No. 840,523. PATENTED JAN. 8, 1907.

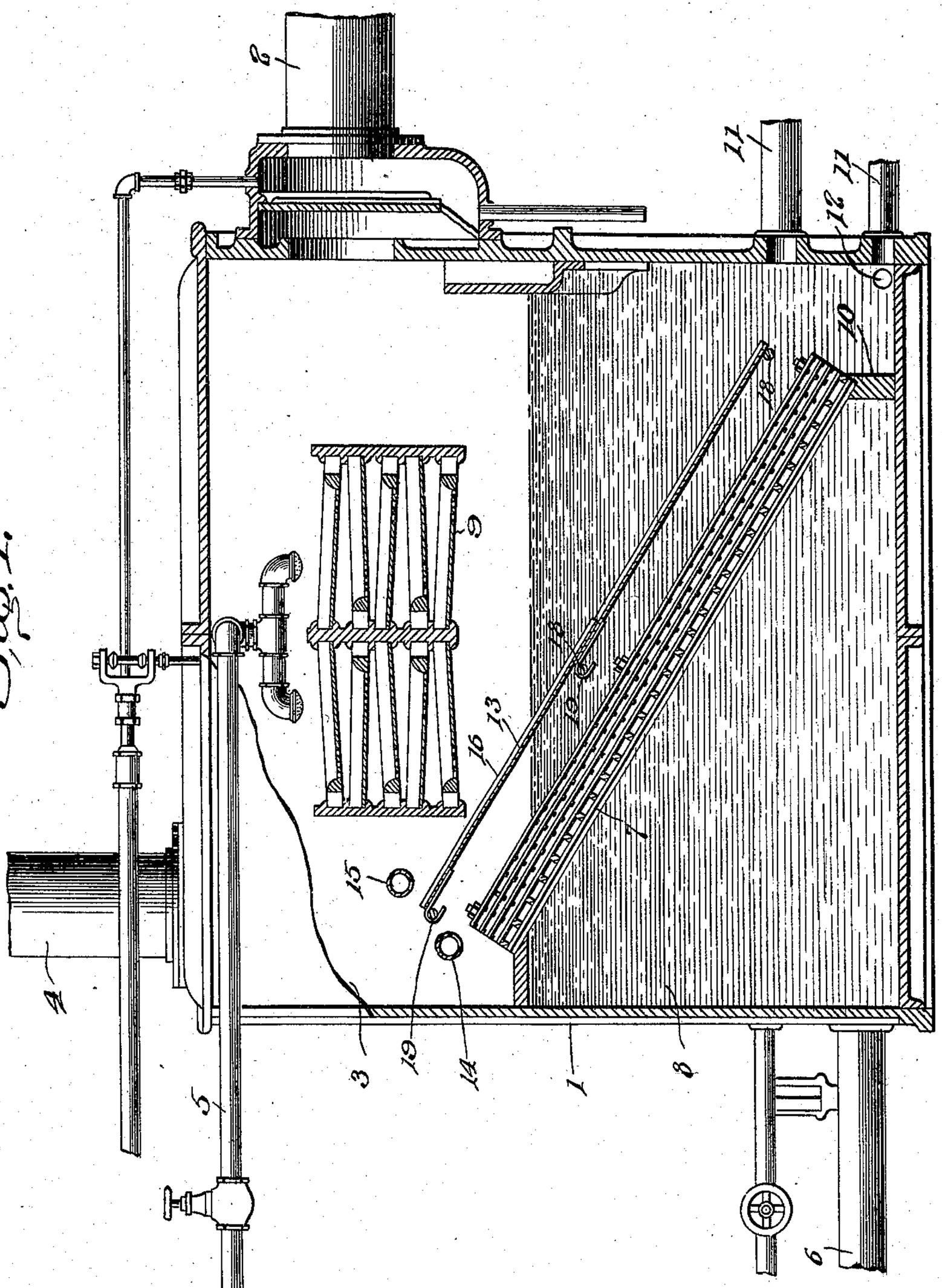
O. L. STUMP, J. REIDENBAUGH & E. D. PACKARD.

FEED WATER HEATER.

APPLICATION FILED JULY 3, 1905.

4 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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Irene Miller.

Inventors

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4 SHEETS—SHEET 2.

