Dec. 18, 1934. C. F. DINLEY 1,984,364

APPARATUS FOR TREATMENT WITH SOLVENTS

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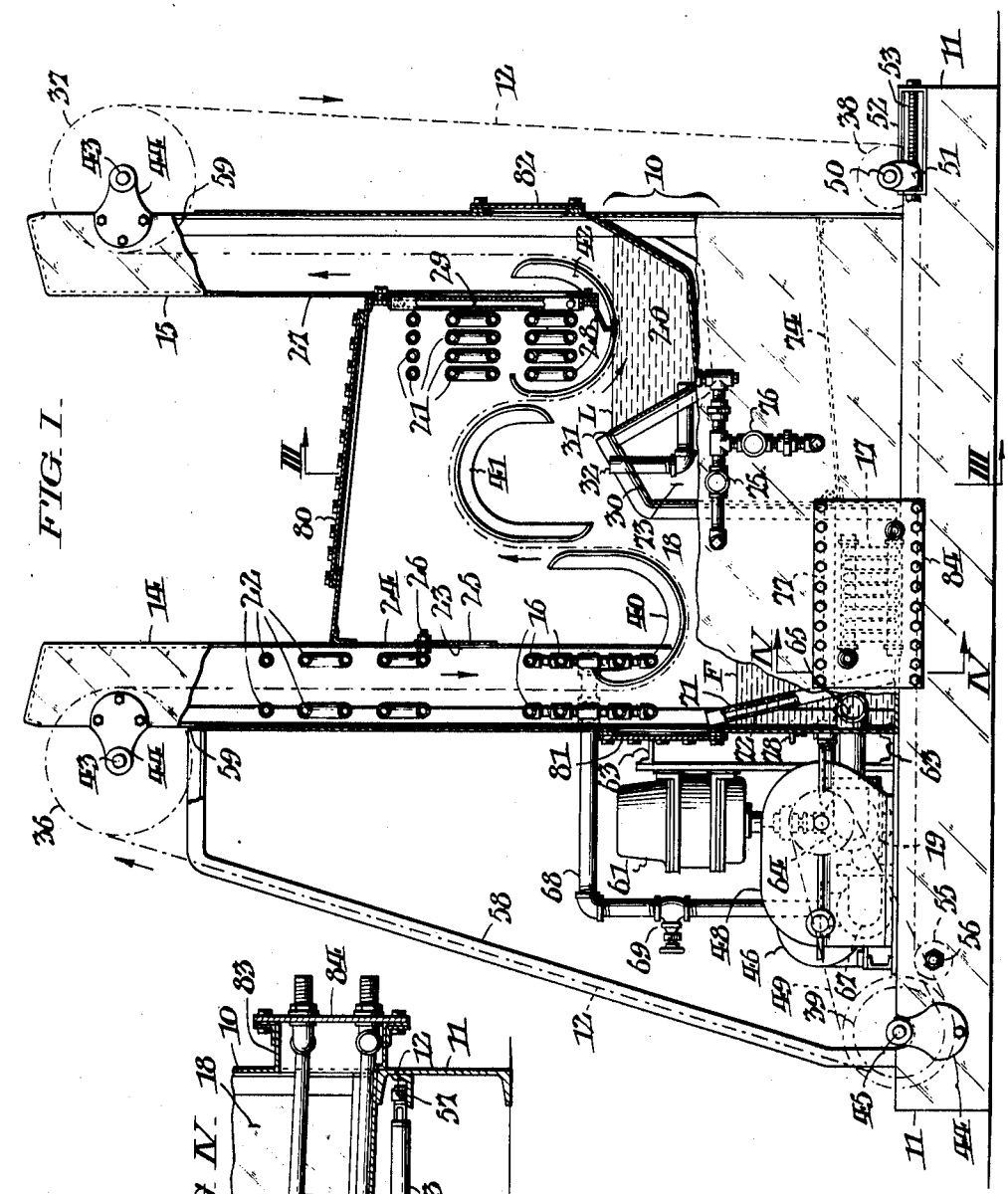


FIG. I.

FIG. IV.

