(No Model.) 2 Sheets—Sheet 1.

# A. M. TODD.

## PROCESS OF AND APPARATUS FOR DISTILLING AND REFINING VOLATILE SUBSTANCES AND ESSENTIAL OILS.

No. 515,889. Patented Mar. 6, 1894.

Fig. 1

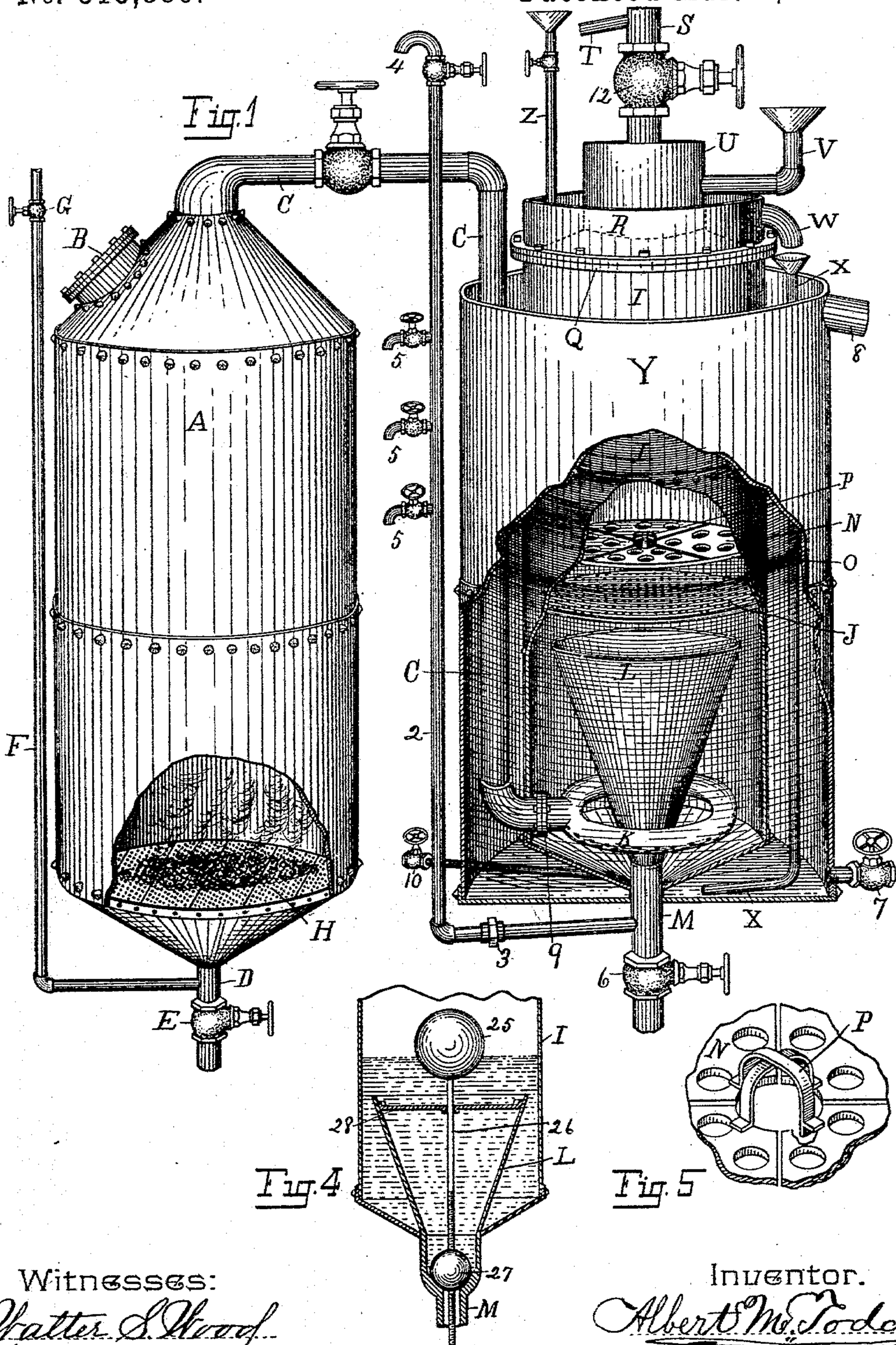





Fig. 4




Fig. 5

Witnesses:
Walter S. Wood
Williams & Shakespeare

Inventor.
Albert M. Todd
By E. M. Marble
Att'y.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

