Aug. 17, 1937. G. EDHOFER ET AL 2,090,192

MEANS FOR DEGREASING AND CLEANING METAL ARTICLES

Filed July 29, 1933 4 Sheets-Sheet 1

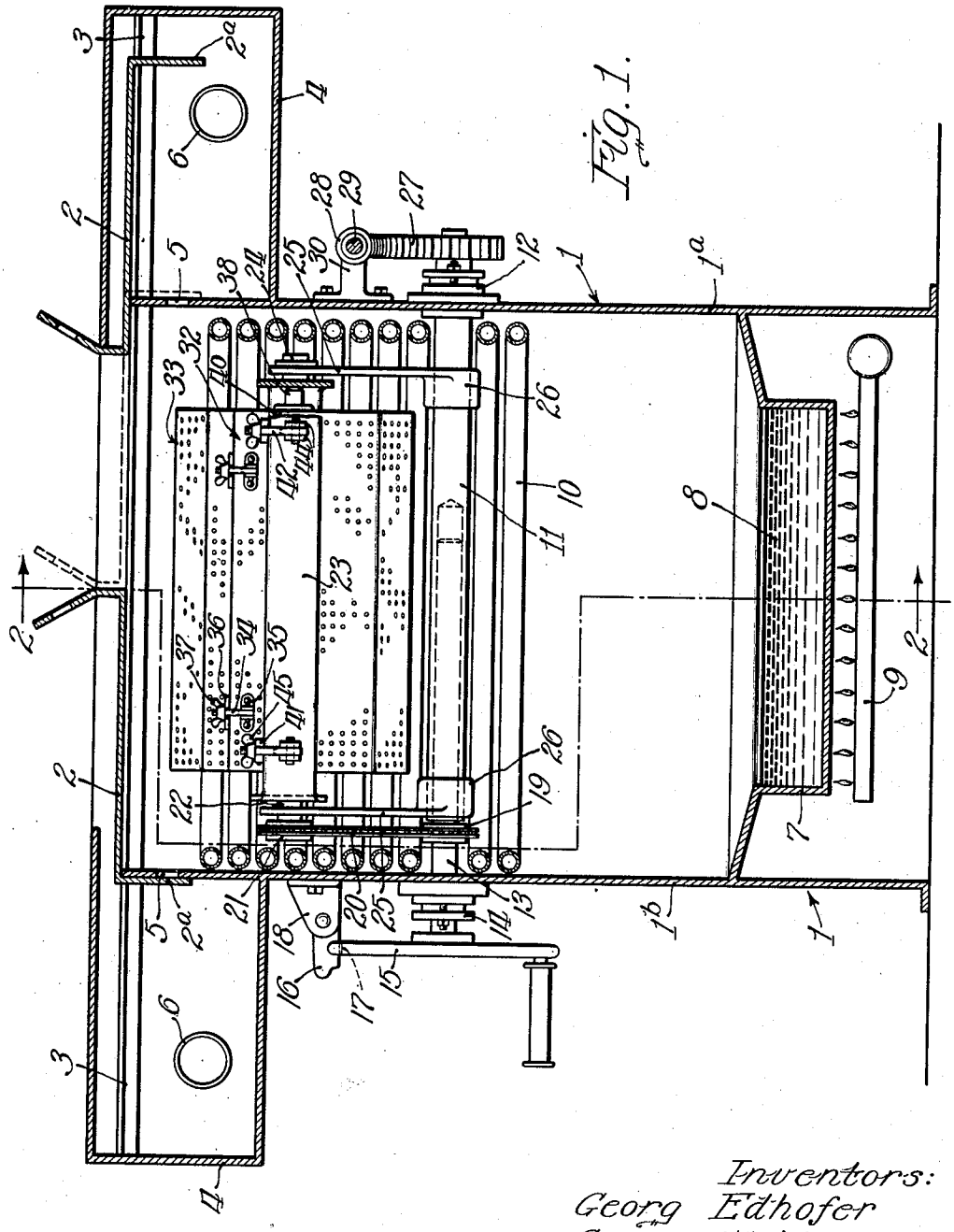


Fig. 1.