Fig. 2

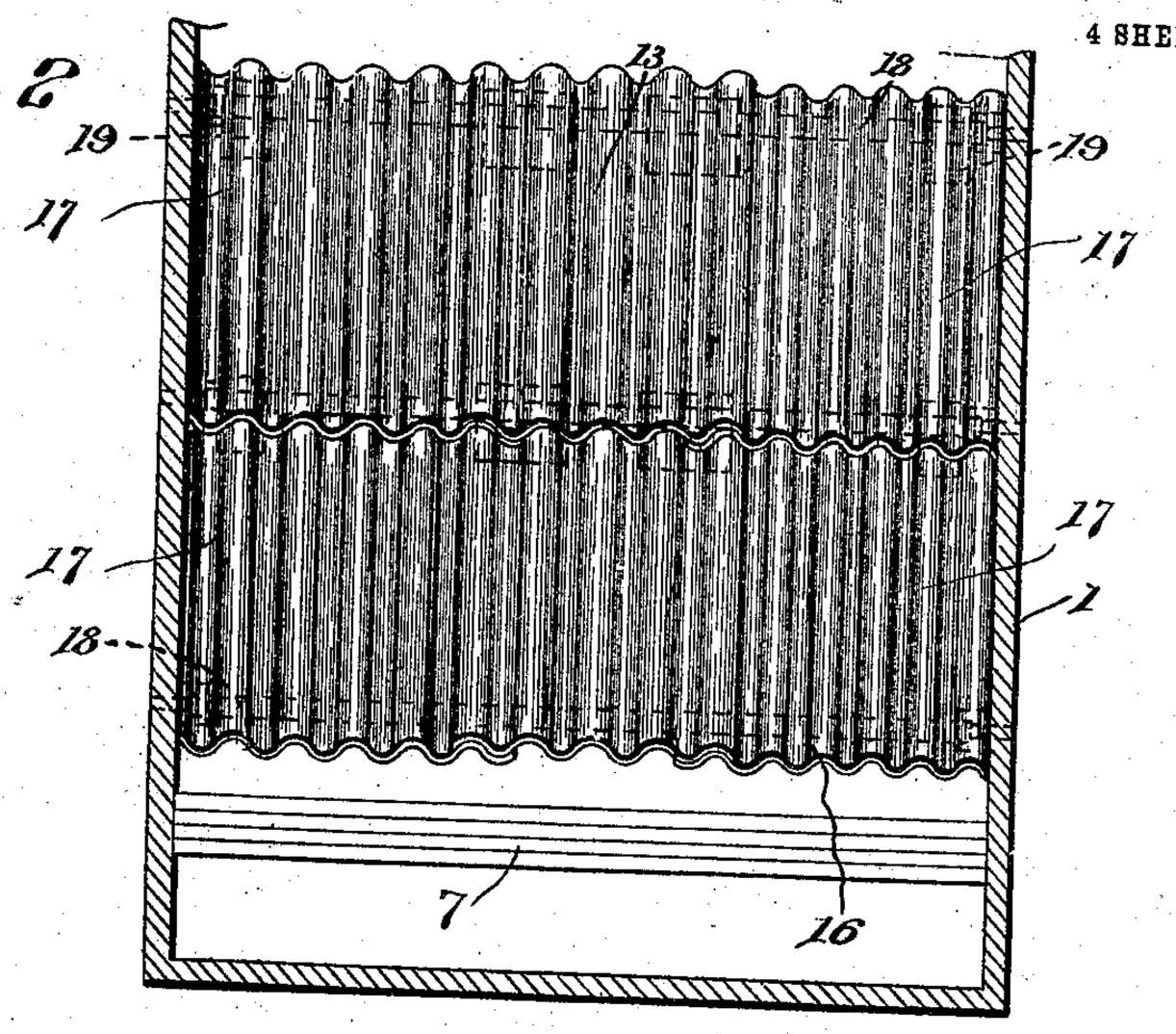


Fig. 3.

