

May 27, 1952

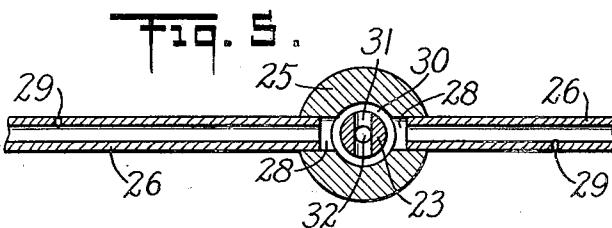
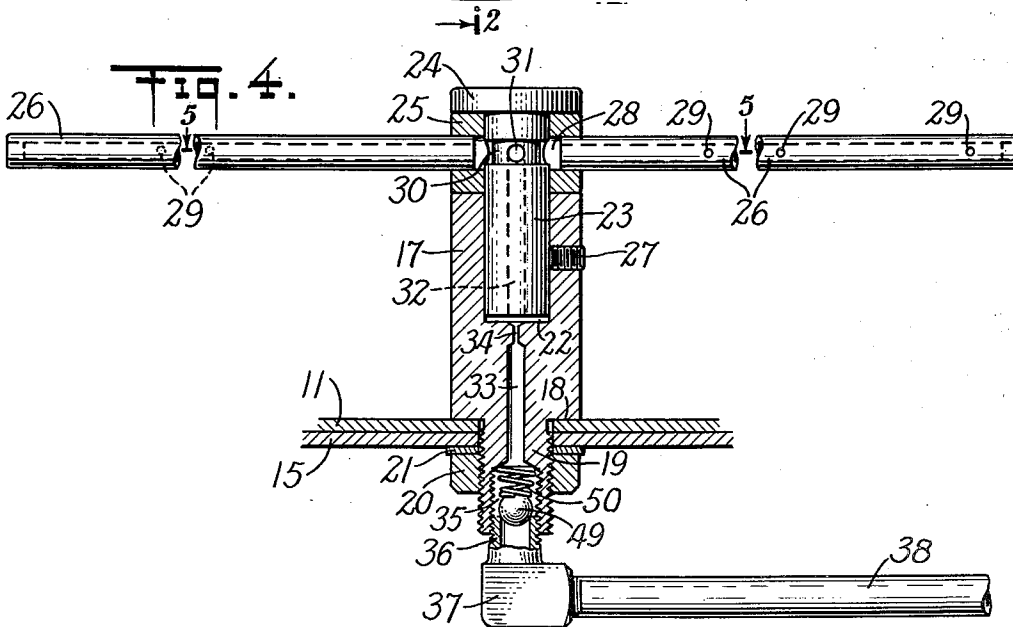
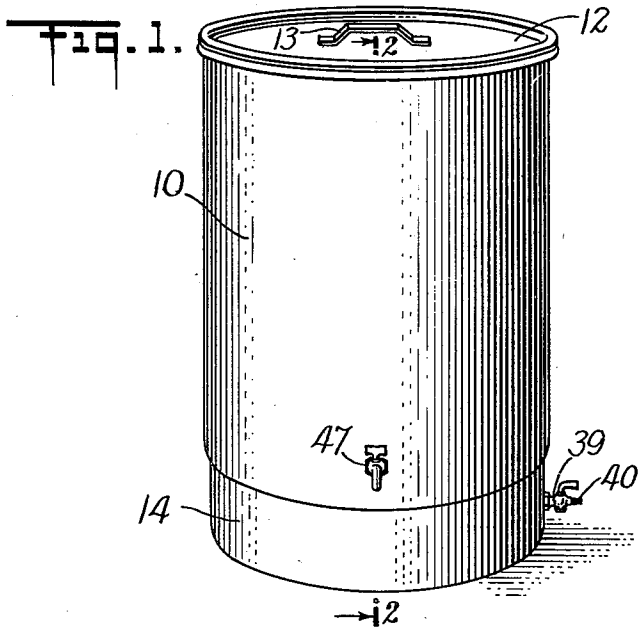
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2,597,931

WASHER WITH ROTARY LIQUID AGITATOR

Filed June 6, 1946

3 Sheets-Sheet 1



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WASHER WITH ROTARY LIQUID AGITATOR