# A. M. TODD.

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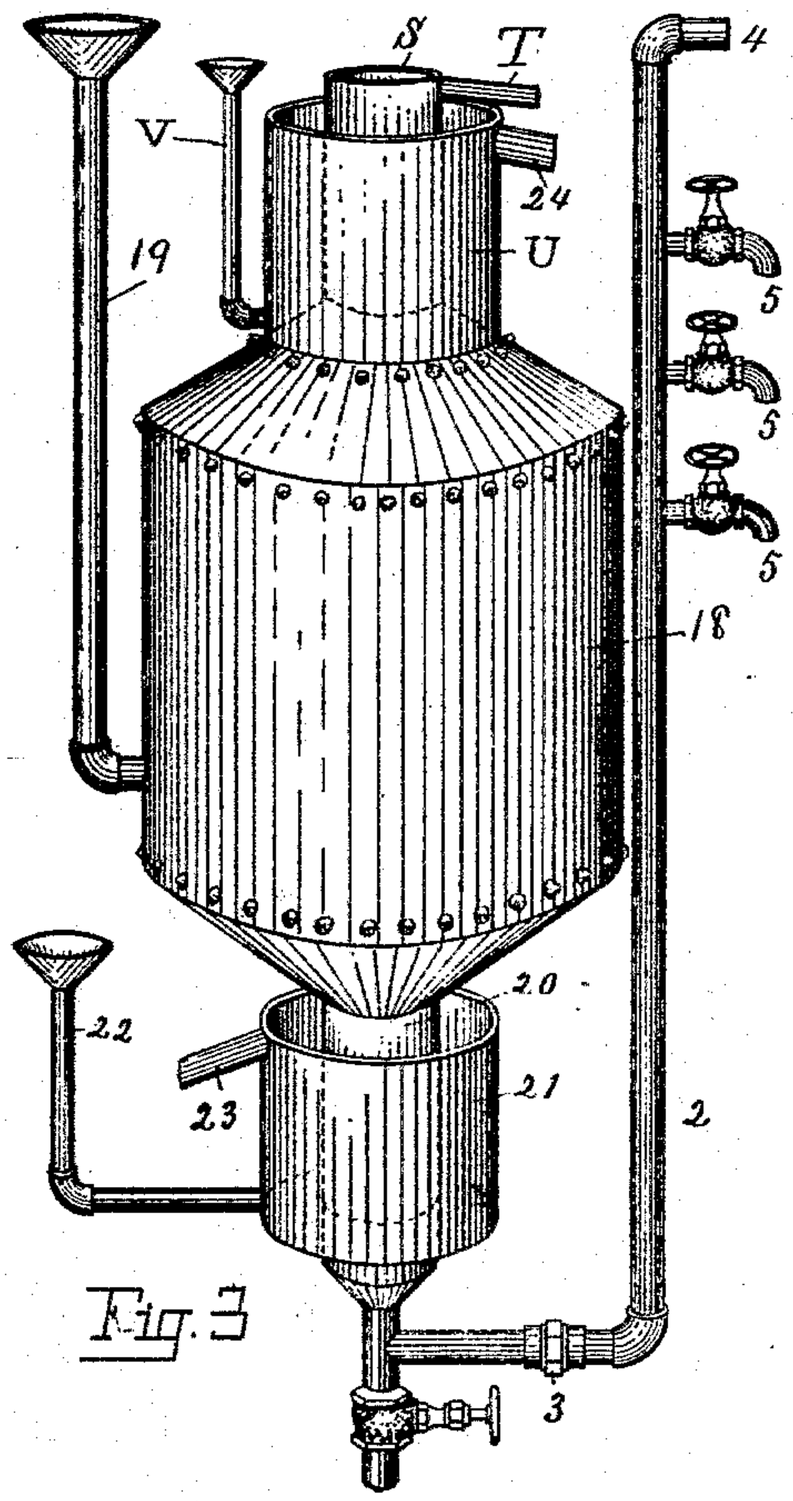