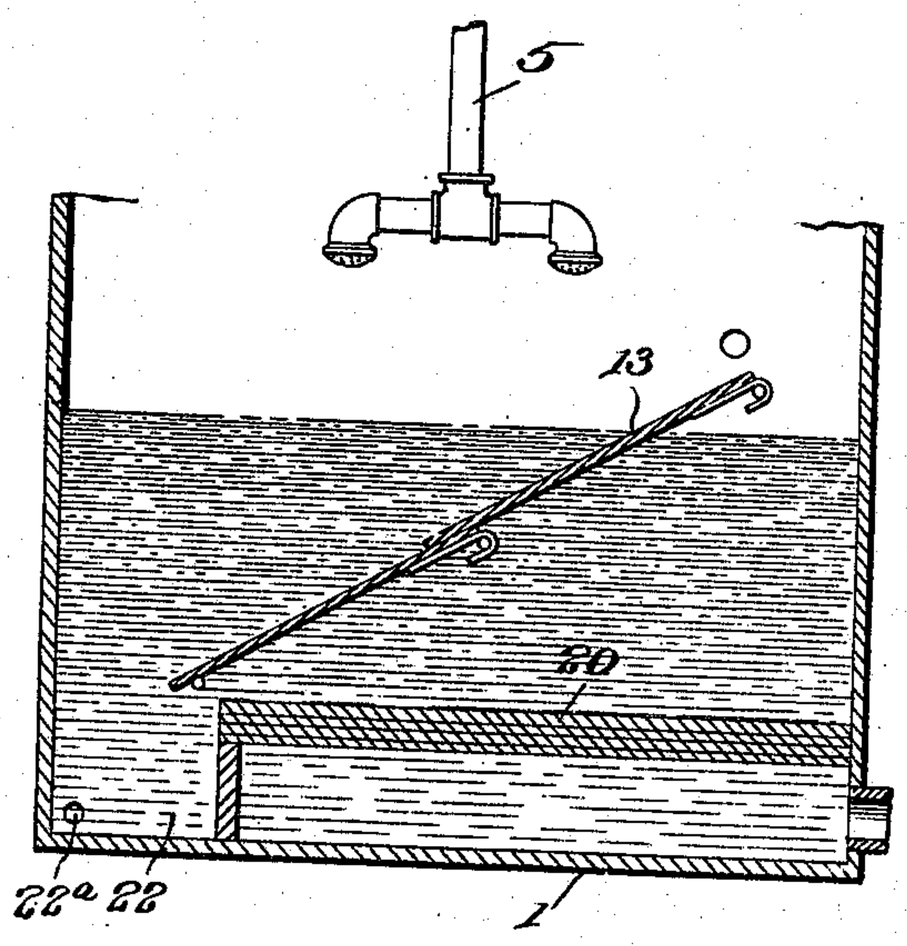
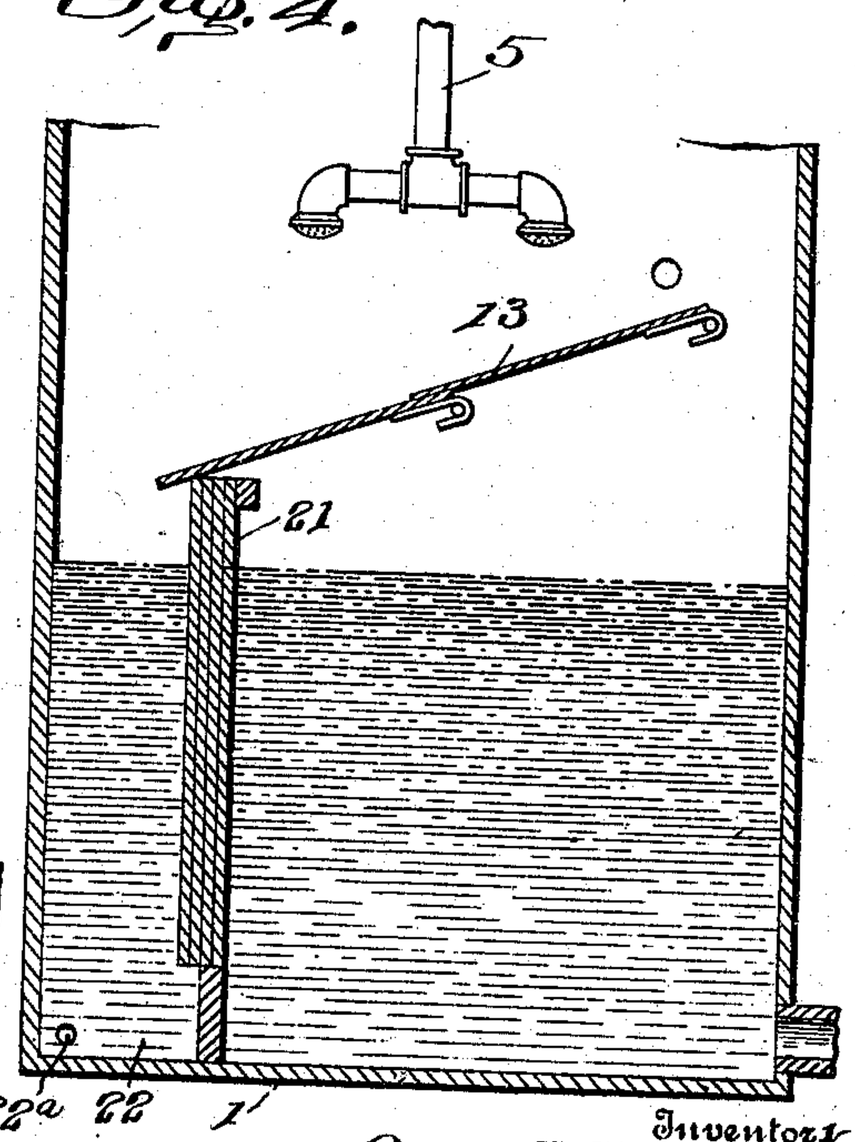


Fig. 4.



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4 SHEETS—SHEET 3.

Fig. 5.

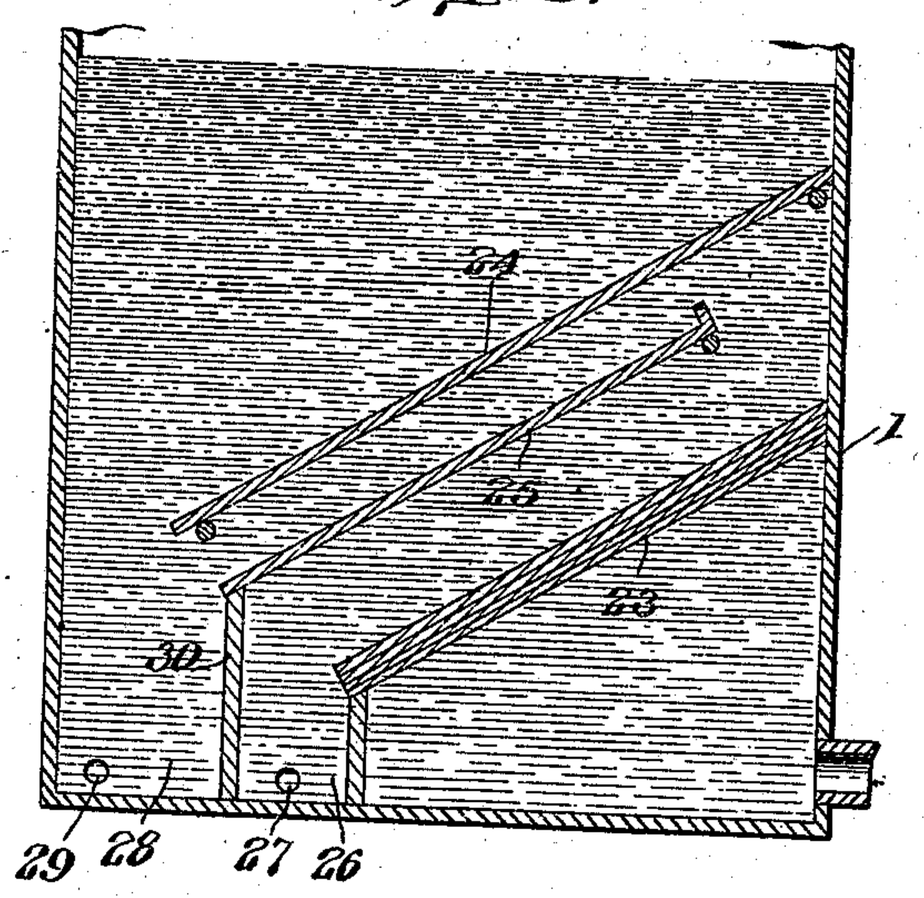

Fig. 7.