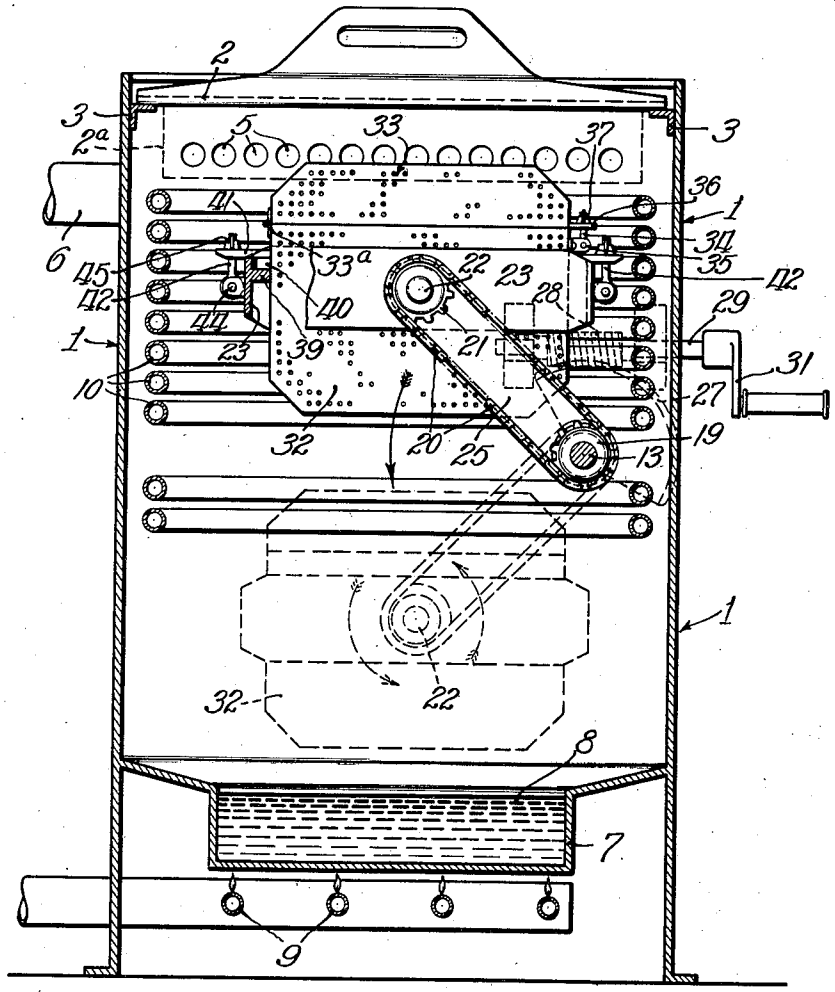
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MEANS FOR DEGREASING AND CLEANING METAL ARTICLES

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Fig. 2.



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MEANS FOR DEGREASING AND CLEANING METAL ARTICLES

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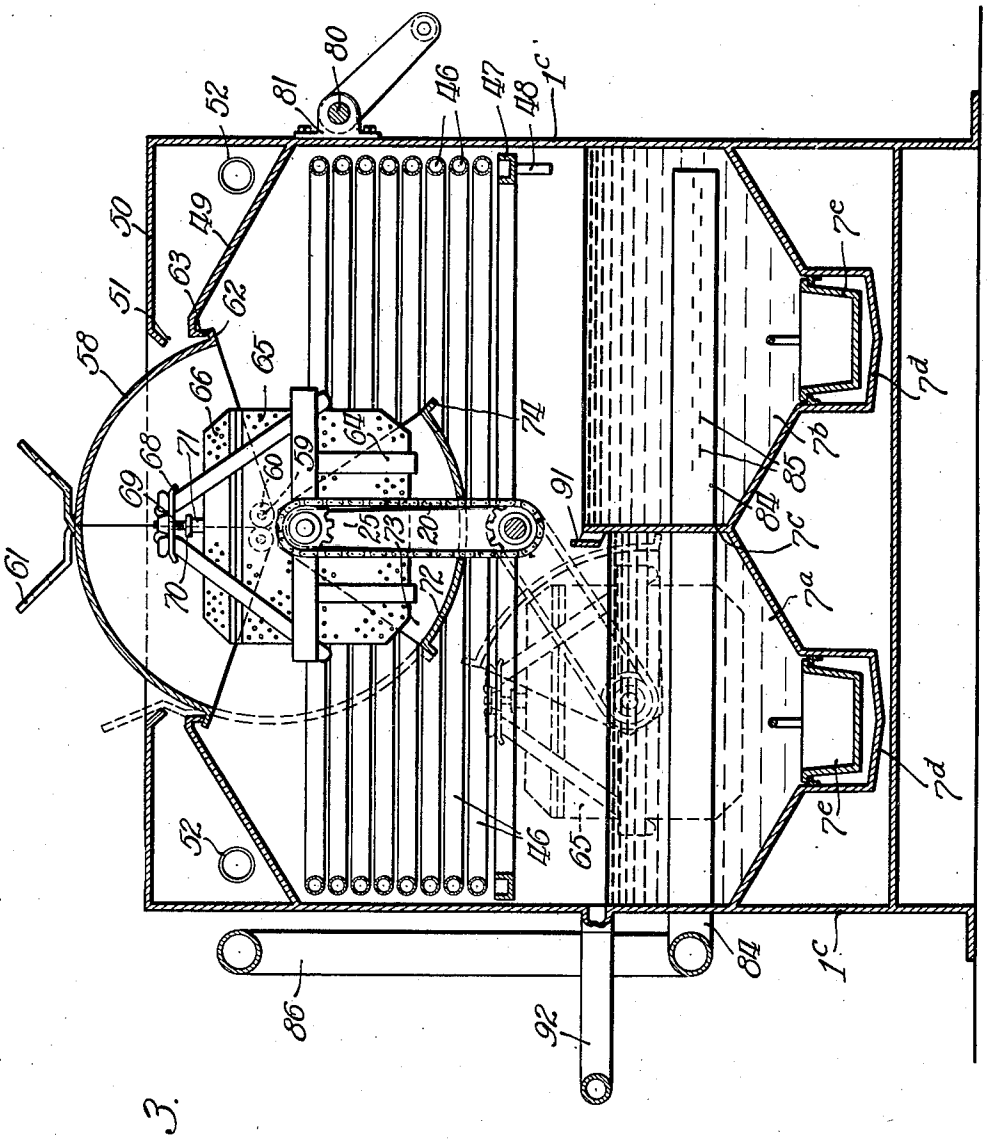