Fig. 3

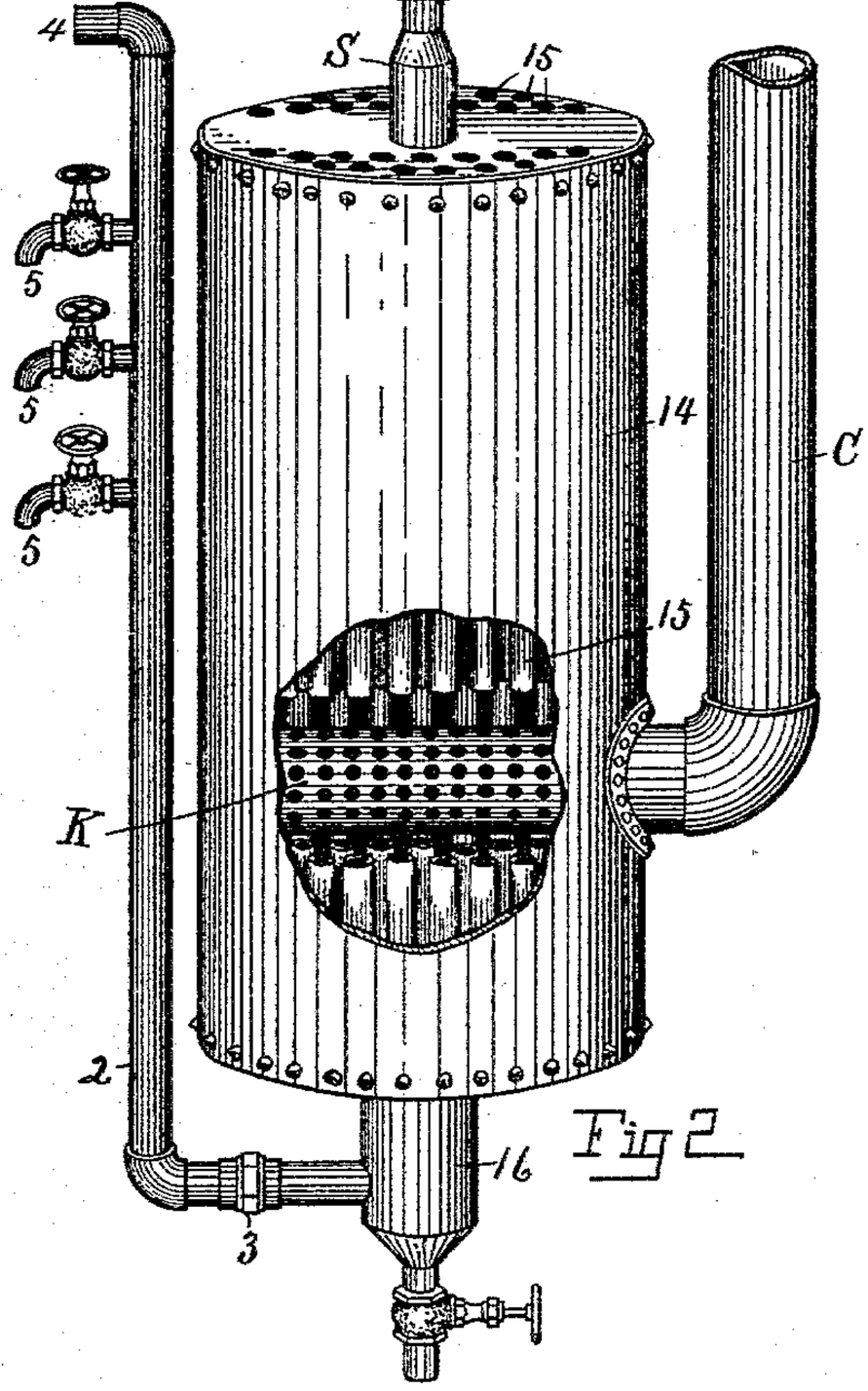


Fig 2

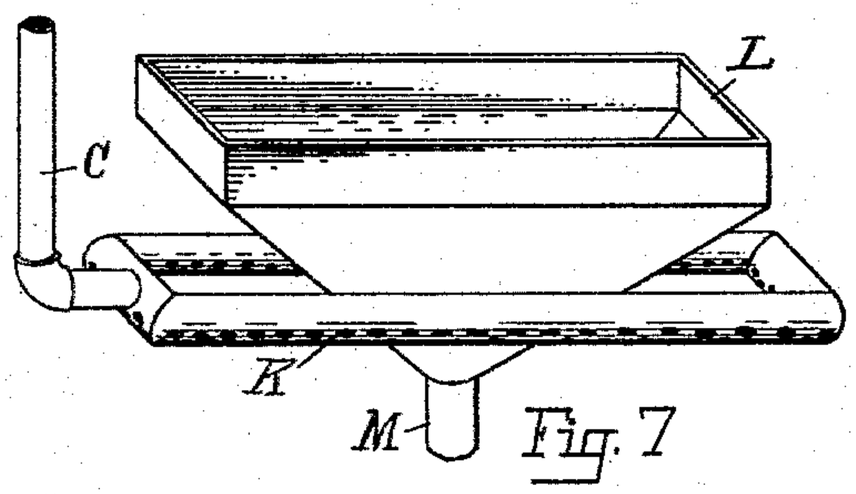


Fig. 7

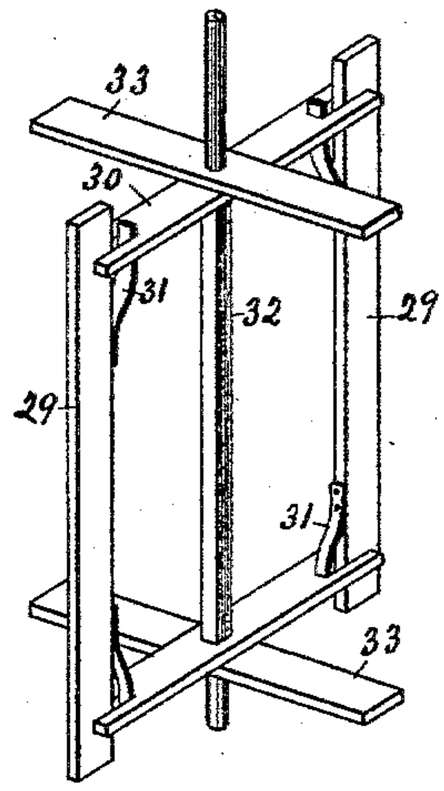


Fig. 6

Witnesses:
Walter S. Wood
William Shakespeare

Inventor.
Albert M. Todd, &c
By E. M. Marble
Att'y.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

# UNITED STATES PATENT OFFICE.

ALBERT M. TODD, OF KALAMAZOO, MICHIGAN.