WITNESSES:
William Dee
John A. Wiedler

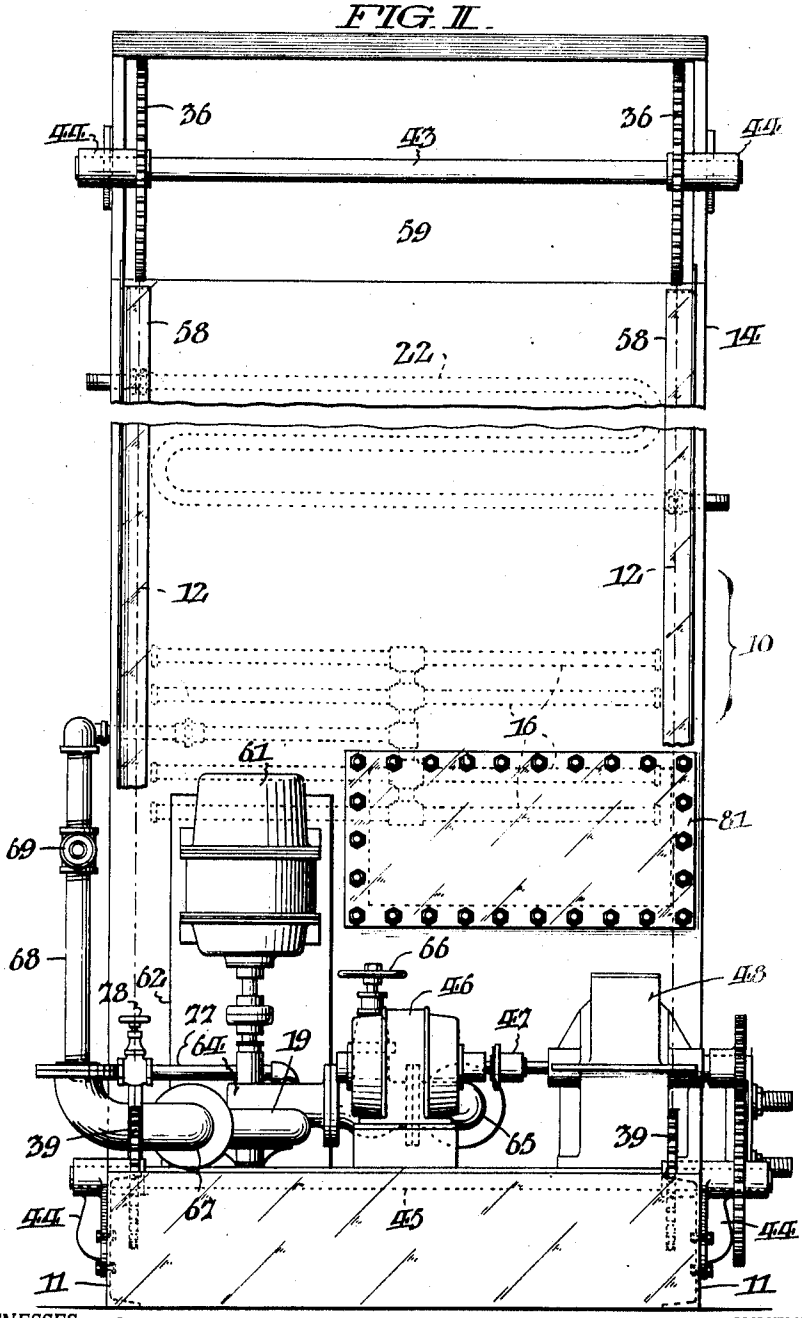
INVENTOR:
Clarence F. Dinley,
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ATTORNEYS.

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APPARATUS FOR TREATMENT WITH SOLVENTS

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FIG. II.



