(No Model.) 4 Sheets—Sheet 1.

G. F. METZGER.

PROCESS OF AND APPARATUS FOR EXTRACTING NAPHTHA FROM OIL.

No. 563,391. Patented July 7, 1896.

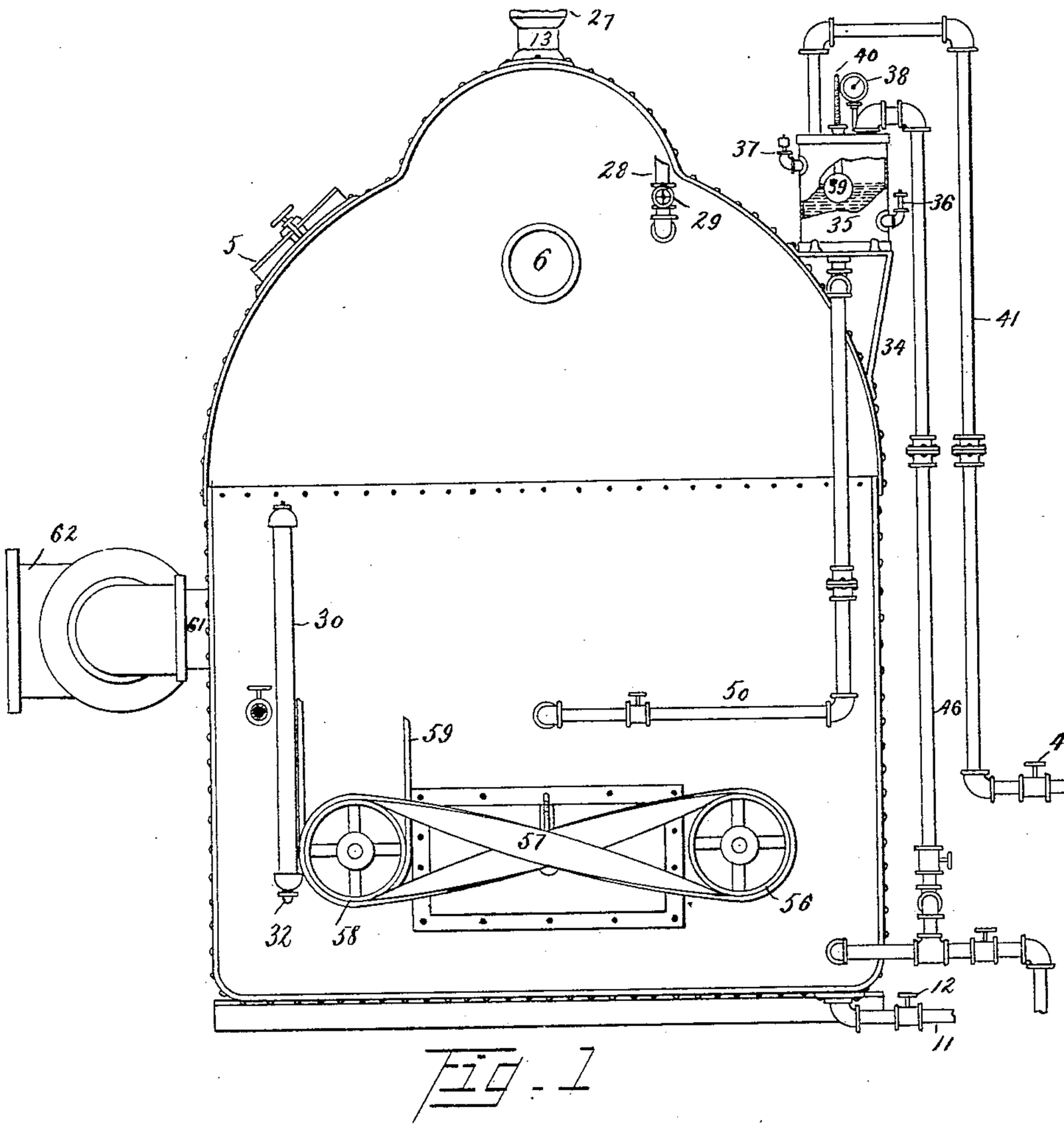

Fig. 1

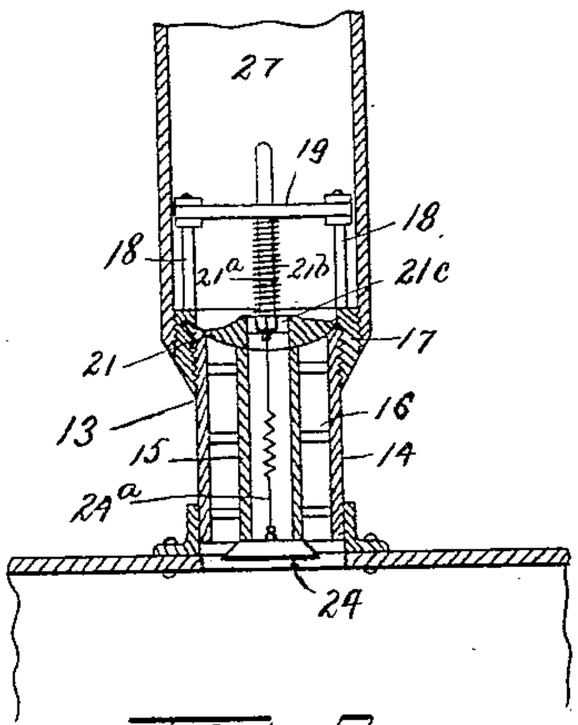