## PROCESS OF AND APPARATUS FOR DISTILLING AND REFINING VOLATILE SUBSTANCES AND ESSENTIAL OILS.

SPECIFICATION forming part of Letters Patent No. 515,889, dated March 6, 1894.

Application filed March 28, 1892. Serial No. 426,836. (No model.)

*To all whom it may concern:*

Be it known that I, ALBERT M. TODD, a citizen of the United States, residing at the city of Kalamazoo, in the county of Kalamazoo and State of Michigan, have invented a new and useful Process of and Apparatus for Distilling and Refining Volatile Substances and Essential Oils; and I do hereby declare that the following is 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.

My invention relates to a process of and apparatus for distilling and refining volatile substances, and particularly to means for vaporizing, distilling, condensing and isolating commercial products, essential oils, chemicals, and the like.

My invention has for its objects—First. To provide an improved process for effecting the refining of substances of the nature stated. Second. To provide an improved apparatus for refining and isolating volatile products, whether solid or liquid, and in which volatile products of either high or low specific gravity can be isolated by a mere reversal of the operation of my improved condenser. Third. To effect the vaporization of the products operated on without subjecting them to the injurious action of direct heat. Fourth. To secure perfect separation of the volatile products from the water of condensation. Fifth. To provide improved means for clearing the interior walls of the condenser of solid or semi-solid products deposited thereon. Sixth. To provide improved means for securing and maintaining the desired height of liquid in the condenser. Seventh. To provide for the return of the water of condensation to the boiler at a high temperature.

My process can be carried out by the use of the apparatus represented in the drawings accompanying and forming a part of this application, in which the same reference letters and numerals refer to the same or corresponding parts, and in which—

Figure 1 is a front elevation of my improved apparatus, partially broken away to show the interior construction of the same. Fig. 2 is a front elevation of a modified, tubular condenser, partially broken away. Fig. 3 is an elevation of the isolating apparatus, constructed independently of the condenser. Fig. 4 is a view of a float valve used in connection with the funnel L in the isolating apparatus. Fig. 5 is a perspective view of my improved scraper, for the removal of the incrustations from the interior walls of the condenser. Fig. 6 is a perspective view of a modified form of a scraper. Fig. 7 is a perspective view of the apparatus in the bottom of the condenser, modified for a condenser horizontally located.

In the drawings, A represents the still, into which such substances as are to be operated upon are placed. It is provided with an opening B for the admission of material, a pipe C for the egress of vapors, a pipe D at the apex of its conical or concave bottom for the ingress of steam or other vapors used to effect vaporization, and a perforated plate H, placed above said conical bottom, for upholding solid substances to be operated upon, and for causing a more even distribution of the steam of vaporization through the substances operated on. Connected with pipe D is a pipe F connected with the steam generating boiler, through which the steam used to effect vaporization is conveyed into the pipe D and thence into the still A, the valve G controlling the amount of steam admitted. Below the joint of pipe F with pipe D, a drainage pipe E, closed by a suitable valve, is placed.

When operating upon commercial products, such products are placed in still A through opening B, which is afterward closed. Steam being admitted through pipe F by valve G, its latent heat is absorbed by the substance in tank A, volatilizing such substance, and the vapors thus formed are carried off in the current of steam through pipe C, controlled by a suitable valve when desired, such egress being aided by the conical form of the top of still A. These vapors are conducted through pipe C into condenser I, which is the inner tank of the condensing system and is partially filled with water, and are injected against the bottom or lower sides of said cylinder through openings in the rose K, which is placed in the bottom of the cylinder I and encircles the funnel-shaped vessel L. The openings in rose K should have a combined capacity about equal

to that of pipe C, and should be sufficiently numerous to insure an even distribution of the vapors.

I have discovered that the condensation of vapors is effected with far greater rapidity and economy by injecting such vapors directly into a body of water, which is maintained at a suitable temperature, than by the present practice of passing the vapors to be condensed through pipes surrounded with a refrigerant. This latter method is more or less ineffective because the vapors to be condensed exist in a rarefied state, with their molecules too far separated for good conductivity, and as such vapors cannot practically be maintained at a high pressure in the condensing pipes, during distillation, they are unable to conduct their heat through the walls of the condensing pipes with the facility possessed by water for such condensation. By my process, the hot vapors are brought into actual contact and intimately commingle with the water used to condense them, a rapid molecular motion and intermingling being thus generated. The molecules of vapor, which are at a high temperature, rapidly combine with those of the water with which they are brought in contact, which are at a relatively low temperature, and by this means the latent heat of the vapors is rapidly absorbed by the water, and they are speedily condensed. It is evident that an unimpeded molecular motion and condensation cannot take place when a solid substance interposes, as in the apparatus and process heretofore used. The object of injecting the vapors through numerous small orifices against the bottom or lower sides of the condenser is to diffuse them evenly against the surface which performs the greatest refrigerating work, otherwise the force of their current might carry them through without condensation.