WITNESSES:
William Bell, Jr.
John A. Weidler

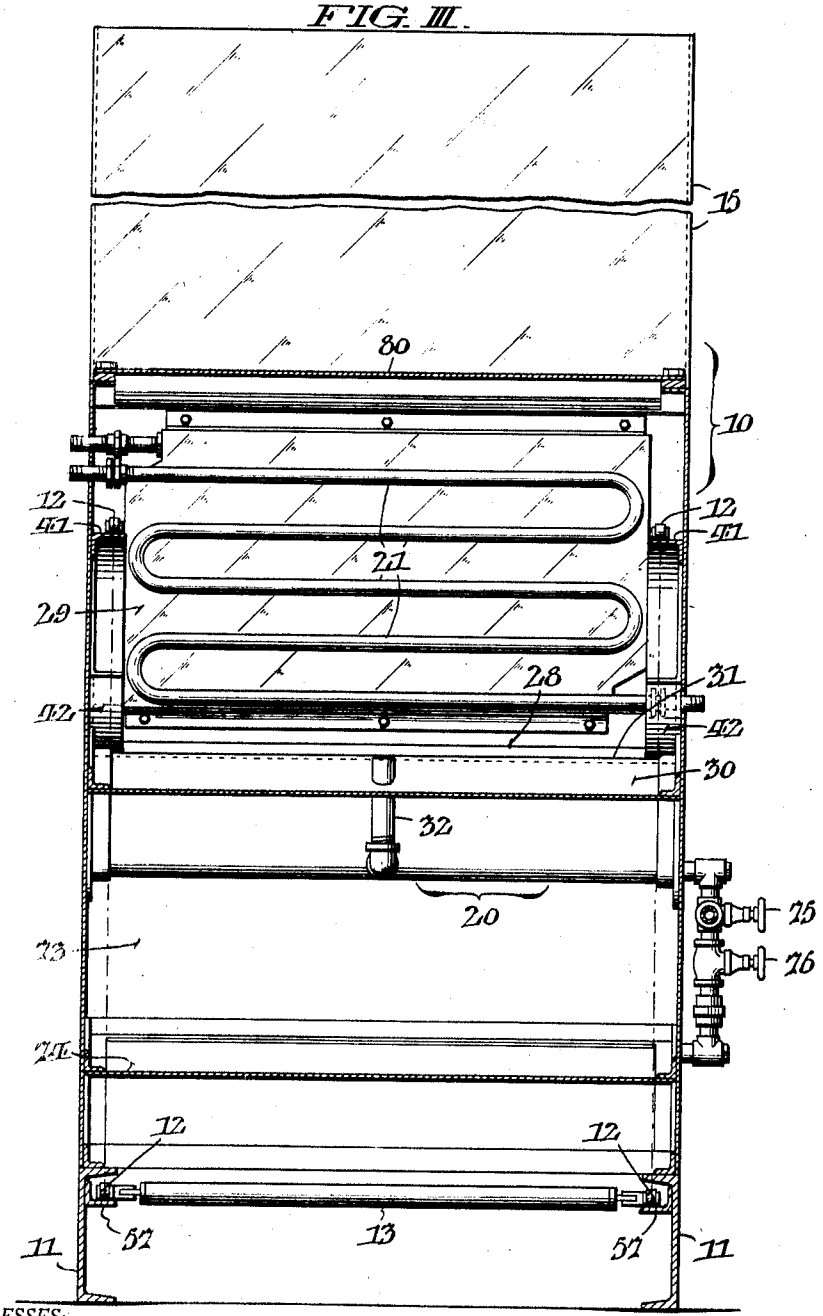
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APPARATUS FOR TREATMENT WITH SOLVENTS

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FIG. III.



WITNESSES:
William Bell, Jr.
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Patented Dec. 18, 1934 1,984,364

UNITED STATES PATENT OFFICE

1,984,364

APPARATUS FOR TREATMENT WITH SOLVENTS

Clarence F. Dinley, Detroit, Mich., assignor to James H. Bell, Philadelphia, Pa.

Application July 7, 1932, Serial No. 621,319

12 Claims. (Cl. 87—6)

My invention relates to treatment with solvents for such purposes as cleaning and degreasing, etc., and particularly to the use of volatile solvents; especially solvents whose vapors are heavier than air, such as benzine, benzol, and chlorinated solvents like carbon tetra chloride and trichlorethylene whose vapors are uninflammable. My invention aims to provide a compact, convenient, and efficient apparatus for this purpose, in which loss of solvent vapor is minimized or prevented, and rapid and thorough cleaning of the work facilitated. How these and other advantages can be realized through the invention will appear from my description hereinafter of a preferred form of embodiment with particular reference to its use for cleaning metal and other parts and objects.

In the drawings, Fig. I is a side elevation of an apparatus embodying my invention, part of its side wall being broken away to show the parts within.

Fig. II is a side elevation at right angles to Fig. I, a portion of the apparatus being broken out to reduce its apparent height, and various parts being broken away or omitted.

Fig. III shows a vertical section through the apparatus, taken as indicated by the line and arrows III—III in Fig. I.

Fig. IV shows a fragmentary vertical section through the apparatus, taken as indicated by the line and arrows IV—IV in Fig. I.

In the drawings, the apparatus is shown as comprising an enclosure or casing 10 mounted on an oblong base frame structure 11 composed of channel sections (Figs. I, II and III). This casing 10 is closed to exclude the air and retain solvent vapor, but is open, as hereinafter described for the introduction and removal of the things or "work" to be treated.

Articles to be treated may be carried through the apparatus 10 by a conveyor system comprising a pair of (roller) sprocket chains 12 interconnected at intervals by tubular crossbars 13, on which hooks or trays may be hung for supporting various kinds of work. The conveyor 12 enters and leaves the enclosure 10 through upright open stacks or ducts 14, 15, which may extend above its highest interior point and also downward into its interior. The entering work is washed with solvent about as it enters, as by means of a hot liquid solvent spray from perforated spray pipes 16 located against the sides of the entrance stack or duct 14, just above its lower end. Liquid for the spray at 16 may be heated by any suitable means, such as a U-tube heating unit 17 in a chamber or "well" 18 in the lower end of the casing 10, and may be pumped to the spray device 16 by a centrifugal pump 19. The work is subsequently rinsed with purer solvent, preferably in a bath in a receptacle 20 beneath the lower end of the exit stack or duct 15.

Solvent vapor evolved from the heated liquid fills the interior of the casing 10; but accumulation of this vapor to the point of overflow from either stack 14, 15 is prevented by condensing the vapor. This may be done partly in the interior of the apparatus, by a condenser 21, of serpentine cold water pipes, (which may supply the receptacle 20 with pure, warm solvent, and may preferably be located directly over the receptacle), and partly in the entrance stack 14, by a condenser 22, of serpentine cold water pipes, mounted adjacent its opposite walls,—partly above and partly below the highest interior point of the casing 10, as represented by its (sloping) top wall. Vapor evolving in the stack 14 from the spray at 16 (or carried into it by eddies due to the spray) may be vented into the interior of the apparatus through an opening 23 in the interior stack wall or partition 24. For controlling this opening 23, there is a sliding gate plate 25 slotted for adjustment to open, shut, or any intermediate position, by means of screw bolts 26 taking into the partition 24. The exit stack 15 is preferably liquid-sealed against entrance of vapor, as by extending the interior stack wall or partition 27 downward (and sidewise) at 28, so as to dip into the rinsing bath at 20. The liquid seal at 20, 27 prevents air drafts through the apparatus that might result in loss of vapor, besides excluding the vapor in the interior of the apparatus from the exit stack or passage 15. Vapor evolved in the stack 15 by evaporation from the ascending articles after emergence from the rinsing bath at 20 may be condensed by chilling the interior partition 27, as by means of an upright water jacket 29 against its inner side, adjacent the condenser 21. This cold-water wall 29 also assists the condenser 21 in supplying pure solvent to the subjacent rinsing bath at 20.

While the surplus of condensed solvent may be allowed to overflow from the bath at 20 over a sloping apron 30 at the outer receptacle edge 31, (which apron 30 may extend down to the bottom of the casing 10 as one wall of the heating chamber or well 18), it is preferred to draw the surplus solvent thus discharged from the cooler lower layers in the bottom of the receptacle 20,—rather than from the warmer top layers. For this purpose, there is shown an "inverted siphon" 32

consisting of a pipe extending from the bottom of the receptacle 20 up through the apron 30, where it terminates slightly below the receptacle edge 31. Thus the rinsing solvent at 20 is kept at a higher average temperature, so as to evaporate from the rinsed articles more readily as they ascend through the stack 15. Accordingly, the work emerges from the exit stack 15 substantially dry of solvent, as well as thoroughly clean.

