(No Model.) 3 Sheets—Sheet 1.

J. VAN RUYMBEKE.

APPARATUS FOR RECOVERING GLYCERIN FROM SPENT SOAP LYE.

No. 522,135. Patented June 26, 1894.

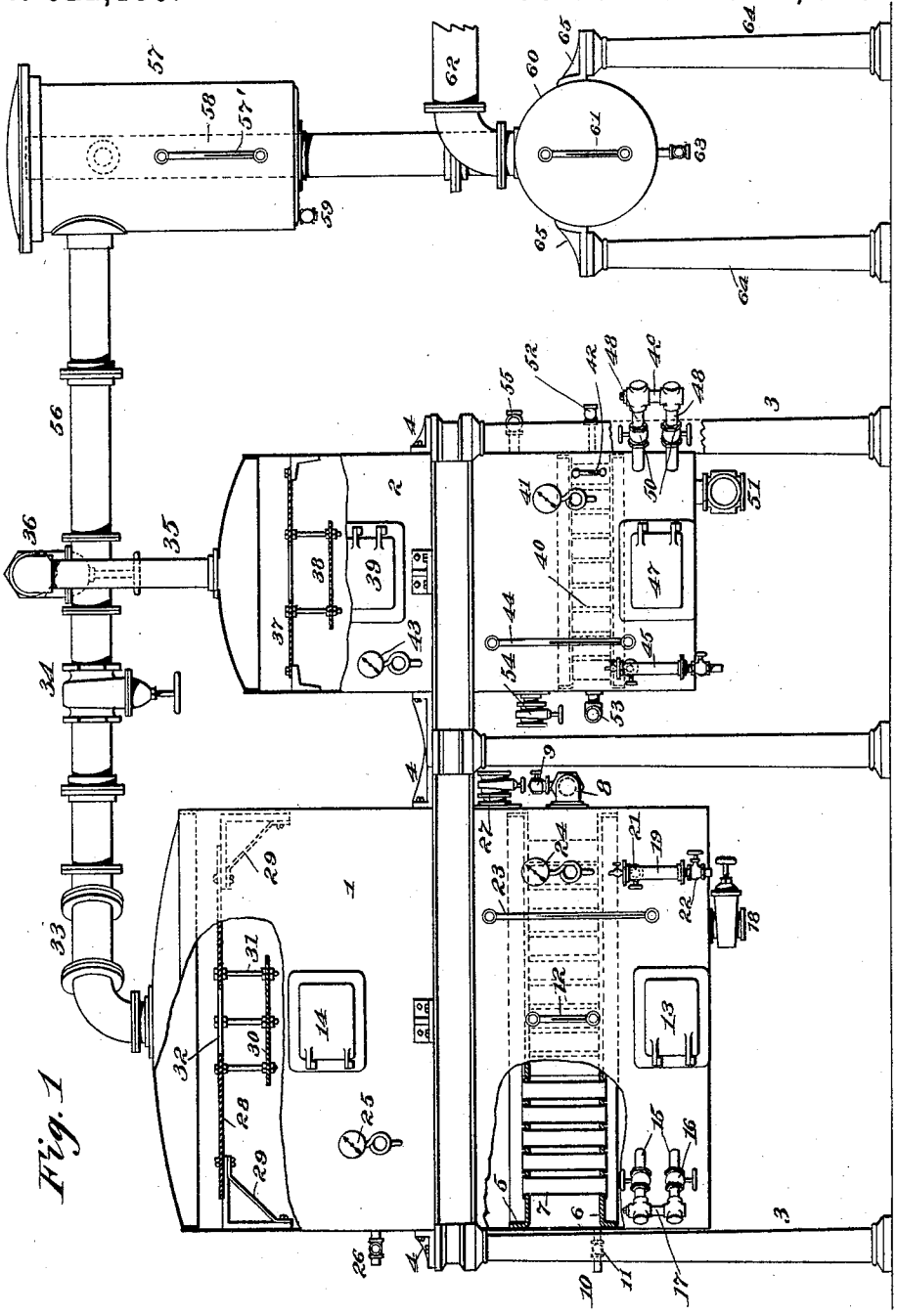

Fig. 1

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(No Model.) 3 Sheets—Sheet 2.

