

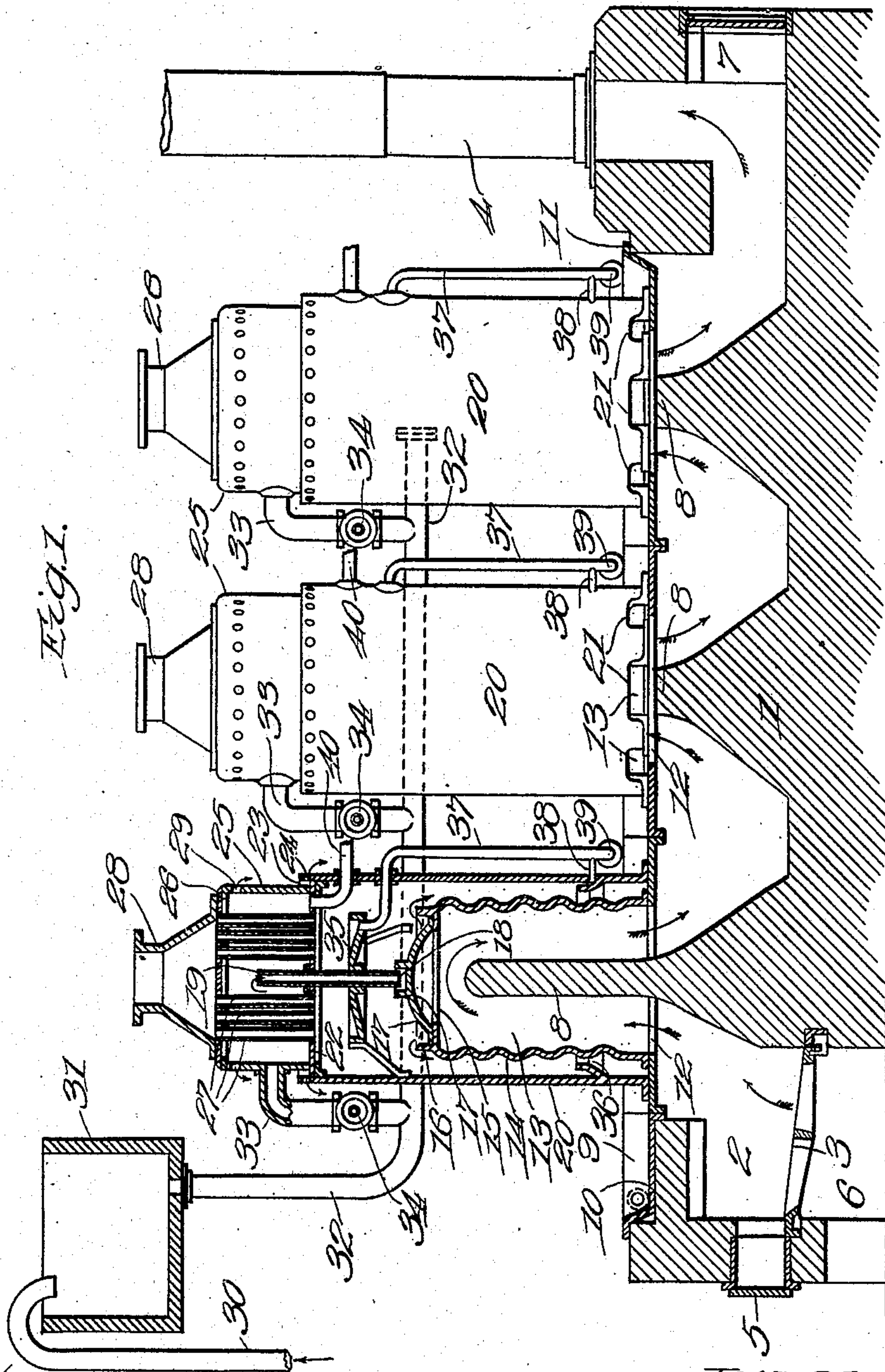
T. SUZUKI.
EVAPORATOR.

APPLICATION FILED DEC. 5, 1907.

916,054.

Patented Mar. 23, 1909.

