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T. J. KEARNEY ETAL

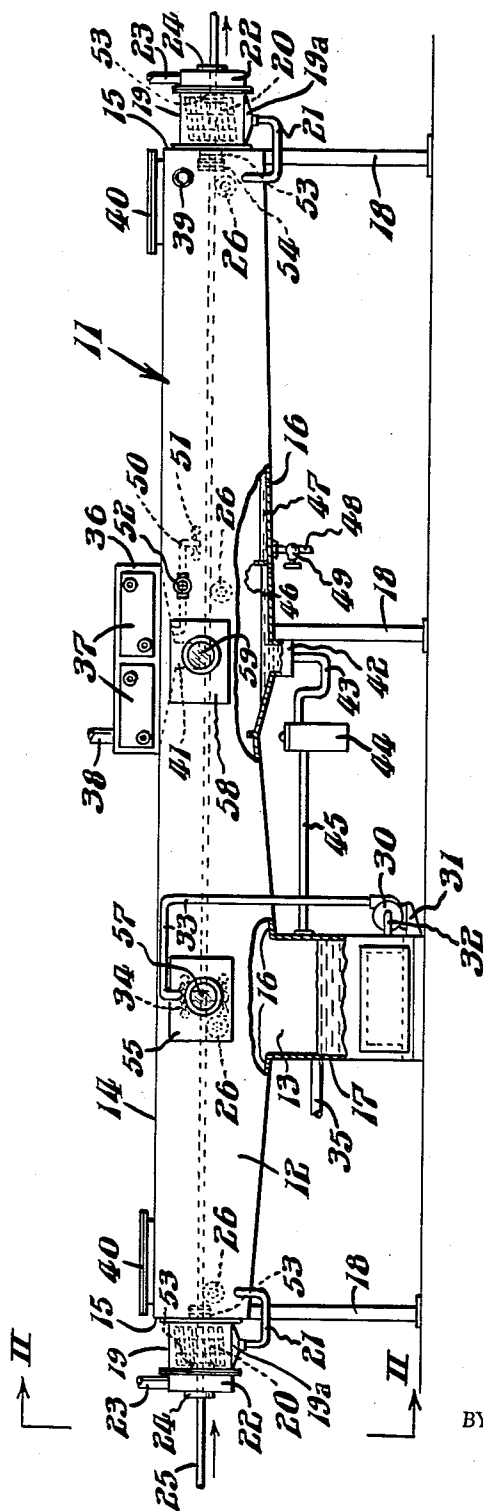
3,123,083

METAL DEGREASING APPARATUS

Filed March 1, 1963

2 Sheets-Sheet 1

FIG. 1 -



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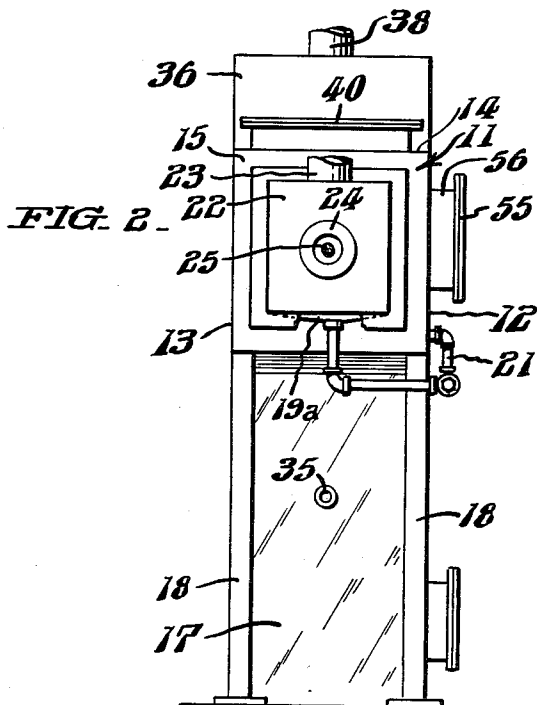
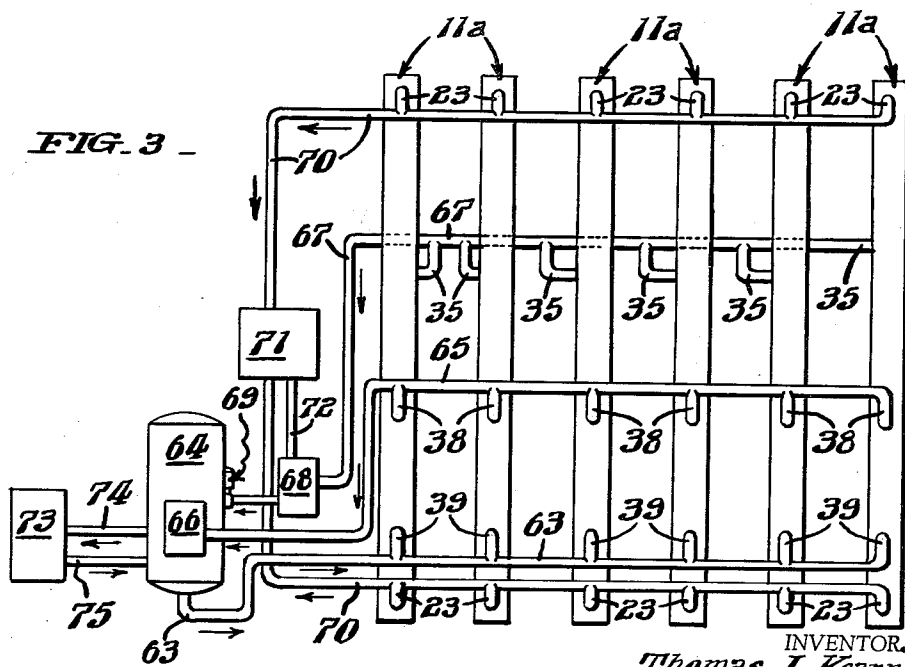
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METAL DEGREASING APPARATUS