Fig. 3.

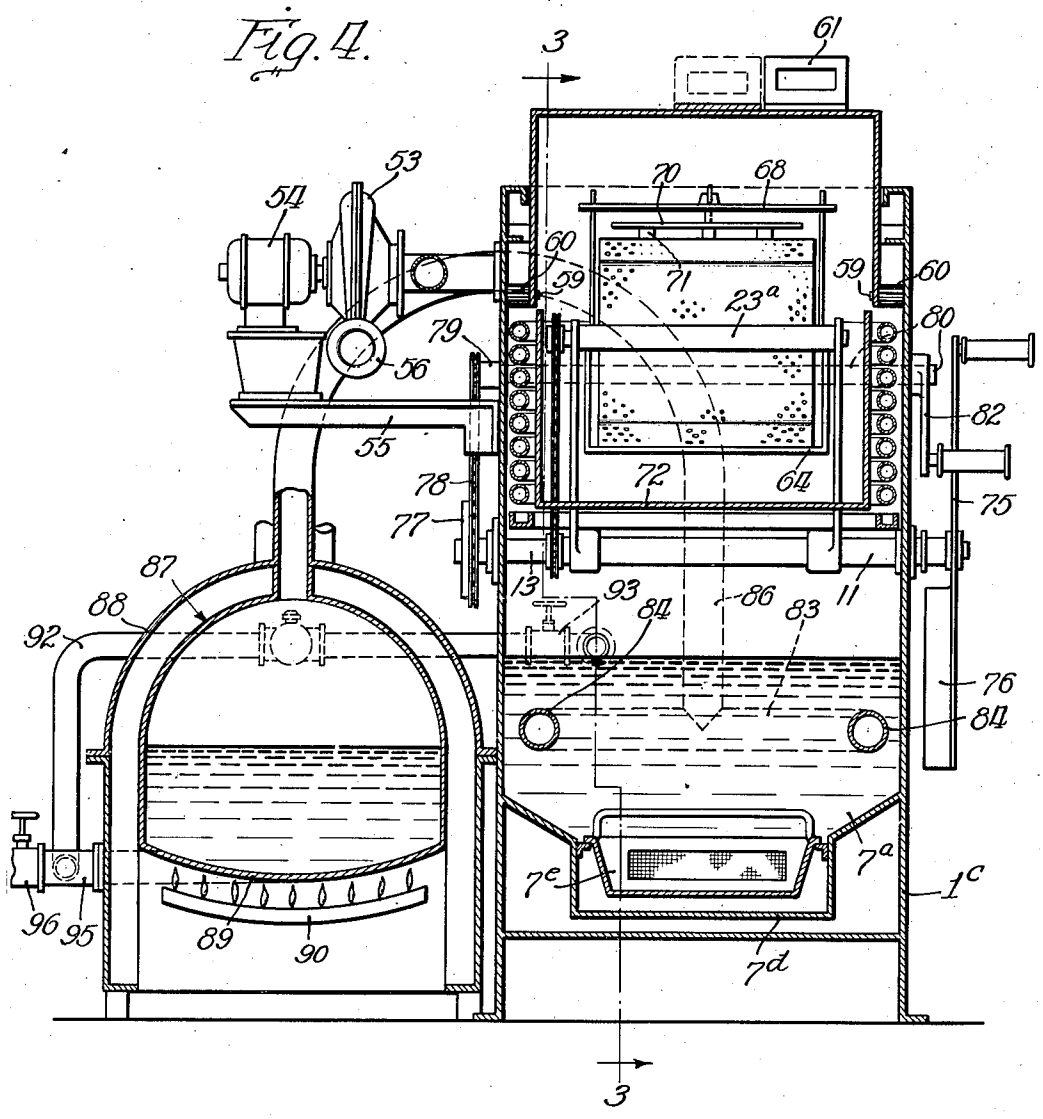
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MEANS FOR DEGREASING AND CLEANING METAL ARTICLES