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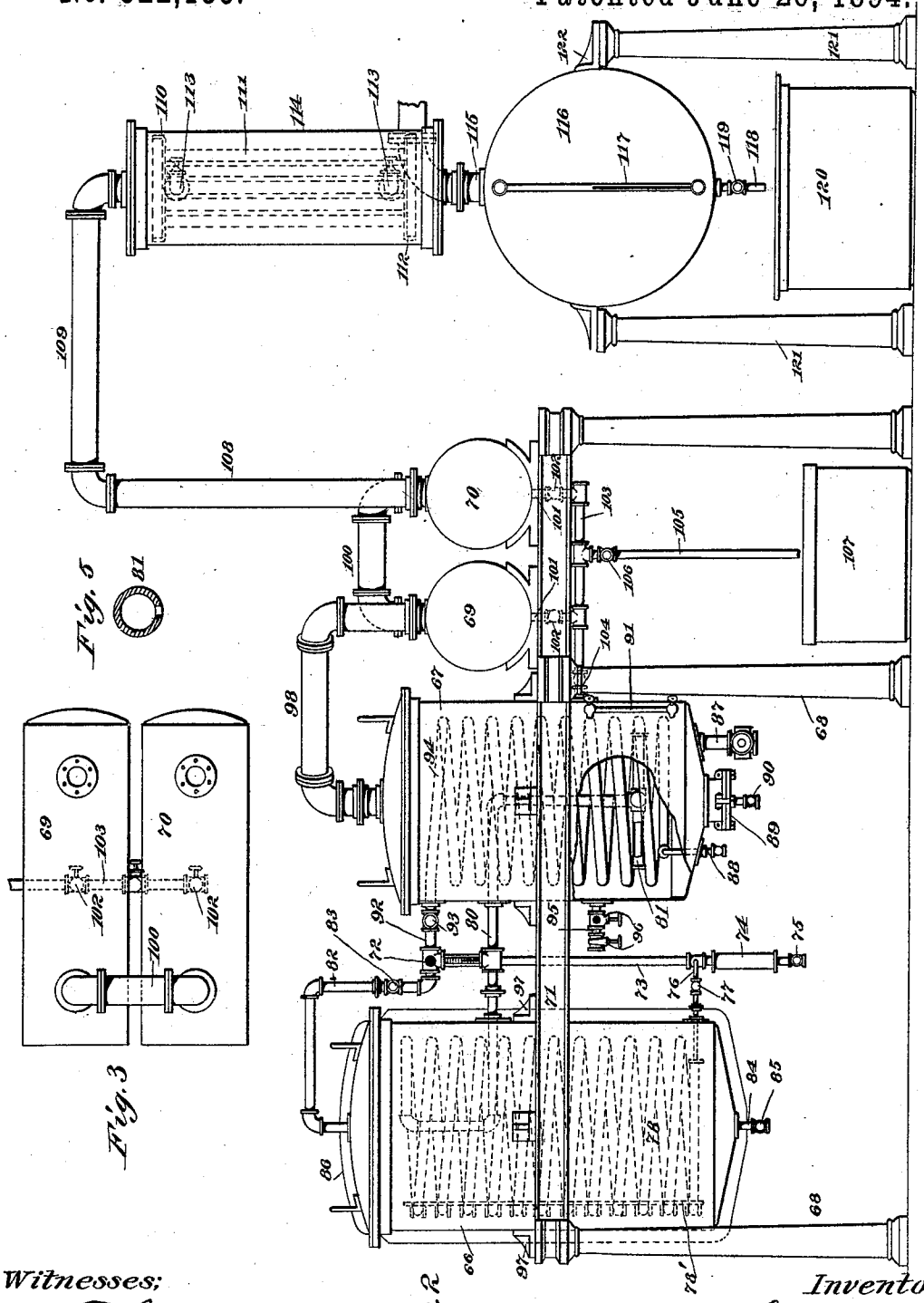

Fig. 2

Fig. 3

Fig. 5

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(No Model.) 3 Sheets—Sheet 3.

J. VAN RUYMBEKE.

APPARATUS FOR RECOVERING GLYCERIN FROM SPENT SOAP LYE.

No. 522,135. Patented June 26, 1894.

