C. D. CRANE.

WATER STILL.

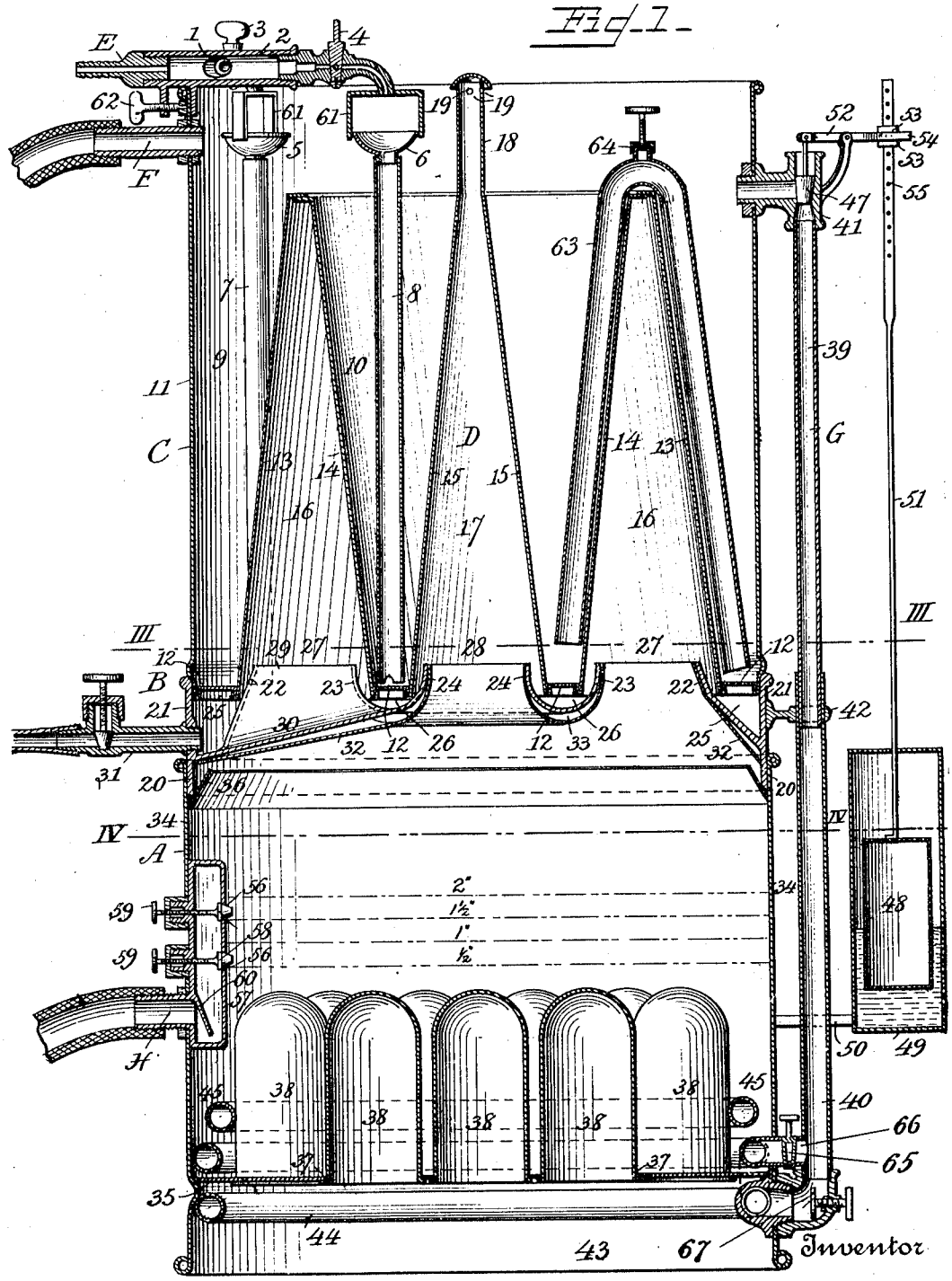
APPLICATION FILED APR. 27, 1918.