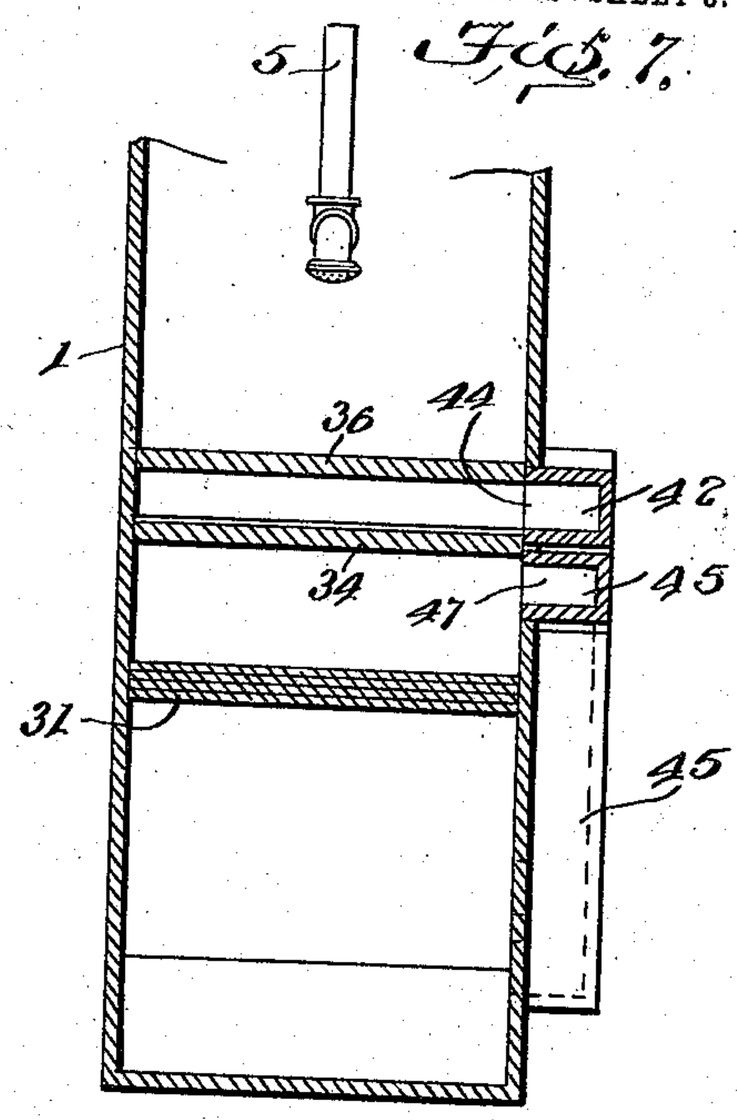

Fig. 6.

Witnesses:

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Irvine Miller.

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FEED WATER HEATER.

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4 SHEETS—SHEET 4

Fig. 9.