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3 Claims. (Cl. 134—60)

This invention relates to improvements in metal degreasing apparatus, and more particularly to such improved apparatus utilizing volatile solvent and adapted to continuously effect the desired degreasing.

Heretofore, the degreasing of metals and similar non-absorbent materials has been effected by the use of volatile solvents such as trichlorethylene, perchlorethylene, and the like. Conventionally, the solvent is maintained in the sump of a tank-type vessel having solid side walls, and having one or more openings in the top thereof for the purpose of admitting and discharging the articles to be degreased. In the known manner, heating means disposed adjacent the bottom of the vessel is utilized to vaporize the volatile solvent which then rises to the upper part of the vessel forming a vapor zone therein. To prevent the vaporized solvent from inordinately escaping from the open topped vessel, cooling means for condensing the solvent vapors are located medially of the top and bottom of the vessel, whereupon the solvent vapors reaching the space adjacent said cooling means are condensed, thereby dropping back into the liquid solvent sump. Additional means are normally provided for continuously or intermittently introducing the metallic or other non-absorbent work objects through the open top of the vessel and into the vapor zone thereof whereby the hot solvent vapors are condensed on the surface of the articles, thereby effecting the desired degreasing, the condensed solvent and degreasing waste dropping from the surface of the objects into the liquid solvent sump. The cleaning action of the degreasing vapors may include any of the known forms of degreasing, including spraying the work with recirculated solvent, spraying with a distillate solvent spray, wiping with felt or brush wipers, and passing the work objects through a chamber containing liquid solvent so as to actually immerse the work in a stream of liquid solvent. In certain applications, the work objects are then allowed to completely dry of condensed solvent on their surfaces before being discharged from the vessel, in order to reduce the loss of volatile solvent. In all of these known applications of volatile solvent degreasing principles, the loss of solvent vapors is inherent in view of the openings existent in the top of the vessel utilized for the introduction and discharge of work to be degreased. Numerous attempts have been made to reduce the loss of solvent vapors through such top openings for reasons of economy and safety, however each such attempt has not been completely successful in reducing all loss of solvent, and additionally such attempts have placed restrictions upon the size and shape of the objects cleaned in the degreasing apparatus, whereupon such apparatus generally is limited to the cleaning of a pre-determined shaped object. Additionally, for these reasons, it is impracticable in accordance with these conventional forms of apparatus to introduce an object into the vessel which has an overall dimension greater than that of the largest dimension of the opening in the top of the vessel. This limitation would therefore exclude the treatment of such articles as continuous lengths of substantially rigid articles, such as, for example, sheathed cable, bi-metallic metals in strip form, and large diameter rods, which may not be accommodated to the space requirements imposed by the necessity of introducing the object through a top opening in the vessel, and then

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withdrawing the same object from the vessel at the same or another top opening. It is apparent therefore that such disadvantages of the former systems could be eliminated by the passage of the articles to be cleaned through the vapor zone within the vessel in a straight line proceeding from one side of the vessel to the other side thereof, thereby accommodating rigid objects of indefinite length which it is desired not to divert from a rectilinear path through the vessel. Apparatus providing such an improvement is disclosed in our copending application Serial No. 230,834, filed October 16, 1962, of which this application is a continuation in part. In the production of continuous length metallic articles, it is economic for multiple lengths to be processed simultaneously. It is obvious, therefore, that the initial cost of a plurality of degreasing machines such as that disclosed in our copending application Serial No. 230,834, would be expensive, and would require separate maintenance and control systems for each individual apparatus.