It is obvious that some positive means must be provided for maintaining a suitable temperature in the body of water used to condense the vapors, otherwise it would soon, in the operation of my process, attain a temperature too high for effective work.

In the drawings, cold water or other suitable refrigerant is shown as being introduced through pipe X, and discharged against the inclined bottom of the condenser I, overflowing, when it has performed its cooling action, near the top of tank Y, which surrounds the cylinder I, through pipe 8. As it is desirable to reduce the temperature of the refined products below that of the escaping water of condensation, to prevent loss by evaporation, cold water is supplied to the cylinder U which surrounds the cylinder S, in which, as will hereinafter appear, the products of small specific gravity collect, which water overflows within the rim R, again overflowing into the pipe X, which discharges it against the bottom of condenser I. If greater simplicity in the construction of the apparatus is desired, cylinder U may be dispensed with, and the rim R may serve to perform its work, in which case rim R should be constructed of a height sufficient to hold a suitable quantity of refrigerating medium. Cylinder S is provided with a valve 12 for controlling the opening or flow through S when desired. In addition to those previously mentioned, the desirable result is secured by this system of condensation of returning the condensed water, (whether resulting from the isolation of commercial products or otherwise,) to the boiler at a high temperature, thus effecting economy in fuel, and supplying to the boiler distilled water free from lime, and injurious substances.

The condenser I is formed with a conical or concave bottom, at the apex of which pipe M is inserted, to the upper end of which pipe the vessel L is connected. Said vessel L is funnel-shaped, and is tightly connected at its lower opening to pipe M, and through pipe M to the overflow pipe 2, and also the drainage pipe 6. The function of funnel L is twofold: first, to assist condensation; second, to assist in the more perfect separation of the condensed products. As it connects directly with pipe M with a tight coupling, no vapors or fluids can escape directly through the bottom of condenser I, but are obliged to traverse its bottom and lower walls at the points of greatest refrigerating work, being forced by the currents produced against the walls of the condenser. By this means, the highest activity and greatest condensation are secured. The funnel shape of the vessel L prevents any violent current or suction which might draw into it the refined products, and thus still further aids in securing perfect condensation. I do not limit myself to the particular shape shown of the vessel L, as it may be made in many forms, it being shown in Fig. 7 as rectangular in shape. Cylinder I is also provided, when desired, above the vessel L with perforated disks, as J, of wire gauze or other suitable material, which disks, held stationary during the operation of the condenser, serve to control the ebullition of the liquids in condenser I, and to cut up or divide the vapors in said condenser. When solid products are treated, these disks should have openings sufficiently large to permit of the easy passage of the particles, or they may be dispensed with if desired. Above disks J, when solid substances are operated on, a circular plate N is placed, said plate being made in sections, held together by ring O or other suitable means, and provided at their center with springs P for pressing their exterior edges against the inner surface of the condenser I. The function of this plate is to remove from the inner surface of said condenser such particles of solid products as may collect thereon, which, if allowed to remain, would decrease the conductivity of the walls of the condenser, being formed with

openings sufficiently large to allow for the passage through of the particles of condensed products. As the process of condensation proceeds it is evident that condenser I would soon become filled with the products of condensation, if no means were provided for the removal of these products, and maintaining a desired height of the surface of the products within said condenser.

For the purpose of regulating the height of fluids or substances within condenser I, pipe 2 is connected to pipe M by a union joint, 3, thus enabling it to be rotated around said joint as a center, and to control, by the height of its exit, 4, the level of the contents of the condenser. When it is desired that the light products should rise to the top of cylinder S, and overflow through pipe T, pipe 2 may be adjusted vertically. When it is desired that the fluids within condenser I should not overflow through pipe T, they may be held at any desired level, either by rotating pipe 2 until its exit 4 shall assume the desired height; or the height of the fluids may be controlled by a series of valves, as 5, placed at different heights. It is evident that if pipe 2 is provided with a suitable opening in direct communication with condenser I, the level of the fluids in said condenser will correspond closely to the level of the overflow through pipe 2, the correspondence not being exact on account of the differing specific gravities of the fluids in the condenser and in the pipe.

There are two modes of procedure in isolating, or separating from the water of condensation, the refined products. When solid, or semi-solid substances of low specific gravity are operated on, the body or shell of the condenser I may be provided with a removable cover, the mechanism above flange Q being dispensed with, and such products may be dipped from the condenser, or removed in any suitable manner; but when solids of high specific gravity, or liquids, of either high or low specific gravity, are acted upon, it is necessary to provide some more efficient means for separating out the refined products, such means consisting in the present instance of a separating receiver, shown connected to the body of the condenser I above flange Q. The fluid separating receiver consists of an upright cylinder S, of small diameter, secured to an opening in the top of condenser I, which top should be conical to accelerate the upward flow of liquids. This cylinder is provided with an overflow pipe T for the removal of the lighter liquids, and is surrounded with a cylinder U, supplied with a refrigerating medium through pipe V for cooling the contents of cylinder S. As has before been stated, this water overflows at the top of cylinder U, and falls on the top of condenser I, filling the rim R surrounding said condenser, from which it overflows through pipe W into pipe X, which discharges it against the bottom of condenser I.

