B. S. LINDSEY.

STILL.

APPLICATION FILED SEPT. 25, 1908.

1,100,834.

Patented June 23, 1914.

2 SHEETS—SHEET 1.

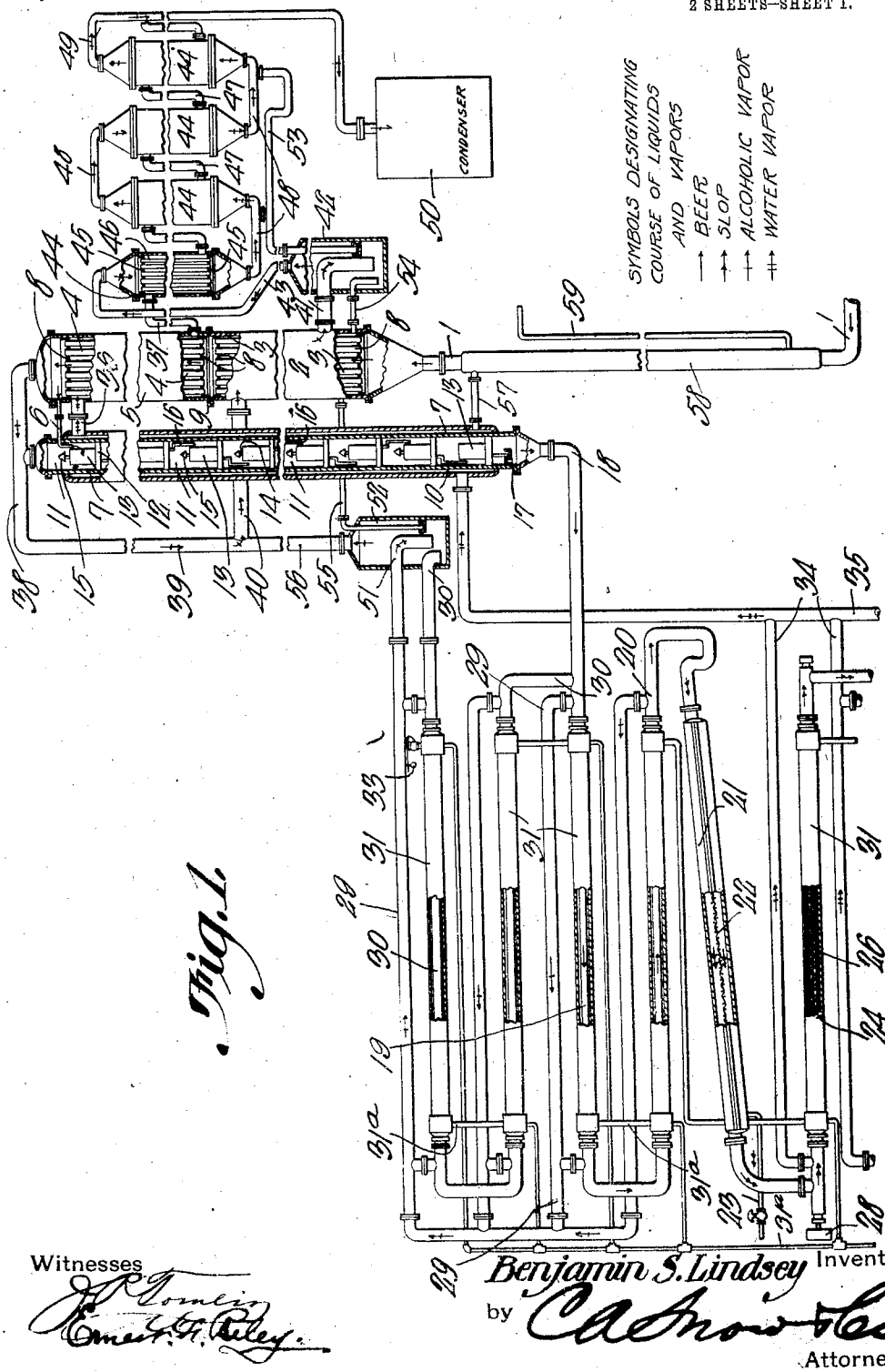


Fig. 1.

Witnesses

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2 SHEETS—SHEET 2.

