

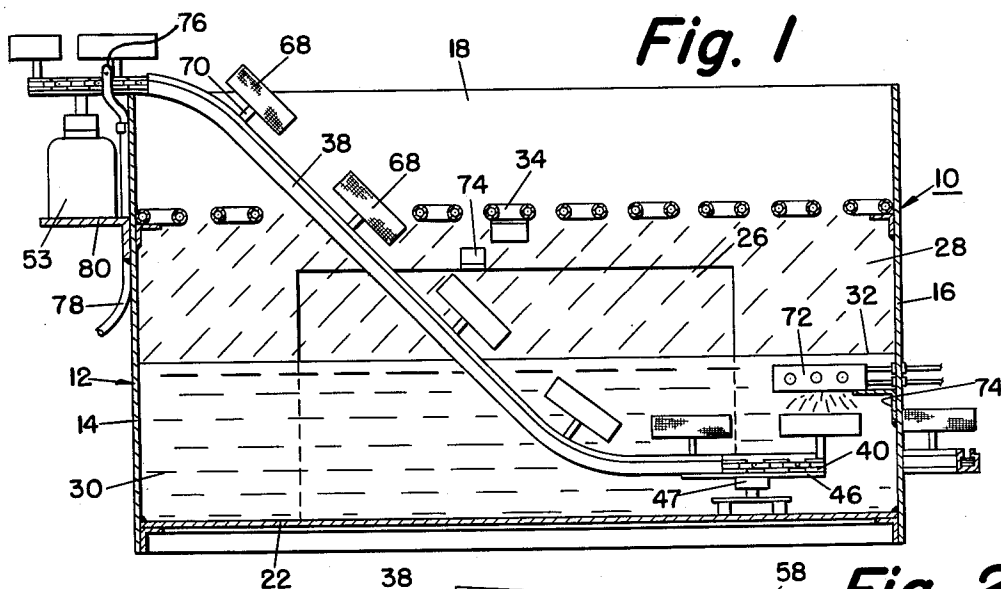
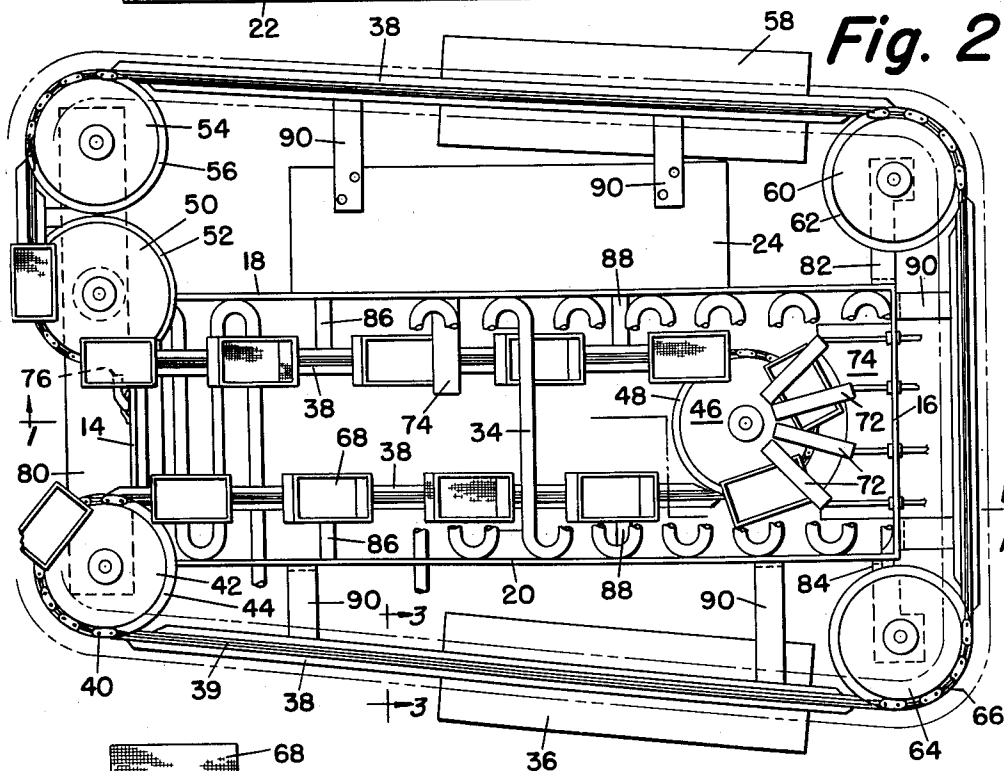
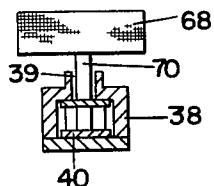
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CLEANING APPARATUS

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CLEANING APPARATUS

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The present invention relates to cleaning apparatus, and more particularly to cleaning apparatus for removing grease and hydrocarbon deposits plus associated dirt or soil from machined parts by treatment with solvents such as trichlorethylene, perchlorethylene, etc.