Fig. 2

Witnesses.
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(No Model.) 4 Sheets—Sheet 2

G. F. METZGER.

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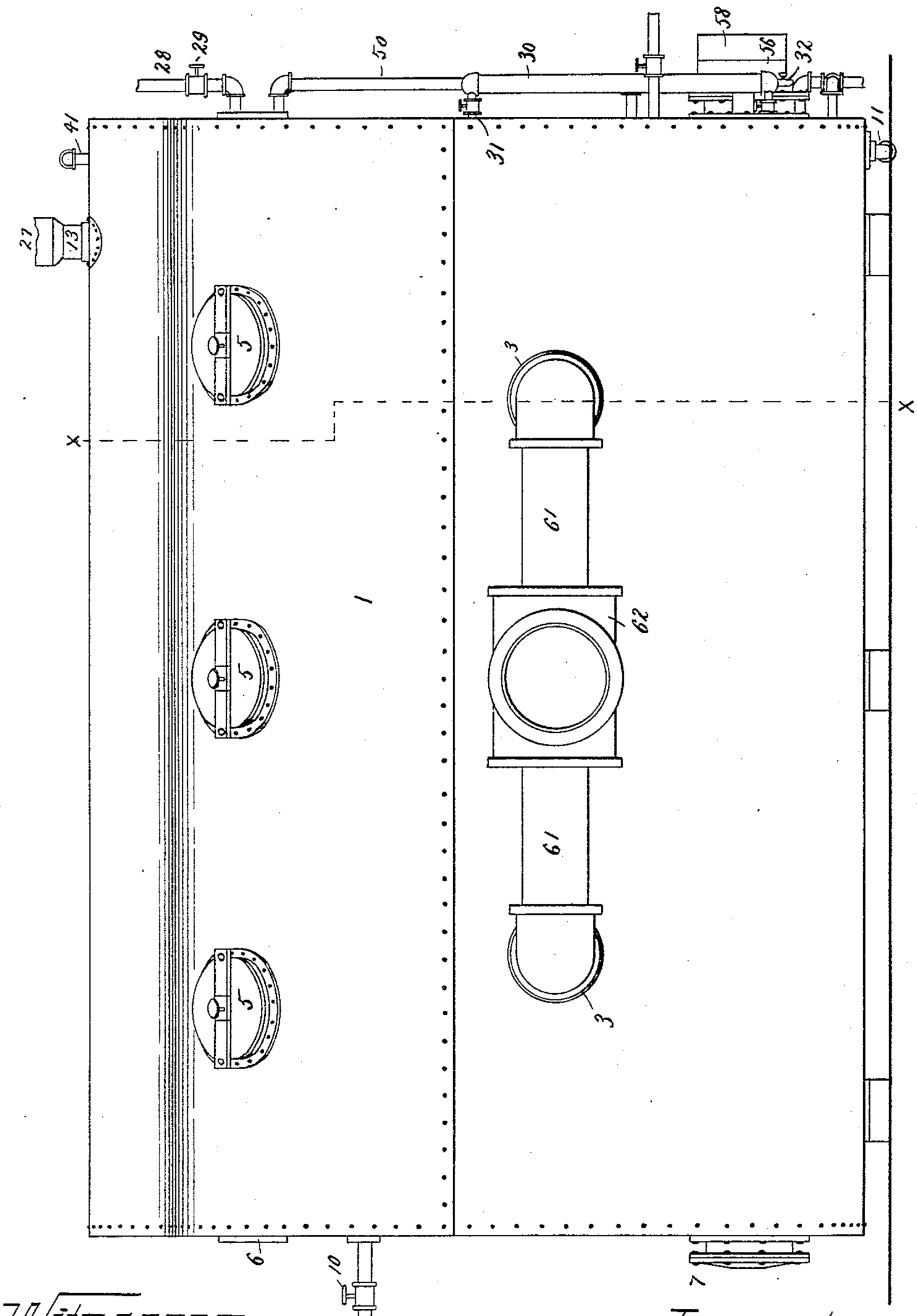

FIG. 2.