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Fig. 4.



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UNITED STATES PATENT OFFICE

2,090,192

MEANS FOR DEGREASING AND CLEANING METAL ARTICLES

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Application July 29, 1933, Serial No. 682,823

8 Claims. (Cl. 87—6)

This invention relates to the cleaning of metal articles, and has to do with means for immersing articles in a solvent for removing grease and dirt from such articles.

It is known to remove grease and dirt from metal articles by immersing them in a suitable solvent, in liquid or vapor form, the solvent being disposed within an open top tank through the top of which the articles are inserted and removed. The solvents used are such that the vapors thereof are of a higher specific gravity than air, such as trichlorethylene, perchlorethylene, or carbon tetrachloride. In practice, a suitable cooling device is provided in the upper portion of the tank for condensing the vapors generated from the liquid solvent, which is in the lower portion of the tank and is heated by suitable means. The cooling device condenses the solvent vapors so as to prevent escape thereof to the atmosphere. After the articles have been immersed in the solvent liquid or vapor, as the case may be, they are raised into the upper portion of the tank, above the vapor zone, where they are permitted to dry and are then removed from the tank. Due to the presence of the cooling device, the major portion of the tank is filled with cool air which takes up a small amount of the solvent vapors by diffusion. Under unfavorable conditions, particularly if there is a draft or the air in the tank is agitated, the cold air and the vapors diffused therein are apt to escape to the atmosphere, creating a disagreeable and objectionable odor.

When using apparatus of the character above referred to, the articles may be placed in suitable baskets or containers which are moved up and down in the tank with a view to facilitating cleaning of the articles. While this facilitates cleaning of the articles, it is open to the objection that it causes a certain amount of agitation of air in the tank, thus increasing the liability of escape to the atmosphere of air and solvent vapors from the tank. Also, this vertical up and down movement or reciprocation of the articles is not sufficient to assure thorough cleaning of hollow articles, and thorough removal therefrom of the solvent liquid when the articles are disposed in the upper portion of the tank for drying.

One of the main objects of our invention is to provide an apparatus suitable for cleaning articles in the manner above referred to, this apparatus embodying a tank which is effectively closed to the atmosphere during the cleaning operation so as to prevent escape from the tank of the vapors of the solvent liquid. A further object is to provide an apparatus of this character in which the articles being cleaned may be rotated and thoroughly agitated within the tank, when the latter is closed, for effecting a thorough cleaning operation of the articles and facilitating drying thereof. Another object of our invention is to provide means whereby the portion of the tank containing the liquid solvent and the vapors thereof is closed to the atmosphere during removal of the cleaned articles and the placing in the tank of a second batch of articles to be cleaned. A further object of our invention is to provide means for regenerating the used solvent and for heating, by means of the hot vapor of the regenerated solvent, liquid solvent within the tank. Further objects and advantages of our invention will appear from the detail description.

In the drawings:—

Figure 1 is a longitudinal vertical sectional view through a cleaning apparatus embodying our invention;

Figure 2 is a transverse vertical sectional view through the apparatus of Figure 1; taken on line 2—2 of Figure 1;

Figure 3 is a longitudinal vertical sectional view through a modified form of apparatus embodying our invention, taken on line 3—3 of Figure 4;

Figure 4 is a transverse vertical sectional view through the form of apparatus shown in Figure 3.