The satisfactory and rapid cleaning of small machined parts present a difficult problem. Experience has shown that conventional cleaning equipment does not remove contaminate in the nature of adhering dirt or the like from the hollows and interstices of the machined parts. If such machined parts are to be utilized where close tolerances are required, the presence of adhering contaminate constitutes a most serious problem.

The present invention is particularly directed to a cleaning apparatus involving an ultrasonic transducer. My apparatus is more compact and cleans faster and more efficiently than the inline production equipment used heretofore. The ultrasonic transducer is disposed within the cleaning solvent and delivers high frequency sound wave energy which produces a phenomenon known as cavitation. Cavitation may be the formation or the bursting of voids or bubbles in the solvent. The formation and bursting of the bubbles exerts a scrubbing action on the machined parts and thereby enables hollows and interstices to be thoroughly cleaned of contaminate. Also, cavitation accelerates the cleaning action on smooth surfaces.

Heretofore, it has been conventional in ultrasonic cleaning apparatus to convey the parts to be cleaned within a wire mesh type basket or other equivalent structure which depends from a conveyor means. In such conventional structure, an ultrasonic transducer is positioned within the solvent below the parts to be cleaned. An example of such conventional structures may be seen in Patents 2,802,758; 2,802,476 and 2,845,077.

The cleaning apparatus in each of the above enumerated patents suffer from a defect which interferes with the efficiency of the cleaning action by the induced cavitation in the solvent. In each of the above enumerated patents, the parts to be cleaned are not subjected directly to the cavitation. That is, some element or structure, such as the wire basket, is interposed between the transducer and the parts to be cleaned. The structure, such as the wire basket, breaks down the cavitation and thereby decreases the efficiency of the cleaning action. In addition, the transducer in each of the above enumerated patents is positioned below the parts to be cleaned. Therefore, it is inevitable that the contaminate and sediment removed from the machined parts will settle to the bottom of the tank over the ultrasonic transducers. I have found that the presence of the sediment and contaminate on the casing of the transducer and in the solvent intermediate the transducer and the parts to be cleaned interferes with the efficiency of the cleaning action. To overcome this situation, the present invention includes the mounting of a transducer above the machined parts to be cleaned, so that the transducer radiates downwardly.

It is an object of the present invention to provide a novel ultrasonic cleaning apparatus.

It is another object of the present invention to provide a novel cleaning apparatus wherein machined parts to be cleaned are conveyed through a solvent beneath ultrasonic transducers.

It is another object of the present invention to provide a novel ultrasonic cleaning apparatus wherein the ma-

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chined parts to be cleaned are conveyed on a conveyor means above the movable element of the conveyor means.

It is still another object of the present invention to provide a novel cleaning apparatus having a reduced overall height and novel arrangement of the cleaning tank and the conveyor means.

Other objects will appear hereinafter.

For the purpose of illustrating the invention there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIGURE 1 is a longitudinal sectional view of the cleaning apparatus of the present invention taken along the lines 1—1 in FIGURE 2.

FIGURE 2 is a top plan view of the cleaning apparatus of the present invention.

FIGURE 3 is a transverse cross-sectional view of the conveyor means of the present invention taken along the lines 3—3 in FIGURE 2.

Referring to the drawing in detail, wherein like numerals indicate like elements, there is shown in FIGURE 1 a cleaning apparatus designated generally as 10.

The cleaning apparatus 10 comprises a rectangular tank 12 having an open top. The tank 12 has a pair of end walls 14 and 16, side walls 18 and 20, and a bottom wall 22. An offset vapor generator 24 is in communication with the interior of tank 12 by way of an opening 26 in the wall 18 of the tank 12. The vapor generator 24 is provided with a heating means disposed within a solvent for generating vapor which provides the vapor zone 28.

The tank 12 is partially filled with a degreasing solvent 30. The vapor zone 28 extends above the solvent 30. The numeral 32 represents the interface between the vapor zone 28 and the solvent 30. The upper extent of the vapor zone 28 is determined by the cooling coils 34 which zig-zag across the tank 12 intermediate the side walls 18 and 20. In FIGURE 2, the cooling coils 34 have been partially broken away for the purpose of illustrating the elements therebelow within the tank 12.