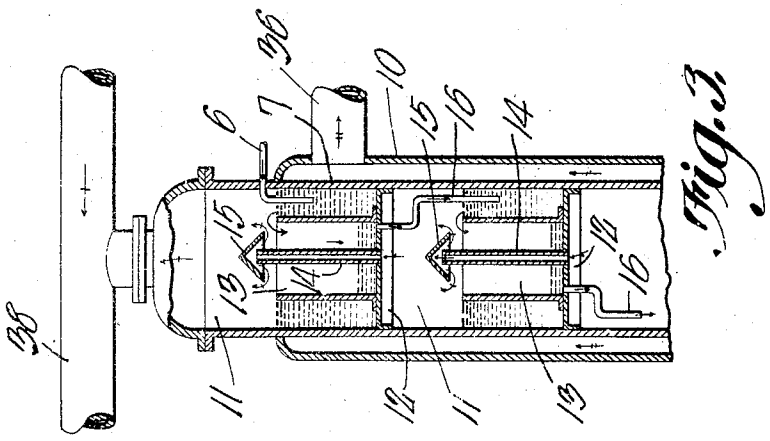


Fig. 3.

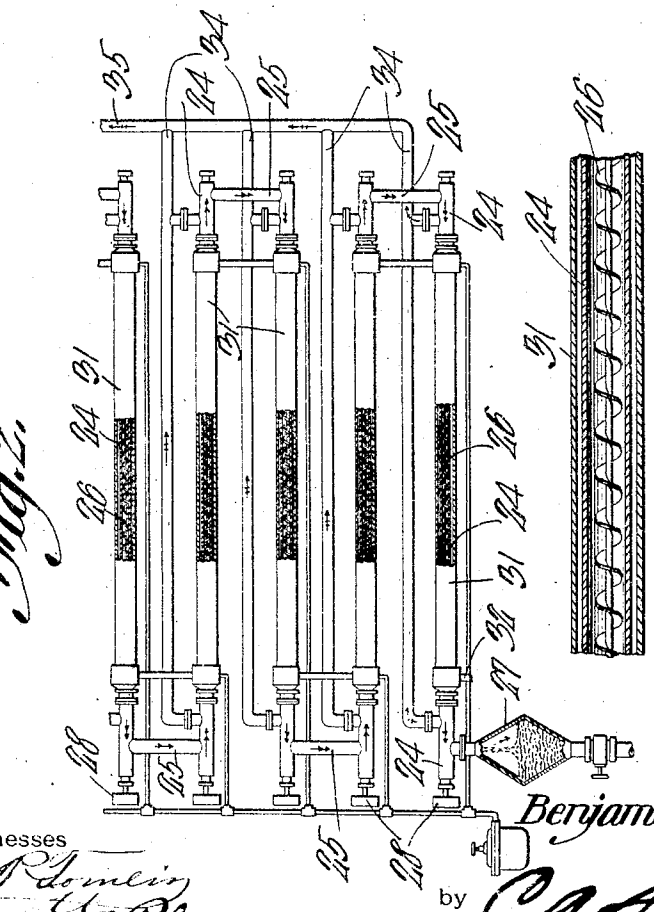


Fig. 2.

Fig. 5.

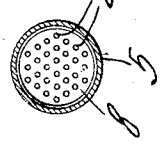


Fig. 4.

Witnesses

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UNITED STATES PATENT OFFICE.

BENJAMIN S. LINDSEY, OF BALTIMORE, MARYLAND.

STILL.

1,100,834. Specification of Letters Patent. Patented June 23, 1914.

Application filed September 25, 1908. Serial No. 454,754.

To all whom it may concern:

Be it known that I, BENJAMIN S. LINDSEY, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented a certain new and useful Improvement in Stills, of which the following is a specification.

This invention relates to improvements in stills, and its object is to provide a still for producing high proof spirits economically and effectively by a single continuous process; and, furthermore, to employ the alcoholic vapor, as well as the steam generated from the drying slop, to furnish heat for the operation of distillation.