Witnesses.
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(No Model.) 4 Sheets—Sheet 3.

G. F. METZGER.

PROCESS OF AND APPARATUS FOR EXTRACTING NAPHTHA FROM OIL.

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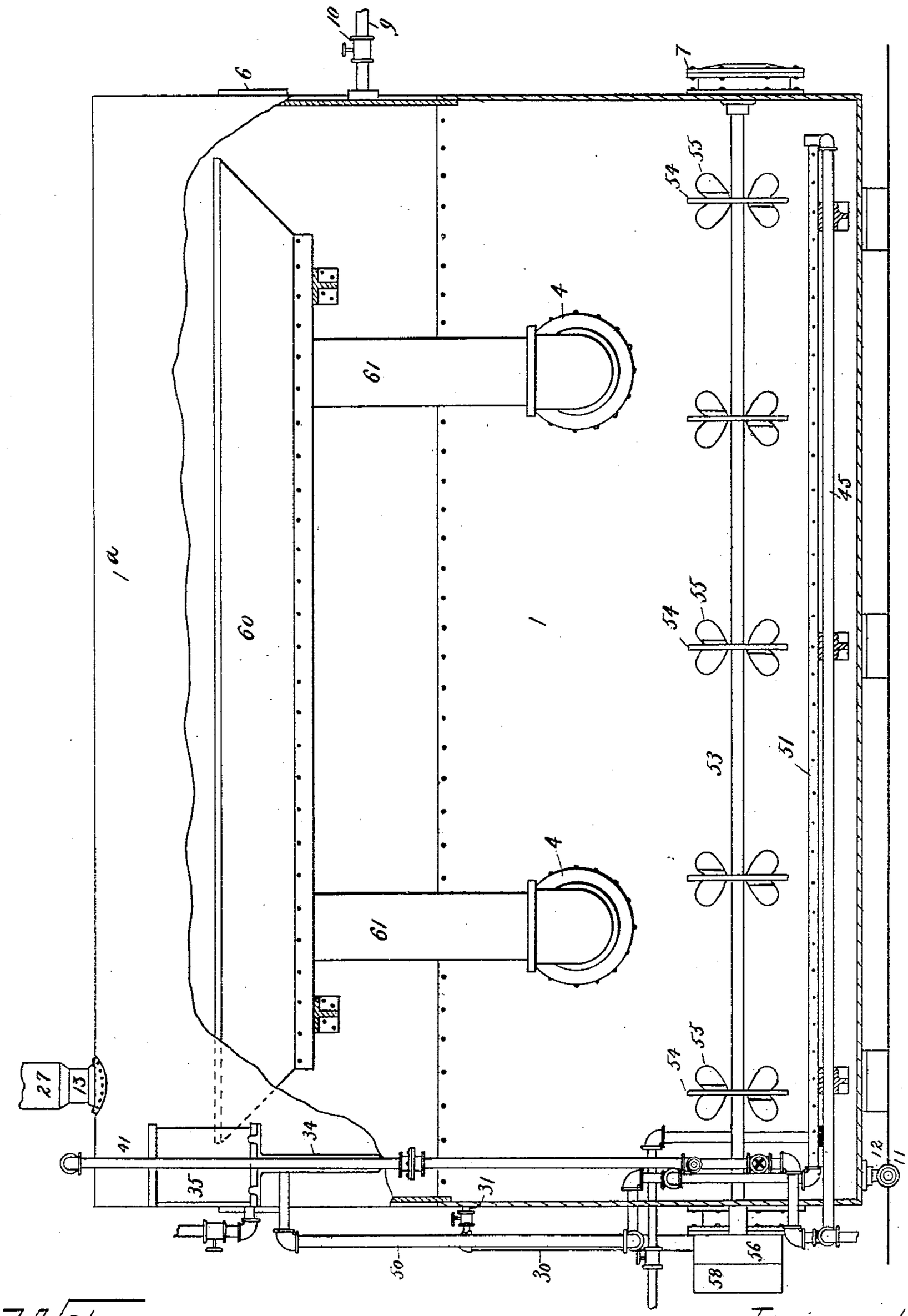

FIG. 4

Witnesses.
F. L. Griswold
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(No Model.) 4 Sheets—Sheet 4.

G. F. METZGER.

PROCESS OF AND APPARATUS FOR EXTRACTING NAPHTHA FROM OIL.