A loading platform or bench 36 is positioned along the side wall 20 of the tank 12. A conveyor means comprising a chain housing 38 and a chain 40 extend upwardly from a position above the platform 36 toward the top edge of the end wall 14. The chain 40 is of a type wherein the links have pivotable movement in mutually perpendicular planes and per se is well known in the art. Therefore, the housing 38 encloses the chain 40 on all sides thereof except for a spindle passageway 39 which extends upwardly and along the entire length of the housing 38. The purpose of the spindle passageway 39 will be made clear hereinafter.

The conveyor means housing 38 is provided with spaced ends which are disposed diametrically opposite one another adjacent a horizontally disposed idler wheel 42. The idler wheel 42 is provided with a flange 44 for supporting the chain 40 as the chain 40 moves through an arc of 180 degrees. Since the chain 40 moves within a housing 38 which substantially encloses the chain 40, excessive friction is avoided by providing the housing with spaced ends and permitting the chain 40 to embrace a horizontally disposed rotatably mounted idler wheel such as idler wheel 42.

The housing 38 continues over the end wall 14 and downwardly through the vapor zone 28 into the solvent 30 wherein the housing 38 is provided with a horizontally disposed end adjacent the periphery of an idler wheel 46. The idler wheel 46 is rotatably mounted on the nylon bearings 47 and is provided with a peripheral flange 48.

As seen more clearly in FIGURE 2, the chain 40 enters the housing 38 which extends upwardly from the

idler wheel 46 and over the end wall 14. The zig-zag spacing of coils 34 permits entrance and exit access for the housing 38. The housing 38 is provided with spaced ends adjacent the horizontally disposed rotatably mounted drive sprocket 50. The drive sprocket 50 is provided with a peripheral flange 52 for supporting the chain 40 and is rotatably driven by a motor 53. The drive sprocket 50 is provided with teeth (not shown) which engage in-between links of the chain 40.

The housing 38 is provided with spaced ends adjacent the horizontally disposed rotatably mounted idler wheel 54. The idler wheel 54 is provided with a peripheral flange 56 for supporting the chain 40. From the idler wheel 54, the housing 38 extends downwardly and over an unloading platform 58. The housing 38 is provided with spaced ends adjacent the idler wheels 60 and 64. The idler wheels 60 and 64 are provided with peripheral flanges 62 and 66 respectively for supporting the chain 40.

The machined parts to be cleaned are conveyed along the conveyor means on a support means. The support means is preferably a perforated or wire mesh type open top basket 68 connected to the chain 40 by a spindle 70. The spindle 70 is upright with respect to the housing 38 and extends through the spindle passageway 39. The baskets 68 are affixed to the chain 40 at spaced points therealong.

A plurality of ultrasonic transducers 72 are mounted within the solvent 30 above a peripheral portion of the idler wheel 46. Preferably, the ultrasonic transducers 72 are arcuately disposed as shown more clearly in FIGURE 2. The ultrasonic transducers 72 are supported within the tank 12 by an L-shaped bracket 74 affixed to the inner surface of the end wall 16. As pointed out above, the baskets 68 are open at their top so that the downwardly radiating transducers 72 generate cavitation which is transmitted directly to the machined parts to be cleaned. In this manner, the wire mesh of the basket is not interposed between the transducer and the parts to be cleaned. Since the transducers 72 are positioned above the parts to be cleaned, contaminate and sediment removed from the parts will settle to the bottom wall 22 of the tank 12 which is out of the cavitation area.

In some installations it has been found desirable to provide a flexible seal on the spindles 70 or a flexible seal on the portions of housing 38 within the solvent deflectable by the spindles 70 to prevent entry of sludge into the housing 38.

A distillate spray nozzle 74 is positioned on the side wall 18 above the opening 26 for spray rinsing the degreased machined parts. A pump (not shown) is connected to the nozzle 74 for delivering clean solvent thereto.

A nozzle 76 is disposed on the end wall 14 for spraying the chain 40 which has been degreased. A conduit 78 extends between the nozzle 76 and a pump (not shown) for conveying the lubricant to the nozzle 76.

A horizontally disposed support plate 80 is affixed to the wall 14 for supporting the idler wheel 42, drive sprocket 50, motor 53, and the idler wheel 54. A support plate 82 is provided for supporting the idler wheel 60. A support plate 84 is provided for supporting the idler wheel 64. Brackets 86 and 88 are provided within the tank 12 for supporting the conveyor housing 38. A plurality of brackets 90 are provided at spaced points around the periphery of the tank 12 for supporting portions of the conveyor housing 38 intermediate the idler wheels.