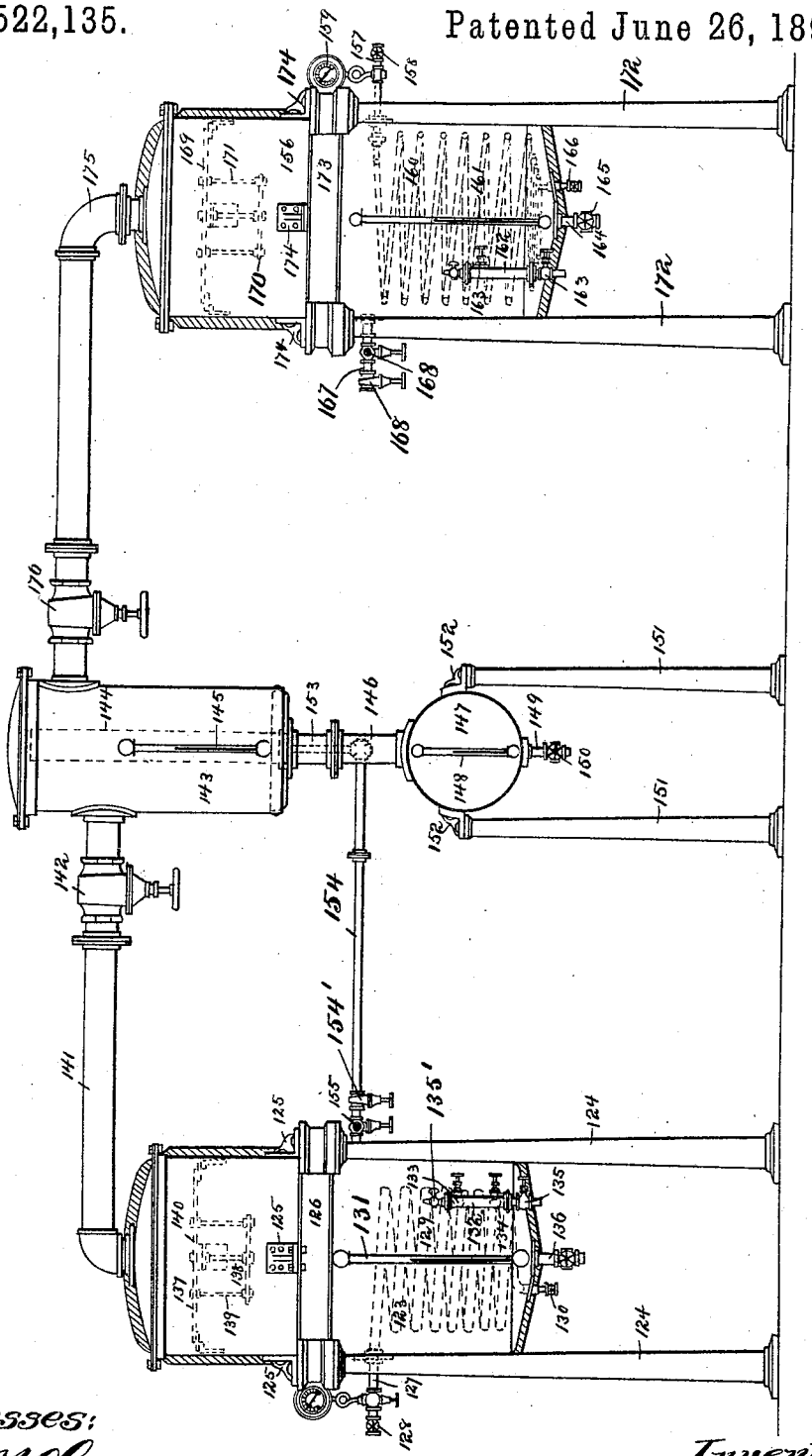

Fig. 4.

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UNITED STATES PATENT OFFICE.

JOSEPH VAN RUYMBEKE, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO WILLIAM F. JOBBINS, OF SAME PLACE.

APPARATUS FOR RECOVERING GLYCERIN FROM SPENT SOAP-LYE.

SPECIFICATION forming part of Letters Patent No. 522,135, dated June 26, 1894.

Application filed March 17, 1894. Serial No. 504,093. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH VAN RUYMBEKE, a subject of the King of Belgium, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Apparatus for Recovering Glycerin; and I do hereby declare the following to be a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an improvement in apparatus for recovering glycerin from soap makers' spent lyes, and consists in novel means for evaporating, distilling and concentrating such lyes.

In the accompanying drawings: Figure 1 is a front elevation partly in section of the evaporators. Fig. 2 is a similar view of the stills. Fig. 3 is a top elevation of the catch-all drums of the stills. Fig. 4 is a front elevation of the concentrators and Fig. 5, a cross sectional view of the distributing pipe or ring of the still.

Referring to Fig. 1, 1 and 2 represent cylindrical evaporators made of sheet iron; 3, 3, 3, are vertical posts or pillars arranged in pairs and of the proper height and 4, 4, are supporting braces at the top of said pillars for supporting the evaporators 1 and 2. 5 and 6 are circular heads or flue sheets within the evaporator 1, and 7, 7, are flues connecting said heads. 8 is a steam inlet pipe for admitting steam into the space between the heads 5 and 6 which constitutes the steam drum, said pipe having a valve 9, and 10 is an outlet pipe for condensed steam for said space, having a valve 11. 12 is a water gage or column on the outside of the evaporator, connected with the steam drum, for measuring the amount of condensation therein. 13 is a man-hole or door in the lower part of the evaporator for removing the salt or other deposits therefrom, and 14 is a similar door in the evaporator about two-thirds of the way from the bottom thereof, to allow the interior of the evaporator to be reached for the purpose of cleaning the same. 15, 15 are draw-off pipes provided with valves 16, 16, and connected with the pipe 17. I make use of two or more of these pipes arranged one above the other, in order that the liquid may be drawn off close to the upper layer of the salt deposited therein. 18 is a gate valve at the bottom of the evaporator for drawing off the contents thereof for any desired purpose. 19 is a vacuum draw off pipe connected with the interior of the evaporator above the maximum limit of the deposited salt. 21 is a valve in the pipe from the evaporator which connects with said pipe 19, and 22 is a valve at the bottom of such pipe. By opening the valve 21 a portion of the liquid in the evaporator may be run out into the pipe 19, after which the valve 21 is closed and the valve 22 is opened and the small quantity of liquid in the pipe 19 is removed and may be tested. In this way a sufficient quantity of liquid in the evaporator may be drawn out for the purpose of testing, against the vacuum therein, and without affecting such vacuum. 23 is a water gage on the side of the evaporator and connected therewith for determining the height of the liquid therein. 24 is a steam gage on the front or side of the evaporator, connected with the steam space between heads 5 and 6, for determining the pressure therein, and 25 is a vacuum gage for indicating the extent of vacuum in the evaporator. 26 is a pipe leading into the evaporator and provided with a valve, by means of which lye not saturated with salt may be introduced into the evaporator for the purpose of dissolving out any salt which may accumulate in the flues 7 and around the same, and thereby prevent incrustation thereof. Such lye should be allowed to be in contact with the pipes to be cleaned for a sufficient length of time to dissolve the incrusting matter. 27 is a pipe with valves, opening into the evaporator above the steam drum therein, for introducing the material to be evaporated. 28 is an annular plate within the evaporator near the top thereof, but of less diameter than the same, strengthened by braces 29 and having the hole or opening 32 at its central part. 30 is a circular dash plate of larger diameter than the opening 32 and supported directly beneath the same by rods 31. This latter dash plate 30 serves to prevent in a great measure any of the material from being projected from the evaporator in case of a sudden application of vacuum or