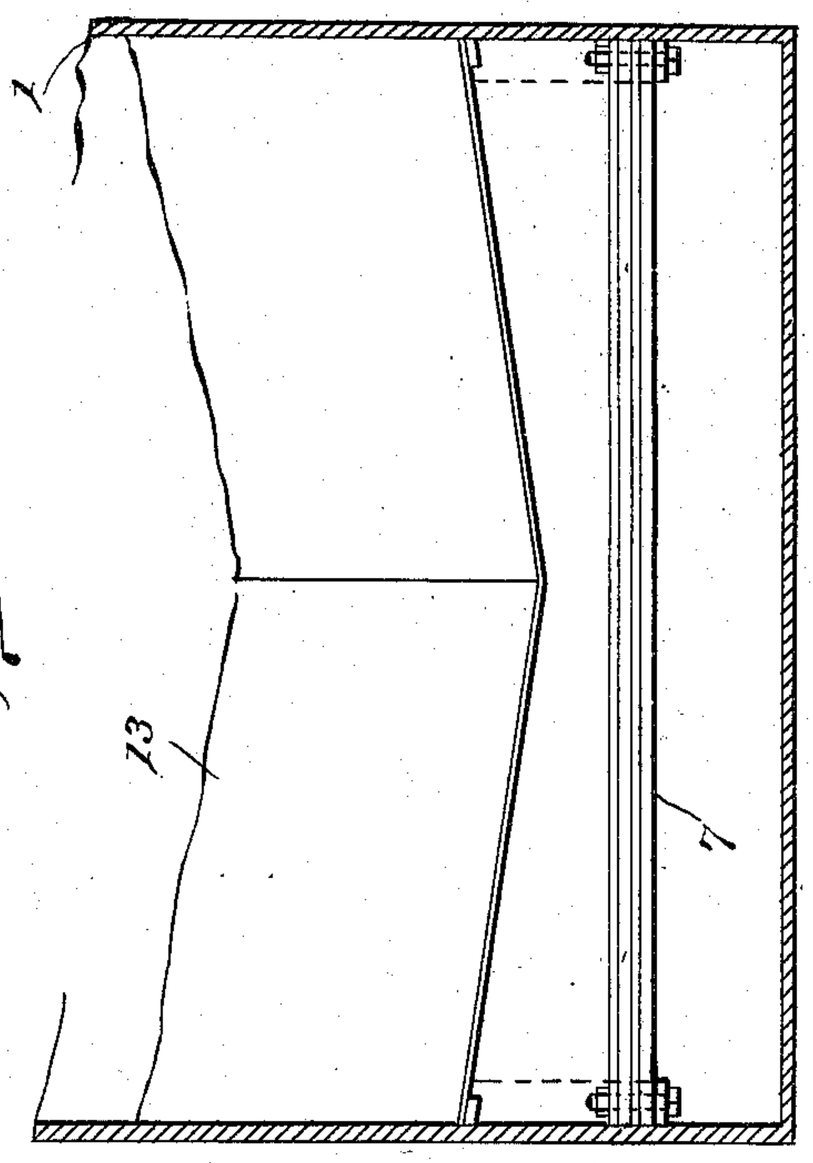

Fig. 11.

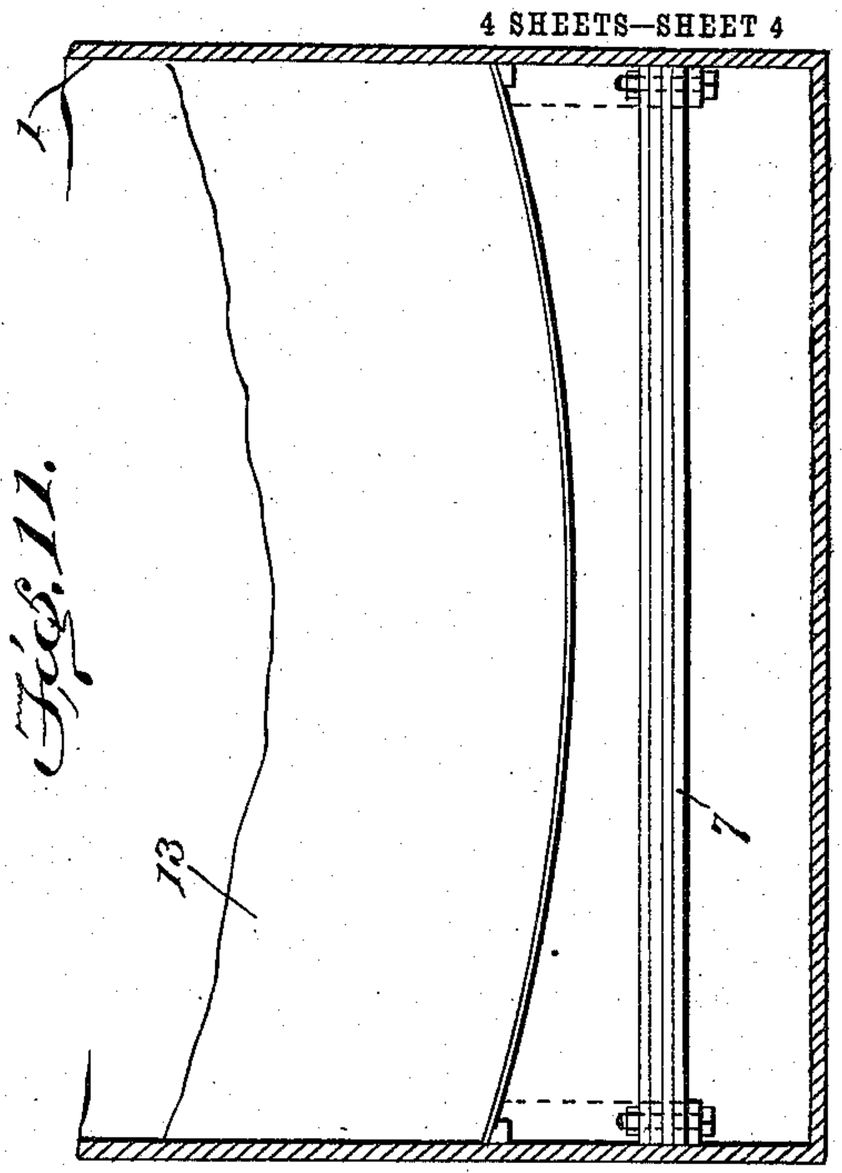

Fig. 8.

Fig. 10.

Witnesses

G. Howard Walmsley.

Irvine Miller

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UNITED STATES PATENT OFFICE.

OMAN L. STUMP, JOHN REIDENBAUGH, AND EDWIN D. PACKARD, OF MARION, OHIO, ASSIGNORS TO THE MARION INCLINE FILTER AND HEATER COMPANY, OF MARION, OHIO, A CORPORATION OF OHIO.

FEED-WATER HEATER.

No. 840,523. Specification of Letters Patent. Patented Jan. 8, 1907.

Application filed July 3, 1905. Serial No. 268,076.