1,314,790.

Patented Sept. 2, 1919.

3 SHEETS—SHEET 1.

Fig. 1.




Inventor

Calvin D. Crane

By H. N. Low Attorney

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3 SHEETS—SHEET 2.

Fig. 2.

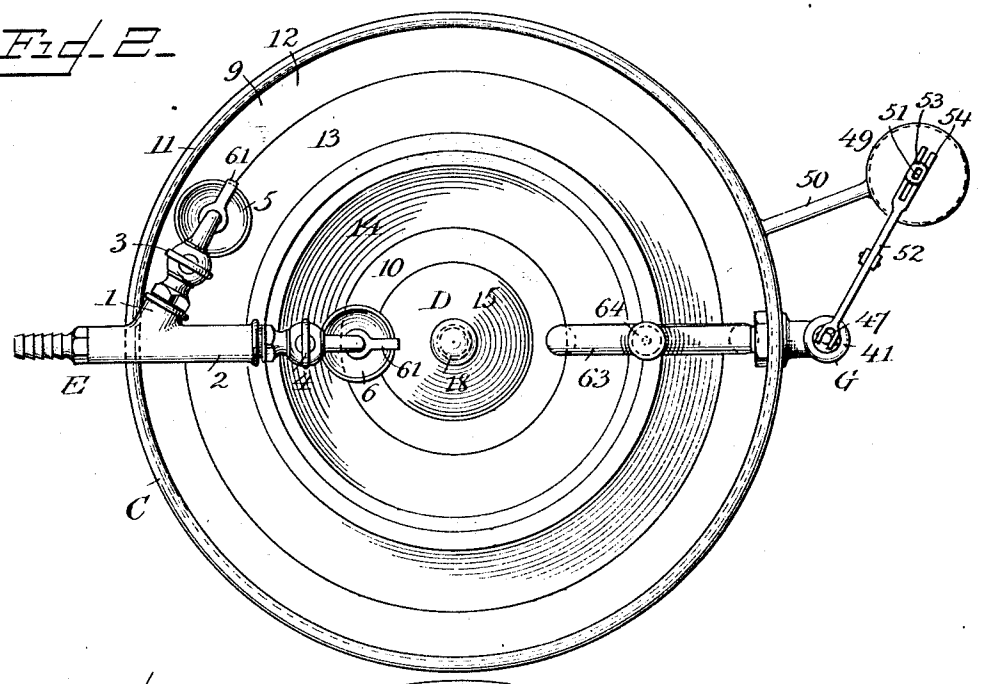
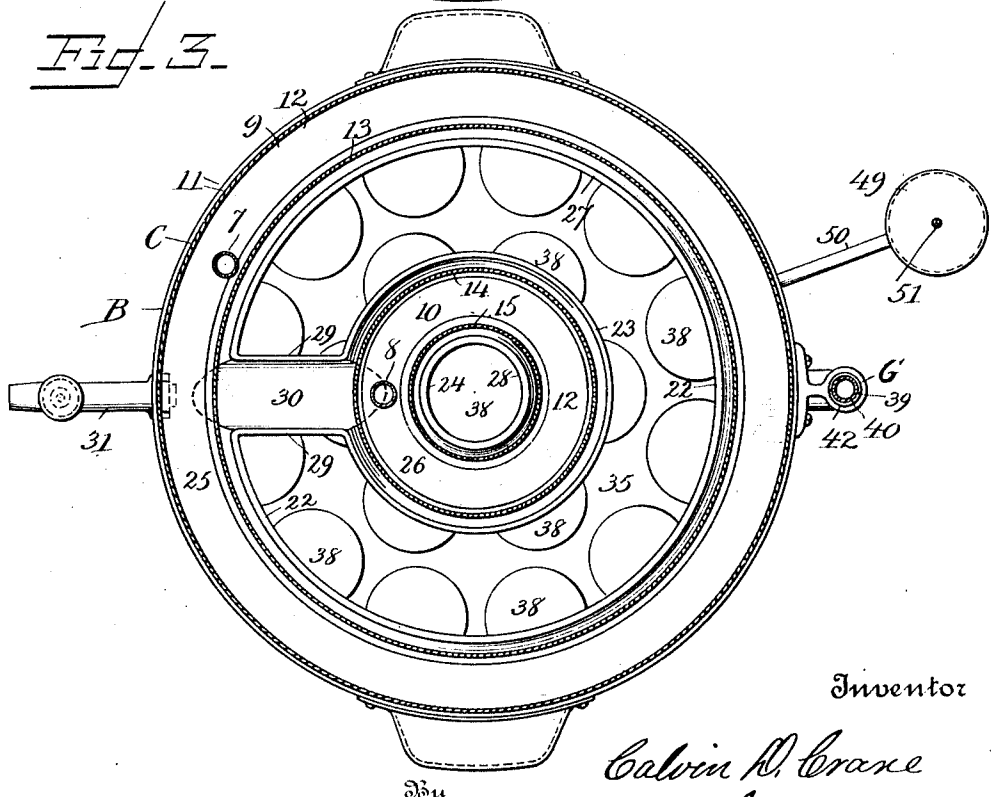