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3 Sheets-Sheet 2

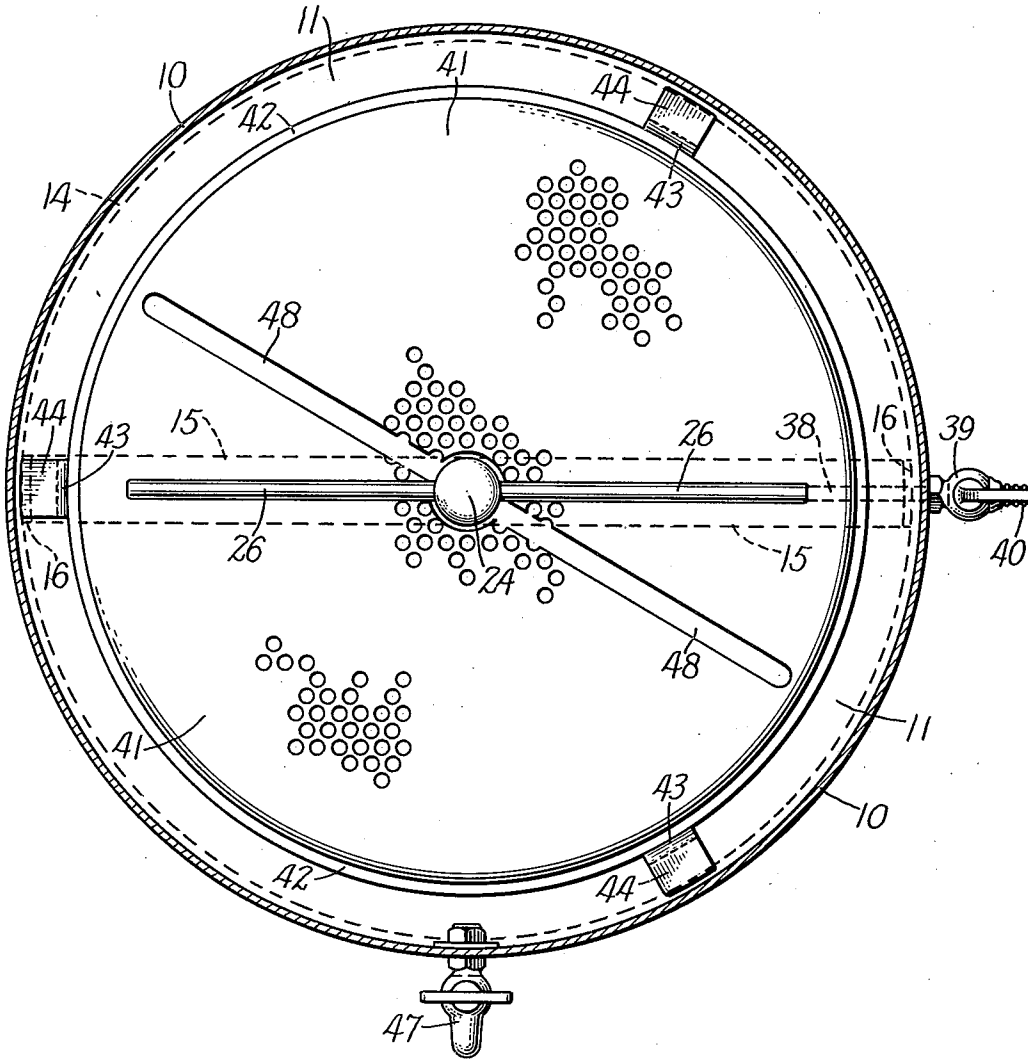


FIG. 3.

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WASHER WITH ROTARY LIQUID AGITATOR

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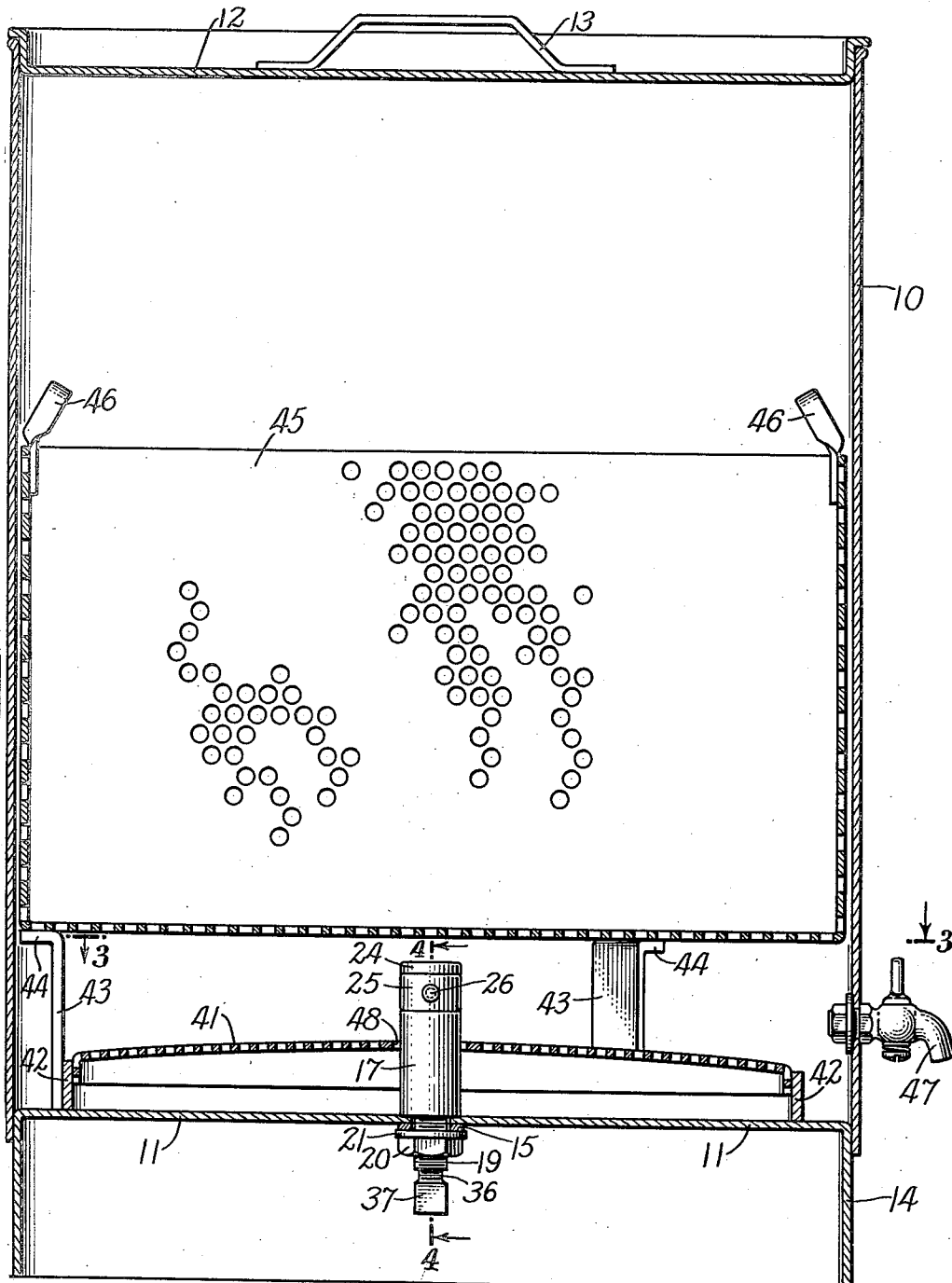


FIG. 2.

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2,597,931

WASHER WITH ROTARY LIQUID AGITATOR

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Application June 6, 1946, Serial No. 674,875

6 Claims. (Cl. 134—94)

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This invention relates to washing apparatus; and it has to do more particularly with a washer which is especially adapted for use in removing grease, carbon, oil and other foreign matter from relatively small machine and motor parts, auto-
mobile accessories and the like, including gears, piston rings, carburetors, air filters, fuel-pumps and similar articles, with the aid of a solvent liquid or other suitable cleaning solution, applied under conditions of vigorous agitation and aeration.