Z is a small pipe placed above condenser I and leading into it, through which water may be conveyed to overflow the contents of condenser I when desired.

10 is a small pipe leading from the bottom of the condenser, for removing the fluid contents of the same when desired.

When fluid substances are operated on, I attach the mechanism above flange Q to the top of condenser I, or else use the isolating apparatus shown in Fig. 3, and also when solid products which are heavier than water are operated on. In either case, the products of small specific gravity will rise and collect upon the surface of the water in condenser I, and by regulating the overflow of the heavier products through pipe 2, may be made to collect in cylinder S, and overflow through pipe T. It is evident that when substances lighter than water are separated, such substances will overflow through pipe T, and the water will overflow through pipes M and 2; but when liquids heavier than water are isolated, the water will pass out through pipe T, and the refined products through pipes M and 2, a reversal of the operation of the condenser taking place.

Heavy solid substances forming in the bottom of the condenser I, which cannot be recovered through funnel L and pipe M, are recovered by removing the flanged top Q of condenser I.

When light solid or semi-solid substances are to be recovered, as gum-camphor, paraffin, menthol, pipmenthol, &c., the top of condenser I is removed to gain easier access to the interior. A plain top or cover may in such case be provided, such cover being more easily applied. When such products are condensed, they rise in small particles through the liquid contents of condenser I, passing through the perforated sectional disk N, and settling upon the surface of the water within condenser I. Some of these particles, however, being attracted to the refrigerated sides of the condenser, adhere to its interior walls. These, if allowed to collect, impair condensation by decreasing the conductivity of said walls, and to remove these formations, disk N is occasionally raised by ropes or other suitable means, its outer edges being pressed against the sides of condenser I by the springs P. Disk N is also useful for the removal of the products from condenser I. The products of condensation falling back into the water from the edges of the disk J will be inconsiderable in amount, as there will be a slight suction into the funnel L, sufficient, however, to carry with it most of these heavy products, but the products that do fall thus back into the water will be carried up again by the upward current at this point, and will then probably be caught in the funnel. Such products as remain when the condenser ceases operation can be removed through pipe 10.

When it is desired to recover fluids of high

specific gravity, funnel L should be removed, and the rose K should be either inverted, or placed at a higher level in the condenser, so that more perfect separation of the heavy products may be assured.

When steam, or the vapors of any substance which are not required to be separated, are condensed, the separating apparatus above flange Q and the disks J and plate N may be dispensed with, if a simpler form be desired. The funnel L may also be dispensed with, but in such case the injecting pipe should deliver the vapors at a higher level, as shown in Fig. 2. The effectiveness of a condenser of a given size may be greatly increased by providing it with a number of flues, through which refrigerating medium may be conveyed, as shown in Fig. 2. This is especially desirable where space and the refrigerating medium are expensive.

Fig. 2 shows the modification of condenser already referred to, more especially adapted for rapid condensation in a limited space, and for the treatment of simple substances, as exhaust steam from engines, where no isolation of solid products is required. It consists of a shell 14, provided with tubes passing through it, as 15, for the flow of the refrigerating medium; a pipe C for the ingress of vapors; a pipe 16 for the egress of products of condensation of high specific gravity; and a pipe 12 for the egress of products of low specific gravity. Like condenser I in Fig. 1, this form may be used either with the rotating pipe 2, or the float valve shown in Fig. 4, according to the manner in which it is desired to control the height of the liquids within it; or the escape of the liquids may be controlled by adjusting a valve, placed in pipe 2. I prefer, however, to control the overflow by means of the rotating pipe, or the float valve, especially when operating upon commercial products. The shell 14 should be inclosed in a suitable jacket containing a refrigerating medium, provided with the accessories attached to tank Y in Fig. 1.

Fig. 3 represents an isolating apparatus similar to the isolating mechanism of the condenser, but constructed independently of it, for separating liquids which have previously been condensed, of differing specific gravity, and for isolating distilled or refined products from the water of condensation apart from the condenser. It consists of a cylindrical shell 18, into which the liquids to be separated, previously condensed, flow with a lateral motion, below the surface of the liquids already in the apparatus, by means of the ingress pipe 19. Said apparatus is provided with a separating receiver mounted on its conical upper portion, similar to that shown in Fig. 1. It is also provided with a conical bottom, from the apex of which a pipe 20 leads, said pipe being surrounded with a jacket 21 for containing a refrigerating medium, which is supplied by pipe 22, overflowing by pipe 23. The liquids of highest specific gravity, which settle in the bottom of the cylindrical shell 18, are brought to the required temperature by the refrigerating medium, and afterward escape through pipe 2, operated in the same manner, and provided with the same accessories as pipe 2, shown in Fig. 1.