The apparatus comprises a sheet metal casing 1 of box-like formation, the upper end of which may be closed by cover members 2 slidable upon angle strips 3 suitably secured in hoods 4 provided at the front and the back of the upper portion of the casing. These hoods communicate with the casing through openings 5 in the upper portions of the front and the back walls of the casing, and conduits 6 lead from the hoods. These conduits may be connected to suitable suction means for drawing air into the upper portion of the casing and through the openings 5, so as continuously to take off any vapors which may be in the upper portion of the casing, when the cover members 2 are in open position. Each of the cover members is provided with a depending flange 2a, which is disposed over the openings 5, when the cover member is closed, thus closing the interior of the casing to the manifolds 4.

A tank 7 is provided within casing 1, at the lower portion thereof, for holding a suitable quantity of a liquid solvent 8, such as trichlorethylene. This solvent is heated in a suitable manner, as by means of a gas burner 9 disposed beneath the tank. A cooling coil 10 extends about the interior of the tank, at the upper portion thereof, and a cooling liquid, such as cold water or brine, is circulated through this cooling coil in a known manner. The coil 10 acts to condense the vapors of the liquid 8 and to prevent escape thereof to the atmosphere through the open top of the tank, when the cover members 2 are in open position, the condensate dripping back into the tank 8. No material amount

of vapor rises above the lower portion of the cooling coil, so that the vapor zone is confined between this coil and the surface of the liquid in tank 8, the space above the lower portion of the coil 10 being substantially free of solvent vapor except for such vapor as may become mixed by diffusion with the cold air in the upper portion of the casing 1.

A shaft 11 is rockably mounted through back wall 1a of casing 1, there being a stuffing box 12 about this shaft to prevent escape thereabout of solvent vapor from within the casing. Shaft 11 is bored out from its inner end and snugly receives a shaft 13 rotatably mounted through front wall 1b of casing 1, there being a stuffing box 14 about shaft 13. A hand wheel 15 is secured on the outer end of shaft 13 for rotating the same and is normally held against rotation by a gravity pawl 16 which engages into a notch 17 in the hand wheel, this pawl being pivoted in a suitable bracket 18 secured to wall 1b of the casing.

A sprocket wheel 19 is secured on shaft 13, within the casing and adjacent wall 1b thereof, and is connected by a chain 20 to a sprocket wheel 21 secured on a stud 22 projecting from one end of a rectangular frame 23. A stud 24 projects from the other end of frame 23, and these two studs are rockably mounted in the upper ends of arms 25 provided at their lower ends with collars 26 suitably secured upon shaft 11 for turning movement therewith. A worm segment 27 is secured on the outer end of shaft 11 and meshes with a worm 28 secured on a shaft 29 rotatably mounted in brackets 30 secured to wall 1a of the casing. A crank 31 is secured upon one end of shaft 29 for rotating the same and thus imparting turning movement to shaft 11.

The frame 23 receives a perforated container or basket 32 provided with a closure member or cover 33 hinged to the body of the basket at 33a. Frame 23 and basket 32 together constitute article receiving and supporting means operatively associated with arms 25, as will more fully appear presently. This cover may be secured in any suitable manner, as by means of swing bolts 34 pivoted in slotted brackets 35 secured to the body of the basket, these bolts engaging into slotted lugs 36 projecting from the cover 33, and receiving wing nuts 37 which contact the lugs 36 for securing the cover closed. Any other suitable or preferred means for closing the basket may be provided. Conveniently, the basket 32 is provided at the center of each end thereof with an outwardly projecting stud 38 to facilitate placing of the basket in the frame 23 and removal of the basket therefrom. Any suitable means may be provided for releasably securing the basket in the frame. For this purpose I have shown the frame as provided, at each side thereof, with a longitudinally extending and inwardly projecting rib 39 upon which seats a similar rib 40 projecting from the side wall of the basket. Slotted lugs 41 project from the side walls of the basket beyond the side members of the frame and receive swing bolts 42 pivoted between lugs 44 projecting from the outer faces of side members of frame 23. These bolts receive wing nuts 45 which bear upon the slotted lugs 41 and secure the basket to the frame in a known manner.