Generally described, the novel washer comprises a tank wherein the articles to be cleansed are maintained submerged in a relatively deep body of cleaning liquid, while disposed in a foraminous container supported above a rotary agitator, which is also submerged in said liquid and is driven by reaction jets of compressed air or other suitable gas that does not dissolve or condense in the liquid. Said jets, in addition to propelling the rotary agitator, also serve to further agitate and aerate the liquid, thereby producing a mixture of the liquid with gas bubbles which is kept constantly moving over all surfaces of said articles to exert highly effective scrubbing action thereon. Provision is made for collecting sediment or sludge in a relatively quiet settling zone below the rotary agitator, in order to make possible more effective and economical use and re-use of the solvent or cleaning solution employed. Other desirable features and advantages of the invention will be apparent from the following detailed description of one desirable practical form of apparatus embodying the invention and illustrated in the accompanying drawings, wherein

Fig. 1 is an exterior view of this embodiment in elevational perspective;

Fig. 2 is a central vertical section on the line 2—2 of Fig. 1, looking in the direction of the arrows;

Fig. 3 is a horizontal sectional view of the unit, on a larger scale, looking downwardly upon the underlying parts from line 3—3 of Fig. 2;

Fig. 4 is a vertical section on the line 4—4 of Fig. 2 and on a still larger scale, showing structural details of the rotor mounting and air supply assembly; and

Fig. 5 is a horizontal section on the line 5—5 of Fig. 4.

Referring to the drawings, the washer unit comprises a tank constructed of fairly heavy gauge sheet metal, having a cylindrical side wall 10, a bottom 11 and a snugly fitting removable cover 12, provided with hand grip 13 by which

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the cover may be easily lifted off or set back into place. As here shown, the tank bottom 11, which is welded or otherwise secured to the cylindrical side wall of the tank to form a liquid tight joint therewith, is suitably spaced away somewhat from the bench or floor on which the washer stands when in use. This spacing away of the tank bottom is effected in the present instance by means of a depending integral flange 14, which in effect forms a chime at this end of the tank. This chimed bottom construction may be further stiffened and strengthened, if desired, by bracing means, such as metal strap 15 extending on a diameter across and in contact with the under side of the circular bottom 11, and having its end portions bent downwardly and welded to the chime 14, as indicated at 16. The tank bottom may desirably be secured to this bracing strap at one or more points, by spot-welding or otherwise.

Supported by and centrally of the tank bottom is rotor-mounting and air-supply means, here shown in the form of a stationary upright cylindrical post comprising a body portion 17, shouldered at 18 to seat accurately against the upper surface of the tank bottom and to provide a reduced portion or shank 19, which passes through aligned apertures in said bottom and stiffening member 15 and projects outside the tank. This reduced portion is threaded to receive securing nut 20, which bears against washer 21 interposed between it and strap 15. By means of said nut, shoulder 18 is drawn down against the tank bottom both to form a tight joint and also to hold said post rigidly in position on the circular tank bottom and substantially coaxial therewith. Liquid-tightness of the joint between the mounting post and the tank bottom may be further ensured, if desired, by the use of suitable sealing material resistant to solvent action of the cleaning liquid. At its upper end, the rotor-mounting post is axially bored or otherwise recessed to provide a socket 22, which receives, with an easy sliding fit, the shank 23 of a mounting stud or pin having a retaining head 24 of somewhat greater diameter. Rotatably held on said shank 23 is annular hub member or collar 25, which carries jet-propelled rotor arms or spokes 26 extending horizontally in opposite directions. In order to prevent axial (vertical) movement of said hub, it is confined between the overhang of said head 24 and annular upper end of the mounting post, but not so snugly as to bind the hub or prevent it from rotating freely on said shank. This relation of the parts having once been established by any necessary slight longitudinal

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adjustment of the mounting stud in its socket, the set-screw 27 which extends through the socket wall is turned down against shank 23 to hold the stud in such adjusted position. Any other suitable means of adjustably securing the stud shank in said socket may of course be employed. Sufficient clearance is provided between the end of the mounting stud and the bottom of its receiving socket, when the parts are assembled as shown in Fig. 5, to permit take-up adjustment that may be necessitated by wear of the surfaces in bearing contact.