5 SHEETS—SHEET 1.



Witnesses:
C. H. Crawford
C. Singer

Inventor:
Tozaburo Suzuki
by B. Singer.
Attorney

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5 SHEETS--SHEET 2.



Inspector:-

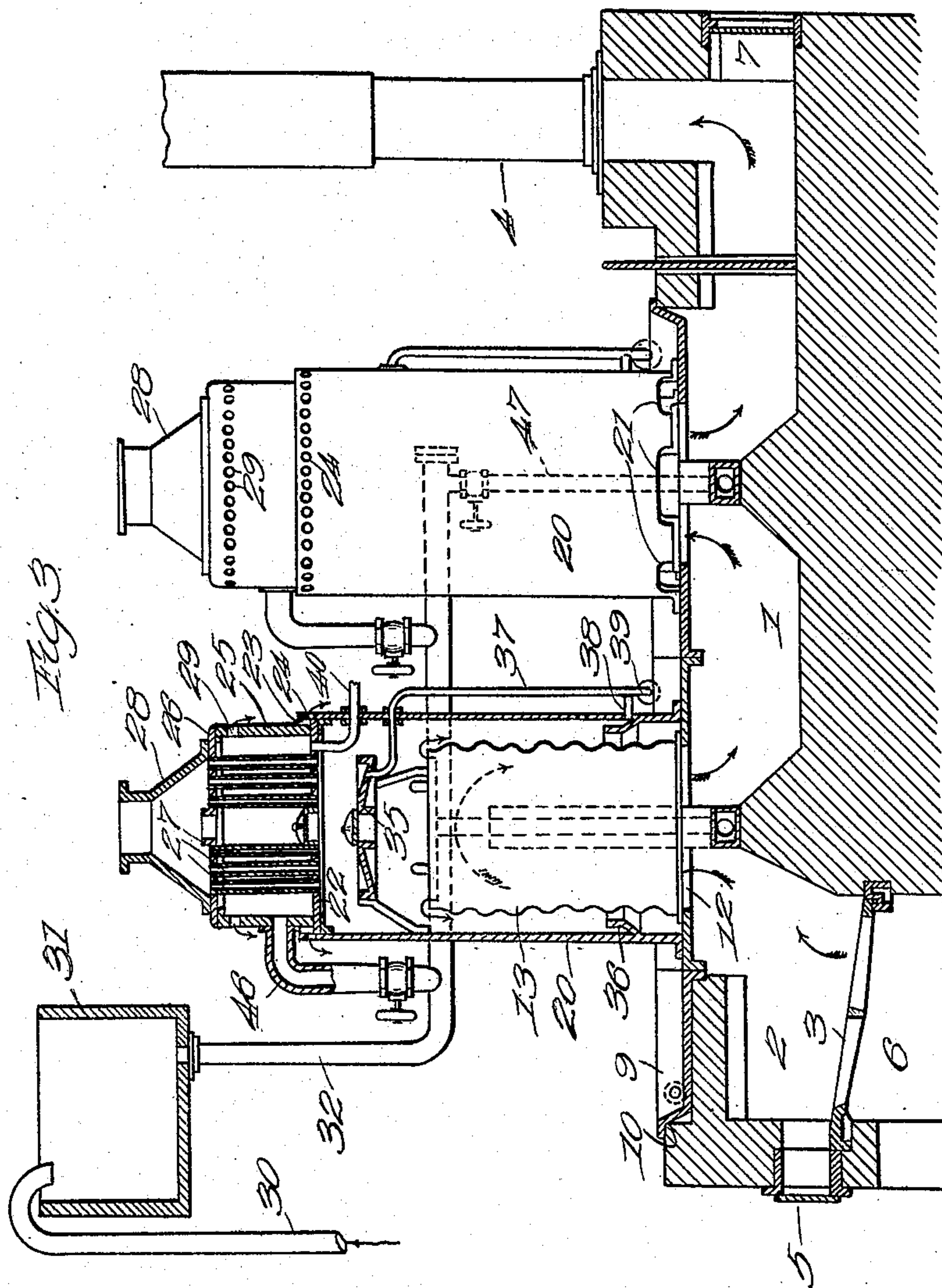
IZABURO SUZUKI
 by BEINGE
 Attorney

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C. H. Crawford
R. A. Singer

Inventor:

Tozaburo Suzuki
by B. Singer
Attorney

T. SUZUKI.

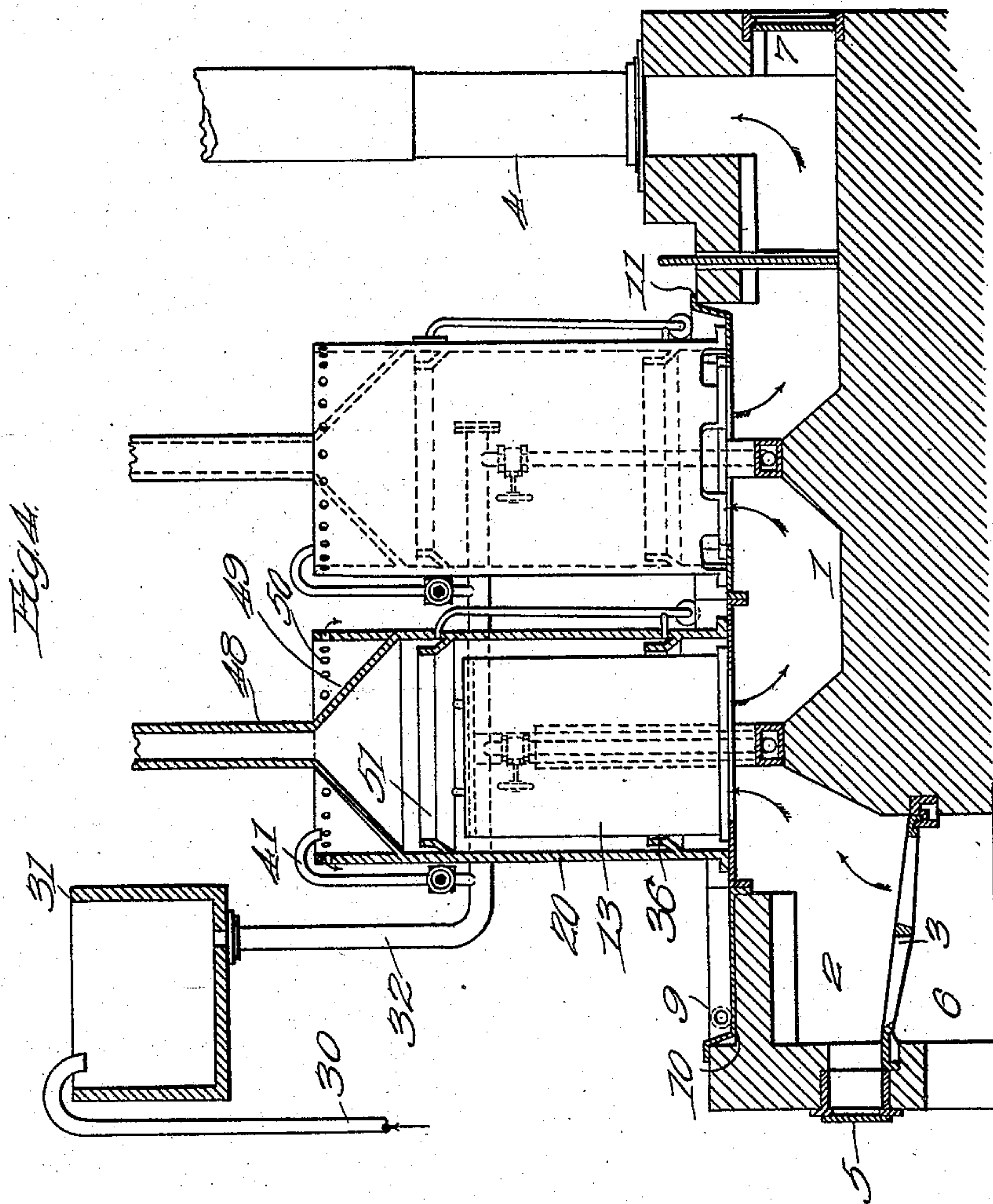
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