As shown in Fig. I, the conveyor chains 12 travel around three pairs of idle sprockets 36, 37, 38 and a pair of driving sprockets 39, and also around a series of semi-circular or U-shaped guides 40, 41, 42 in the interior of the apparatus. The idle sprockets 36 and 37 are mounted on shafts or studs 43 carried by bearing brackets 44 secured to the sides of the stacks 14, 15, and the driving sprockets 39 are mounted on a shaft 45 supported by bearing brackets 44, similarly mounted on the base 11. The shaft 45 and its sprockets 39 may be driven by any suitable means, such as an (electric) motor 46 mounted on the base 11 and connected to the shaft 45 through a flexible coupling 47, a reduction gearing 48, and a sprocket chain drive 49. The tension on the sprocket chains 12 may be adjusted, or any slack taken up, by means of the idle take-up sprockets 38, which are mounted on a shaft 50 carried by bearing brackets 51 movable along ways in take-up frames 52 which are mounted on the base 11. Adjusting screws 53 in threaded engagement with the bearing brackets 51 are rotatively mounted in the frames 52. The sprocket chains 12 are given a more extensive wrap or arc of engagement with the driving sprockets 39 by means of small idle sprockets 55 mounted on studs 56 fixed on the frame 11. The return run of the sprocket chains 12 from the take-up sprockets 38 to the idle sprockets 55 may be supported by horizontal guide angles 57 on the base 11. As shown in Fig. I, there are also angle guides 58 for the sloping upward run of the chain 12, from the drive sprockets 39 to the idle sprockets 36 associated with the entrance stack 14,—these guides 58 being attached to the base 11 and to the wall of the stack below its lateral opening 59 through which the sprockets 36 extend and through which the conveyor 12 and its load enter the stack 14. The exit stack 15 may have a similar lateral opening 59. Both stacks 14, 15 may be preferably closed at the top, as shown in Fig. I.

Hot solvent from the well 18 may be supplied the spray device 16 by any suitable means, such as a centrifugal pump 19 (with vertical axis) mounted on the base 11 and driven by a direct connected variable speed (electric) motor 61, itself mounted on an upright base plate 62 secured to the base 11 and to the casing 10 by channel clips 63. The pump intake 64 is preferably arranged at its upper side and connected to the lower portion of the casing 10 by a suction pipe 65 of ample area, so arranged that liquid can flow freely to the pump by gravity, provided with a control and regulating valve 66. The pump delivery 67 is preferably located at its lower side and connected to the spray device 16 by a pipe 68 provided with a control and regulating valve 69. As shown in Fig. I, the pump suction 65 may be protected from inspiration of solids by dual screens 71, 72, the one coarse and the other fine, arranged on a slope in the corner of the casing 10 whence said pipe draws.

When operation of the apparatus is started, the well or chamber 18 is filled with solvent up to the filling line F, and the heater 17 is supplied with steam (at its upper header) and the condensers 21, 22, 29 are supplied with cooling water, which preferably circulates upward through them by the inlet and outlet connections shown. The vapor rises slightly above the lower portion of the cooling coils 22 in the entrance duct 14 before being entirely condensed. By the heater 17 and the condenser 21, solvent is distilled over into the receptacle 20 until the rinsing bath reaches normal sealing level L, as determined by overflow at 32. Thereupon the pump 19 is started into operation to supply the spray 16, and the motor 46 to operate the conveyor system 12. The apparatus being thus ready for normal operation, the conveyor 12 is loaded with work during its upward travel from 39 to 36, and is unloaded during its downward travel from 37 to 38. Passing downward between the condenser coils 21 and the spray pipes 16, the work is thoroughly washed on all sides by the forcibly impinging jets of hot solvent. The upward and downward travel of the conveyor 12 from the entrance guide 40 to the exit guide 42 around the intermediate guide 41 not only carries the work over the edge of the receptacle 20, but also affords opportunity for the less pure solvent from the spray 16 to drain or dry off before the work enters the purer rinsing bath at 20. This bath at 20 removes the less pure solvent (and its dissolved matter) still remaining on the work, which emerges clean and dries during its ascent through the exit stack 15.