It is therefore an object of this invention to provide an improved degreasing apparatus having a sealed top wherein continuous lengths of metallic articles are passed through the apparatus without varying substantially from a rectilinear path.

It is another object of this invention to provide such an improved apparatus embodying means for operating such apparatus in parallel with other similar apparatus.

It is another object of this invention to provide such an improved apparatus embodying a continuous circulating solvent liquid vapor supply.

Other objects and advantages of the apparatus of this invention will readily become apparent from a reading of the following description and drawings wherein:

FIG. 1 is a side elevational view of the novel degreasing apparatus of this invention, portions being broken away to show interior enlarged details thereof;

FIG. 2 is an end view of the apparatus of this invention taken along the lines and in the direction of the arrows II—II of FIG. 1;

FIG. 3 is a schematic view showing means for operating the degreasing apparatus of this invention in tandem.

As shown in FIGS. 1 and 2 the apparatus of this invention comprises an elongated degreasing vessel 11, including sidewalls 12, 13, top wall 14, end walls 15, bottom wall 16, and a main sump portion 17. The vessel 11 is supported by the sump portion 17 and a plurality of vertical standards 18, in a generally horizontal orientation. Affixed to each end wall 15, and extending laterally therefrom is a hollow condenser housing 19. Each condenser housing 19 has mounted therein a condenser 20, which may be of the helical coil or other conventional structure. Coolant is supplied conventionally to the condensers 20 through inlet and outlet conduits (not shown). Moreover, each condenser housing 19 is formed with a tapered bottom 19a, which terminates in a conduit 21. Conduits 21 communicate through side wall 12 into the interior of the vessel 11.

Affixed to each condenser housing 19 and extending laterally thereof in a sealed relationship thereto is a hollow plenum chamber 22. Each chamber 22 is provided with a vapor duct 23 which communicates into the interior of the chamber 22, and an end opening fitting 24. During use of the vessel 11, a continuous length metallic article 25 is progressed longitudinally through one end opening fitting 24, through plenum chamber 22, condenser housing 19, over roller sets 26, through the remaining condenser housing 19, the attached plenum chamber 22, and exits through end opening fitting 24.

A motor driven pump 30 is mounted adjacent the sump portion 17 near the bottom thereof on a bracket 31. A conduit 32 communicates from the interior of the sump

portion 17 into the inlet of the pump 30, while the outlet of the pump 30 communicates through a conduit 33 through the side wall 12 of vessel 11. Interiorly of vessel 11, conduit 33 is formed into a ring spray header 34, which is disposed about the metallic article 25 in spraying relationship thereto. The spray header 34 is positioned substantially vertically above the center of the sump portion 17. An overflow conduit 35 communicates from the interior of sump portion 17 to an outside reservoir for liquid solvent, hereinafter described. A distillate condenser 36 is mounted on the top of the vessel 11 and has cooling coil units 37 disposed therein in communication with the interior of vessel 11. A vent 38 communicates with the interior of the distillate condenser 36. A vapor inlet 39 is provided at one end of the vessel 11, and a pair of access covers 40 are provided at either end of the vessel 11.

It will be seen that the internal construction of that portion of distillate condenser 36 situated within the vessel 11 has a configuration such that a drain spout 41 is formed adjacent to and directly above the path of the metallic article 11. It is also seen that the bottom wall 16 is irregularly shaped, and in the area of the condenser 36, creates a distillate sump 42. A trapped conduit 43 leads from the bottom of the sump 42 into a water separator 44, a solvent take off conduit 45 of which communicates into the sump portion 17.

Adjacent the distillate sump 42, a vertical dam 46 is formed, which, in combination with the slightly sloping bottom of the bottom wall 16 forms a check-point sump 47. A valved sample line 48, including valve 49 communicates into the check-point sump 47 through the bottom wall 16. A thief line 50 communicates from a portion of the drain spout 41 to a spray head 51. An externally operated valve 52 is contained in line 50.