Fig. 3.




Inventor

Calvin D. Crane

By N. N. Low Attorney

C. D. CRANE.

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3 SHEETS—SHEET 3.

Fig. 4.

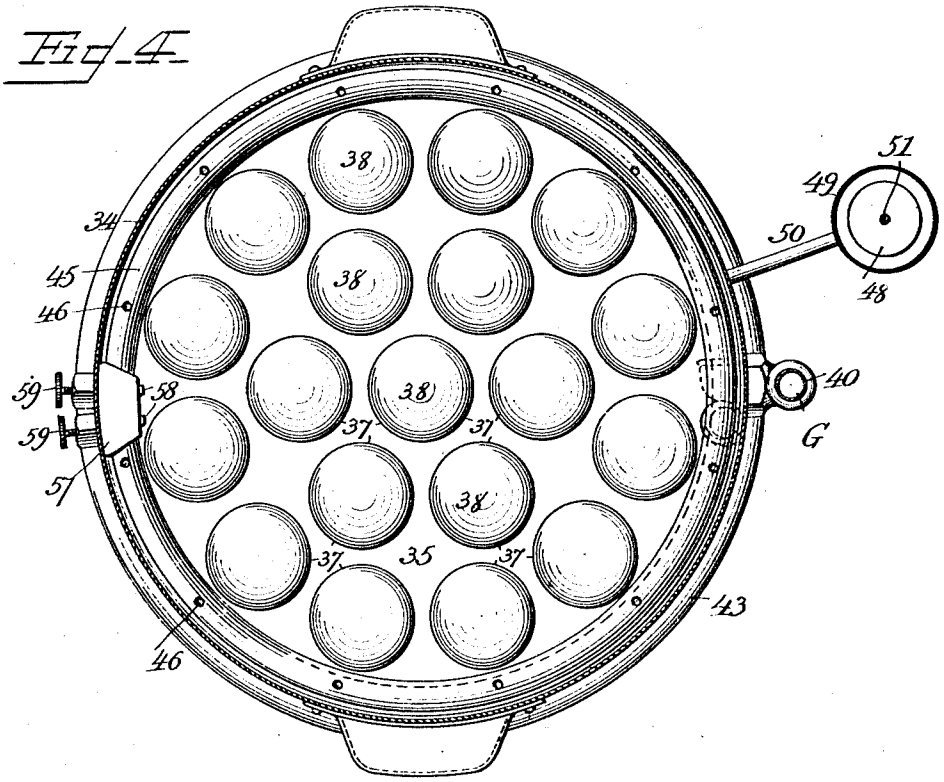
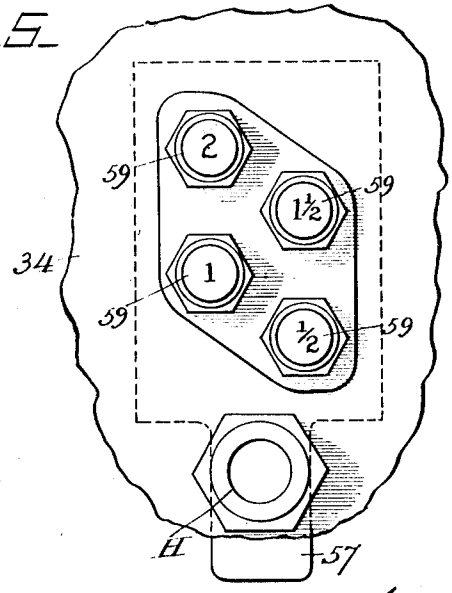