With these objects in view, the invention consists in a novel construction and arrangement of parts to be hereinafter described and claimed, reference being had to the accompanying drawings forming a part of this specification, in which drawings—

Figure 1 is a view, partly in elevation and partly in section, of the apparatus, parts being broken away. Fig. 2 is a view partly in elevation and partly in section of the driers. Fig. 3 is a detail vertical section on an enlarged scale showing the upper portion of the main vaporizer. Fig. 4 is a horizontal section through the secondary heater or condenser. Fig. 5 is an enlarged detail view of one of the conveyers of the drier, adjacent parts being shown in section.

In the drawings, the beer is designated by an arrow, the slop by a double-headed arrow, the alcoholic vapors by an arrow crossed centrally by a line and the water vapors by an arrow crossed by two lines.

Referring more particularly to the drawings, in which like reference numerals designate like parts throughout the several views, 1 designates a pipe through which the beer is pumped to the main heater or concentrating element 2, where it passes through the tubes 3 on up through the tubes 4 of the secondary heater and condenser or concentrating element 5, and through the pipe 6 to the main vaporizer 7. The heaters 2 and 5 comprise cylindrical vessels which are each provided with a head 8 near the ends thereof, through which the ends of the tubes 3 and 4 project, forming an air tight chamber in each of said heaters between the heads, and surrounding said tubes. The heaters 2 and 5 are secured together by an air-tight joint 9.

The concentrating element or main vaporizer 7 is provided with a heat conductor which, in the present instance, is in the form of a steam jacket 10, and is provided with a number of compartments 11 formed by horizontal partitions 12 arranged equidistant within the said vaporizer. In each of said compartments 11 is a cylinder having a flange on its lower end secured to the upper surface of the partition 12, said cylinder forming a cup 13. A pipe 14 has its lower end secured in an aperture in the center of the partition 12, within the cup, and its upper end projects above the cup, and is provided with a hood 15 to cause the vapor to spread in each compartment after it passes through the pipe 14. A pipe 16 has its upper end secured in an aperture in the partition 12 so as to enter the cup 13, and has its lower end projecting down into the liquid in the next compartment on the outside of the cup 13 therein, said pipe 16 being thus liquid sealed, as clearly shown in Fig. 5, to prevent the vapor from passing therethrough. The vapor rising in each compartment 11 passes upwardly through the pipe 14 and is expanded in the next compartment above, and finally passes out through the pipe at the top of the vaporizer. As the beer flows into the uppermost compartment 11 of the vaporizer 7, it rises therein until it overflows into the cup 13, and passes out of said cup through the pipe 16 into the next compartment below and so on throughout the entire series. The pipe 16 of the lowermost compartment has its lower end projecting into a cup 17 containing a liquid to seal said pipe and prevent the vapor generated in the pipes 18, 19, 20, 29 and 30 from backing up into the vaporizer.

The partially exhausted beer leaves the vaporizer 7 through the pipe 18 at the lower end thereof, and passes through the jacketed pipes 19 and 20 into the pipe 21. After the liquid passes into the pipe 21 it is termed slop. Pipe 21 is provided with a strainer 22. As the slop flows over the strainer 22, the excess liquid, or slop, drops through the strainer, and passes out through a pipe 23 to a tank or other suitable vessel, and the remaining liquid and heavier refuse matter passes through the pipe 21 to a drier, which latter is composed of a number of pipes 24 connected at 25, and each provided with a screw conveyer 26 to convey the refuse from one pipe to the other until the dried material is discharged at 27. The conveyers

are operated by means of power transmitted to pulleys 28 on the outer ends of the conveyer shafts. To the pipe 18 is connected a pipe 29 which latter is connected to a pipe 30 extending into a doubler 52.

The pipes 24, 20, and 19 and the return pipes 29 and 30 are surrounded by intercommunicating steam jackets 31, the connecting pipes of the jackets being indicated at 31ª. The jackets are supplied with superheated steam through an inlet 32 at the bottom, and they are provided with a safety valve 33 at the top, to regulate the steam pressure. The steam passing through the jackets 31 heats the beer in the pipes 19 and 20, and the alcohol which returns through pipe 30 as hereinafter described, and also heats the beer or slop in the pipes 24. The steam generates in the pipes 24 from the drying of the beer or slop, is collected in pipes 34, and conveyed through a pipe 35 to the steam jacket 10, where a part of the steam is used to heat the beer in the vaporizer 7, and the remainder is then conveyed through a pipe 36 to the heater 5 where it heats the beer passing through the tubes 4, and is reduced to boiling water, which passes out through a pipe 37 to the dephlegmators, for a purpose which will hereafter more fully appear.