Beneath the receptacle 20 is a storage chamber or tank 73, provided with a sloping bottom 74, and additionally bounded by the exterior walls of the casing and by the receptacle 20 and its apron 30. A system of piping with control valves 75, 76 affords a means of draining the solvent bath in receptacle 20 either into the subjacent storage tank 73 or into the heating chamber or well 18. There is also a pipe connection 77, with a control valve 78, from the lowest point of the tank 73 to the intake 64 of the circulating pump 19.

When the supply of solvent in the apparatus has been so contaminated with dirt from the work treated as no longer to clean effectively, the valve 75 may be opened and the solvent from the receptacle 20 thus drained into the heating chamber 18. Thereupon the valve 75 is closed and the valve 76 opened, so that as the solvent is vaporized and condensed, it may drain from the receptacle 20 into the storage tank 73, until the entire supply of solvent has been distilled and thus purified. Thereupon the U-tube heating unit 17 is removed, to afford access to the chamber 18, which is thus cleaned of the accumulated dirt, and the heating unit 17 (also cleaned off, if necessary) is replaced. After this, the valve 78 may be opened and the entire supply of purified solvent thus pumped back into the chamber 18 through the spray device 16, whereupon the valves 76 and 78 are closed. Heat being again supplied to the unit 17, sufficient solvent is distilled into the receptacle 20 to restore the rinsing bath to its proper sealing level,—as determined by the inverted siphon 32,—when the apparatus is again ready for normal operation as described above.

As shown, the casing 10 has various openings with removable covers: i. e., a top opening and cover 80 permitting introduction and removal of the condensers 21, 29, and general access to the interior of the casing; an opening and cover 81 at and below the lower end of the duct 14, afford-

ing access (as for cleaning) to the spray device 16, or to the screens 71, 72 for cleaning or removal; and an opening and cover 82 at the lower end of the duct 15, affording access (as for cleaning) to the receptacle 20. As already indicated, there is also an opening affording access to the heating chamber 18, provided with a rectangular rim 83 forming an outward lateral extension of the casing 10, and normally closed by the removable header-supporting cover plate 84 of the heating unit 17.

Having thus described my invention, I claim:

1. Treating apparatus of the character described, for treating things therein with hot volatile solvent whose vapor is heavier than air, closed to exclude air and retain the vapor, but having an open upright stack or duct for passage of the things treated extending above the highest interior point of said apparatus and also downward into its interior, means in said apparatus for treating things therein with hot liquid solvent, means for condensing solvent vapor in said stack and thus preventing its escape therefrom, and means in the interior of the apparatus, beyond the stack opening thereinto, for also condensing the solvent vapor.

2. Treating apparatus of the character described, for treating things therein with hot volatile solvent whose vapor is heavier than air, closed to exclude air and retain the vapor, but having an open upright stack or duct for passage of the things treated extending downward into the interior of said apparatus, means for spraying things with hot liquid solvent in said stack, and means for condensing the solvent vapor in said stack above said spraying means.

3. Treating apparatus of the character described, for treating things therein with hot volatile solvent whose vapor is heavier than air, closed to exclude air and retain the vapor, but having an open upright stack or duct for passage of the things treated extending downward into the interior of said apparatus, means for spraying things with hot liquid solvent in said stack, means for condensing the solvent vapor in said stack above said spraying means, means for venting vapor from said stack into the interior of the apparatus at a level intermediate said spray and said condensing means, and condensing means in the interior of the apparatus for condensing the solvent vapor.