The cleaning apparatus 10 of the present invention is utilized as follows:

Parts to be cleaned are placed within the open top baskets 68 by an operator at the loading platform 36. The basket 68 is conveyed around the idler wheel 42, over the end wall 14, down through the vapor zone 28 and into the solvent 30. As the chain 40 moves around the idler wheel 46, the open top baskets 68 pass beneath the

ultrasonic transducers 72. The baskets 68 are then conveyed upwardly beneath the rinse nozzle 74 and over the end wall 12. The baskets 68 are then conveyed around the drive sprocket 50 and idler wheel 54 and downwardly to the unloading platform 58 where the clean machined parts are removed by an operator. Then the baskets 68 proceed around the idler wheels 60 and 64 to the loading platform 36 where they are again loaded with machined parts to be cleaned.

If desired, a door having a liquid-tight seal may be provided in the end wall 16 adjacent the bottom wall 22 of the tank 12 for selectively removing sediment which accumulates on the bottom wall 22.

As used hereinafter, the housing 38 and the chain 40 may be referred to as a conveyor means. Also, the baskets 68 and the spindle 70 may be referred to as a support means connected to the conveyor means to support machined parts to be cleaned.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. A cleaning apparatus for degreasing machined parts comprising an open tank adapted to contain a solvent partially filling said tank and defining a solvent zone, means for providing a vapor zone in said tank above the solvent zone, a conveyor means extending into said tank through said vapor zone into the solvent zone and out of the solvent zone through said vapor zone and out of said tank, means connected to a movable portion of said conveyor means to support machined parts to be cleaned, said support means being upright with respect to said conveyor means and extending upwardly in a direction away from the bottom wall of said tank, and at least one ultrasonic transducer in said solvent zone, said transducer radiating downwardly toward the bottom wall of said tank, and the support means on said conveyor means passing immediately below said transducer.

2. A cleaning apparatus in accordance with claim 1 wherein said conveyor means includes a housing having a chain therein, and a passageway extending through a wall of said housing for the full length of said housing.

3. A cleaning apparatus in accordance with claim 1 wherein said support means comprises an open top mesh type container mounted on a spindle, said spindle being connected to a chain within said conveyor means, whereby movement of said chain moves said support means so that machined parts within said container may be cleaned.

4. A cleaning apparatus in accordance with claim 1 including an idler wheel a portion of which is positioned below said transducer, said conveyor means making a 180 degree turn about said idler wheel, said conveyor means within said tank including a pair of chain housings extending horizontally from said idler wheel and then upwardly over an end wall of said tank.

5. A cleaning apparatus in accordance with claim 4 including a rinse nozzle supported by said tank within said vapor zone for rinsing degreased machined parts.

6. A cleaning apparatus in accordance with claim 4 including a lubrication nozzle supported by said tank adjacent said end wall for spraying said conveyor means which has been degreased with a fine spray of lubricant, and conduit means connected to said nozzle for delivering lubricant to said nozzle.

7. A cleaning apparatus for degreasing machined parts comprising an open top tank adapted to contain a degreasing solvent partially filling said tank and defining a solvent zone, a vapor zone within said tank above the solvent zone, an endless conveyor means having a first portion extending around a horizontally disposed idler wheel positioned outside of said tank, a second portion of said conveyor means extending over an end wall of said

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tank and downwardly through said vapor zone into the solvent zone, a third portion of said conveyor means extending beneath the transducer, a fourth portion of said conveyor means extending out of the solvent zone through said vapor zone and over said end wall, a fifth portion of said conveyor means extending around a horizontally disposed drive sprocket positioned outside of said tank, means connected to said drive sprocket for rotating said sprocket, and support means mounted above said conveyor means at spaced intervals along said conveyor means for supporting machined parts to be cleaned.

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8. A cleaning apparatus for degreasing machined parts comprising a tank adapted to contain a degreasing solvent partially filling said tank and defining a solvent zone, an endless conveyor means extending through the solvent zone, support means at spaced intervals on said conveyor means for supporting machined parts to be cleaned, a transducer in the solvent zone above at least one of said support means, whereby the parts to be cleaned are directly subjected to cavitation in the solvent zone caused by

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said transducer and whereby contaminate from said parts may settle to the bottom of said tank and out of the area extending between the transducer and said one support means.

9. A cleaning apparatus in accordance with claim 8 wherein said support means is an open top wire mesh type basket, a spindle connected at one end to said basket, the other end of said spindle being connected to a movable portion of said conveyor means, the spindle on each basket being upright with respect to the bottom wall of said tank as said baskets pass beneath said transducer.

References Cited in the file of this patent

UNITED STATES PATENTS

1,772,320	Marsh	Aug. 5, 1930
2,784,119	McCown	Mar. 5, 1957
2,834,359	Kearney	May 13, 1958
2,896,640	Randall	July 28, 1959