The steam which condenses in the jacket 10 passes out of the same in the shape of hot water through a pipe 57 to a jacket 58 which surrounds the pipe 1, and assists in heating the beer as it passes to the main heater 2. The jacket 58 is provided with an overflow pipe 59.

The alcoholic vapor rising in the heater 5 and the vaporizer 7, passes through pipes 38 and 39, then through a pipe 40 to the main heater 2, then through a pipe 41 to a doubler 42, and up through a pipe 43 to the first of the dephlegmators or concentrating elements 44, said pipe being connected to the top of the doubler, and entering the top of the dephlegmator. The alcoholic vapor created in the pipes 18, 19, 20, 29 and 30 concentrates in a pipe 51 which discharges into the doubler 52. The vapor collecting in this doubler passes out of the same through a pipe 56 which is connected to the pipe 40.

The dephlegmators 44 are formed with heads 45 near each end, through which heads a number of tubes 46 open, thus forming an air tight chamber between said heads, into which the boiling water flows from the heater 5, through the pipe 37. The boiling water flows from one dephlegmator to the other through pipes 47. The pipe 43 leads from the doubler 42 to the top of the first dephlegmator 44, and the alcoholic vapor which is conveyed to said doubler, passes out of the same through the said pipe 43 to the top of the first dephlegmator. The alcoholic vapor then passes through the tubes 46, and out through the pipe 48 to the next dephlegmator, and so on until it passes out of the last dephlegmator through a pipe 49 to the condenser 50.

The boiling water which enters the first dephlegmator 44 through the pipe 37, and the alcoholic vapor which enters through the pipe 43, travel parallel to each other, downwardly through the first and third dephlegmators. In the second and fourth dephlegmators the boiling water flows downwardly while the vapors flow upwardly. The water will naturally lose in heat as it passes from one dephlegmator to the other, but it is not in the apparatus a sufficiently long time to cool to an objectionable extent. Consequently it will never drop below a temperature of 173° F., which is the vaporizing or boiling point of pure ethyl alcohol, thus preventing the alcohol from condensing. It will therefore be seen that the alcoholic vapor passing from one dephlegmator to the other will always be subjected to a heat above the temperature of 173° F., which is the vaporizing or boiling point of pure alcohol, and below the temperature of 212° F., which is the boiling point of water, thus preventing the alcohol from condensing, and at the same time condensing the water which may be carried into the dephlegmators with the alcoholic vapor, and allowing it to flow back through the pipe 53 to the doubler 42. The alcohol which may be carried back to the doubler 42 will be vaporized by the vapor passing into the doubler 42 through the pipe 41, and again carried up through the pipe 43 to the first dephlegmator. The heavier part of the liquid which flows back to the doubler 42 will back up through a pipe 54 to the heater 2, and then through a pipe 55 to the doubler 52, where it is revaporized, and the alcoholic vapor passes up through the pipe 56 and joins the vapor in the pipe 40. The heavier liquid accumulates in the doubler 52 until it reaches the level of the pipe 30, and it then flows by gravity through the pipes 29 and 30, and joins the beer in the pipe 18.

It will be apparent from the foregoing that the steam generated from the drying beer or slop, and the alcoholic vapors, furnish the heat for the operation of the still, and high proof spirits are produced economically and effectively in a continuous distillation. If the invention is to be used in the production of a potable spirit or whisky, the number of dephlegmators will be reduced, or dispensed with, to produce the desired proof, or the desired amount of alcohol when used in a vinegar plant.

The cup 17 forms a division between the vaporizer 7 and the pipes 18, 19, 20, 29 and 30, thus forcing the vapor arising in the said pipes to concentrate in the pipe 51, and to pass therefrom to the doubler 52. At the

same time the vapors in the vaporizer 7 are prevented from taking a downward course and passing into the pipe 18. Without this cup 17 there would be nothing to prevent the vapors in the vaporizer 7 and the pipes 18, 19, 20, 29 and 30 from inter-mixing, and in operation there would be no control over them. The idea is to force the vapor in the vaporizer 7 to pass into the pipe 38, and at the same time to force the vapors in the pipes 18, 19, 20, 29 and 30 to pass into the doubler 52.