4. Treating apparatus of the character described, for treating things therein with hot volatile solvent whose vapor is heavier than air, closed to exclude air and retain the vapor, but having an open upright stack or duct for passage of the things treated extending downward into the interior of said apparatus, and affording a liquid bath for sealing the lower end of said stack, and means in the interior of the apparatus, within this liquid seal, for condensing solvent vapor and thereby replenishing said bath.

5. Treating apparatus of the character described, for treating things therein with hot volatile solvent whose vapor is heavier than air, closed to exclude air and retain the vapor, but having an open upright stack or duct for passage of the things treated extending downward into the interior of said apparatus, means for spraying things with hot liquid solvent in said stack, means for condensing the solvent vapor in said stack above said spraying means, and means for venting vapor from said stack into the interior of the apparatus at a level intermediate said spray and said condensing means.

6. Treating apparatus of the character described, for treating things therein with hot volatile solvent whose vapor is heavier than air, closed to exclude air and retain the vapor, but having open upright entrance and exit stacks or ducts extending upward above its highest interior point, means beneath said entrance stack for heating the solvent, a receptacle beneath said exit stack for a bath of the solvent, and means for condensing the solvent vapor and thereby supplying said receptacle.

7. Treating apparatus of the character described, for treating things therein with hot volatile solvent whose vapor is heavier than air, closed to exclude air and retain the vapor, but having open upright entrance and exit stacks or ducts extending upward above and downward below its highest interior point, means at the lower end of the entrance stack for washing articles entering, and means at the exit stack to maintain a purified solvent bath for rinsing articles and for sealing the lower end of said exit stack against outflow of solvent vapor therethrough.

8. Treating apparatus of the character described, for treating things therein with hot volatile solvent whose vapor is heavier than air, closed to exclude air and retain the vapor, but having open upright entrance and exit stacks or ducts extending upward above its highest interior point and also extending downward into its interior, means for spraying things with hot liquid solvent as they enter, means beneath said entrance stack for receiving and heating the sprayed solvent, means for condensing the solvent vapor in said stack and thereby preventing it from overflowing therefrom, a receptacle beneath said exit stack for a bath of the solvent to seal the latter against escape of solvent vapor, and means for condensing the solvent vapor inside of the seal and thus replenishing said bath.

9. Treating apparatus of the character described, for treating things therein with hot volatile solvent whose vapor is heavier than air, closed to exclude the air and retain the vapor, but having an open stack or duct for the things treated extending downward into the interior of the apparatus, and affording a liquid bath for sealing said passage, means for condensing the solvent vapor in said apparatus and thereby supplying liquid solvent to said bath for maintaining the seal, and inverted siphon means for the overflow of liquid from lower layers of said bath, for controlling the depth of the bath.

10. Treating apparatus of the character described, for treating things therein with hot volatile solvent whose vapor is heavier than air, closed to exclude air and retain the vapor, but having open upright entrance and exit stacks or ducts extending upward above and downward below its highest interior point, means at the lower end of the entrance stack for washing articles entering, means at the exit stack to maintain a purified solvent bath for rinsing articles and for sealing the lower end of said exit stack against outflow of solvent vapor therethrough, and means permitting overflow of solvent from the bottom of the rinsing bath and thereby controlling the depth of the bath.

11. Treating apparatus of the character described, for treating things therein with hot volatile solvent whose vapor is heavier than air, comprising a casing closed to exclude air and retain the vapor, but having open upright entrance and exit stacks extending upward above its highest interior point and also extending downward

into its interior, a reservoir beneath tne exit stack with means for heating and vaporizing liquid solvent, a receptacle beneath the exit stack affording a rinsing bath sealing its lower end, a condenser in the casing for supplying liquid solvent to said bath, a tank in the casing beneath said receptacle adapted to receive solvent therefrom, and means for returning the solvent from said tank to said reservoir.

12. Treating apparatus of the character described, for treating things therein with hot volatile solvent whose vapor is heavier than air, closed to exclude air and retain the vapor, but having open upright entrance and exit stacks or ducts extending downward into the interior of said apparatus, and means at the exit stack to maintain a purified solvent bath for rinsing articles and for sealing the lower end of said exit stack against outflow of solvent vapor therethrough.

CLARENCE F. DINLEY.