steam heat. 33 is a heavy vapor pipe leading from the evaporator and provided with a gate valve 34 therein. 35 is a pipe from the evaporator 2, provided with a gate valve 36 therein the latter being arranged above the pipe 32, so that any material from the evaporator 1 will be prevented from entering the evaporator 2. 37 is an annular dash plate in the evaporator 2, and 38 is a circular dash plate secured beneath the same. These elements correspond to those in the evaporator 1. 39 is a man-hole for entering the evaporator 2. 40 is a steam drum, 41 a steam gage connected therewith, 42 a water gage or column for determining the amount of condensation in the steam drum 40. 43 is a vacuum gage and 44 a water gage for determining the height of the liquid in the evaporator. 45 is a vacuum draw off pipe on the evaporator, corresponding to the pipe 19 of the evaporator 1. 47 is a door at the lower part of the evaporator for removing the salt and other sediment that may be deposited therein. 48, 48, are draw off pipes for removing the contents of the evaporator close to the salt therein, connected with the pipe 49 and provided with valves 50. 51 is a draw off pipe corresponding to the draw off pipe 18 of the evaporator 1. 53 is a steam pipe for admitting steam into the steam drum 40, and 52 is a pipe for removing the water of condensation therefrom. 54 and 55 are pipes on the side of the evaporator for introducing the material therein. 56 represents the continuation of the pipe 33 leading into the catch all 57. Within this catch all 57 is a pipe 58, its upper end being open and arranged with its opening above the upper level of the pipe 56, passing down through the bottom of the catch all 57 and connected with the drum 60. 59 is a draw off pipe provided with a valve therein for removing any condensed liquid or material entrained or mechanically carried off with the distillate that may be deposited in catch-all 57. The catch-all 57 is provided the with a removable head and with a water gage 57′, for determining the amount of material that may be caught by and deposited within the same. 60 is a horizontal cylindrical drum beneath the catch all 57 and connected with the pipe 58, as before stated. This drum 60 is provided with a water gage 61 for indicating the amount of condensed water therein. 62 is a pipe extending up from the top of the drum 60 and connected with any desired form of vacuum pump. 63 is a draw off pipe for removing the contents of the drum 60, either into a tank placed beneath said drum or to any desired receptacle. The drum 60, on which rests the catch all 57 is supported on the standard 64 by means of lugs or brackets 65 bolted to the tops of said standards and to the drum.

Referring to Fig. 2, 66 is a reheater made preferably cylindrical in shape, of iron or of steel, and 67 is a still. The heater 66 and still 67 are vertically arranged side by side, as shown. 68, 68, 68, are pillars or posts having the braces or I-beams 71 at the top thereof. The heater 66 and still 67 are supported by these braces by means of lugs or brackets 97 bolted to the same. 72 is a steam pipe from a boiler or any suitable source of steam supply. This pipe 72 connects with the steam pipe 73 running parallel midway between the heater and the still and provided at its lower end with the enlarged cylindrical chamber 74, for receiving the water of condensation from said pipe. Beneath this chamber 74 is a valve 75, for removing the water of condensation. 76 is a small steam pipe connected with the pipe 73 above the chamber 74 and provided with a valve 77 therein. The steam pipe 76 enters the heater 66 near the lower part thereof and connects with the steam coil 78 in said heater. This steam coil 78 is preferably made of considerably larger diameter than the steam pipe 76, so that the steam from the pipe 76, on entering the coil 78, will rapidly expand therein, its temperature being correspondingly reduced. Instead of this arrangement it is obvious that the steam pipe 76 may be of the same diameter as the steam coil 78, or even larger, and that the valve 77 may be so adjusted as to allow the steam to expand into the steam coil 78 in the same way. The steam coil 78 is supported within the heater 66 by means of braces 78′ arranged vertically in the heater. The upper end of the coil 78, which I shall hereinafter refer to as the "expansion coil," connects with the pipe 80, which passes out through the side of the heater and enters the still 67, being provided at its lower end with a distributing ring or pipe 81, (see Fig. 5) having perforations therein preferably extending downward for injecting steam into the contents of the still. 82 is a pipe extending out from the pipe 72 and provided with a valve 83 therein, said pipe 82 entering the top of the heater 66. 84 is a pipe at the bottom of the heater 66, provided with a valve 85 therein, for removing water of condensation from the heater. 86 is an asbestus or other insulated covering around the heater 66, in order that the heat of the same may be retained without loss by radiation. 87 is a draw off pipe provided with a valve for removing the contents of the still when desired. 89 is a door in the lower part of the still, provided with a valved pipe 90 for removing the sediment and residue from the still. 91 is a water gage or column on the still 67 for determining the amount of material therein. 92 is a pipe branching out from the steam pipe 72 and having a valve 93 therein. This pipe 92 connects with a steam coil 94 within the still for heating the contents thereof. 88 is a valved steam pipe connected with the lower end of the coil 94 for carrying off the steam or condensed water therefrom. 95 is a pipe having valves 96, for introducing the material into the still 67. The still may be provided with a dash plate if desired, arranged in any suitable way. 98