The impeller arms 26, which in this illustrative example are two in number and are frictionally held with a driving fit in passages 28 extending radially through the hub annulus, are small-bore tubes, closed at their outer ends but each provided laterally with a small number of fine jet orifices 29 which are in communication with the tube bore, whereby air-jets will be discharged horizontally from said orifices when air under pressure is supplied to said bore. The jet orifices of the oppositely extending arms or spokes are positioned to discharge in opposite horizontal directions substantially at right angles to the arms, so that the propelling effects of the respective sets of jets supplement each other and are therefore additive. Most desirably, the jet orifices of one spoke are located in staggered relation to those of the opposite spoke as regards radial distance from the hub. This arrangement favors maximum agitating action.

Suitable provision for supplying compressed air to the rotor spokes for production of such propelling jets may take various specific forms. In the construction here illustrated, the retaining stud is provided with a continuous circumferential recess 30, with which the open inner ends of rotor spokes 26 are always in communication through passages 28, regardless of the angular position of the spokes. A transverse bore 31 connects the base of this recess or groove with the axial bore 32 which extends therefrom to the lower end of shank 23 where it opens into socket 22. In the lower part of body 17 is an axial bore 33, which has a relatively constricted pressure-reducing portion 34 opening into the base of socket 22; also an enlarged portion 35, threaded for connection by threaded nipple 36 of piping elbow 37 to compressed air supply pipe 38 which extends radially outward to and just through chime 14, where it is provided with a cut-off cock 39 and suitable coupling means 40 for connection to compressed air supply means, not shown.

A sediment or sludge collecting chamber is provided in the lower part of the tank, below the jet-driven agitating rotor. In this instance such chamber is formed by a removable baffle device comprising a foraminous circular plate 41, to the periphery of which is welded or otherwise suitably secured a depending rim 42 that seats on the tank bottom and spaces said plate away therefrom. To the outer face of said rim are secured a plurality of upright legs or standards 43, three in this instance, having their upper end portions bent or otherwise suitably formed, to provide supporting feet 44 that are adapted to be engaged by the bottom periphery of the removable cylindrical container 45 for the articles to be washed, and to support said container with its bottom a small distance above and clear of the rotor device. The container or basket, which has a foraminous bottom and

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side walls and is open at the top, is provided with grips 46 attached to its upper margin and sloped inwardly to facilitate their being easily grasped and held when the basket is to be lifted out of the washer or set in place therein.

At a level intermediate that of the bottom of the basket 45 and that of baffle plate 41, in this instance only slightly higher than the baffle plate, the tank 10 is provided with a valved draw-off cock 47 which is normally closed.

To enable removing the baffle device or replacing it in position, the foraminous plate 41 is provided with an elongated opening 48 located on a diameter and conforming in general outline with the agitating rotor and its mounting, viewed in plan, but slightly larger in all dimensions. Therefore, upon turning rotor arms 26 into vertical alignment registry with the opening 48, the baffle device can readily be lifted out of the tank by means of the legs 43, and can as readily be replaced in a similar manner. The baffle plate is most desirably dished or convexed upwardly, partly in order to stiffen and strengthen the baffle device as a whole, and partly for another reason which will be referred to hereinafter.

The article container or basket and the baffle plate may be constructed of any suitable material that is foraminous, using this term generically to include reticulate. In the present example, the material employed is punched sheet metal screen of fairly heavy gauge, having circular holes or perforations. In order to minimize resistance to free circulation of cleaning liquid and air bubbles through the bottom and side walls of the basket, the aperturing of the material used for the basket should be relatively coarse. On the other hand, since it is desirable to maintain the liquid in the sludge-collecting or settling space below baffle plate 41 in relatively quiet condition, it is desirable that the apertures or foramina in the plate be as small as is consistent with the purpose of permitting heavy solid particles, which may be detached from articles in the basket and drop through the body of liquid in the tank during the washing operation, to pass through the baffle upon arriving at this level and thus to be trapped in the settling space therebelow. Therefore, in the construction here illustrated, the circular holes punched in baffle plate 41 are substantially smaller than those in the bottom and side wall of basket 45.

Means may desirably be provided for preventing back flow of liquid from the tank into air supply line 38 and beyond, when the washer is not in operation. In the apparatus here illustrated, this function is performed by a check valve comprising ball member 49 which is held against its seat by coiled spring 50, except when lifted by pressure of air admitted through pipe 38 from the compressed air supply.

Any good solvent or cleaning solution of a type commonly used in repair shops, garages and filling stations can be satisfactorily used in the novel washer. In general, it should be substantially non-aqueous in character, and it may desirably contain one or more soluble penetrating and gum-dissolving agents of which a number are well known. Its evaporation rate should be low in view of the violent air agitation to which it is subjected in this washer, and if combustible, its flash point should be relatively high. A heavy solvent naphtha meets these requirements and is practical to use in the present washer. One

liquid cleaner that has been found especially satisfactory is commercially available under the trade name "Champion Small Parts Solvent."

In the operation of the washer, the dirty parts or articles to be cleaned are placed in the perforated basket 45, which is then set on the upper ends 44 of the upwardly extending supporting standards or brackets of the sludge retaining base 41-42. The tank being filled with liquid cleaner up to a level preferably high enough to completely submerge the contents of the perforated basket, and cover 12 having been set in place, the valve in the compressed air inlet cut-off cock 39 is opened to admit air at the desired rate from the source of compressed air supply to which connection has been made at 43, and which may be of the character commonly available in auto repair shops and service stations, maintained usually at around 75 to 100 pounds pressure per square inch, for example. Reduction to the much lower effective pressure, say 20 to 35 pounds, at the point of delivery into passages 23 of the rotor hub, which is ordinarily sufficient for satisfactory operation of the air-driven jet rotor, is effected partly through provision of the throttling constriction of air passage 33 at 34, and partly by suitable adjustment of cut-off cock 39 in the air-supply line. Under these conditions, the rotor spins rapidly, strongly agitating the detergent solution, whose turbulence is greatly enhanced by the large mass of air bubbles constantly surging upwardly therethrough and causing the parts in the apertured container or basket 45 to be vigorously scoured with the cleaning liquid. As a rule, only a few minutes of this intensive scouring action of the mass of mixed liquid and gas bubbles swirling in contact with all surfaces of the parts suffices to achieve the desired cleaning action; whereupon the air may be cut off by closing cock 39, the tank cover removed, and the basket of cleansed parts lifted out.

Most of the sludge or sediment settling down through the body of liquid cleaner, either while it is being agitated or later while it is quiescent, eventually finds its way into the sludge collecting and retaining compartment via the perforations in its top or cover member 41. Having once thus entered this compartment, sludge or sediment does not readily escape therefrom, due to the baffle-like action of apertured member 41 in shielding to a considerable extent the body of liquid therebelow from the swirl and turbulence of the agitated body of liquid thereabove, and thereby maintaining the former comparatively quiet. Temporary discontinuance of the washer operation therefore automatically effects clarification of the liquid cleaner in the tank that is in large part permanent, even if operation of the washer be resumed without removing settled-out sludge, because the clarifying separation of sludge and sediment is not accomplished merely by settling out but involves also a positive trapping out and retention thereof in a zone below and relatively isolated from the main body of liquid. Consequently the same body of liquid cleaner may be used repeatedly, with a number of interspersed automatic clarifications effected as described, without stopping to remove trapped-off sludge until so much has accumulated as to render this necessary or advisable. Or, such settled and trapped-off sludge may be removed after each batch of parts has been cleaned. In either case, removal of sludge is accomplished by first drawing off the clarified portion of the liquid cleaner or solvent by opening drain cock 47 located at an effective level slightly higher than perforated

baffle plate 41 covering the sludge-retaining compartment or chamber. Then, cover 12 having been removed, rotor arms or spokes 26 are turned, if necessary, to bring them into vertical registry with slot 48, and the sludge retainer unit or assembly 41-44 is lifted out of the tank. The accumulation of trapped sludge, mixed with a relatively small part of the quantity of cleaning liquid with which the washer was originally charged is then dumped out by inverting the tank; the tank being thereupon flushed out and re-charged with the clarified liquid previously drawn off, plus such amount of fresh solvent as may be necessary to make up the loss.