To all whom it may concern:

Be it known that we, OMAN L. STUMP, JOHN REIDENBAUGH, and EDWIN D. PACKARD, citizens of the United States, residing at Marion, in the county of Marion and State of Ohio, have invented certain new and useful Improvements in Filters for Feed-Water Heaters, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to filters for feed-water heaters, being designed for use more particularly in connection with that class of feed-water heaters known as "open" heaters, having a water-space below and a steam-space above, through which latter exhaust-steam is caused to pass, the feed-water to be heated and purified being discharged into this steam-space and thoroughly exposed to contact with the exhaust-steam.

In a general way the present invention is in the nature of an improvement upon the filter set forth in an application filed by Oman L. Stump, August 19, 1904, Serial No. 221,348, in which a self-cleaning filter is set forth, located within the body of the heater and serving to remove the sediment or precipitate from the heated feed-water before it passes from the heater to the boiler.

The specific object of our present invention is to provide means for diverting from the filter proper the solid matter in suspension in the water, this diversion being effected to as great an extent as possible, and thereby relieving the filter proper and increasing its efficiency and life by diminishing the amount of sediment deposited on it, so that where the filter is self-cleaning the amount of sediment it will have to discharge will be reduced and the length of time during which it will remain in efficient operation will be correspondingly extended.

Our invention is also applicable to feed-water filters of other types not self-cleaning, and in either case the period of operative efficiency before the filter requires to be cleaned is greatly increased and the number of cleanings correspondingly reduced.

To these ends our invention consists in certain novel features, which we will now proceed to describe and will then particularly point out in the claims.

In the accompanying drawings, Figure 1 is a vertical sectional view through a well-known type of open feed-water heater, a filter structure embodying our invention in one form being shown in vertical section located within the heater. Fig. 2 is a detail view showing the deflecting-plate and filter in elevation, the body of the heater being shown in section. Fig. 3 is an illustrative view in the nature of a vertical section, showing the application of the deflecting-plate to a horizontal filter. Fig. 4 is a view similar to Fig. 3, showing the application of the invention to a vertical filter. Fig. 5 is a similar view showing the application of two deflecting-plates to a filter. Fig. 6 is a similar view showing a further modification of the form of structure shown in Fig. 5. Fig. 7 is a sectional view taken on the line $x\,x$ of Fig. 6 and looking in the direction of the arrows. Figs. 8, 9, 10, and 11 are detail views similar in their nature to Fig. 2, showing various forms of transverse inclination of the deflecting-plate.

In the accompanying drawings we have shown our improvements as applied to a well-known type of feed-water heater known as the "open" type, the particular structure of this class chosen for purposes of illustration being the Cochrane heater, set forth in United States Letters Patent No. 420,718, of February 4, 1890, and No. 530,349, of December 11, 1894. However, it will be understood that our invention is not limited in its application to this particular heater. In heaters of this class the exhaust-steam is admitted to the vessel or heater 1 through a pipe 2 and passing through the steam-space 3 in the upper part of the heater escapes through the outlet-pipe 4. The feed-water is admitted to the heater through a pipe 5 and is brought into intimate contact with and thoroughly heated by the steam in the steam-space 3, chemicals being introduced, if desired, along with the feed-water. The feed-water is drawn off through a pipe 6, preferably by means of a pump, and a filter-bed or filter proper, 7, is interposed between the feed-water outlet and the upper part of the heater to extract from the water the sediment held in suspension therein by reason of the heating of the water or by the chemical

treatment which it has received. The lower portion 8 of the heater below the water-line *w w* (indicated in dotted lines in Fig. 1) thus forms a filtering-chamber into which the feed-water drops from the steam-space, being discharged in the present instance from the pans 9. In the construction illustrated in Figs. 1 and 2 we have shown the filter-bed as constructed and arranged in accordance with the application of Oman L. Stump hereinbefore referred to, the filter-bed extending in an inclined position across the filtering-chamber, its inclination making it self-cleaning, and the construction being such that the water must pass through it to get to the outlet-pipe 6. At the foot of the inclined filtering-bed is located a sediment-chamber 10. With this sediment-chamber wash-out and blow-off pipes 11 and 12 communicate. The construction so far described is that set forth in the Stump application above specified. In said construction the upper or receiving face of the filter is exposed directly to the sediment, which as it ascends by gravity falls directly upon the face of the filtering-bed, down which it passes to the sediment-chamber. It will be seen that to the extent that the filtering-bed is covered by the sediment, whether it remains in position thereon or is in movement toward the sediment-chamber, the efficiency of the bed in permitting the passage of filtered water therethrough is correspondingly diminished. To obviate this, we provide a deflecting-plate (indicated as a whole by the reference-numeral 13) interposed between the filtering-bed and feed-water discharge and covering the bed in such a way as to prevent the sediment from being deposited by gravity directly upon the bed, said plate being so inclined that the sediment deposited upon it descends along it by gravity and is discharged into the sediment-chamber. In the construction shown in Figs. 1 and 2 the plate 13 is shown as having an inclination corresponding with that of the bed above which it is arranged, being separated from it by a space sufficient to permit the free circulation of the water and extending from a point above the water-line to the sediment-chamber. The arrangement which we prefer is such that every part of the filtering-bed lies vertical below a part of the deflecting-plate, so that the entire receiving-surface of the filtering-bed is protected.