What is claimed is:

1. In a still, the combination of a vaporizer, a heater, said heater being in communication with said vaporizer, a drier for the slop, and means for carrying the vapor generated from the drying slop to the vaporizer and the heater for heating said heater and vaporizer.

2. In a still, the combination of a heater, a vaporizer, a connection between said heater and vaporizer, means for passing the material to be distilled through said heater and vaporizer, a drier, means for supplying the vapors arising from the drying material to said vaporizer, said vapor passing through said vaporizer to said heater, a dephlegmator communicating with said heater, said vapors being condensed and supplied to said dephlegmator.

3. In a still the combination with a vaporizer and a conductor for heating the vaporizer, of a drier for slop, and means for conveying the heating agent generated in the drier to the conductor and out of communication with the vaporizer.

4. In a still the combination with a vaporizer, a heater, and a dephlegmator, of a slop drier, and means for conveying successively to and out of communication with the interior of the vaporizer, heater and dephlegmator, the heating agent generated in the drier.

5. In a still the combination with a heater, a drier, and means for directing beer successively into the heater and drier, of means separate from said beer directing means for conveying to the heater the heating agent generated in the drier.

6. In a still the combination with vaporizing means, means for directing beer thereto, a dephlegmator, and means for directing vapor from said vaporizing means and into the dephlegmator, of a drier, means for directing beer from the vaporizing means to the drier, said beer entering the drier in the form of slop, and means separate from said beer and vapor directing means, for directing to the dephlegmator the heating agent generated in the drier.

7. In a still the combination with main and supplemental heaters, and means for directing beer successively into the heaters, of a drier, means for directing beer thereto from the supplemental heater, said beer entering the drier in the form of slop, means separate from said beer directing means for directing to the supplemental heater the heating agent generated in the drier, thereby to partly vaporize the beer within the supplemental heater, and means separate from said beer directing means for conveying the generated vapor from the supplemental heater to heat the beer within the main heater.

8. In a still the combination with main and supplemental heaters, and means for directing beer successively into the heaters, of a drier, means for directing beer thereto from the supplemental heater, said beer entering the drier in the form of slop, means separate from said beer directing means for directing to the supplemental heater the heating agent generated in the drier, thereby to partly vaporize the beer within the supplemental heater, means separate from said beer directing means for conveying the generated vapor from the supplemental heater to heat the beer within the main heater, a dephlegmator, means separate from said beer directing means for directing the said vapor from the main heater to the dephlegmator, and means separate from said beer directing means for conveying the heating agent from the supplemental heater to the dephlegmator to partly condense the vapor discharged into said dephlegmator.

9. In a still the combination with main and supplemental heaters, and means for directing beer successively into the heaters, of a drier, means for conveying beer from the supplemental heater to the drier, said beer entering the drier in the form of slop, means separate from said beer directing means for conveying to the supplemental heater the heating agent generated within the drier, thereby to partly vaporize the beer within the supplemental heater, means separate from said beer directing means for conveying the generated vapor from the supplemental heater to the main heater to heat the beer contained within the main heater, a dephlegmator, means separate from said beer directing means for conveying to the dephlegmator the vapor discharged into the main heater, means separate from said beer directing means for conveying into the dephlegmator the agent directed into the supplemental heater, thereby to partly condense the vapor discharged into the dephlegmator, and means for returning to the drier the liquid formed in the dephlegmator.

10. In a still the combination with main and supplemental heaters, and means for directing beer successively into the heaters, of a drier, said beer entering the drier in the form of slop, means for conveying beer from the supplemental heater to the drier, means separate from said beer directing means

for conveying to the supplemental heater the heating agent generated within the drier, thereby to partly vaporize the beer within the supplemental heater, means separate from said beer directing means for conveying the generated vapor from the supplemental heater to the main heater to heat the beer contained within the main heater, a dephlegmator, means separate from said beer directing means for conveying to the dephlegmator the vapor discharged into the main heater, means separate from said beer directing means for conveying into the dephlegmator the agent directed into the supplemental heater, thereby to partly condense the vapor discharged into the dephlegmator, means for returning to the drier the liquid formed in the dephlegmator, means for vaporizing the said liquid during its return to the drier, and means separate from said liquid returning means for directing the generated vapor to the main heater.