The articles to be cleaned, which may be small metal parts, are placed in the basket, which is then closed and secured in the frame 23 in the manner above described. Shaft 11 is then turned in proper direction for lowering the frame and the basket into the dotted line position of Figure 2, at which time the basket is disposed in the vapor zone at the lower portion of casing 1. During this lowering of the basket, hand wheel 15 is held against turning movement by the gravity pawl 16 so that the sprocket wheels 19 and 21 and the chain 20 cooperate to maintain the frame 23 in a horizontal position, in an obvious manner. The basket may remain stationary in the vapor zone for a sufficient time to assure thorough cleaning of the articles by the solvent vapor, it being noted that during this time the relatively hot vapor comes in contact with and condenses upon the articles to be cleaned, which articles are relatively cold, the condensate flowing back into the tank 8. The vapor thus acts to dissolve all grease and like foreign materials upon the articles and also acts to flush off or wash the articles, by flowing thereover, so as to remove effectively all foreign materials therefrom. Though the basket may remain stationary in the vapor zone during the cleaning of the articles, as noted, we preferably rotate the basket when in this position so as to effect more thorough and rapid cleaning of the articles. For rotating the basket, gravity pawl 16 is raised into inoperative position, and shaft 13 is rotated by means of hand wheel 15, thus imparting rotation to the basket by means of the sprocket wheels 19 and 21 and the chain 20. This rotation of the basket is advantageous, particularly when cleaning hollow articles in which the vapor condensate would tend to collect, and it also imparts a tumbling action to the articles which thoroughly agitates the same and assures proper exposure of all surfaces thereof to the solvent vapor.

After the articles have been treated for a proper time in the vapor zone, shaft 11 is turned so as to raise the frame 23 and the basket into the upper portion of the casing so that they occupy the position shown in full lines. During the cleaning operation, the articles absorb an appreciable amount of heat from the hot vapor and, when the basket is positioned in the upper portion of the casing, these articles quickly dry. The cover members 2 of the casing are then moved into open position and the basket of cleaned articles is removed from the frame 23, a second basket containing articles to be cleaned being then mounted in the frame, after which the cover members 2 are closed and the articles are cleaned and dried in the manner previously described. During the operation of removing the basket from the frame and placing a second basket therein, any air containing diffused vapors, which may enter the upper portion of the casing, is withdrawn therefrom through the openings 5, thus preventing escape to the atmosphere of solvent vapors from the casing, in the manner previously described.

In the form of apparatus illustrated in Figures 3 and 4, casing 1c is provided, at the lower portion thereof, with two solvent liquid receiving tanks 7a and 7b, separated by a plate 7c. Each of the tanks is provided, at the bottom thereof, with a trough 7d in which is removably supported a sediment receiving tray 7e conveniently provided with lateral flanges which seat upon angle strips secured to the side walls of the trough, as shown. A cooling coil 46 is mounted in the upper portion of the casing above a trough 47 provided with a discharge tube 48 which delivers to tank 42 condensate which drips from the coil into the trough.

Plates 49 extend upward and inward from the front and back walls of the casing and are spaced

at their upper edges from top plates 50 extending inward from said walls of the casing, the plates 49 and 50 and the adjacent portions of the casing walls defining hoods open at their inner sides at 51 and communicating, by means of conduits 52, with the intake side of a blower 53 of known type. This blower and the motor 54 therefore are conveniently mounted on a bracket 55 suitably secured to the casing. Outlet fitting 56 of the blower may be connected, by a suitable conduit, to a space for discharging the air and vapor which may be withdrawn from the hood, the point of discharge being located exterior of the space in which the apparatus is disposed.

The space between the hoods is closed by two cover members 58, each constituting a segment of a cylinder. The cover members are pivotally mounted on the casing at the lower ends of the side walls of said members, at 59. Preferably, the cover members are interconnected by meshing pinions 60 secured to the pivots of the cover members for turning therewith, so that when either cover member is moved equal and corresponding movement will be imparted to the other cover member, in a known manner. Each of the cover members is provided with a suitable handle 61 for convenience in operating the same, and these handles are disposed in overlapping or crossed relation when the cover members are closed, as shown in Figure 3. Each cover member 58 is provided, at the lower edge thereof, with a bead 62 which contacts a bead 63 at the upper end of the associated plate 49 and forms therewith a substantially airtight closure, when the cover member is in closed position.

A frame 23*a*, similar to frame 23 of Figure 1 and Figure 2, is supported by arms 25 in the manner previously described. Two U-shaped straps or stirrups 64 are suitably secured to and depend from frame 23. These stirrups receive the lower portion of a perforated basket 65 disposed within the frame and provided with a removable cover 66. Upwardly and inwardly inclined arms 67 are suitably secured to the frame 23*a* at the ends thereof. These arms are of hooked shape at their upper ends and receive a slotted plate 68 which extends the length of frame 23*a*. A pressure screw 69 threads through plate 68 and has a loose nut connection, in a known manner, to a pressure bar 70 which extends lengthwise of basket 65 and is provided with depending lugs 71 which bear upon the top of cover 66 of the basket. This provides means for effectively securing the basket within the frame with expedition and facility.