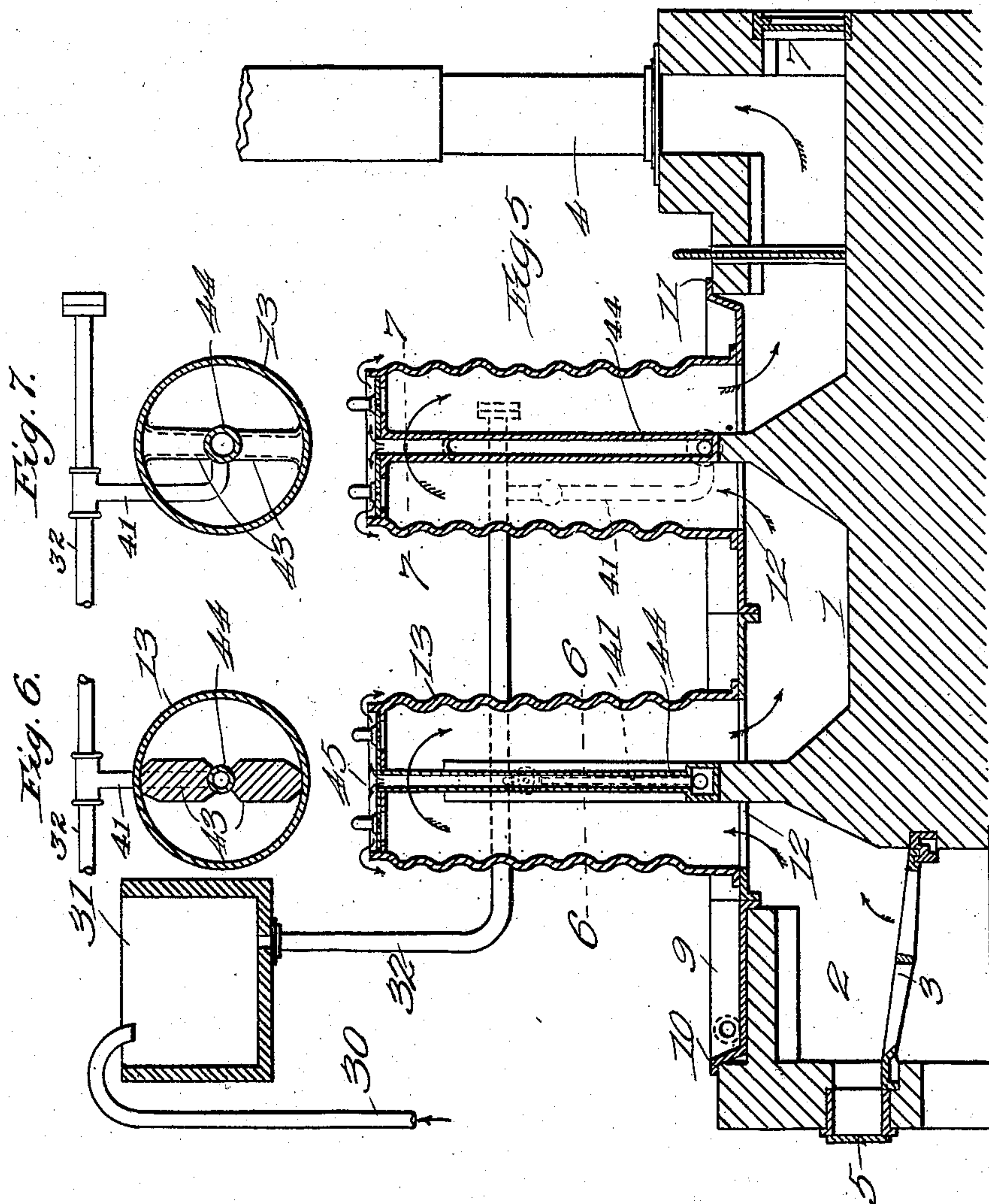
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R. A. Singer.