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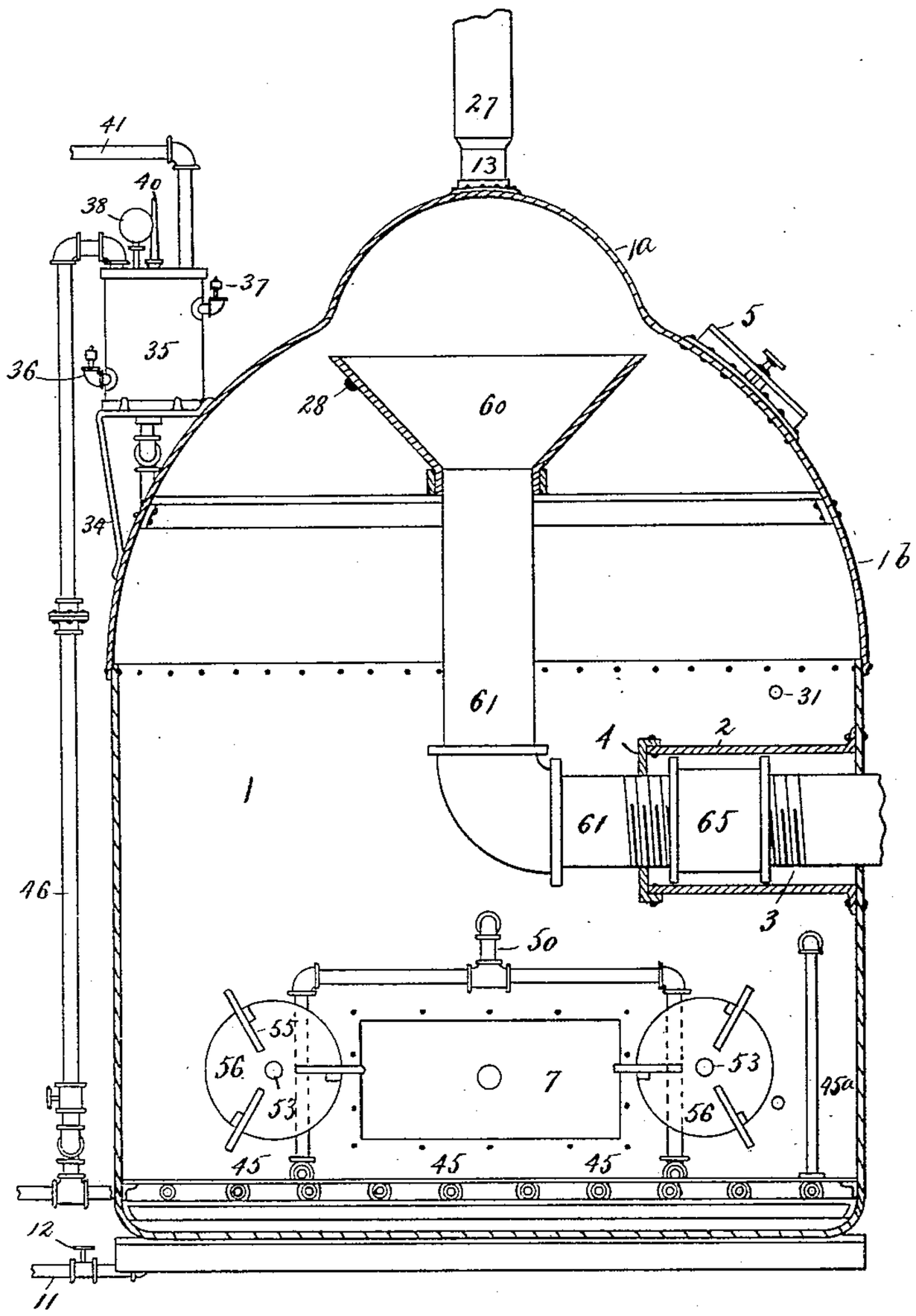

Fig. 5.

Witnesses.
L. Griswold
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UNITED STATES PATENT OFFICE.

GOTTLIEB F. METZGER, OF ELYRIA, OHIO.

PROCESS OF AND APPARATUS FOR EXTRACTING NAPHTHA FROM OIL.

SPECIFICATION forming part of Letters Patent No. 563,391, dated July 7, 1896.

Application filed February 19, 1896. Serial No. 579,980. (No model.)

To all whom it may concern:

Be it known that I, GOTTLIEB F. METZGER, a citizen of the United States, residing at Elyria, in the county of Lorain and State of Ohio, have invented certain new and useful Improvements in Processes of and Apparatus for Separating Naphtha from Oil; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In the practice of the so-called "naphtha process" of producing linseed-oil the oil is first extracted or dissolved out of the meal, in a percolator, by means of naphtha. The next step in the process consists in separating the naphtha from the oil; and it is to this step in the process that my present invention relates. The only method for effecting this result which heretofore has been practically successful consists in injecting live steam into the mixture in the separator-tank, whereby the naphtha is vaporized; and the naphtha-vapor, as formed, is withdrawn from the separator-tank. While this method of effecting this result has been and is still practiced commercially, it is objectionable for several reasons, the chief of which is that the resulting oil has a peculiar rank taste and smell, probably due to the fact that a permanent combination has been effected between the naphtha and a small quantity (more or less) of the oil. This is due, as I believe, to the extreme heat and dryness of the live steam which is injected into the mixture. The hot steam brought into direct contact with the oil-globules suddenly raises their temperature, and some of the globules, I believe, are broken, and thereupon a permanent combination between some of the naphtha and the oil released from said globules is effected. The live steam furnishes to the mixture very little (certainly not enough) moisture or water to protect the oil-globules and prevent this action. I may be wrong in my theory as to why the oil gets the taste and smell referred to, but it is a fact that it does get it when live steam is used as described.

Another objection to the old method under consideration is that the resulting oil contains a greater or less quantity of the glutinous impurity commonly known as "foots." A small quantity of glutinous matter in the meal is probably dissolved by the naphtha in the percolator. The extreme heat of the live steam, and the absence of moisture, cause this glutinous matter to coagulate in the separator-tank as the naphtha is vaporized. The foots do not commonly appear in the oil when it is first made, probably because the glutinous particles are so finely subdivided that they are not visible; but after the oil has stood for awhile these particles seem to be attracted to each other, and become visible as an impurity. The peculiar taste and smell of the oil heretofore produced by the naphtha process, and the presence therein of the foots, make the oil of less value commercially than the oils which are produced by pressure; and these facts have also prevented the successful use of the naphtha process for producing cotton-seed oil or other oils which are used as food products. Another objection, which is of considerable practicable importance, is the excessive cost of the steam which must be used.

The objects of my invention are to produce a superior quality of oil, which is devoid of any rank taste or smell and which contains no foots, and to effect a considerable saving in the cost of separating the naphtha from the oil; and with these ends in view the invention consists in the process hereinafter described and claimed—that is to say, in heating the mixture of oil and naphtha to the temperature at which the naphtha will be vaporized, in injecting into the mixture water heated to a temperature approximating that of the mixture, in mechanically agitating the mixture, and in conducting away the vapor as it is formed.

This process may be practiced by a variety of apparatuses, but that which is shown in the drawings is especially adapted for the use. It is especially contrived with the following desirable objects in view, viz: first, to effect a saving by its use, through utilizing the exhaust from the steam-coil in the separator-tank, by which the mixture is heated for heating the water which is injected into the tank; second, to prevent the loss of oil or naphtha in the event of the steam-pipes becoming leaky; third, to facilitate complete removal of the vapor as formed. A part of the invention resides in the said apparatus,

and consists in the construction and combination of parts hereinafter described and claimed.

In the drawings, Figure 1 is a front elevation of my improved apparatus. Fig. 2 is a sectional view of the combined safety and vacuum valve. Fig. 3 is a side elevation of said apparatus. Fig. 4 is a longitudinal vertical sectional view, and Fig. 5 is a transverse vertical sectional view on line $x\,x$ of Fig. 3.

The separator-tank 1 is preferably made of sheet metal of a rectangular form. It has an arch-shaped top 1^b, in the center of which is a roll or supplemental arch 1^a, of smaller diameter, which extends from one end of the tank to the other. Attached to the inside of one side of said tank are the pipes 2 2, closed at their inner ends by the plates 4 4, thereby forming reëntrant-chambers 3 3. Manholes, closed by covers 5, are formed in the top of the tank, and a sight-glass 6 is set into each end, near the top, so that the contents of the tank may be seen. An opening, near the bottom of each end, is tightly closed by a door 7. The mixture of oil and naphtha to be separated is admitted to the tank through the pipe 9, having a valve 10. A pipe 11, having the valve 12, is connected with the tank near one of the lower front corners, and it is through this pipe that the remaining oil and water are drawn after the naphtha has been driven off. The tank rests upon any suitable blocking in such manner that the corner to which the pipe 11 is connected shall be the lowest point, thereby providing a natural drain. In the front of the tank 1 is an oil-glass 30, opening through pipes 31 into the interior of said tank, and provided with a cock 32 at the bottom. Each pipe 31 has the valve 33, which may be closed and the contents of the oil-glass 30 drawn off by opening the cock 32.

A combined safety and vacuum valve 13 is secured to the top of the tank over an opening therein, and is constructed as follows: It includes an external cylinder 14 and a concentric internal cylinder 15, which is supported by means of the lateral braces 16. A collar 17 is screwed onto the top of the cylinder 14, and a pipe 27, which is fastened to this collar, may be connected with a tank, which is not shown in the drawings. Inside of the pipe 27 is a cross-bar 19, secured to the tops of posts 18, which are in turn secured to the collar 17. A valve 21 is adapted to fit the tops of the cylinders 14 and 15, and thereby close the entrance to the space between them. This valve has a valve-stem 21^a, which extends through an opening in the plate 19, whereby said valve is guided. A coil-spring 21^b, surrounding the said valve-stem, thrusts endwise against said plate and valve, and thereby forces the said valve 21 down upon its seat. In the middle of the valve 21 is an opening 21^c, through which communication is had with the interior of the cylinder 15. A valve 24 is fitted to the lower end of the cylinder 15, and it is connected by means of a coil-spring 24^a with the valve 21. If the pressure in the tank becomes too great, the valve 21 is lifted from its seat against the force of its spring 21^b, and the vapor escapes from the tank through the space between the cylinders 14 and 15. When a partial vacuum is formed in the tank, the valve 24 is automatically opened, and vapor from the pipe 27 passes into the tank through the cylinder 15 and through the central opening in the valve 21. The use of a combined safety and vacuum valve prevents any possible explosion or collapse of the tank by reason of too much or too little pressure therein. A pipe 28, having a valve 29, which may be operated by hand, projects from the front of the tank, near the top thereof, and is for the purpose of supplementing the action of the combined safety and vacuum valve, if necessary. A hot-water tank 35 is suitably supported, preferably by the brackets 34, which are secured to the tank. This water-tank has a thermometer 36 attached to one side, a safety-valve 37 at the opposite side, and a steam-gage 38 at the top. Inside of the tank 35 is a float 39, having a graduated stem 40, projecting through a packed hole in the top of said tank for the purpose of indicating the height of water therein. The interior temperature of the tank is registered by the thermometer, the pressure of steam therein gaged by the gage 38, while the valve 37 automatically relieves any excessive steam-pressure therein. A pipe 41, having a valve 42, supplies a regulated quantity of water to said tank 35 during the vaporization of the naphtha. In the bottom of the separator-tank 1, resting upon any suitable supports, is a steam-coil 45, having sufficient capacity to heat the contents of said tank to a temperature at which the naphtha and some of the water will be vaporized—approximately 212° Fahrenheit. A pipe 45^a for supplying live steam to this coil passes through the end of the tank. The other end of the coil is connected by means of the pipe 46 with the hot-water tank 35. By reason of this construction the exhaust-steam from the coil enters the tank 35 and thereby heats the water which is entering the said tank 35 to the desired temperature, thus utilizing for this purpose the exhaust-steam which might otherwise be wasted. This construction also effects the result of conducting and delivering into the hot-water tank 35 (from which it will be delivered into the tank 1) any oil or naphtha which may get into the steam-coil through any leaky joints therein. The described connection of the water-tank 35 with the steam-coil also provides a steam-pressure therein, by means of which the hot water is forced from said tank into the perforated spraying-pipes 51, from which it is sprayed into the contents of the separator-tank 1. These pipes 51 are supported within the tank, close above the steam-coil and close to the agitators, to be

presently explained. The pipes are connected by means of the pipes 50 with the bottom of the hot-water tank.

Journaled within the tank are two shafts 53, which extend from one end of the tank to the other and through one end. Agitators consisting of disks 54, having wings 55, are secured at intervals to the shafts 53 within the tank 1. The pulleys 56 are fast to the ends of the shaft, which are outside of the tank and are connected by the cross-belt 57, while the pulley 58, which is fast on one of said shafts, furnishes the means by which both shafts are driven by the belt 59. The two shafts are driven in opposite directions constantly during the process of separating the naphtha from the oil, and they keep the contents of the tank in constant agitation.

A trough 60 is suspended within the tank a little below the base of the supplemental arch 1^a, and it extends to within a short distance of each end of said tank. Near the ends of the trough are the pipes 61, which are secured to the bottom thereof and extend therefrom downward and pass out through the reëntrant-chambers 3, being connected outside of the tank by drum 62 with a pipe which conducts the vaporous and liquid naphtha and water to a suitable tank. (Not shown.) The vapor created within the tank rises to the top thereof, and is then deflected downward into the trough, from whence it enters the pipes 61. This trough not only catches the vapor, but it catches any condensation of the vapor which may be formed in the supplemental arch in the top of the tank, and thus prevents it from falling back into the tank, where it might check the vaporizing action. The reëntrant-chambers 3, which are open at their outer ends, serve to cool the horizontal section of the pipes 61, and thus assist in condensing the vapor passing through the same, whereby it is more quickly reconverted into a liquid state. Within each chamber 3 is a coupling 65, which connects the sections of the horizontal portion of the pipe 61 and permits of the ready separation of the same, for cleansing or other purposes.

Although I have described in detail the construction of all of the parts which go to make up the apparatus which the drawings show, it is obvious that in many respects these details are susceptible of change; and I do not intend that this patent shall be limited to the details of construction which are shown and described to any greater extent than is particularly pointed out in the several claims.

In conducting my improved process with the described apparatus the mixture of oil and naphtha (or oil and any other volatile solvent which may have been used for extracting oil) is admitted to the tank through the pipe 9. Steam is turned into the steam-coil and the heating of the mixture begins. The exhaust from the steam-coil enters the hot-water tank 35, whereby the water therein is heated. When the contents of the separator-tank 1 are heated to the temperature at which the naphtha is vaporized, the valve in the pipe 50 is opened, whereupon the hot water begins to be sprayed into the mixture from the perforations in the pipe 51. At the same time the agitator-shafts are set in motion, and these several parts of the process are continued simultaneously until all of the naphtha and a considerable quantity of the water which has been sprayed into the mixture have been vaporized and carried away through the pipes 61.

By reason of the described connection of the hot-water tank with the exhaust from the steam-coil it is evident that the temperature of the water in said tank will always be approximately the temperature of the mixture within the separator-tank 1; and thus, when said water is introduced into the tank 1, it does not reduce the temperature and thereby check the evaporation to any considerable extent; nor does it suddenly heat the particles of the oil and naphtha with which it comes in contact. It is a fact that this water is of a slightly lower temperature than the contents of the tank, but since the water is injected in the form of a spray into the mixture and close to the heating-coils, as shown, this water spray is almost instantly raised to a temperature substantially equal to the temperature of said mixture. When the operation of separating the naphtha from the oil has been completed, nothing will flow through the pipe 61 but water. Thereupon the steam is shut off from the steam-coil, the water is shut off from the tank, and the operation of the agitators is stopped. The mixture remaining in the tank will be about ninety per cent. oil and ten per cent. water, more or less; and this mixture is drawn off through pipe 11 to another tank (not shown) for final treatment.

One advantage of the described apparatus which may be here mentioned is the fact that it does not require to be constantly watched, and in this respect it differs from any apparatus heretofore used for separating naphtha from oil by injecting live steam into the mixture.

By employing the described process and apparatus an oil is produced which is sweet to the taste and smell, being devoid of the peculiar taste and smell which have heretofore characterized oil produced by the naphtha process. The water which has been injected into the tank has washed and cleansed the oil, thereby making it unnecessary to effect this result by a subsequent operation. The oil produced contains no foots or other impurities, and it is invariably much lighter in color than the oil which has heretofore been produced by the naphtha process. In fact, the oil produced by the described process is equal in every respect to the so-called "Calcutta" oil produced by pressure from Calcutta seed.

Having described my invention, I claim—

1. The herein-described process of separating oil from its volatile solvent, which consists in heating the mixture of oil and solvent to a temperature at which the solvent will vaporize, in injecting hot water into said mixture, in mechanically agitating the mass, and removing the resulting vapors until the vaporization of the solvent is completed, substantially as and for the purpose specified.

2. The process of separating a volatile solvent from oil, consisting in heating the mixture of oil and solvent to the desired temperature by indirect steam radiation, in condensing the heating medium by a body of water, in introducing the said water into and through said mixture in the form of hot-water spray, in mechanically agitating the resulting mixture of oil, solvent and water, and in removing the resulting vapors, substantially as and for the purpose specified.

3. In an apparatus for separating naphtha from oil, the combination of a separator-tank, having a vapor-outlet, with a heating device, water-pipes, and mechanical agitators, all contained within said tank below the operative level of the mixture therein, a hot-water tank, connected with said water-pipes, and means for forcing hot water from said tank into and through said water-pipes, substantially as and for the purpose specified.

4. In an apparatus for separating naphtha from oil, the combination of a separator-tank, having a vapor-outlet, with a steam-heating coil, perforated spraying-pipes and mechanical agitators, all contained within said tank, and means for forcing hot water into the separator-tank through said spraying-pipes, substantially as and for the purpose specified.