A plate 72, in the form of a segment of a cylinder and curved on the same radius as the cover members 58, is suitably supported by arms 25 and segments 73, at each end of this plate, extend upwardly therefrom between the cooling coil 46 and the adjacent supporting arm 25. When frame 23 is in its uppermost position, shown in full lines, it is disposed within a cylinder generated by movement of either of the cover members 58 on its pivot. When the cover members are moved into full open position, the beads 62 at the lower edges thereof contact beads 74 at the edges of plate 72 so as to form substantially airtight closures therewith, and the upper portions of the cover members fit snugly against beads 63 of plates 49, as indicated by dotted lines in Figure 3. The basket 65 is thus enclosed in a housing closed to the interior of casing 1, when the basket is in its uppermost position and the cover members are in open position. This is advantageous as reducing possibility of escape to the atmosphere of vapors from the interior of the casing. Any cool air containing diffused vapors, which may tend to escape through the top of the casing, is drawn into the hoods through openings 51 thereof, this air and the vapors contained thereby being delivered to a point remote from the space in which the apparatus is disposed, by means of the suction blower 53. The plate 72 is, of necessity, provided with suitable openings to accommodate the arms 25 and the sprocket chain 20. Any vapors which enter the space about the basket, through these openings, and diffuse into the air in this space, will be removed in the manner above set forth.

A crank handle 75 is suitably secured on the outer end of shaft 11 for turning the latter in desired direction. A counterweight 76, suitably secured to and depending from the crank handle 75, normally serves to hold the frame 23*a* in its uppermost position. By means of this crank handle 75, the shaft 11 may be turned so as to lower the basket into either tank 7*a* or tank 7*b*, as desired. A sprocket wheel 77 is secured on the outer end of shaft 13 and is connected by a sprocket chain 78 to a sprocket wheel 79 secured on one end of a shaft 80 rotatably mounted exterior of the casing and transversely thereof, in suitable bearing brackets 81 secured to the casing in a known manner. A crank handle 82 is secured to the other end of shaft 80 for imparting rotation thereto and thus rotating shaft 13. This provides means for rotating frame 23*a*, and the basket mounted therein, in any position of this frame within the casing.

A pipe frame 83 of U-shape in plan is disposed at one end of casing 1*c*, and arms 84 of this pipe frame extend lengthwise of the casing through tanks 7*a* and 7*b*. The portion of the respective arms 84 which is disposed within tank 7*b* is provided with slots or perforations 85, arms 84 being closed at the ends thereof within tank 7*b*. A gooseneck 86 connects the mid-point of the bight portion of pipe frame 83 to the top of a boiler or still 87 disposed at one side of casing 1*c*. This still is enclosed by a suitable housing 88 and is provided with a concaved bottom wall 89 beneath which is disposed suitable heating means, such as a gas burner 90 of known type, within the lower portion of the housing. A strip 91 is suitably supported in spaced relation to the upper portion of plate 1*c* and defines therewith an overflow opening from tank 7*a* to tank 7*b*. An overflow pipe 92, provided with a suitable control valve 93 of known type, opens into tank 7*a* below the upper edge of plate 1*c*. This pipe is connected, at its other end, to a drain pipe 95, provided with a suitable control valve 96 of known type, this drain pipe opening into the still through the bottom wall 89 thereof.

After the basket 65, containing the articles to be cleaned, has been suitably secured in frame 23*a*, and the cover members 58 have been closed, shaft 11 is turned so as to move the basket into the dotted line position of Figure 3 thus immersing the articles in the liquid solvent within tank 7*a*. The basket may be rotated, in this position, to facilitate cleaning of the articles. The basket may then be positioned within the tank 7*b*, by turning shaft 11 in the opposite direction, and again rotated with the articles immersed in the liquid of tank 7*b*, thus thoroughly rinsing the articles and removing therefrom any particles of grease or other foreign materials which may not have been removed by the first treat-

ment in tank 7a. After the articles have been thoroughly rinsed, the shaft 11 is turned into position to dispose the basket 65 in its uppermost position, after which the articles are dried and the basket is removed and replaced by a second basket containing articles to be cleaned, in the manner previously described. The liquid solvent in tank 7a is heated by the hot vapors passing through the arms 84 of the pipe frame 83, and the liquid solvent within tank 7b is heated by the hot solvent vapors projected thereinto through the slits 85. These hot vapors are condensed by the liquid in tank 7b and thus serve continuously to supply pure solvent liquid to this tank, while also heating the liquid in both tanks in the manner stated. The excess liquid supplied to tank 7b overflows into the tank 7a so as to replenish the supply of liquid therein, and the excess liquid from tank 7a is returned to the still where it is distilled, the pure solvent vapors being delivered to tank 7b, as previously described. The drain pipe 95 provides convenient means for draining off, as required, grease and other impurities which, if permitted to collect in considerable quantity within the still, might result in overheating and decomposition of the liquid solvent. Grease and other foreign materials which collect in the lower portions of the tanks 7a and 7b are removed by means of the collecting trays 7e previously referred to.