Fig. 5.




Inventor

Calvin D. Crane

By

N. N. Low

Attorney

# UNITED STATES PATENT OFFICE.

CALVIN D. CRANE, OF DAYTON, OHIO.

## WATER-STILL.

1,314,790. Specification of Letters Patent. Patented Sept. 2, 1919.

Application filed April 27, 1918. Serial No. 231,173.

*To all whom it may concern:*

Be it known that I, CALVIN D. CRANE, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Water-Stills, of which the following is a specification.

My invention relates to the boiling, condensing, water feed regulating and condensation collecting devices of water stills, and has for its object to very materially increase the rapidity of operation of the still and the output thereof, in the form of water of condensation, in proportion to the time and heat expended; thereby greatly increasing the convenience of use, in respect of time and attention required, and greatly decreasing the cost of fuel and of the distilled water produced.

With such object in view, as well as other advantages which may be incident to the use of the improvements, the invention consists in the parts and combinations thereof hereinafter set forth and claimed, with the understanding that the several necessary elements constituting the same may be varied in proportions and arrangement without departing from the nature and scope of the invention.

In order to make the invention more clearly understood there are shown in the accompanying drawings means for carrying the same into practical effect, without limiting the improvements, in their useful applications, to the particular constructions which, for the purpose of explanation, have been made the subject of illustration. In the said drawings:—

Figure 1 is a vertical sectional view of a water still embodying the invention.

Fig. 2 is a plan view of the same.

Fig. 3 is a horizontal section on line III—III of Fig. 1.

Fig. 4 is a horizontal section on line IV—IV of Fig. 1.

Fig. 5 is an elevation of a portion of the water heating chamber showing the regulating devices for maintaining the desired water level in said chamber.

Referring to the drawings, A indicates the water heating chamber or boiler; B a separate water-recovery section adapted to collect the condensed water and conduct it to the exterior of the still, said section being shown as adapted to fit tightly but removably within the upper end of the boiler; C is the cold water section adapted to fit removably within the top flange of the section B, and comprising also the condensing element D; E is the cold water feed pipe; F is the overflow or waste pipe for the cold water chamber; G is the feed pipe which supplies the boiler with water from the upper part of the cold water chamber; and H is the overflow or waste pipe from the boiler. The pipes E, F, and H are shown as short connections, and it will be understood that ordinarily flexible hose will be or may be connected with these pipes for conducting the water. The said parts A, B and C are shown as separable cylindrical sections fitting one above and into the other so that the still may be readily taken apart for cleaning or other purposes, but the invention is not confined to such shape or sectional construction.