It will be seen that when the feed-water descends from the steam-space 3 into the filtering-chamber 8 any sediment carried thereby is prevented from falling directly upon the filtering-bed, and in practice by far the greater portion of said sediment will be deposited upon the deflecting-plate, which, it will be understood, extends transversely across the heater from side to side thereof like the filtering-bed and has its upper end at or above the water-line, while its lower end, as already stated, terminates at the sediment-chamber. The sediment thus deposited upon the deflecting-plate will be carried down and discharged into the sediment-chamber, and the water which passes back under the deflecting-plate to the filtering-bed will be correspondingly relieved of its sediment, thus diminishing the deposit upon the filtering-bed, and thereby increasing the efficiency of said bed. The bed will be provided at its upper end with the usual wash-pipe 14, and a similar wash-pipe 15 will be located at the upper end of the deflecting-plate, so that said bed and plate may be washed clear of the sediment thereon when it becomes desirable or necessary.

The deflecting-plate may be constructed of any suitable material and may be mounted or supported within the heater in any suitable manner. In the present instance we have shown the plate as composed of corrugated iron, the corrugations 16 extending lengthwise of the plate in the direction of its inclination. This construction we deem desirable, because in addition to the combined strength and lightness arising from the corrugated structure the corrugations thus arranged form channels which concentrate the flow of the water and sediment in the desired direction, and thus tend to render more effectual the self-cleaning action of the plate. A still further advantage of the corrugated construction is apparent in connection with the construction of the deflecting-plate in sections 17, as shown more particularly in Figs. 1 and 2, where it will be seen that the plate 13 is composed of six of these sections 17, supported by transverse rods 18, on which the sections rest and to which they are connected by hook-plates 19. This sectional construction permits the ready assembling and removal of the deflecting-plate through the somewhat constricted door of the heater, thus rendering it unnecessary to take the heater apart in order to apply or remove the plate. Where the sectional deflecting-plate is thus built up of corrugated sections, the corrugations fit the one within the other where the plates overlap, as indicated in Fig. 2, and thus make better and firmer joints without the necessity of special construction for that purpose at these points.

While we have illustrated in Figs. 1 and 2 a construction in which our improved deflecting-plate is employed in conjunction with a self-cleaning filtering-bed, our invention is not restricted to this type of bed. In Fig. 3, for instance, we have shown the deflecting-plate as employed in connection with a horizontal filtering-bed 20, while in Fig. 4 we have shown the deflecting-plate as employed in conjunction with a vertical filtering-bed 21, extending, of course, above the water-line, so as to insure the passage of all

of the water through the filtering-bed. In each case the filtering-bed and deflecting-plate discharge into a common sediment-chamber 22, having a sediment-outlet 22ª.

In cases where the deposit of sediment is very heavy it may be desirable to use more than one deflecting-plate, and in Fig. 5 we have shown a filtering-bed 23, above which are arranged two parallel alined deflecting-plates 24 and 25 the one above the other. In this construction a sediment-chamber 26, having an outlet 27, is provided to receive the discharge from the filtering-bed 23, and a second sediment-chamber 28, having an outlet 29, is provided to receive the discharge of the two deflecting-plates 24 and 25. The upper plate 24 extends from the wall of the heater farthest from the sediment-chamber 28 downward to said chamber, where it terminates short of the opposite wall of the heater. The second deflecting-plate 25 terminates short of both of said walls of the heater, and a partition or plate 30 is interposed between its lower end and the bottom of the heater, thus separating the sediment-chambers 26 and 28. The sediment-charged water must thus first flow downward along the upper deflecting-plate 24 and then upward along the lower deflecting-plate 25 before it has access to the filter, so that the water is largely cleared of its sediment before it reaches the filter.

In Figs. 6 and 7 we have shown a modification of this construction, in which the water-conduits are employed, located outside of the body of the heater, and in which the flow of water is downward along each of the deflecting-plates. Here the filtering-bed is indicated by the reference-numeral 31 and has its own sediment-chamber 32 and outlet 33. The lower deflecting-plate (indicated by the reference-numeral 34) extends from one end wall of the heater over and beyond the filtering-bed and is connected to the bottom of the heater by a partition 35. The upper deflecting-plate 36 extends similarly beyond the lower plate 34 and is connected to the bottom of the heater by a partition 37. Thus the deflecting-plate 34 has its individual sediment-chamber 38, with outlet 39, and the plate 36 has its individual sediment-chamber 40, with outlet 41. Each deflecting-plate extends entirely across the heater, and the water, after descending along the first deflecting-plate 36, is conducted to the upper end of the second plate by means of an external conduit 42 (shown in dotted lines in Fig. 6) and having its receiving-mouth 43 located at the lower end of the deflecting-plate 36 and its discharge-mouth 44 located at the upper end of the deflecting-plate 34. A similar external conduit 45 has its receiving-mouth 46 located at the lower end of the plate 34 and its discharge-mouth 47 located above the upper end of the filtering-bed. By this construction a very effectual separation of the sediment may be effected before the water reaches the filtering-bed. It will also be noted that with this construction, as with the similar construction as shown in Fig. 5, a filtering-bed of comparatively small area may be employed without diminishing the delivery of purified feed-water.

In the constructions which we have heretofore described the deflecting-plate has been referred to as having but a single inclination—to wit, the downward inclination from the water-line toward the sediment-chamber. In case it is deemed desirable, by reason of the location of the blow-off or wash pipes or for other causes, to cause the deflecting-plate to deliver its sediment in any particular part or parts of the sediment-chamber said plate may be given a transverse inclination also either toward the center or toward the lateral edges of the plate or otherwise, as may be desired. In Fig. 8 we have shown the sediment-plate as inclined not only downward toward the sediment-chamber, but also downward in each direction from its central line toward the sides of the heater in planes meeting at an angle in the center. This construction will cause the sediment to be delivered at the sides of the heater or at the ends of the sediment-chamber. Fig. 9 illustrates a reverse construction in which the deflecting-plate is transversely-inclined downward toward its center to cause the sediment to be centrally delivered. In Figs. 8 and 9 the two parts of the plate which are inclined toward each other are planes meeting at an angle; but the same results may be obtained by curving the plate in either direction, as shown in Figs. 10 and 11, the former giving the same delivery as the construction shown in Fig. 8 and the latter giving the same delivery as the construction shown in Fig. 9.