11. In a still the combination with a drier, a dephlegmator, means for withdrawing from the dephlegmator the liquid formed therein by condensation, and for conveying said liquid to the drier, and means for partly vaporizing said liquid during its passage to the drier, of main and supplemental heaters, means for directing beer into said heaters successively, means separate from the beer directing means for conveying to the supplemental heater the heating agent generated in the drier, thereby to partly vaporize the beer within the secondary heater, means separate from the beer directing means for conveying said generated vapor and the first named vapor to the main heater to heat the beer contained within said main heater, means separate from the beer directing means for conveying said vapor from the main heater to the dephlegmator, and means separate from the beer directing means for conveying the heating agent from the supplemental heater to said dephlegmator to partly condense the vapor within the dephlegmator.

12. In a still the combination with a vaporizer and a heater, of a drier, means for directing beer successively into the heater, vaporizer and drier, said beer entering the drier in the form of slop, means separate from said beer directing means for directing successively to the vaporizer and heater, the heating agent generated in the drier, thereby to partly vaporize the contents of the heater and vaporizer, and means separate from said beer directing means for conveying a portion of said heating agent from the drier to heat the beer prior to its admission to the heater.

13. In a still the combination with a heater and a drier, of means for conveying beer from the heater to the drier, said beer entering the drier in the form of slop, means for conveying beer to the heater, and means separate from said beer conveying means for utilizing the heating agent generated in the drier for heating the beer prior to its discharge into the heater.

14. In a still the combination with a heater, means for directing beer thereinto, a plurality of dephlegmators, a drier, and means for conveying beer from the heater to the drier, said beer entering the drier in the form of slop, of means separate from said beer directing and conveying means for conveying a generated heating agent from the drier to the heater and respective dephlegmators successively, said heating agent being gradually reduced in temperature during its course through the heater and dephlegmators, to separate steam from alcoholic vapor by condensation, and means separate from said beer directing and conveying means for directing generated vapor from the heater to the dephlegmator successively.

15. In a still the combination with a heater, means for directing beer thereinto, a plurality of dephlegmators, a drier, and means for conveying beer from the heater to the drier, said beer entering the drier in the form of slop, of means separate from said beer directing and conveying means for conveying a generated heating agent from the drier to the heater and respective dephlegmators successively, said heating agent being gradually reduced in temperature during its course through the heater and dephlegmators, to separate steam from alcoholic vapor by condensation, means separate from said beer directing and conveying means for directing generated vapor from the heater to the dephlegmators successively, and means for returning to the drier the liquid formed by condensation within the dephlegmators, said conveying means including means for partly vaporizing the liquid, and means for directing said generated vapor to the vapor generated within the heater.

16. In a still the combination with a vaporizer, a dephlegmator, and a drier, of means for directing beer successively into the vaporizer and drier, means separate from said beer directing means for conveying to the vaporizer and dephlegmator the heating agent generated in the drier, a doubler, a return pipe extending from the doubler to the drier, means for conveying vapor from said return pipe to the doubler, means for conveying vapor from the vaporizer and doubler to the dephlegmator, and means for conveying to the doubler the liquid produced by condensation within the dephlegmator.

17. In a still the combination with a dephlegmator and a drier, of a doubler, means for draining liquid formed by condensation from the dephlegmator to the doubler, a

heated return pipe for receiving said liquid from the doubler and directing it to the drier, means for collecting vapor from the return pipe and directing it into the doubler, means for directing the vapor into the dephlegmator from the doubler, and means separate from the return pipe, for directing to the dephlegmator the heating agent generated in the drier to partly condense the vapor in the dephlegmator.

18. In a still the combination with a vaporizer, a dephlegmator and a drier, of a doubler, means for directing liquid formed by condensation from the dephlegmator to the doubler, a heated return pipe for receiving said liquid from the doubler and directing it to the drier, means for collecting vapor from the return pipe and directing it into the doubler, means for directing the vapor from the doubler and vaporizer into the dephlegmator, and means separate from the return pipe, for directing to the dephlegmator the heating agent generated by the drier to partly condense the vapor within the dephlegmator.