The cold water which is conducted to the still by the pipe E passes through two branches 1 and 2 of said pipe controlled respectively by cocks 3 and 4, and delivering the water into funnels 5 and 6. These funnels are on the top ends of pipes 7 and 8 which conduct the water to the bottoms of outer and inner cold water channels 9 and 10. These chambers are formed by an outer shell 11, a bottom 12 and conical partitions 13, 14 and 15 which are or may be substantially concentric one within another and which are united at their lower edges with the edges of openings through the bottom 12 and are united at their top edges with each other, so as to form said cold water chambers 9 and 10 and inclosed condensing chambers 16 and 17. The chamber 17 terminates in a pipe 18 having small escape openings 19 to prevent accumulation of steam pressure within the still.

The water recovery device or section B may be of sheet metal or (as shown) as a casting of aluminum or other suitable metal, comprising a bottom flange 20 which fits into the top of the boiler section A, a top flange 21 into which fits the bottom of the shell 11 and inner upwardly extending flanges 22, 23 and 24 which form channels 25 and 26 arranged under the bottom edges of the condensing partitions 13, 14 and 15 to catch the water which condenses on and runs down therefrom. Said flanges 22, 23 and 24 also form openings 27 and 28 which are the passages for steam from the boiler A into the condenser D. Radially arranged flanges

29 form a channel 30 which connects the inner and outer channels 25 and 26 and declines to the lowest point of the channel 25, and at that point is located a draw-off pipe 31 through which the condensed and pure water is collected from the still. The condensed water makes the section B enough cooler than the ascending steam to cause condensation of the latter on the under surface of such section, and this would be a material loss of generated steam all of which is desired to pass up through the openings 27, 28 to the condenser D, and I prevent such loss by attaching sheet metal to the under side of the section B so as to form dead air chambers 32, 33. Such inclosed air will prevent the cooling of said sheet metal and the latter will be kept so hot by the steam that there will be no condensation thereon.

The water heating chamber or boiler section A comprises a cylindrical shell 34 to which is tightly joined a bottom 35. Within the upper end of the shell 34 is attached a flange 36 which will form a water seal around the flange 20 and prevent the escape of steam and the ingress of air to the still. The bottom is provided with apertures 37 in which are tightly fitted flues 38 which are closed at their tops and extend up into the body of water in the boiler to bring the products of combustion and the heat of any fire or flame (not shown) over which the still may be set as near as possible to all interior parts of the body of water which is to be vaporized. The swaged joints at the bases of said flues may be dipped in solder to make them perfectly tight.

The feed water for the boiler is taken from near the top of the cold water chamber into the pipe G and delivered thereby into the boiler. The pipe G is made in two separable sections 39 and 40 the upper of which can be readily inserted into the lower section when the parts of the still are assembled for use. The upper section 39 is secured at its upper end in a pipe fitting and valve casing 41 which is connected with the shell 11 so as to conduct water therefrom. The lower section 40 is removably supported at its upper end by a bracket 42 into which said end is inserted when the sections A and B are put together, and at its lower end it is bent to pass inward through an opening in the bottom flange 43 of the boiler. Thence said pipe is bent upward and formed into one or more coils 44 extending around the boiler horizontally within the flange 43 and under the bottom 35, so as to be exposed to a high degree of heat, with the result that the feed water is prevented from objectionably lowering the temperature of the boiler water. Thence the feed pipe passes up through the bottom 35 by a tight joint and is formed into one or more coils 45 passing around inside of the boiler and formed with numerous small quarter-inch apertures 46 through which the feed water enters the boiler at widely distributed points and cannot materially reduce the temperature of the boiler water at any one point. Preferably the apertures 46 are arranged opposite the flues or tubes 38 and deliver the feed water below the surface of the boiler water and at places of greater heat. Thus the boiler water is kept at the greatest heat and any impeding of its vaporization is prevented.