As above indicated, and as will be understood by those skilled in this art, changes in construction and arrangement of parts of the invention may be resorted to without departing from the field and scope of the same, and we intend to include all such variations, as fall within the scope of the appended claims, in this application, in which the preferred forms only of our invention are disclosed.

What we claim is:—

1. In an apparatus of the character described, a casing for containing a solvent, a rotatably mounted main shaft extending into the casing from one side thereof, a rotatably mounted supplemental shaft extending into the casing from the opposite side thereof and telescoping the main shaft, said shafts being coaxial and independently rotatable, arms rigid with the main shaft, article receiving and supporting means rotatably mounted on said arms for turning movement on an axis parallel with the axis of said shafts, and driving connections between said supplemental shaft and said receiving and supporting means.

2. In an apparatus of the character described, a casing for containing a solvent, a rotatably mounted main shaft extending into the casing from one side thereof, a rotatably mounted supplemental shaft extending into the casing from the opposite side thereof and telescoping the main shaft, said shafts being coaxial and independently rotatable, arms rigid with the main shaft, a frame rotatably mounted on said arms for turning movement on an axis parallel with the axis of said shafts, sprocket wheels of equal diameter secured to the supplemental shaft and the frame respectively, and a sprocket chain passing about said wheels.

3. In an apparatus of the character described, a casing for containing a solvent, two coaxial shafts extending into the casing and mounted for independent rotation, one of said shafts normally being held against rotation and the other shaft being rotatable in either direction, arms within said casing and rigid with said other shaft, a frame mounted on said arms for turning movement on an axis parallel to the axis of said shafts, a sprocket wheel secured to said frame coaxially with the axis of turning thereof, a sprocket wheel secured on said one shaft and of the same diameter as the sprocket wheel secured to said frame, and a sprocket chain passed about said sprocket wheels.

4. In an apparatus of the character described, a casing for containing a solvent, two coaxial shafts extending into the casing and mounted for independent rotation, one of said shafts normally being held against rotation and the other shaft being rotatable in either direction, arms within said casing and rigid with said other shaft, a frame mounted on said arms for turning movement on an axis parallel to the axis of said shafts, a wheel secured to said frame coaxially with the axis of turning thereof, a wheel secured on said one shaft and of the same diameter as the wheel secured to said frame, and a flexible member passed about said wheels and establishing driving connection therebetween.

5. In an apparatus of the character described, a casing for containing a solvent, a main shaft rotatably mounted on said casing at one side thereof and extending into said casing, a supplemental shaft rotatably mounted on the opposite side of and extending into said casing, said supplemental shaft telescoping said main shaft and supporting the inner end thereof, arms within the casing and rigid with said main shaft, a frame mounted on said arms for turning movement on an axis parallel with the axis of said shafts, and driving connections between said frame and the supplemental shaft.

6. In an apparatus of the character described, a casing for containing a solvent, one shaft, another shaft, said shafts being coaxial and extending into said casing and being independently rotatable, arms within said casing and rigid with said other shaft, a frame rotatably mounted on said arms, and driving connections between said frame and said one shaft.

7. In an apparatus of the character described, a casing for containing a solvent, a horizontal shaft mounted in the casing for rotation in either direction about a fixed axis, arms within the casing rigid with said shaft, a frame mounted on said arms for turning movement about an axis parallel to said shaft, means actuated by rotation of said shaft for turning said frame oppositely to and to the same extent as said shaft, in the rotation of the latter in either direction for lowering and raising said frame, and supplemental means for turning said frame independently of said shaft, optionally.

8. In an apparatus of the character described, a casing for containing a solvent, a horizontal shaft extending into the casing and mounted for rotation in either direction, arms within the casing and rigid with said shaft, a frame mounted on said arms for turning movement on an axis parallel to the axis of said shaft, and positively acting means actuated by rotation of said shaft for turning said frame oppositely to and to the same extent as said shaft in the rotation of the latter in either direction for lowering and raising said frame thereby maintaining unvaried the angular relation of said frame to said shaft, with respect to rotation, during raising and lowering of said frame.

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