5. In an apparatus for separating naphtha from oil, the combination of a tank provided with the arch 1^a at the top, and one or more reëntrant-chambers, having an oil and naphtha inlet, and an oil-outlet, with a steam-coil, one or more spraying-pipes, and a trough, all within said tank, and vapor-exit pipes leading from said trough through said reëntrant-chambers outside of said tank, a steam-inlet pipe, connected with said coil, a water-tank, a pipe connecting said hot-water tank with the outlet end of said coil, and a hot-water pipe connecting said tank with said spraying-pipes, substantially as and for the purpose specified.

6. In an apparatus for separating naphtha from oil, the combination of a separator-tank having an oil and naphtha inlet, a vapor-outlet, and an oil-outlet, with a steam-coil, and one or more perforated spraying-pipes within the tank, a steam-inlet pipe connected with said coil, a water-tank connected by a pipe with the outlet end of said coil, and a hot-water pipe connecting said tank with said perforated pipes, substantially as and for the purpose specified.

7. In an apparatus for separating naphtha from oil, the combination of a tank having an oil and naphtha inlet, an oil-outlet, and a vapor-outlet, with a steam-coil, one or more spraying-pipes, and one or more rotatable shafts having agitators thereon, all within the tank, a steam-inlet pipe connected with said coil, a water-tank connected by a pipe with the outlet end of said coil, a hot-water pipe connecting said tank with said spraying-pipes, and means for rotating said shafts, substantially as and for the purpose specified.

8. In an apparatus for separating naphtha from oil, the combination of a tank having an arch-shaped top, a trough suspended in the tank near said top, and one or more vapor-exit pipes connected with said trough and passing therefrom downward and out of said tank, with means for heating the contents of the tank to a temperature which will vaporize the naphtha, substantially as and for the purpose specified.

9. In an apparatus for separating naphtha from oil, the combination of a tank having an oil and naphtha inlet, and an oil-outlet, with a steam-coil, one or more spraying-pipes, and a trough, all within the tank, and vapor-exit pipes leading from said trough outside of said tank, a steam-inlet pipe connected with said coil, a water-tank connected by a pipe with the outlet end of said coil, and a hot-water pipe connecting said tank with said spraying-pipes, substantially as and for the purpose specified.

10. In an apparatus for separating naphtha from oil, the combination of a tank having an oil and naphtha inlet, and an oil-outlet, with a steam-coil, one or more spraying-pipes, one or more rotatable shafts having agitators attached thereto, and a trough, all within said tank, vapor-exit pipes connected with said trough and extending therefrom outside of said tank, a steam-inlet pipe connected with said coil, a water-tank connected by a pipe with the outlet end of said coil, and a hot-water pipe connecting said tank with said spraying-pipes, substantially as and for the purpose specified.

11. In an apparatus for separating naphtha from oil, the combination of a tank having an oil and naphtha inlet, a vapor-outlet, and an oil-outlet, with a steam-coil, and one or more spraying-pipes, all within the tank, with steam outlet and inlet pipes connected to opposite ends of said coil, a hot-water pipe connected to said spraying-pipes, and means for forcing hot water through said pipes, and a combined safety and vacuum valve connected with said tank, substantially as and for the purpose specified.

12. In an apparatus for separating naphtha from oil, a tank having an oil and naphtha inlet, and an oil-outlet, with a steam-coil, one or more spraying-pipes, and a trough, all within said tank, vapor-exit pipes leading from said trough outside of said tank, a steam-inlet pipe connected with said coil, a water-tank connected by a pipe with the outlet end

of said coil, a hot-water pipe connecting said tank with said spraying-pipes, and a combined safety and vacuum valve connected with said tank, substantially as and for the purpose specified.

13. In combination, a tank having an oil and naphtha inlet, and an oil-outlet, the arch 1^a at the top, and reëntrant-chambers 3, 3, with a steam-coil, one or more spraying-pipes, and rotatable shafts with agitators thereon, and a trough, all within the tank, a steam-inlet pipe connected with said coil, a water-tank connected by a pipe with the outlet end of said coil, and a hot-water pipe connecting said water-tank with said spraying-pipes, vapor-exit pipes leading from said trough through said reëntrant-chambers to the outside of said tank, a combined safety and vacuum valve, the safety-pipe 28 with valve, and the necessary connections and valves, substantially as and for the purpose specified.

14. In combination with an apparatus for separating naphtha from oil, a tank having the supplemental arch 1^a at the top, and one or more internal air-chambers opening outward, substantially as and for the purpose specified.

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

GOTTLIEB F. METZGER.

Witnesses:
E. L. THURSTON,
L. F. GRISWOLD.