The feed of the water through the pipe G and said coils thereof is regulated by the level of the boiler water by a valve 47 in the casing 41 which valve is connected with a float 48 in a chamber or casing 49, the latter being connected by a water passage 50 with the boiler at a point below the lowest water level. Said float varies in height with the water level in the boiler and opens and closes the valve 47 by means of a stem 51 and a lever 52. The stem 51 may be graduated or otherwise marked near the top of the chamber 49 so as to show to the eye the height of water in the boiler. The stem 51 is adjustably connected with the lever 52 so as to set the float for any water level which it is desired to maintain. This adjustable connection may be by means of rubber or leather disks 53 fitted tightly but slidably on the stem above and below the bifurcated end 54 of the lever. Or it may be by means of a series of holes 55 in the stem and pins (not shown) inserted in said holes so as to engage the lever arm. In connection with such adjustable water feed the level in the boiler is initially kept from going above a maximum level by a series of waste or water exit openings 56 formed in a trap 57 attached to the shell 34. I have illustrated four of said openings at different levels about one-half inch apart, each opening being closable by its valve 58 which is operable by a handle 59 on the outside of the boiler. Only one opening is used at a time. At the lower part of said trap is constructed the said waste pipe H of the boiler, and between said pipe and the upper part of the trap is arranged a flange or wall 60 which extends down below the pipe H so as to maintain a water seal to prevent the escape of steam and the ingress of air. If it is desired to evaporate the boiler water rapidly, or if the source of heat is not very strong, the lowermost valve 58 is opened and the level of water is reduced to near the tops of the flues 38, so that the heat will be greater relative to the amount of water. If it is desired to vaporize more slowly or if the fire is relatively strong the uppermost valve is opened (all others being closed) and a higher level and more water is provided for; and under intermediate conditions one of the intermediate openings 56 may be similarly used.

Whenever the boiler water level is thus changed the stem 51 is correspondingly adjusted in the lever 52, so that while the opening 56 will determine the maximum height of water, and the valve 47 will not allow the water to fall below such maximum. It will be understood that the invention is not confined to regulating the valve 47 by the described automatic connection, and this operation may be performed by hand without the aid of the float 48. Water distilled slowly has a certain superiority for chemical and medical uses on account of its great purity, but for domestic or mechanical uses rapidly distilled water is of greater quantity (in a given time) and is not objectionable in quality. By the above described apparatus the still may be readily adjusted for the desired rate of distillation, according to the use to which the water is to be put, the condition of the fire or the attention which can be given to the operation of the still. The still is constructed to be readily taken apart and to be reassembled, as already described in respect of the three main sections and the pipe G. The pipes 7 and 8 are not attached to the cold water section but are put in place therein, as illustrated, when the still is to be used, and the upper ends of the funnels 5 and 6 are held in yokes 61 screwed on to the ends of the branch pipes 1 and 2. The pipe E can be attached to the outer rim of the section C (Fig. 1) by a clamp 62. The still will be set up with the pipes F and H directed toward the most convenient drain for waste water and the pipe 1 will then be adjusted and secured upon the section C on that side of the still which is toward the cold water supply. This is a material advantage in saving undue lengths of or bends in the flexible hose which will ordinarily be employed.

63 is a siphon adapted to be used to withdraw water from the chamber 10 into the chamber 9, its two branches extending to the bottoms of said chambers. After the siphon is put in place in the position illustrated the valve 64 at its upper end may be opened to permit the escape of air. Then the valve is closed and thereafter, when the level of the water in the chamber 9 is lower than that in the chamber 10 the water will flow to the outer chamber. The air is let out of said siphon when the water level in the section C is above the top of the siphon.

65 is a valve (shown as closed, in Fig. 1) suitably arranged in a short pipe 66 which connects the pipe 40 with the coil 45 and 67 is a valve (shown as open) which is arranged at a convenient point so that it can be closed to cut off the pipe 40 from the coil 44. If the heat should be too intense the valve 67 can be closed and the valve 65 opened to admit the boiler feed water direct to the coil 45 without passing through the more intensely heated coil 44.