Some sediment or sludge descending through the body of liquid cleaner in the washer tank, either while the washer is in operation or while it is at rest, instead of immediately passing into the sludge-retaining chamber upon reaching baffle plate 41, may lodge upon a portion of its upper surface between the perforations. However, the continued (or later resumed) rapid rotation of the jet-impelled rotor arms only a short distance above the baffle plate produces a swirling movement of liquid at its upper surface that tends to move heavy particles of deposited sludge outwardly thereover and permit them to drop through the plate perforations into the sludge-retaining compartment below. This action may desirably be furthered by dishing plate 41, as hereinabove mentioned, to render its upper surface convex so that it slopes downwardly somewhat from its center toward its outer periphery.

It will be seen that the washer construction herein disclosed combines simplicity of construction with highly effective, easy and economical operation, in a compact unit of general utility in the field indicated. It is to be noted especially that the violent turbulence or "boiling" of the main body of liquid cleaner produced by the rapidly revolving jet-driven rotor has such a strong scouring action upon the articles to be cleaned that the use of heat to increase the effectiveness of the cleaner is quite unnecessary. In normal use, the novel apparatus is therefore operated at temperatures commonly prevailing in auto repair shops.

In constructing the novel apparatus it is desirable to construct it of metal that is resistant to or surface-protected against corrosion by liquid cleaners of the type referred to hereinabove.

Within the scope of the invention, various detailed structural changes may be made in the specific apparatus shown in the accompanying drawings and described hereinabove, while still realizing the benefits of the invention in large degree. Furthermore, while use of air-jet-driven rotor means or other form of agitator that aerates the liquid cleaner is characteristic of the invention in what are now regarded as its best forms, the general combination of parts functionally related and cooperating in the manner herein disclosed is of great utility and is believed novel irrespective of the particular form of liquid-agitating means constituting a part of such general combination. Therefore, it is to be understood that the specific construction here illustrated and described by way of illustrative example merely represents one especially desirable practical embodiment of the invention, the essential features of which invention are particularly pointed out in the appended claims.

What is claimed is:

1. Cleaning apparatus comprising a tank adapted to hold a cleaning liquid, a jet-propelled

agitating and aerating rotor disposed in the lower part of said tank, including a hub mounted for rotation about an upright axis and means preventing substantial axial movement of said hub, together with hollow arms or spokes extending horizontally therefrom and provided laterally with orifices for discharge of gaseous propelling jets, piping connections for conducting a compressed gas to said hub for actuating said rotor, a foraminous article container supported within the tank above said rotor, and a foraminous baffle removably supported below said rotor and above the tank bottom to provide in conjunction with said bottom a sludge compartment, said baffle being slotted to provide an aperture conforming in general outline and size with said agitating rotor, whereby said baffle may be moved vertically past said rotor arms when the latter are vertically aligned with such slotting.

2. Cleaning apparatus as defined in claim 1, which further includes a valved outlet for draining liquid from said tank at a level intermediate said baffle and the rotor arms or spokes.

3. Cleaning apparatus comprising, in combination, a tank adapted to hold a relatively deep body of cleaning liquid, a jet-propelled agitating and aerating device rotatably mounted in the lower part of said tank, piping connections for conducting a compressed gas to said device for actuating the same, a foraminous article container supported within the tank above said device at such level as to maintain contained articles substantially submerged in said body of liquid, a foraminous baffle supported below said agitating and aerating device and superadjacent the tank bottom and cooperating therewith to provide a sludge-trapping compartment, and valve-controlled draw-off outlet means constructed and arranged to permit draining liquid from said tank at a level intermediate said baffle and said agitating and aerating device, wherein the upper surface of said baffle is convex.

4. Cleaning apparatus as defined in claim 1, wherein the upper surface of said baffle is convex, and the tank is provided with a valved out-

let for draining liquid therefrom at a level intermediate said baffle and the rotor arms or spokes.

5. Cleaning apparatus as defined in claim 1, wherein said baffle is a perforated plate having a depending rim which seats on the tank bottom, said rim having rigidly secured thereto a plurality of legs which extend upwardly and support said foraminous article container.

6. Cleaning apparatus as defined in claim 1, wherein said baffle is a perforated plate having a depending rim which seats on the tank bottom, said rim having rigidly secured thereto a plurality of legs which extend upwardly and support said foraminous article container; and which further includes a valved outlet for draining liquid from said tank at a level intermediate said baffle and the rotor arms or spokes.

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