19. In a still the combination with a dephlegmator and a drier, of a doubler, means for draining liquid formed by condensation from the dephlegmator to the doubler, means for sealing said draining means to prevent the escape of vapor thereinto from the doubler, a heated return pipe for receiving said liquid from the doubler and directing it to the drier, means for collecting vapor from the return pipe and directing it into the doubler, means for directing the vapor into the dephlegmator from the doubler, and means separate from the return pipe, for directing to the dephlegmator the heating agent generated in the drier to partly condense the vapor in the dephlegmator.

20. In a still the combination with a vaporizer, a dephlegmator, and a drier, of a doubler, means for conveying liquid formed by condensation from the dephlegmator to the doubler, means for retaining a portion of said liquid within the doubler to seal said conveying means and prevent the flow of vapor from the doubler to the dephlegmator, a heated return pipe for receiving liquid from the doubler and directing it to the drier, means for collecting vapor from the return pipe and directing it into the doubler, means for conveying vapor from the doubler and vaporizer into the dephlegmator, and means separate from the return pipe, for directing to the dephlegmator the heating agent generated in the drier to partly condense the vapor in the dephlegmator.

21. In a still the combination with a dephlegmator, a heater and a drier, of a doubler, means for conveying liquid formed by condensation from the dephlegmator to the heater and from said heater to the doubler, said liquid constituting means for heating the contents of the heater to partly vaporize said contents, a heated return pipe for receiving the liquid from the doubler and directing it to the drier, means for collecting vapor from the return pipe and directing it into the doubler, means for directing the vapor from the heater and doubler into the dephlegmator, and means separate from the return pipe, for directing to the dephlegmator the heating agent generated in the drier to partly condense the vapor in the dephlegmator.

22. In a still the combination with a dephlegmator, a heater and a drier, of a doubler, means for conveying liquid formed by condensation from the dephlegmator to the heater and from said heater to the doubler, said liquid constituting means for heating the contents of the heater to partly vaporize said contents, a heated return pipe for receiving the liquid from the doubler and directing it to the drier, means for collecting vapor from the return pipe and directing it into the doubler, means for directing the vapor from the doubler and heater into said heater to coöperate with the liquid to heat the contents of the heater, means for conveying the vapor from the heater to the dephlegmator, and means separate from the return pipe for directing to the dephlegmator the heating agent generated in the drier, to partly condense the vapor in the dephlegmator.

23. In a still the combination with a dephlegmator, a heater and a drier, of a doubler, means for conveying liquid formed by condensation from the dephlegmator to the heater and from said heater to the doubler, said liquid constituting means for heating the contents of the heater to partly vaporize said contents, a heated return pipe for receiving the liquid from the doubler and directing it to the drier, means for collecting vapor from the return pipe and directing it into the doubler, means for directing the vapor from the doubler and heater into said heater to coöperate with the liquid to heat the contents of the heater, and means for conveying the vapor from the heater to the dephlegmator, and means separate from the return pipe, for directing to the dephlegmator the heating agent generated in the drier, to partly condense the vapor in the dephlegmator, said last named means including a secondary heater for partly vaporizing the contents of the heater.

24. In a still the combination with a dephlegmator, a heater and a drier, of a doubler, means for conveying liquid formed by condensation from the dephlegmator to the heater and from said heater to the doubler, said liquid constituting means for heating the contents of the heater to partly vaporize said contents, a heated return pipe for re-

ceiving the liquid from the doubler and directing it to the drier, means for collecting vapor from the return pipe and directing it into the doubler, means for directing the vapor from the doubler and heater into said heater to coöperate with the liquid to heat the contents of the heater, means for conveying the vapor from the heater to the dephlegmator, and means separate from the return pipe, for directing to the dephlegmator the heating agent generated in the drier, to partly condense the vapor in the dephlegmator, said last named means including a vaporizer and a secondary heater for partly vaporizing the contents of the vaporizer and secondary heater, and means for conveying vapor from the vaporizer and secondary heater to the first named heater with the vapor from the doubler.

25. In a still the combination with concentrating means, of a drier for slop, and means for conveying the heating agent generated in the drier, to the concentrating means along a path separate from the path of the liquid being concentrated.

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

BENJAMIN S. LINDSEY.

Witnesses:
CHAPIN A. FERGUSON
WM. H. WATSON.