A set of tightly fitting seals 53 is formed adjacent end walls 15 so as to wipe the metallic article 25 as it enters the vessel 11 and exits therefrom. Additionally, a set of spring loaded brush wipers 54 of conventional construction, may be utilized as shown to dislodge insoluble soils adjacent the exit of vessel 11, which soils were for some reason not completely removed during the degreasing cycle. An additional set of seals 53 is formed between each condenser housing 19 and plenum chamber 22, and adapted to likewise wipe the metallic article 11 as it passes therebetween.

An access door 55 is mounted on a combing 56 formed about an opening in the wall 12 of the vessel 11 adjacent the ring spray header 34, permitting access thereto. Door 55 has formed therein a glazed porthole 57. Similarly, an access door 58 with a glazed porthole 59 formed therein is mounted adjacent the distillate drain spout 41.

The apparatus of this invention shown in FIGURES 1 and 2 is operated by first filling the sump 17 with a degreasing solvent in liquid form such as trichlorethylene, perchlorethylene, or the like, to the level of the overflow conduit 35. The motor driven pump 30 is then energized, thereby pumping the liquid solvent through conduit 33 and out of the ring spray header 34 in sufficiently high pressure over the article 25 so that heavy contaminants, soluble or insoluble, may be removed. Coolant is introduced to the cooling coil units 37, and solvent vapors of the same solvent as that contained in sump 17 are introduced under pressure from a remote source into the vapor inlet 39, such source which may for instance be a vapor generator such as that fully described in U.S. Patent No. 3,046,163. As the article 25 is progressed through the vessel 11, and past the ring spray header 34, the article passes beneath the drain spout 41. Vapors which fill the interior of the vessel 11 after their introduction through vapor inlet 39 circulate over the cooling coils of the units 37, the condensate therefrom falling by gravity through the drainspout 41 and being directed over the surface of the article 25, thereby performing a distillate rinse. The off-fall from this distillate rinse drops into the

sump 42, from where it is carried by conduit 43 into and through the water separator 44, and then by conduit 45 into the sump 17. This flow of condensed solvent continuously dilutes the oil and solids contamination in the solvent contained in sump 17. The liquid solvent cycle within the apparatus is maintained continuously as the liquid in the sump 17 overflows by addition of the solvent received from conduit 45, such overflow being conducted by conduit 35 to a remote supply of liquid solvent, such as that more fully described hereinafter.

The degree of soil remaining on the article 25 after the distillate rinse provided by spout 41, may be checked periodically by opening the valve 52 and thereby spraying condensed solvent over the article 25. This small amount of distillate is passed through conduit 50 and spray nozzles 51 and collected in sump 47, wherefrom it may be withdrawn for analysis through the valve 49 and sample line 48.

To insure vapor circulation through the apparatus shown in FIGURES 1 and 2, the vent 38 is connected to external recovery means from which fresh vaporized solvent is returned through the vapor inlet 39, as herein-after more fully explained.

Solvent vapors which escape from the interior of the vessel 11 past the seals 53 are condensed to a great extent within the condenser housing 19, and any vapors which escape from housing 19 into the plenum chambers are conducted by suction and air entering fitting 24 to suitable recovery means, all in accordance with the principles described in our copending application Serial No. 230,834.

It will readily be apparent from the copending application Serial No. 230,834, filed October 16, 1962, and from U.S. Patent No. 3,046,163, that it would not only be expensive as regards the total initial cost of each of the vapor generators described therein, but also would result in rather high maintenance costs, if it were necessary to utilize a separate vapor generator for each of the degreasing apparatuses described and claimed herein where it is required that multiple production lines of strip, cable, rods and the like be operated concurrently. Therefore it has been discovered as part of the apparatus of this invention that an arrangement such as that shown diagrammatically in FIGURE 3, may effectively be used to economically carry out such plural operation. Referring to FIGURE 3, each of the units 11a represents a complete apparatus such as that shown in FIGURE 1, and hereinbefore described. Each of the vapor inlets 39 is supplied with freshly vaporized solvent through a vapor header 63 from a common vapor generator 64. Each vent 38 is connected to a vent header 65 which conducts vapor to a condenser 66 mounted in communication with the vapor generator 64. Each of the overflow conduits 35 is conducted to an overflow header 67 which communicates into a tank 68 from which an outlet conduit communicates into the pump 69. Each of the vapor ducts 23 communicates into one of the common exhaust headers 70 which in turn communicates into a conventional carbon recovery unit 71. The effluent from the carbon recovery unit is conducted through a conduit 72 into the tank 68. A conventional still 73 is associated with vapor generator 64, an inlet conduit 74 and an outlet conduit 75 providing the means for communicating used and fresh solvent from the vapor generator 64 to the still 73 and back to the vapor generator 64. In FIGURE 3, the arrows show the direction of vapor and liquid flow in the respective conduits.