Inventor:-
Tozaburo Suzuki
by R. A. Singer.
Attorney

UNITED STATES PATENT OFFICE.

TOZABURO SUZUKI, OF SUNAMURA, JAPAN.

EVAPORATOR.

No. 916,054.

Specification of Letters Patent.

Patented March 23, 1909.

Application filed December 5, 1907. Serial No. 405,292.

To all whom it may concern:

Be it known that I, TOZABURO SUZUKI, a subject of the Emperor of Japan, residing at Sunamura, Province of Tokio, Empire of Japan, have invented certain new and useful Improvements in Evaporators, of which the following is a specification.

The object of this invention is to provide an evaporator which will be efficient in action and which will utilize to the fullest possible extent the heat units applied thereto for effecting evaporation, a further object being to restrict the area of the evaporating surfaces as much as possible and to so arrange the same with respect to the heat applied thereto as to render the entire area of said evaporating surfaces effective.

The invention will be more fully described in connection with the accompanying drawings and will be more particularly pointed out and ascertained in and by the appended claims.

In the drawings: Figure 1 is a longitudinal sectional view, partly in elevation, of an evaporator illustrating one embodiment of my invention. Fig. 2 is a similar view of a modified form of the invention. Fig. 3 illustrates a further modification of the invention. Fig. 4 illustrates a further modification. Fig. 5 illustrates a still further modification. Fig. 6 is a detailed sectional view on line 6—6 of Fig. 5. Fig. 7 is a detailed sectional view on line 7—7 of Fig. 5.

Considered generally the invention comprises means for supplying heat, which may be in the form of a furnace or the like, to a receiving vessel which may if desired be superposed upon the furnace and which serves the purpose of a receiver for liquid during the process of evaporation and concentration. Upon the receiver or vessel and located in a manner to receive the products of combustion of the furnace during the passage thereof to a stack or outlet is located one or more evaporators which are preferably hollow in construction and are adapted to deliver the liquid to the receiving vessel. Means are provided, which preferably forms a part of the furnace, for directing the products of combustion against the inner surfaces of said evaporators so that the outer surfaces thereof may be heated to a high temperature for the purpose of evaporating the liquid. Means are provided for delivering the liquid to the exterior of said evaporators to bring the former into contact with the heated walls of

the latter and thereby effect the desired vaporization and resultant concentration.

Considered more specifically and with special reference to the form shown in Fig. 1, 1 60 designates a furnace as a whole which as shown is provided with a fire box 2, a grate 3 and suitable outlet or stack 4. The usual fuel door 5 and ash pit 6 are shown and beneath the stack 4 is provided a closable passage 7 through which collecting soot may be removed. One or a plurality of deflectors are shown as interposed in the path of the products of combustion passing from the fire box 2 to the stack 4 and conveniently said 70 deflectors consist of extensions of the furnace 1 and the same are indicated by 8. A receiving vessel, preferably in the form of a shallow pan 9, is located in a manner to be acted upon by the products of combustion 75 and preferably said vessel or pan is mounted directly upon the furnace 1 as at 10 and 11. Said pan 9 is provided with openings 12 which permit the deflectors 8 to project upwardly therethrough as clearly shown in Fig. 80 1. Said openings 12 are relatively enlarged with respect to the deflectors 8 to afford an open space on opposite sides thereof for the passage of the products of combustion, the said deflectors 8 as shown in Fig. 6 being of 85 sufficient width to prevent lateral passage and serving to force the products of combustion to pass above said deflectors. Evaporators, preferably in the form of cylinders 13, are shown as mounted upon the pan 9 and 90 are provided with internal diameters which are equal to the diameters of the openings 12. Said evaporators when secured in place as shown surround the deflectors 8 and are of sufficient height to permit the products of 95 combustion to pass over the upper ends of said deflectors which latter thereby serve to uniformly force the products of combustion into engagement with the entire inner area of the evaporators thereby serving to efficiently heat the same and present to the liquid a uniformly and highly heated exterior evaporating surface as will hereinafter more fully appear. If it is desired to increase the exterior surface area of the evaporators and 105 thereby obtain a more extensive evaporating surface the cylinders 13 may be corrugated as shown in Fig. 1 or the walls thereof may be straight as shown in Fig. 4. As shown the evaporators are provided with liquid receivers which are conveniently disposed upon 110 the upper ends of said evaporators and are

designed to receive the liquid to be evaporated and heat the same and subsequently discharge said liquid upon the exterior or evaporating surfaces 14. As shown in Fig. 1 the liquid receiver is formed by an upper wall 15 of the cylinder 13 and a flange 16 which may if desired be formed by extending the wall of the cylinder 13 above the upper wall 15. The wall 15 is provided with an opening and a receiving member 17, preferably formed in a separable part, is mounted on said wall 15 and spans the opening therein and is thereby subjected to the action of the products of combustion as will be obvious by reference to Fig. 1. I conveniently make the member 17 convex so that the liquid received thereon will pass directly toward the flange 16 and into the cavity formed thereby so that a relatively small quantity of liquid will be retained thereby effecting more rapid heating thereof. When the cavity formed by the flange 16 is filled the liquid overflows and passes down the corrugated evaporating surface 14 where it is discharged into the vessel 9. The receiver 17 is also provided with a cavity 18 into which the liquid is first fed and from which it overflows upon the concave surface to the cavity formed by the flange 16. As shown the liquid is fed through a pipe 19 and desirably said pipe extends into the cavity 18 a slight distance to form a seal and prevent the vapor from passing upwardly in said feed pipe in case the feed is shut off temporarily.

According to the form shown in Fig. 1 a pre-heater is provided to heat the liquid before the same is delivered to the evaporator and conveniently the pre-heater receives the vapor from the evaporator so as to effect such preliminary heating of the liquid. As shown and in order that the passage of the vapor may be controlled and made to perform this function the evaporator is provided with a casing or shell 20 which is conveniently mounted upon the pan 9 and is provided with openings 21 to permit the liquid to be discharged from the evaporator into the pan proper. Said casing 20 is provided with an upper wall 22 which is conveniently located somewhat below the upper margin of said casing thereby forming a receiving cavity 23 provided with outlets 24 the purpose of which will hereinafter more fully appear. A cylinder 25 is mounted upon said wall 22 and is provided with an upper wall 26 between which and the wall 22 is provided a plurality of vapor tubes 27 which are closed to the cylinder 25 and permit passage of the vapor therethrough to an outlet 28 which may discharge to the outer air or to a condenser (not shown). Cylinder 25 is provided with openings 29 whereby the surplus liquid may overflow into the cavity 23 and may discharge therefrom down the outer wall of the casing 20 to the pan 9. Said feed pipe 19

extends some distance into the cylinder 25 so as to insure the retention of a quantity of liquid in said cylinder to be heated by the vapor from the evaporators which not only plays upon the wall 22 but passes upwardly through the flues 27. Desirably the liquid is delivered from a feed pipe 30 to a reservoir 31 which latter discharges to a delivery pipe 32 connected by branch pipes 33 with the cylinders 25. Preferably the branch pipes 33 are provided with valves 34 to permit of independent regulation of the several evaporator units of which three are herein shown in this construction. A condensing receiver 35 is disposed beneath the tubes 27 and serves to collect condensed liquid falling therefrom. A condensing receiver 36 is also provided for the casing 20 and said receivers are conveniently connected by pipes 37 and 38 with a discharge pipe 39. When it is desired to empty the cylinder 25 after the evaporators are cut out of service pipes 40 may be utilized.

In the form shown in Fig. 2 the casings 20 are dispensed with and likewise the pre-heaters and the vapor is permitted to discharge into open space. In this form of the invention the delivery pipe 32 is provided with valved branch pipes 41 which deliver directly to the concave receivers 17. Otherwise the apparatus shown in Fig. 2 performs its function in substantially the same manner as that shown in Fig. 1.

In the form shown in Fig. 5 a different method is provided for heating the liquid prior to its delivery to the evaporator. As shown in this construction the liquid is discharged from the reservoir 31 to a delivery pipe 32 which is provided with valved branch pipes 41, one of which is shown at one side of the pipe 44 and the other of which is shown directly behind the pipe 44 and both of which are shown in dotted lines. In this construction the deflectors 43 are made in two sections and pipes 44 are embedded therein and are exposed to the action of the products of combustion, and the pipes 41 discharge into said pipes 44. The pipes 44, at their upper ends, discharge into receivers 45 formed in the upper ends of the evaporators 13. In this construction the operation is substantially the same as in prior constructions with respect to the passage of the liquid from the receiver 45 to the pan 9.

In the form shown in Fig. 3 all of the features illustrated in Fig. 1 are retained except the feed pipe 19 and to this form is also added the feature described in connection with Fig. 5. In Fig. 3 all of the liquid fed to the cylinder 25 is discharged therefrom over the casing 20 into the pan 9 as hereinbefore described. The delivery pipe 32 is provided with branch valve pipes 46 delivering to the cylinder 25 and also with branch valve pipes 47 delivering to pipes con-

constructed in the manner clearly shown in Fig. 5 so that the liquid is preheated prior to its delivery to the evaporators 13.

In Fig. 4 the cylinders 25 are dispensed with and the outlets 48 are constructed in a manner to form receiving chambers 49 provided with outlets 50. The liquid is delivered to the chambers 49 and passes through outlets 50 down the exterior of the casing 20 in the manner described in connection with Fig. 1. The liquid is also pre-heated prior to its delivery to the evaporators by construction similar to that described in connection with the form shown in Fig. 5. In this form the upper condensing receiver 51 is constructed and arranged similar to the receiver 36.

I claim:—

1. An evaporating apparatus comprising in combination, a receiver provided with an opening for passage of the products of combustion, a hollow evaporator forming with said opening a flue for the products of combustion and having an exterior evaporating surface delivering to said receiver, a deflector projecting into said evaporator to form therewith a return flue and direct the products of combustion against the interior of the evaporator, and means for delivering the liquid to the exterior of said evaporator.

2. An evaporating apparatus comprising in combination, a shallow receiver provided with an opening for the products of combustion, a hollow evaporator forming with said opening a flue for the products of combustion and having an exterior corrugated evaporating surface delivering to said receiver, a deflector projecting into said flue to direct the products of combustion against the interior wall thereof, and means delivering the liquid to the top of said evaporator.

3. An evaporating apparatus comprising in combination, a vertically disposed hollow evaporator provided with an exterior evaporating surface and forming with its interior a flue for the products of combustion, a deflector projecting into said evaporator to direct the products of combustion against the interior walls thereof, means delivering the liquid to be evaporated to the exterior and at the top of said evaporator, and a relatively shallow pan receiving the liquid discharged by said evaporator.

4. An evaporating apparatus comprising in combination, a shallow receiving pan provided with an opening for the products of combustion, a hollow evaporator forming with said opening a flue for the products of combustion and having an exterior corrugated evaporating surface, a deflector projecting into said flue to direct the products of combustion against the interior of said evapo-

rator, means delivering the liquid to be evaporated to the exterior of said evaporator wherefrom the same is delivered to said pan, a shell surrounding said evaporator and provided with an exterior evaporating surface heated by the vapor from said evaporator, said shell delivering to said pan and being provided with a liquid supply delivering to the exterior of said shell.

5. An evaporating apparatus comprising in combination, a receiver provided with an opening for the products of combustion, a hollow evaporator provided with an exterior evaporating surface delivering to said receiver and forming with its interior a flue for the products of combustion, a deflector projecting into said evaporator for directing the products of combustion against the interior thereof to heat the exterior, a liquid supply delivering to the exterior of said evaporator, a shell surrounding said evaporator and heated thereby and provided with an exterior evaporating surface delivering to said receiver, a liquid supply delivering to the exterior of said shell and heated by the vapor from said evaporator, and means for draining the water of condensation from said shell.

6. An evaporator comprising in combination, a hollow evaporator having an exterior evaporating surface and forming with its interior a flue for the products of combustion, a deflector projecting into said flue to direct the products of combustion against the walls of said evaporator, and a liquid inlet delivering to the exterior of said evaporator and extending through said deflector.

7. An evaporating apparatus comprising in combination, a hollow evaporator having an exterior evaporating surface and forming with its interior a flue for the products of combustion, a deflector projecting into said flue to direct the products of combustion against the walls of said evaporator, a liquid inlet delivering to the exterior of said evaporator and extending through said deflector, a shell surrounding said deflector and provided with an exterior evaporating surface and having its interior heated by the vapor arising from said evaporator, a reservoir for said shell communicating with a source of supply and having overflow outlets delivering the liquid to the exterior of said shells, said reservoirs having outlets for the vapor arranged to heat the contents of said reservoirs.

In testimony whereof I affix my signature in presence of two witnesses.

TOZABURO SUZUKI.

Witnesses:

YASUNOSUKE FUKUKITA,
JAMES B. DAVIES.