.

EDWARD J. MOORE, OF PHILADELPHIA, PENNSYLVANIA.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 382,546, dated May 8, 1888.

Application filed May 24, 1887. Serial No. 239,169. (No model.)

To all whom it may concern:

Be it known that I, EDWARD J. MOORE, of the city of Philadelphia and the State of Pennsylvania, have invented certain Improvements in Feed-Water Heaters, of which the following is a specification.

In the description of the said invention which follows reference is made to the accompanying drawings, forming a part hereof, and in which—

Figure I is a sectional elevation of the improved feed-water heater, and Figs. II and III are similar views of parts of the same, which are somewhat modified in construction, as will be hereinafter described.

Similar letters of reference indicate similar parts in all the figures.

In the said drawings, A is the casing of the heater, and B and C are respectively the upper and the lower head of the same. D is the upper tube sheet or head, and E, E are the lower tube-sheets, which are separated, so as to be independent of each other. All these tube-sheets are made double—that is to say, they are each formed of two plates, respectively denoted by *a b* and *c d*, which are separated by the studs *e* and *f*. These studs may be formed as a part of one or both of the plates, or be separated from them, as preferred, and the whole connected by means of bolts or rivets *g*, as shown in the drawings. The object of the double tube-sheets is to effect a better hold for the tubes *F* and *G*, which are expanded in them without increasing the thickness of the metal.

The exhaust-steam from the engine enters the chamber I, attached to the tube-sheet E, through the pipe H and passes through the tubes *F* into the space J formed between the upper tube-sheet, D, and the casing-head B, thence down through the tubes *G* to the chamber K, similar to the one I, and out by way of the pipe L. The feed-water enters the heater at M and is delivered from the same at N.

It is evident that the steam upon entering the heater is at a higher temperature than when it leaves it, and the tubes *F*, through which the steam first passes, are therefore expanded to a greater length than the ones *G*, through which it subsequently passes in its escape from the heater. Consequently the tubes *F* and *G* are generally of different lengths when

the heater is in use. It is for this reason that I form the lower tube-sheets in two parts, E, as shown; and to admit of their assuming different heights with reference to the lower heater-head, C, I provide that head with the stuffing-boxes O and P and make the necks *h* and *i* to slide therein.

In case the necks *h* and *i* become fixed in their stuffing-boxes O and P, which would tend to strain the tubes *F* and *G*, I make the outer shell sufficiently elastic to prevent injury to the tubes by means of expansion-bands *j*. (Shown in Fig. I.) These bands are also shown in Fig. II; but in the latter case they are inverted.

In Fig. III, I make the whole casing corrugated, as shown, which has the same effect as the bands *j*.

Q is a mud-reservoir at the lower end of the heater, from which the accumulated mud may be blown through the pipe *k* upon opening the valve L.

To prevent the mud from collecting on the lower tube-sheets and to deflect it to the mud-reservoir, I provide the said sheets with plates *m*, connected together so as to present an angular form, as shown.

R is a scum-chamber formed in the upper heater-head, D, in which the scum as it rises collects. The scum enters through a small aperture, *n*, and the chamber can be cleaned at any time by first removing the cap *o*.

I claim as my invention—

1. In a feed-water heater, a casing or shell, heating-tubes divided into two groups and attached at their upper ends to a single or continuous tube-sheet and at their lower ends to separate tube-sheets, combined with chambers formed on the under side of the lower tube-sheets, having necks which pass through stuffing-boxes in the lower heater-head, substantially as and for the purpose specified.

2. In a feed-water heater, heating-tubes divided into two groups and attached at their upper ends to a single or continuous tube-sheet and at their lower ends to separate tube-sheets, chambers formed on the under side of the lower tube-sheets, having necks which pass through stuffing-boxes in the lower heater-head, combined with an extensible and contractible outer shell or casing, substantially as and for the purpose specified.

3. In a feed-water heater, one or more of the tube-sheets formed of two plates separated by means of studs, the said tubes being expanded in both of the separated plates, substantially
5 as and for the purpose specified,

4. In a feed-water heater, the lower tube-sheets provided with deflecting-plates to prevent the accumulation of mud on the same and to deflect it to a mud-reservoir, substantially
10 as and for the purpose specified.

5. In a feed-water heater, the lower tube-sheets provided with deflecting-plates to prevent the accumulation of mud on the said

sheets, combined with a mud-receptacle situated below the said deflecting-plates, substantially as and for the purpose specified. 15

6. In a feed-water heater, a scum-chamber situated near to the top of the heater, having a contracted entrance-aperture in its lower end, substantially as and for the purpose specified. 20

EDWARD J. MOORE.

Witnesses:

WM. T. HOWARD,
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