It is obvious that other modifications than those hereinbefore described and illustrated in the accompanying drawings may be made without departing from the principle of our invention, and we therefore do not wish to be understood as limiting ourselves to the precise details of construction hereinbefore set forth and shown in said drawings.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. A feed-water heater having a steam-space above and a filtering-chamber below in open communication therewith, a filtering-bed located in the filtering-chamber, a feed-water inlet on one side of said filtering-bed, discharging into the steam-space, a feed-water outlet on the other side of the filtering-bed, a sediment-chamber, and an imperforate deflecting-plate located between the feed-water inlet and filtering-bed, above said filtering-bed covering and protecting the same, and inclined so as to be self-cleaning,

said deflecting-plate being arranged to discharge its sediment into the sediment-chamber, substantially as described.

2. A feed-water heater having a steam-space above and a filtering-chamber below in open communication therewith, a filtering-bed extending across said filtering-chamber in an inclined position to make it self-cleaning, a feed-water inlet on one side of said filtering-bed, discharging into the steam-space, a feed-water outlet on the other side of the filtering-bed, a sediment-chamber, and a deflecting-plate located between the feed-water inlet and filtering-bed, covering and protecting the latter, and inclined so as to be self-cleaning, said deflecting-plate being arranged to discharge its sediment into the sediment-chamber, substantially as described.

3. A feed-water heater having a steam-space above and a filtering-chamber below in open communication therewith, a filtering-bed located in the filtering-chamber, a feed-water inlet on one side of said filtering-bed, discharging into the steam-space, a feed-water outlet on the other side of the filtering-bed, a sediment-chamber, and a plurality of imperforate deflecting-plates located one above the other between the feed-water inlet and filtering-bed, above said filtering-bed covering and protecting the same, and inclined so as to discharge the sediment by gravity into the sediment-chamber, substantially as described.

4. A feed-water heater having a steam-space above and a filtering-chamber below in open communication therewith, a filtering-bed located in the filtering-chamber, a feed-water inlet on one side of said filtering-bed, discharging into the steam-space, a feed-water outlet on the other side of the filtering-bed, and a plurality of deflecting-plates located between the feed-water inlet and filtering-bed, and covering and protecting the latter, said filtering-bed and deflecting-plates being inclined to make them self-cleaning, and the heater being provided with means for receiving the sediment discharge therefrom, substantially as described.

5. A feed-water heater having a steam-space above and a filtering-chamber below in open communication therewith, a filtering-bed located in the filtering-chamber, a feed-water inlet on one side of said filtering-bed, discharging into the steam-space, a feed-water outlet on the other side of the filtering-bed, a plurality of deflecting-plates located between the feed-water inlet and filtering-bed, and covering and protecting the latter, said filtering-bed and deflecting-plates being inclined to make them self-cleaning, and the heater being provided with means for receiving the sediment discharge therefrom, and means for causing the feed-water to pass downward successively over said plates and bed, substantially as described.

6. A feed-water heater having a steam-space above and a filtering-chamber below in open communication therewith, a filtering-bed located in the filtering-chamber, a feed-water inlet on one side of said filtering-bed, discharging into the steam-space, a feed-water outlet on the other side of the filtering-bed, a sediment-chamber, and an imperforate deflecting-plate located between the feed-water inlet and filtering-bed, covering and protecting the latter, and inclined so as to be self-cleaning, said deflecting-plate being arranged to discharge its sediment into the sediment-chamber, said deflecting-plate being longitudinally corrugated in the direction of its inclination, substantially as described.

7. A feed-water heater having a steam-space above and a filtering-chamber below in open communication therewith, a filtering-bed located in the filtering-chamber, a feed-water inlet on one side of said filtering-bed, discharging into the steam-space, a feed-water outlet on the other side of the filtering-bed, a sediment-chamber, and a deflecting-plate located between the feed-water inlet and filtering-bed, covering and protecting the latter, and inclined so as to be self-cleaning, said deflecting-plate being arranged to discharge its sediment into the sediment-chamber, said deflecting-plate being constructed of a plurality of separable sections, overlapping and longitudinally corrugated in the direction of their inclination, substantially as described.

8. A feed-water heater having a steam-space above and a filtering-chamber below in open communication therewith, a filtering-bed located in the filtering-chamber, a feed-water inlet on one side of said filtering-bed, discharging into the steam-space, a feed-water outlet on the other side of the filtering-bed, a sediment-chamber, and a deflecting-plate located between the feed-water inlet and filtering-bed, covering and protecting the latter, and longitudinally inclined so as to be self-cleaning, said deflecting-plate being arranged to discharge its sediment into the sediment-chamber, said deflecting-plate being also inclined from its longitudinal center toward the side of said chamber, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

OMAN L. STUMP.
JOHN REIDENBAUGH.
EDWIN D. PACKARD.

Witnesses:
REX M. ANDREWS,
ROBERT G. LUCAS.