What I claim is:

1. In a still, in combination, a water heating chamber, valve-controlled exits therefrom at different water levels, a float which is maintained at the water level of said heating chamber, a cold water chamber and a condensing chamber inclosed by said cold water chamber, a feed pipe leading from said cold water chamber, a valve automatically controlling said feed pipe, and a connection between said valve and float which is adjustable according to which of said exits from the heating chamber is opened.

2. In a still, in combination, a water heating chamber, condensing chambers above and communicating therewith, cold water chambers surrounding said condensing chambers, means for supplying water to said cold water chambers, a feed pipe leading from the upper part of said cold water chambers, a valve controlling said feed pipe, a valve stem and lever for operating said valve, a rod having an adjustable connection with said lever, a float at the water level of said heating chamber and attached to said rod, a float casing inclosing said valve and communicating with said heating chamber so as to have the same water level, heating flues extending into said heating chamber, and valve-controlled water exist openings at different water levels above said flues.

3. In a still, the combination of a water heating chamber, a condensing chamber, a water-recovery device, a cold water chamber, a feed pipe leading from the cold water chamber and arranged to be exposed to direct heat at points under the heating chamber and thence extending into and around within the heating chamber and having distributed openings in that part of the pipe which is within the heating chamber for the delivery of water into the heating chamber, and means for cutting off the directly heated part of said pipe from the part thereof which is within the heating chamber.

4. In a still for the recovery of condensed water, the combination of a water heating chamber, a condensing chamber and a water-recovery device, said water heating chamber having a trap provided with water entrance openings at different water-levels, independently operable valves for closing said openings, and a water escape opening controlled by said trap to prevent the escape of vapor.

5. In a still, a water heating chamber having heat flues extending thereinto and a trap provided with water entrance openings at different water-levels above the said heat

flues, valves for closing said openings, and a water escape opening controlled by said trap to prevent the escape of vapor.

6. In a still, in combination with inner and outer cold water chambers thereof, feed cold water pipes extending to the lower parts of said chambers respectively, a water supply pipe having branches extending to and delivering into said feed pipes, valves controlling said branches, means for clamping said water supply pipe adjustably to the rim of said outer chamber, inner and outer vapor chambers at the under sides of said inner and outer cold water chambers, and a boiler feed pipe leading from the upper part of said cold water chambers.

7. In a still, in combination with inner and outer cold water chambers thereof, cold water feed pipes extending to the lower parts of said chambers and provided with funnel-shaped upper ends, a water-supply pipe having branches arranged to deliver water into said funnels, valves controlling said branches, inner and outer vapor chambers at the under sides of said inner and outer cold water chambers, and a boiler feed pipe leading from the top part of said cold water chambers.

8. In a still, in combination with inner and outer cold water chambers thereof, feed pipes extending to the lower parts of said chambers, a water supply pipe having branches extending to said feed pipes, valves controlling said branches, yokes inclosing the upper ends of said feed pipes, an inner vapor chamber extending up within the inner cold water chamber, and an outer vapor chamber extending up between said cold water chambers.

9. In a still the combination of an outer cold water chamber, an inner cold water chamber, a condensing chamber between said outer and inner cold water chambers, a siphon connecting the bottom part of said inner chamber with the bottom part of said outer chamber, and a valve at the top part of said siphon above said condensing chamber.

10. A water still having, in combination: a condensing section having inner and outer cold water chambers, an inner vapor chamber extending up within the inner cold water chamber, an outer vapor chamber extending up between the inner and outer cold water chambers, cold water supply pipes delivering at the bottoms of said inner and outer cold water chambers, a cold water distributing pipe leading from the bottom of the inner cold water chamber to the bottom of the outer cold water chamber, a separable collecting section supporting the said condensing section and having means arranged at the bottom edges of the vapor chambers for receiving the water of condensation, a separable boiler section supporting said collecting section, and a pipe leading from the top of the condensing section to the lower part of the boiler section.

In testimony whereof I affix my signature.

CALVIN D. CRANE.