Fig. 4 represents a modified form of the apparatus used to control the escape of the fluids of high specific gravity from the bottom of condenser I. It consists of a valve 27, resting in a suitable valve seat in the bottom of funnel L, to which is connected by rod 26 a hollow ball 23, adapted to float on the surface of the product of higher specific gravity. Rod 26 is maintained in a vertical position by means of a suitable collar in the upper end of the funnel. When the liquid of higher specific gravity has collected in the bottom of the condenser in sufficient quantity, its pressure against the bottom of the ball will cause it to rise, thus raising valve 27 from its seat, and allowing the heavier liquid to escape until valve 27 is again restored to its seat. Since the length of the connecting rod 26 can be adjusted by means of a screw thread in one of its ends working in a correspondingly-threaded opening in either the valve, or ball 25, the cutting off of the heavier product effected by said valve can be made as exact as desired. This mechanism may also be used to perform the function of pipe 2 in Fig. 2, by proper adjustment.

Fig. 5 is a detail perspective view showing the disks N held pressed outward by the springs P. The particular form of springs illustrated need not be used, as any form of springs adapted to the purpose may be substituted.

Fig. 6 represents a modified form of scraper for removing incrustations from the interior walls of the condenser. It consists of scraping bars 29, held within slots formed in the ends of the crossbars 30, said cross-bars being rigidly secured to the revolving shaft 32. Said revolving shaft is held in position by stationary cross-pieces 33, revolving within suitable bearings in the center of said cross-pieces. By attaching suitable brackets or slots to the walls of the condenser, within which the ends of the cross-pieces may rest, the cross-bars and the attendant mechanism may be readily fixed in place or removed as desired. The bars 29 are made to press against the interior walls of the condenser by springs 31, resting between them and the rigid cross-bars. It is desirable that the different parts of this revolving scraper should be so constructed as to permit of its being readily taken apart, as shown in the drawings.

Fig. 7 represents a modification of the form of funnel L adapted to a horizontal condenser, with a perforated injecting pipe similarly adapted.

In constructing the still A for operating upon fluids only, I prefer to dispense with the per-

forated plate H, and to distribute the vapors by a perforated pipe or rose placed in the bottom of the tank, constructed and used like pipe K in condenser I. It is obvious that the vapors may be injected into the distilling chamber and the condenser through a single orifice, but a more even distribution of the vapors through the material operated on is secured by a number of orifices, as shown in the drawings.

By regulating the valve in pipe C in Fig. 1, the vapors within the distilling chamber may be held at a desired pressure to increase their effectiveness.

It is obvious that the form and proportion of the parts of the apparatus may be changed from that represented in the drawings, but I have shown therein the form I deem most desirable for general purposes.

I prefer to construct the apparatus entirely of metal, which metal should be free from corrosive properties which would injuriously affect the products operated on. The refrigerating tank Y may be constructed of wood or other suitable material, as may also the still A, when it is not desired to subject them to a high pressure.

When operating upon solid substances like camphor, paraffin, and menthol, some water of condensation adheres to them on their removal from the condenser. This I usually separate by subjecting such products to pressure, though in some cases I dry them in the atmosphere, and in some cases *in vacuo*.

Having thus fully described my invention, its construction and operation, what I claim as new, and desire to secure by Letters Patent, is—

1. The process of distilling and refining volatile substances, which consists in placing such substances in a suitable receptacle, volatilizing them without the action of direct heat, conveying the vapors resulting from such vaporization into direct contact with water or other suitable condensing liquid, maintained at a suitable temperature, and injecting them against the walls of the condenser at the points of greatest refrigerating work, thus condensing said vapors, separating the condensed products according to their different specific gravities, and removing said products, substantially as described.

2. The process of distilling and refining solid and semi-solid substances, which consists in placing said substances in a suitable receptacle, volatilizing them by the injection of steam, condensing the resultant vapors by conveying them into direct contact with a body of water maintained at a desired temperature, separating the condensed products according to their different specific gravities, and freeing the distilled or refined products from adhering water of condensation.

3. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor-inlet opening, and separate outlets for the products of different specific gravity, the outlet for the heaviest product being provided with a funnel-shaped opening extending above the level of the vapor-inlet opening, substantially as described.

4. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor-inlet pipe, ending in a perforated rose, and separate outlets for the condensed products of different specific gravity, the outlet for the heaviest product being provided with a funnel shaped opening extending above the level of the vapor inlet pipe, and encircled by the circular end of the same, substantially as described.

5. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor-inlet pipe ending in a perforated rose, separate outlets for the condensed products of different specific gravity, the outlet for the lighter product consisting of a cylinder placed in the conically-shaped top of the condenser, and the outlet for the heavier product in the bottom of the condenser being provided with a funnel-shaped opening encircled by the circular end of the vapor-inlet pipe, substantially as described.

6. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor-inlet pipe, separate outlets for the condensed products of different specific gravity, the upper outlet consisting of a cylinder having a discharge pipe placed at the apex of the conical top of the condenser, the lower outlet consisting of a funnel shaped opening in the bottom of the condenser, encircled by the circular end of the vapor inlet pipe, and means for regulating the height of the products within the condenser, substantially as described.

7. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor inlet pipe, separate outlets for the condensed products of different specific gravity, the upper outlet consisting of a cylinder having a discharge pipe, placed at the apex of the conical top of the condenser, the lower outlet consisting of a funnel shaped opening in the bottom of the condenser encircled by the circular end of the vapor-inlet pipe, and a pipe, parallel to the condenser and rotatively attached to said lower outlet, for regulating the height of liquid in the condenser, substantially as described.

8. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor-inlet pipe, separate outlets for the condensed products of differing specific gravity, the upper outlet consisting of a cylinder placed at the apex of the conical top of the condenser, the lower outlet having a funnel-shaped opening encircled by the circular end of the vapor-inlet pipe, means for regulating the height of the contents of the condenser, and means for maintaining the contents of the condenser at any desired temperature, substantially as described.

9. In an apparatus for distilling and refining

volatile substances, a condenser provided with a vapor-inlet pipe, separate outlets for the condensed products of different specific gravity, the upper outlet consisting of a cylinder placed at the apex of the conical top of the condenser, the lower outlet having a funnel-shaped opening encircled by the circular end of the vapor-inlet pipe, means for regulating the height of the products in the condenser, means for maintaining the contents of the condenser at any desired temperature, and separate means of refrigeration for the cylinder surmounting the conical top of the condenser, whereby the lighter product may be more effectually cooled than the heavier product, substantially as described.

10. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor-inlet pipe, separate outlets for the products of different specific gravity, the lowest outlet having a funnel-shaped opening encircled by the circular end of the vapor inlet pipe, and a valve seated in the contracted end of the funnel shaped opening, substantially as described.

11. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor-inlet opening, separate outlets for the products of different specific gravity, the outlet for the product of greatest specific gravity being provided with a funnel-shaped opening encircled by the circular end of the vapor-inlet pipe, and a perforated disk placed in said condenser above said funnel shaped opening, substantially as described.

12. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor-inlet opening, separate outlets for the products of differing specific gravity, a scraper for removing incrustations from the interior walls of the condenser, and means for operating the same, substantially as described.

13. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor-inlet opening, separate outlets for the products of different specific gravity, a sectional scraper for removing incrustations from the interior walls of the condenser, and means for operating the same, substantially as described.

14. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor-inlet pipe, separate outlets for the products of different specific gravity, a sectional disk for removing incrustations from the interior walls of the condenser, said disk being provided with means for forcing its edges against said interior surfaces, and means for operating the same, substantially as described.

15. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor-inlet opening, separate outlets for the products of differing specific gravity, a sectional disk, provided with springs for pressing its edges against the interior walls of the condenser, for removing incrustations from said walls, and means for operating the same, substantially as described.

16. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor-inlet opening, separate outlets for the condensed products of differing specific gravity, the outlet for the heaviest product being formed with a funnel-shaped opening encircled by the circular end of the vapor-inlet pipe, and a scraper for removing incrustations from the interior walls of the condenser, substantially as described.

17. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor-inlet pipe, separate outlets for the products of differing specific gravity, the lowest outlet being formed with a funnel shaped opening, a scraper for removing incrustations from the interior walls of the condenser, and means for maintaining any desired height of the contents of the condenser, substantially as described.

18. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor-inlet opening, separate outlets for the products of differing specific gravity, the lowest outlet being formed with a funnel shaped opening encircled by the circular end of the vapor-inlet opening, a perforated disk placed above said funnel shaped opening, and a scraper for removing incrustations from the interior walls of the condenser, substantially as described.

19. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor-inlet opening, separate outlets for the products of differing specific gravity, the lowest outlet being formed with a funnel-shaped opening encircled by the end of the vapor-inlet pipe, a perforated disk placed above said funnel-shaped opening, a scraper for removing incrustations from the interior walls of the condenser, means for operating the same, and means for maintaining the contents of the condenser at any desired level, substantially as described.

20. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor-inlet opening, separate outlets for the products of different specific gravity, the upper outlet consisting of a cylinder placed at the apex of the conical top of the condenser, and the lower outlet being formed with a funnel-shaped opening, encircled by the end of the vapor-inlet pipe, a scraper for removing incrustations from the interior walls of the condenser, means for operating the same, and means for maintaining the contents of the condenser at any desired height, substantially as described.

21. In an apparatus for distilling and refining volatile substances, a condenser provided with a vapor-inlet opening, separate outlets for the condensed products of differing spe-

cific gravity, the upper outlet consisting of a cylinder placed at the apex of the conical top of the condenser, and the lower outlet being formed with a funnel-shaped opening encircled by the circular end of the vapor-inlet pipe, a perforated disk placed above said funnel-shaped opening, a scraper for removing incrustations from the interior walls of the condenser, and means for maintaining the contents of the condenser at any desired height, substantially as described.

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

ALBERT M. TODD.

Witnesses:
EDITH E. MELCHIOR,
WM. SHAKESPEARE.