is a pipe for carrying off the distillate or vapor from the still 67, which pipe connects with the upper end of the drum 69. 100 is a pipe connecting the upper end of the drum 69 with the upper end of a similar drum 70 arranged at the side of the drum 69, both of these drums being supported on the braces 71 by means of the saddles or brackets 99. 101 are pipes leading out from the bottom of the catch-all drums 69 and 70 and provided with valves 102 therein. The pipes 101 connect at their lower ends with the pipe 103 which enters the side of the still and which is provided with a valve 104. 105 is a pipe connected with the pipe 103, which enters the side of the still and which is provided with a valve 106 therein. 107 is a tank beneath the pipe 105. Instead of making use of two drums, as described, it is obvious that only one drum, or three or more drums, may be employed. Extending up from the top of the drum 70 is a vertical pipe 108, provided with a horizontal branch pipe 109 at its upper end. This pipe 109 connects with the upper end of the upright cylindrical condenser 114. Within this condenser are the heads or drums 110 and 112 connected together by tubular flues 111. 113 are pipes leading into the top and out of the bottom of the space formed between the heads 110 and 112, for maintaining the circulation of water or other cooling agent therein. 115 is a pipe leading out of the lower end of the condenser 114 and connected with the receiving drum 116. This receiving drum 116 is provided with a water gage 117 thereon, for determining the amount of condensed distillate therein. The said drum is also provided with a draw off pipe 118, having a valve 119 for drawing off the condensed distillate. A tank 120 placed beneath the receiving drum 116 may be used for receiving this distillate. The receiving drum 116, and also the condenser 114 are supported on pillars or posts 121 by means of lugs or brackets 122, bolted to the tops of said pillars and to the side of said drums.

Referring to Fig. 4, 123 represents a concentrator made preferably either of iron or steel. This concentrator 123 is supported on pillars or posts 124 by means of brackets or lugs 125 bolted to said concentrator, and to braces 126 connecting the tops of the posts. 127 is a steam pipe provided with a valve 128, having a steam gage thereon for registering the amount of pressure in the pipe. This pipe connects with a steam coil 129 within the still for heating the contents thereof. 130 is a steam pipe having a valve therein for carrying off the condensed steam from the coil 129. 131 is a water gage or column on the side or front of the concentrator 123, for indicating the height of the material therein. 132 is a vacuum draw off pipe, connected with the concentrator 123 at one or more levels, and provided with valves 133, 134 for drawing material into said pipe 132 from any desired portion of the liquid in the concentrator. 135 is a valve beneath the pipe 132 for removing the material drawn therein for the purpose of testing the same. 135′ is a pet cock at the top of the pipe 132 for admitting air into the same. 136 is a draw off pipe at the lower end of the concentrator for removing the concentrated material therefrom. 137 is an annular dash plate within the concentrator near the top of the same, and provided with a circular dash plate 138, supported beneath the plate 137 by means of rods 139. 140 is the opening in the annular plate 137 above the circular dash plate 138, but of smaller diameter than the same. 141 is a pipe from the concentrator 123 for carrying off the aqueous vapors and other volatile matters therefrom, and provided with a valve 142. This pipe 141 is connected with a catch-all 143 provided with a pipe 144 therein, having its open upper end arranged above the opening of the pipe 141. 145 is a water gage for indicating the amount of liquid that may be caught by and retained in the catch all 143. 146 represents the continuation of the pipe 144 and which connects with the top of the drum 147, provided at one of its ends with a water gage 148. 149 is a draw off pipe for removing the contents of the drum 147, provided with a valve 150. 151, 151, are pillars or posts on which the drum 147 is supported by means of brackets 152 bolted to the top of said pillars or posts, and to said drum. 153 is a pipe which leads out from the bottom of the catch-all 143 at one side of the pipe 144, and is connected with a horizontal pipe 154 by means of a four way casting, as shown, to enable the pipes 153 and 154 to be cleaned. The pipe 154 enters the side of the concentrator 123 and is provided with a valve 154′ thereon. 155 is a valved pipe entering the pipe 154 between the concentrator and the valve 154′ in said pipe, for introducing the material into the concentrator. 156 is a second concentrator provided with a steam pipe 157 having a valve 158 therein, and a steam gage 159 thereon. This steam pipe 157 connects with a coil 160 on the inside of the concentrator 156. 161 is a water gage on the concentrator, and 162 is a vacuum draw off pipe connected therewith and having valves 163, 163. 164 is a draw off pipe for the concentrator and having the valve 165; and 166 is a steam pipe connected with the end of the coil 160 for carrying off the steam therefrom, or for removing the water of condensation therein. 167 is a pipe having valves 168 for introducing material into the concentrator 156. 169 is an annular dash plate near the top of the concentrator 156, provided with a circular dash plate 170, supported by rods 171, as before explained. 172 are pillars or posts for supporting the concentrator 156 by means of lugs or brackets 174 bolted to the braces 173, and to the concentrator. 175 is a pipe for carrying off the aqueous vapors from the concentrator 156, and provided with a valve 176, which pipe 175 connects with the catch-all

143. In practice it is desirable that the concentrator 156 which concentrates the glycerin after the second distillation should be made of copper, preferably tinned on its interior, in order that there may be no danger of contaminating or discoloring the glycerin.

In making use of the apparatus shown, I take waste soap lye, which has been first limed if necessary, and treated with ferric sulfate, or any other suitable metallic salt in the usual way, and introduce it into the evaporator 1, through the pipe 27. I then close the valve 36 so as to maintain a fairly high vacuum, preferably say about twenty-six inches, within the drum 60, catch all 57 and evaporator 1. Steam is now introduced through the pipe 8 into the steam drum of the evaporator and heats the flues 7 and the heads therein, to the proper temperature. This heat should be sufficient to concentrate the lye until it has been concentrated to the proper degree, preferably to about 28° Baumé when drawn from the evaporator, or 30° Baumé at 15° centigrade. This heating may be conveniently accomplished by means of exhaust steam. This evaporation of the lye causes the salt therein to separate after the salting point has been reached, which salt accumulates at the bottom of the evaporator and may be removed therefrom through the door 13 and dried and treated or purified in any suitable way. By means of the pipe 19 the specific gravity of the lye may be tested and when it has reached the desired strength, preferably that indicated, the lye is drawn off as closely to the salt as possible through one of the draw off pipes 15 By making use of the annular and circular dash plates 28 and 30, I prevent the liquid from being projected into the pipe 33 by any sudden increase of the vacuum or steam heat. At the above described density (30° Baumé at 15° centigrade) the lye contains about 50 per cent. of glycerin and most of the salt contained therein has been deposited. After the lye has been evaporated to the proper specific gravity, it is removed through one of the draw off pipes 15 into the evaporator 2, this removal being generally accomplished by the suction of the high vacuum therein. The concentrated lye having a density of 30° Baumé at 15° centigrade, as before stated, is now subjected to a second concentration in the evaporator 2 by means of steam introduced into the steam drum 40 until the lye has attained a specific gravity of 34° Baumé at 15° centigrade. An additional quantity of salt separates during this operation, which salt may be removed and dried in any suitable way. The reason for carrying on the evaporation process in two steps as above described, is that when the salt is impregnated with concentrated crude glycerin it is difficult to dry and to free from its adherent mother liquor but by evaporating it in the first evaporator until it reaches a specific gravity of not more than 30° Baumé at 15° centigrade I am enabled, as before explained, to free it of most of the salt originally contained therein. By carrying on the evaporation in a vacuum of about twenty-six inches and with steam at a low pressure, the loss of glycerin by evaporation is reduced to a minimum and in fact there is practically no loss of glycerin from this source when the process is properly carried out. A sufficient quantity of the concentrated lye is now introduced into the still 67 through the pipe 95 preferably by reason of the vacuum therein. I now close the valve 96 and maintain the vacuum in the still, and steam is introduced through the pipe 72, and passing through the pipe 92, into the steam coil 94, heats the contents of the still up to a temperature approximating the boiling point thereof at the vacuum used. Steam from the pipe 72 also passes through the pipe 82 into the heater 66, and heats the expansion coil 78 therein to the proper temperature. Steam from the pipe 72 also passes through the pipe 82, into the heater 66 and heats the expansion coil 78 therein to the proper temperature. Steam from the pipe 72 also passes through the pipe 73 into the smaller pipe 76, and thence into the large expansion coil 78 where it rapidly expands, its temperature being thereby reduced corresponding to the extent of expansion. By heating the expansion coil 78 by means of free steam in the heater 66, the expanded steam in such expansion coil will be reheated approximately to its original temperature, and in its expanded and reheated form will pass through the pipe 80 and be injected into the material through the perforated pipe or ring 81. By first allowing this steam to expand and by then reheating it before injecting it into the liquid, I find that expansion in the still in the presence of the vacuum used is reduced to a minimum. This injected steam, at a temperature of about 300° Fahrenheit at a vacuum of twenty-eight inches or more, in passing through the liquid will rapidly distill the same, and the distillate passes out through the pipe 98 into the drum 69. The less volatile distillate, comprising glycerin, generally of an excellent quality, will be deposited in the drum 69. From the drum 69, the distillate passes by means of the pipe 100 into the drum 70, and more glycerin will be condensed and retained therein. The more volatile distillate, consisting of glycerin with a large percentage of watery vapor, passes up from the drum 70 by means of the pipe 108 and enters the condenser 114 where it is condensed by passing through the cooling pipes 111. The condensed distillate will now be deposited in the receiving drum 116. The sweet water thus collected in the drum 116 may be removed therefrom into the tank 120 after the distillation has ceased, or by stopping the vacuum pump. The less volatile distillate collected in the drums 69 and 70, which as before mentioned, is concentrated glycerin, generally of a bright color and of an excellent

quality, may be drawn out of said tanks into the tank 107 through the pipes 101, 103 and 105, but if upon test it is found that this glycerin is not of sufficient purity, it may be returned through the pipe 103 into the still by opening the valve 104. The distillate in the tank 120 is now ready for the first concentration in the concentrator 123, which may be an iron concentrator. The valve 176 is closed so as to cut off the concentrator 156 and a vacuum is maintained in the concentrator 123 by means of a vacuum pump connected with the receiving drum 147. By thus maintaining a vacuum in the concentrator, the glycerin from the receiving tank 120 may be drawn through the pipe 155 by suction, or by any other suitably located pipe. Steam is now admitted into the coil 129 through the pipe 127 and the glycerin is maintained at a temperature above the boiling point of water at the vacuum used. The watery vapor thus driven off passes through the pipe 141 and enters the catch all drum 143. This watery vapor generally carries with it small and varying quantities of glycerin. The watery vapor and glycerin passing into the catch all drum will impinge against the pipe 144 and the glycerin contained in the vapor will condense and deposit in the drum 143. The watery vapor thus driven off passes into the pipe 144 and accumulates in the receiving drum 147, from which it may be removed as desired.

The glycerin which is condensed in and collected by the catch all drum 143, by reason of the fact that it is of a less volatile nature than the watery vapor passing through the same, may be returned to the concentrator 143 by the pipe 154 by opening the valve 154′ therein. When the glycerin has been sufficiently concentrated, which can be determined by means of the pipe 132, it is passed through another distilling apparatus, preferably like that illustrated in Fig. 2, except that it is advisable that the catch all drums 69 and 70, condenser 114, and receiving tank 116 of the second still should be made of copper lined with tin, so as not to contaminate the glycerin of the second distillation. After this second distillation, the glycerin is introduced into the concentrator 156 through the pipe 167 and is heated so as to drive off the water therein by steam in the steam coil 160. The watery vapor passing out of the still 156 enters the catch all 143 by means of the pipe 175, and is condensed and collected in the receiving drum 147. This concentration is carried on until the distillate has reached a specific gravity of 1.262 for dynamite purposes, or even higher if necessary.

It is obvious that by making use of a catch all 143 and in providing means for returning the glycerin caught therein back to the concentrators, the loss of glycerin during the operation of concentration is reduced to a minimum. It is also obvious that the apparatus above described may be used for the evaporation, distillation and concentration of other materials besides glycerin and that the evaporators, stills and concentrators described may be used separately in the treatment of liquids and fusible materials. Instead of making use of a dash plate consisting of an annular plate with a circular plate supported therefrom beneath the opening therein, it is obvious that such circular plate may be arranged above the annular plate; and also that the annular plate may be provided with a square or polygonal or other shaped opening, and that the plate supported above or below such opening may be of any configuration desired.

Having now described my invention, what I claim as new therein, and desire to secure by Letters Patent, is as follows:

1. As an improvement in vacuum evaporators, the combination of an evaporator body, an eduction pipe therefrom connected with a chamber, a perpendicular pipe in said chamber, communicating by means of its upper open end located in the upper part of said chamber with a receiving tank, and a pipe from said tank adapted to be connected with a vacuum pump, substantially as described.

2. As an improvement in vacuum evaporators, the combination of an evaporator body, an eduction pipe therefrom connected with a chamber, a perpendicular pipe in said chamber communicating by means of its upper open end located in the upper part of said chamber with a second chamber, and a pipe leading from the upper part of said second chamber adapted to connect with a vacuum pump, substantially as described.

3. As an improvement in vacuum evaporators, the combination of an evaporator body, a tubular steam heating drum in the lower part thereof, an eduction pipe therefrom, connected with a chamber, a perpendicular pipe in said chamber communicating by means of its upper open end located in the upper part of said chamber with a receiving tank, and a pipe from said tank adapted to be connected with a vacuum pump, substantially as described.

4. As an improvement in vacuum evaporators, the combination of an evaporator body, a tubular steam heating drum in the lower part thereof, draw off pipes arranged one above the other below said drum and located at a distance from the bottom of the evaporator, an eduction pipe from said evaporator connected with a chamber and a perpendicular pipe in said chamber adapted to communicate by means of its upper open end located in the upper part of said chamber, with a vacuum pump, substantially as described.

5. As an improvement in vacuum evaporators, the combination of the evaporator body, an annular dash plate in the upper part of the evaporator, a circular dash plate located beneath the annular dash plate, a tubular steam heating drum in the lower part of the evaporator, and draw-off pipes arranged one

above the other below said drum and located at a distance from the bottom of the evaporator, substantially as described.

6. As an improvement in vacuum evaporators, the combination of the evaporator body, an annular dash plate in the upper part of the evaporator, a circular dash plate located beneath the annular dash plate; a tubular steam heating drum in the lower part of the evaporator, an eduction pipe therefrom connected with a chamber, a perpendicular pipe in said chamber communicating by means of its upper open end located in the upper part of said chamber, with a receiving tank and a pipe from said tank adapted to be connected with a vacuum pump, substantially as described.

7. As an improvement in vacuum evaporators, the combination of an evaporator body, an annular dash plate in the upper part thereof, a circular dash plate located beneath the annular dash plate, a tubular steam heating drum in the lower part of the evaporator, draw off pipes in the lower part of the drum arranged one above the other and located at a distance from the lower part of the evaporator, an eduction pipe in said evaporator connected with a chamber, and a perpendicular pipe in said chamber adapted to communicate by means of its upper open end located in the upper part of said chamber, with a vacuum pump, substantially as described.

8. In an evaporating apparatus, the combination of the evaporators 1 and 2, a catch-all 57 common to both evaporators, and a receiving tank 60, beneath said catch-all and connected with the same, substantially as described.

9. In an evaporating apparatus, the combination of the evaporators 1 and 2, a catch all 57 common to both evaporators, tank 60 connected with said catch all and pipe from said tank 60 adapted to be connected with a vacuum pump, substantially as described.

10. In an evaporating apparatus, the combination of the evaporators 1 and 2, a catch all common to both evaporators, a receiving vessel 60 connected with said catch all, and a pipe leading from the upper part of said receiving vessel adapted to be connected with a vacuum pump, substantially as described.

11. In an evaporating apparatus, the combination of the evaporators 1 and 2, a catch all 57 common to both evaporators, a perpendicular pipe 58 in said catch-all, communicating by means of its upper open end located in the upper part of said catch-all with a receiving tank 60, and a pipe from said tank adapted to be connected with a vacuum pump, substantially as described.

12. As an improvement in vacuum evaporators, the combination of an evaporator body, a tubular steam heating drum in the lower part thereof, and two or more draw off pipes 15, arranged vertically one above the other for the purpose mentioned, substantially as described.

13. As an improvement in vacuum evaporators, the combination of an evaporator body, a tubular steam heating drum in the lower part thereof, a door in the evaporator beneath said steam heating drum, and one or more draw off pipes beneath said steam heating drum arranged vertically one above the other for the purpose mentioned, substantially as described.

14. As an improvement in vacuum evaporators, the combination of an evaporator body, a tubular steam heating drum in the lower part thereof, one or more draw-off pipes beneath said steam heating drum; a vacuum draw-off pipe 19 beneath said steam heating drum; a valve 22, at the lower end of said vacuum draw-off pipe 19, a pet cock at the upper end of said vacuum draw-off pipe, and a valved pipe connecting said vacuum draw-off pipe with the evaporator, said valved pipe entering said vacuum draw-off pipe near the upper part of the latter, substantially as described.

15. As an improvement in vacuum evaporators, the combination of an evaporator body, a tubular steam heating drum in the lower part thereof, a door in the lower part of said evaporator beneath said steam heating drum for the purpose mentioned, one or more draw off pipes 15, beneath said steam heating drum; a vacuum draw off pipe 19 beneath said steam heating drum, and a door 14 above said steam heating drum, substantially as described.

16. In an evaporating apparatus, the combination of the evaporators 1 and 2, the pipe 33 from the evaporator 1, and the pipe 35 from the evaporator 2, connected with the pipe 33 at the top of the same for the purpose mentioned, substantially as described.

17. In an evaporating apparatus, the combination of the still, the heater and expansion coil in the heater, a coil in the still and a steam pipe connected with the coil in the still, the expansion coil of the heater and the space in the heater surrounding the expansion coil, substantially as described.

18. In an evaporating apparatus, the combination of the still, a heater and expansion coil in the heater, a coil in the still, a steam pipe connected with the coil of the still, the expansion coil in the heater, and the space in the heater surrounding the expansion coil, and a perforated delivery pipe in the still connected with the expansion coil, substantially as described.

19. The combination of a still, a perforated steam delivery pipe in the still, means, substantially as described, for expanding and reheating steam previous to its introduction into the still, an eduction pipe from the still connected with the first of a series of communicating drums, and a perpendicular pipe connected with the last of said drums and with a condenser, as and for the purpose set forth.

20. The combination of a still, a perforated steam delivery pipe in the still; means, substantially as described, for expanding and reheating steam previous to its introduction

into the still, an eduction pipe from the still connected with the first of a series of communicating drums, pipes beneath said drums and communicating between said drums and the still, and a perpendicular pipe connected with the last of such drums and with a condenser, as and for the purpose set forth.

21. In an evaporating apparatus, the combination of a still, a catch all drum or drums connected therewith, a condenser 114 connected with said catch all drum or drums, a receiving tank 116 connected with said condenser and a pipe extending from the upper part of said tank adapted to be connected with a vacuum pump, substantially as described.

22. In an evaporating apparatus, the combination of a still, a heater and expansion coil in the heater, a coil in the still, a steam pipe connected with the coil of the still, the expansion coil of the heater and the space in the heater surrounding the expansion coil, a perforated pipe in the still connected with the expansion coil, an eduction pipe connected with the first of a series of communicating drums, and a perpendicular pipe connected with the last of said drums and with a condenser, said condenser being adapted to be connected with a vacuum pump, substantially as described.

23. In an evaporating apparatus, the combination of a still, catch all drums 69 and 70 connected together and with said still; a pipe 101 from each of said catch all drums; a pipe 103 connecting said pipes 101 and communicating with the still; a pipe 105 connected with the pipe 103; a condenser 114 connected with the catch all drum 70; a receiving tank 116 connected with the condenser 114, and a pipe from said tank adapted to be connected with a vacuum pump, substantially as described.

24. In an evaporating apparatus, the combination of the standards 68, the braces 71 at the tops of said standards, the heater 66, still 67 and catch-all drums 69 and 70 supported by said braces, the condenser 114 connected with the catch all drum 70, the receiving tank 116 connected with the condenser 114 and a pipe from said tank adapted to be connected with a vacuum pump, substantially as described.

25. As an improvement in vacuum concentrating apparatus, the combination of a concentrator, an eduction pipe from said concentrator leading into a chamber, a perpendicular pipe in said chamber open at its upper end and communicating with a receiving tank, a pipe from said tank adapted to be connected with a vacuum pump and a pipe connecting said chamber with the concentrator, substantially as described.

26. As an improvement in vacuum concentrating apparatus, the combination of two concentrators communicating with a common catch all, a receiving tank connected with said catch-all and adapted to connect with a vacuum pump and a pipe establishing a communication between said catch all and one of said concentrators, substantially as described.

27. As an improvement in vacuum concentrating apparatus, the combination of a dash plate in the upper part of a still, and having an opening in its center, of an imperforate dash plate located adjacent to and opposite said opening and supported by said perforated dash plate, substantially as described.

28. As an improvement in vacuum evaporators, the combination of an evaporator body, an annular dash plate in the upper part thereof, a circular dash plate located adjacent to the annular dash plate, and supported therefrom, an eduction pipe from said evaporator body connected with a chamber, and a perpendicular pipe in said chamber with its upper open end located above the level of the eduction pipe, and adapted to communicate with a vacuum pump, substantially as described.

29. An improved dash plate for use in vacuum evaporators or similar chambers in which liquids or fusible solids are heated, comprising a perforated dash plate within the chamber with a clear passage between said dash plate and the interior of said chamber, and an imperforate dash plate adjacent to the perforated dash plate and in line with and larger than the opening therein, substantially as described.

This specification signed and witnessed the 9th day of March, 1894.

JOSEPH VAN RUYMBEKE.

Witnesses:

WILLIAM F. JOBBINS,

CHARLES L. BURGOYNE.