The operation of the apparatus of this invention shown in FIGURE 3 is similar to that of the apparatus shown in FIGURES 1 and 2, the internal apparatus of vessel 11a being identical to that of vessel 11, and each of the vessels 11a having accommodated therethrough a continuous metallic article (not shown in FIG. 3). The apparatus associated with each vessel 11a is actuated as hereinbefore described. The vapor generator 64 is

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actuated in accordance with the description contained in U.S. Patent No. 3,046,163, whereby freshly generated vapor is conducted through vapor header 63 to each of the vapor inlets 39, thereby filling the interior of each vessel 11a, and covering the distillate condensers 36 associated with each vessel 11a. Excess vapor within the individual vessels 11a is then conducted back to the vapor generator condenser 66 by means of the individual vents 38 and the common vent header 65. The overflow of liquid solvent from the sump 17 of each vessel 11a is conducted through overflow conduits 35 and the common overflow header 67 into the tank 68. The exhaust vapors which escape through the vapor ducts 23 are carried by the exhaust header 70 to a conventional carbon recovery unit 71, the recovered solvent therefrom being conducted through conduit 72 and likewise into tank 68, wherefrom the combined recovered liquid is provided to the suction side of the pump 69. It therefore is apparent that a closed continuous cycle of both liquid and vapor degreasing solvent is provided to enable the continuous operation of a parallel array of individual degreasing vessels 11a. It will readily be apparent that liquid and vapor shut-off valves may be provided in the supply and exhaust conduits from each vessel 11a, thereby permitting one or more of the parallelly arranged vessels 11a to be cut into the production line or cut out therefrom.

Having thus described our invention, we claim:

1. In an apparatus for degreasing elongated solid work objects, the combination of

- (1) an enclosed vessel having (a) a lower liquid sump portion formed therein and (b) an upper elongated portion formed therein, said sump portion being open at the upper portion thereof in communication with the interior of said elongated portion;
- (2) means for conveying a continuous length of a solid work object into, through and out of said elongated portion along a substantially rectilinear path;
- (3) liquid spray means within said elongated portion and position to spray liquid onto said work object, whereby the sprayed liquid returns by gravity into said lower liquid sump portion;
- (4) liquid overflow means communicating out of said sump portion;
- (5) vapor inlet means communicating into said vessel;
- (6) vapor condensing means in communication with the interior of said vessel, said condensing means

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having a condensing surface thereof exposed to the interior of said vessel;

- (7) means formed within said vessel and adapted to receive the condensate from said condensing means, and to direct said condensate into the path of said solid work object as determined by said conveying means at a point spaced apart from said liquid spray means in the direction of exit from said vessel;
- (8) a second sump portion formed in said elongated portion and adapted to receive said condensate as it falls from the path of said work object;
- (9) means for conducting liquid from said second sump portion into said lower liquid sump portion;
- (10) means external to said vessel for recovering spent liquid solvent in vapor and liquid form and for supplying said recovered solvent in vapor form; and
- (11) (a) means for conducting liquid from said overflow means into said solvent recovery means, (b) means for conducting vapor from the interior of said vessel into said solvent recovery means, and (c) means for conducting vapor from said solvent recovery means into the vapor inlet means of said vessel.

2. The apparatus in accordance with claim 1 wherein said (11) (b) means for conducting vapor from the interior of said vessel into said solvent recovery means communicates into the vapor side of said (6) vapor condensing means.

3. The apparatus in accordance with claim 1, comprising, in combination (A) a plurality of said (1) enclosed vessels arranged in spaced apart relationship with the separate (1) (b) elongated portions thereof mutually parallel to each other; (B) a single (10) means external to said vessel for recovering spent liquid solvent and for supplying recovered solvent in vapor form; (C) means for conducting vapor from the interior of each of said plurality of vessels into said single solvent recovery means including a separate vapor vent communicating into each enclosed vessel and a common vent header joining said separate vapor vents and communicating into said (b) single solvent recovery means; and (D) a common overflow header joining the liquid overflow means of each vessel, and communicating therefrom into the (B) single (10) means external to said vessel for recovering spent liquid solvent and for supplying said recovered solvent in vapor form.

No references cited.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,123,083

March 3, 1964

Thomas J. Kearney et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, line 40, for "position" read -- positioned --.

Signed and sealed this 14th day of July 1964.

(SEAL)

Attest:

ESTON G. JOHNSON
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents