United States Patent

Corbett

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[54] **APPARATUS FOR TREATING ARTICLES WITH LIQUID TREATMENT MEDIA**

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[*] Notice: The portion of the term of this patent subsequent to Dec. 2, 1986, has been disclaimed.

[22] Filed: **Oct. 27, 1969**

[21] Appl. No.: **869,805**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 705,212, Feb. 13, 1968, Pat. No. 3,481,347.

[52] **U.S. Cl.** **134/69,** 51/164, 134/159

[51] **Int. Cl.** **B08b 3/06**

[58] **Field of Search** 134/69, 159; 51/164

[56] **References Cited**

UNITED STATES PATENTS

3,116,578	1/1964	Bottler	51/164 X
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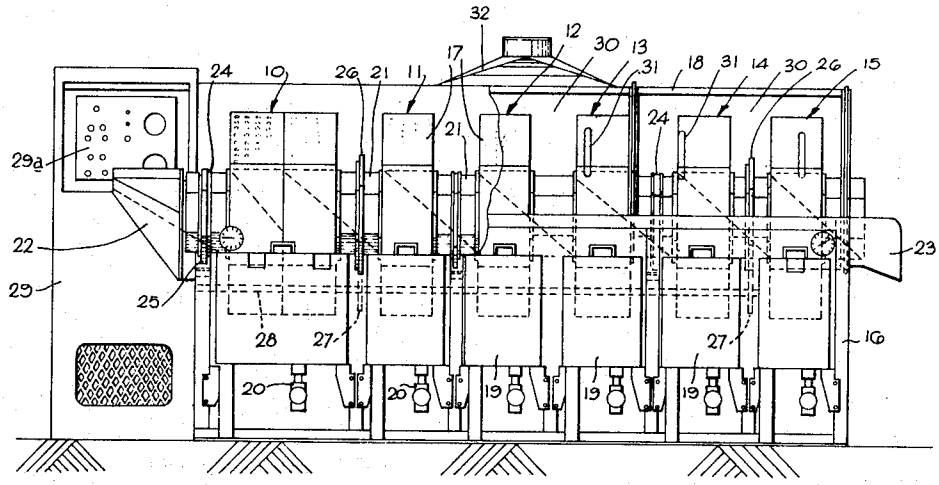
Primary Examiner—Robert L. Bleutge
Attorney—Kurt Kelman

[57] **ABSTRACT**

A drum of polygonal cross-section has a hollow spindle secured to each side thereof. The spindles support the drum for rotation thereof about the axes of the spindles and provide means for loading and unloading workpieces to and from the drum. The drum is provided with perforations so that, when it dips into a treatment medium in a tank, workpieces within the drum are exposed to the medium. The drum is oscillated during treatment of the workpieces and is rotated through 360° to effect discharge of the workpieces.

3 Claims, 5 Drawing Figures



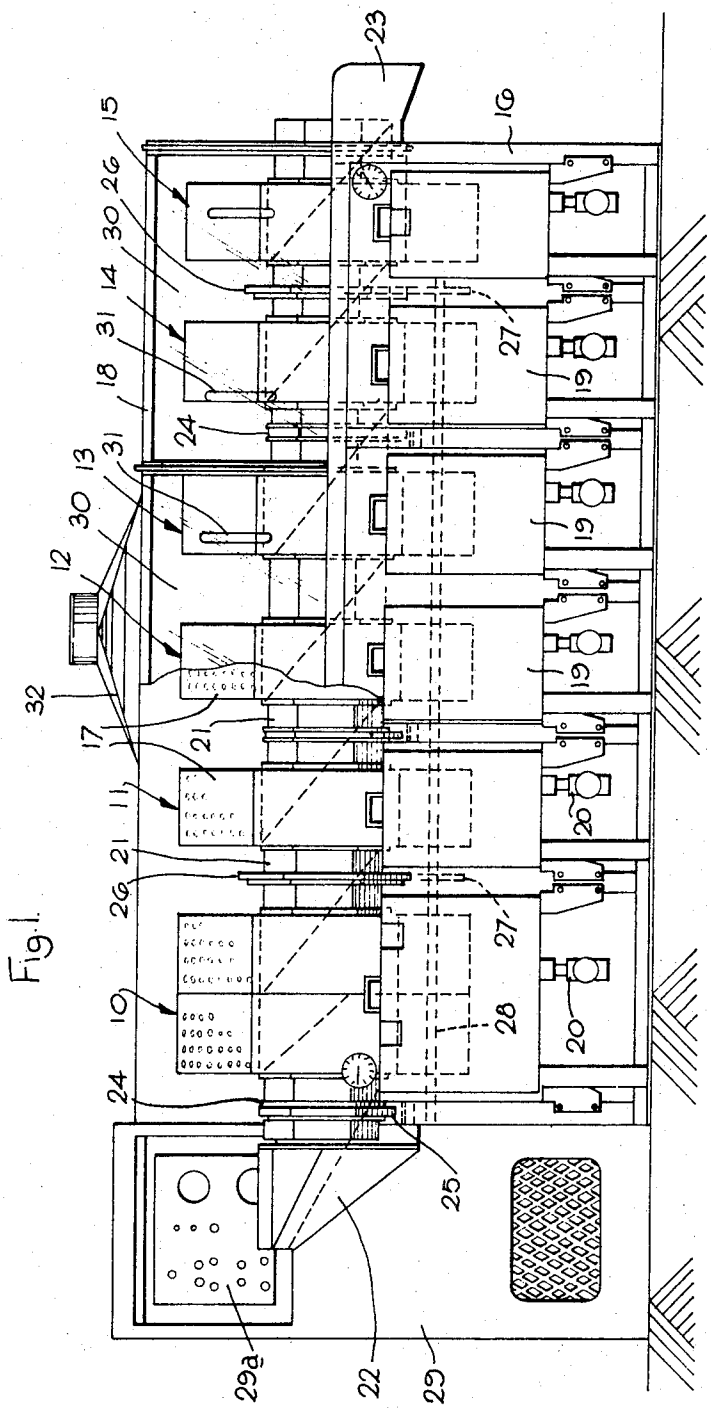

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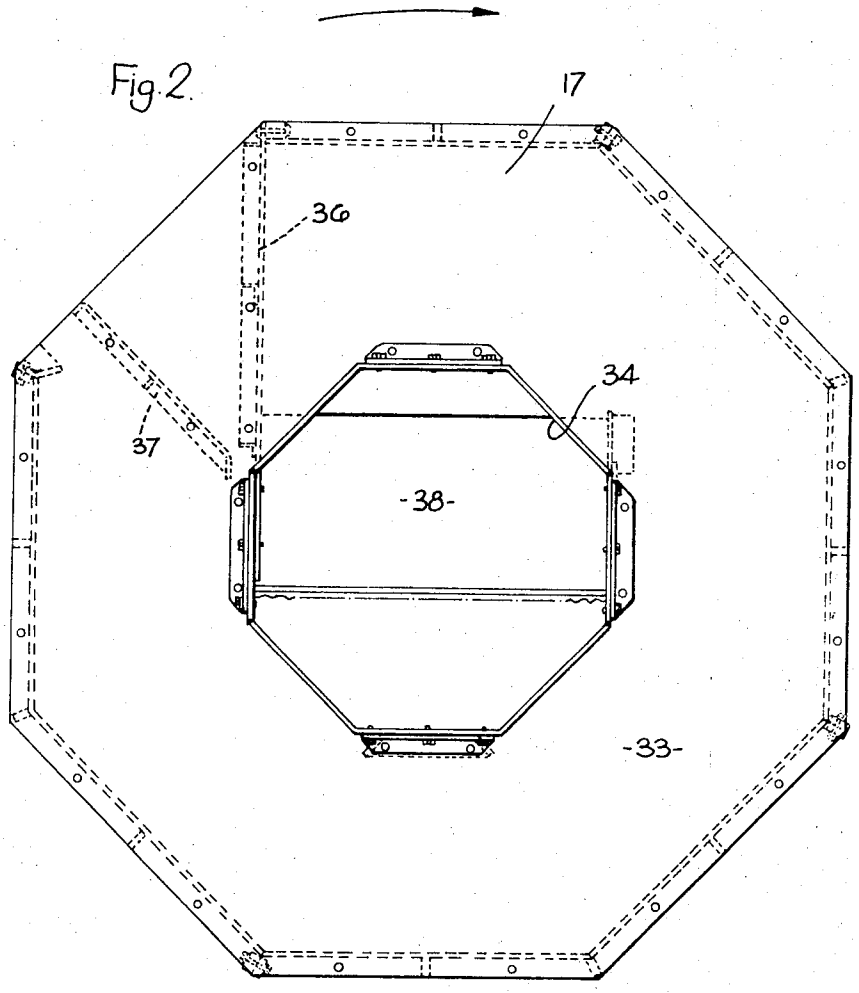
Fig. 1.

Fig. 2.



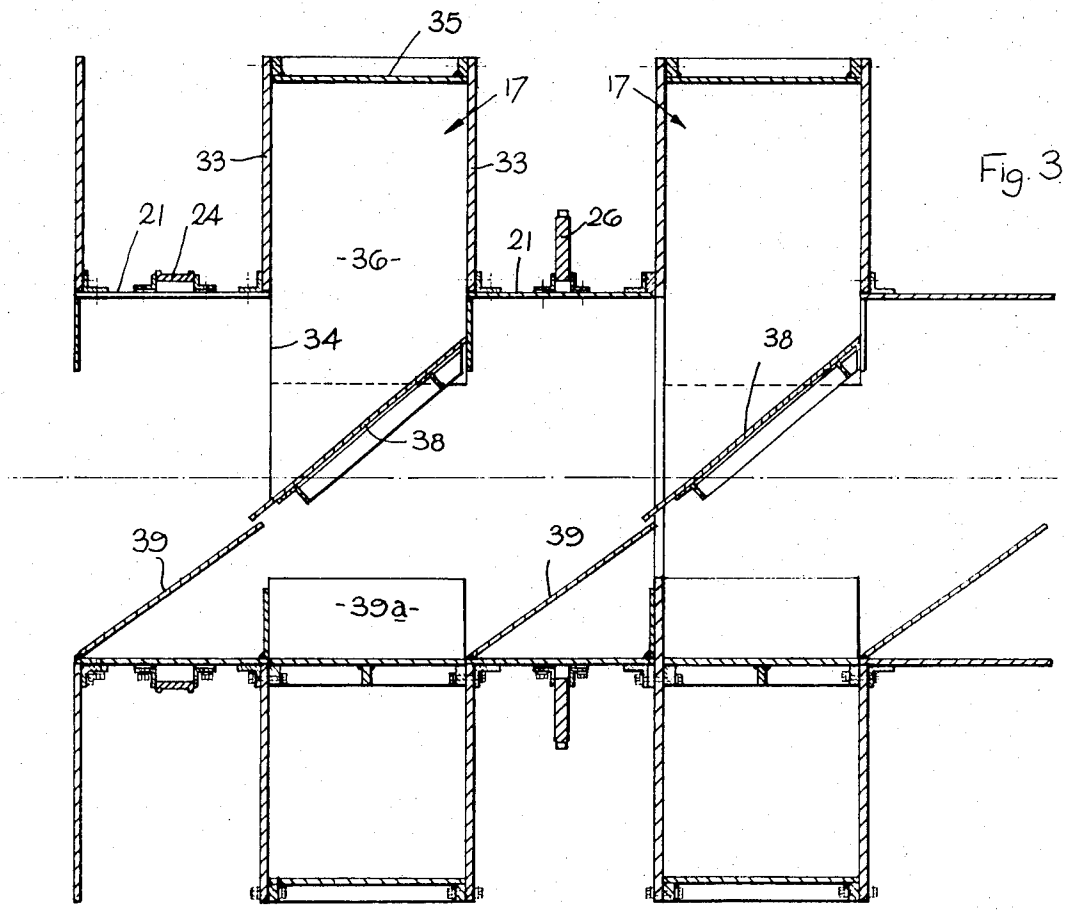


Fig. 3

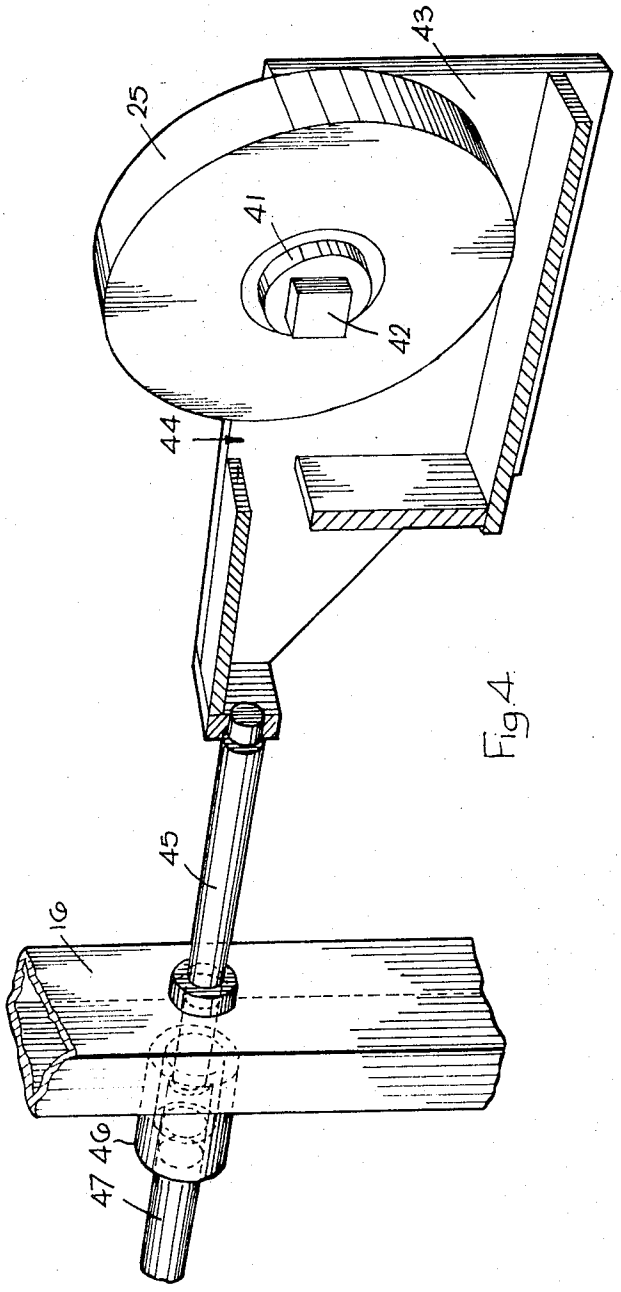


Fig. 4

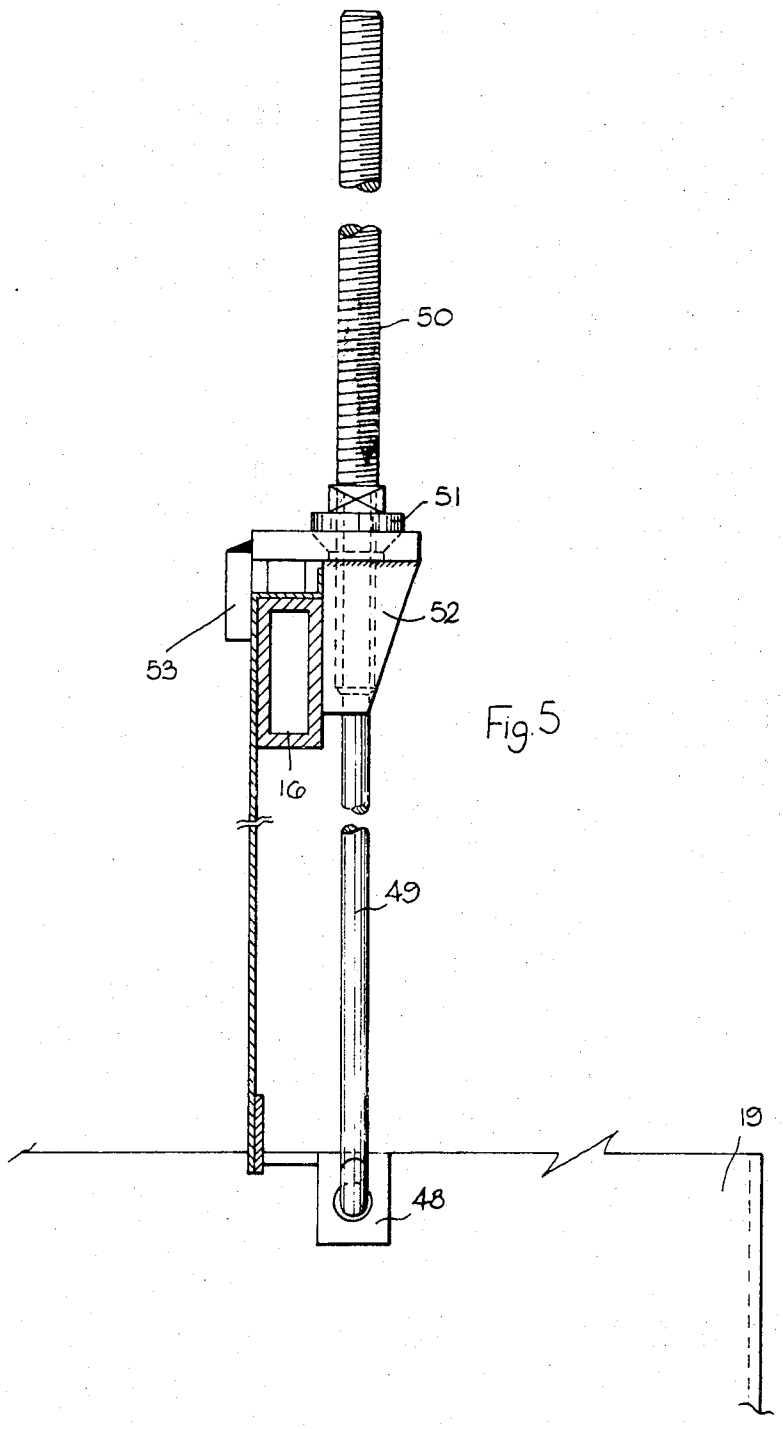


Fig. 5

APPARATUS FOR TREATING ARTICLES WITH LIQUID TREATMENT MEDIA

This application is a continuation in part of co-pending application Ser. No. 705,212, now U.S. Pat. No. 3,481,347 filed Feb. 13, 1968.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to treatment apparatus for carrying out various treatment operations such as, for example, cleaning, rinsing, bright dipping, chromating, phosphating, chemical blacking, pickling, descaling, drying and cooling on workpieces. The apparatus is of the kind including a plurality of drums or like vessels adapted to have workpieces fed thereinto and to have workpieces discharged therefrom, each vessel being supported at its treatment station by a frame in such a position relative to a tank in which the selected treatment medium is disposed and the construction of the drum being such that the workpieces contained therein are exposed to the medium.

2. Description of the Prior Art

One form of treatment apparatus of the above kind has included a tippable basket at each treatment station and means have been provided whereby, on completion of a treatment operation at a station, the basket has been tipped to transfer the workpieces into a succeeding basket or to transfer the workpieces to a discharge station.

It is an object of the present invention to provide an improved form of treatment apparatus of the above kind.

In co-pending application Ser. No. 705,212 referred to above, there is described a liquid treatment apparatus including an elongate frame, a plurality of aligned workpiece treatment vessels supported from said frame, each of said vessels being of drum-like form, with a perforate circumferential wall supported between two side walls, each side wall being formed with a central aperture and each side wall having secured thereto in register with the aperture therein a hollow spindle adapted, on the one hand, to receive workpieces from a preceding station and to feed them into the vessel and, on the other hand, to receive workpieces from the vessel and discharge them therefrom. Means are disposed within each vessel for effecting agitation of the workpieces contained therein in response to limited angular movement of such vessel and for effecting discharge of such workpieces therefrom in response to complete rotation of said vessel, said apparatus further including means for supporting the treatment liquid in operative relation to said vessels and means for effecting limited angular movement of said vessels and for effecting complete rotation thereof.

In the particular embodiment described in co-pending application Ser. No. 705,212 each vessel is of generally cylindrical form and the means disposed within each vessel for effecting agitation of the workpiece comprises a plurality of internal baffles.

It is a more specific object of the present invention to provide a modification of the treatment apparatus described in co-pending application Ser. No. 705,212 in which the construction of each vessel can be more economically performed and in which each vessel is so

shaped that, on oscillation thereof, agitation of the workpieces is effected as a result of the shaping of the vessel.

SUMMARY OF THE INVENTION

The apparatus disclosed in co-pending application Ser. No. 705,212 is modified by forming each treatment vessel of polygonal cross-section, each side wall of each vessel being in the form of a regular polygon and the circumferential wall of each vessel comprising a plurality of relatively inclined wall members.

By providing each vessel with side walls which are of regular polygonal form, the cutting of said side walls from metal sheet is considerably facilitated since the sheet can be sheared to the required polygonal configuration, the connection of the circumferential wall to the side walls is facilitated and the shaping of the vessel is such as to effect agitation of the workpieces on oscillation of the vessel.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in side elevation, partly broken away, of a complete treatment unit,

FIG. 2 is an end view, on an enlarged scale, of one of the treatment vessels of the unit,

FIG. 3 is a sectional view of a pair of treatment vessels of the unit,

FIG. 4 is an enlarged view showing the supporting means for the vessels and

FIG. 5 is an enlarged view showing means whereby the tanks for containing the treatment medium can be removed from the unit.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The treatment unit shown in FIG. 1 includes seven treatment drums or vessels and can be used, for example, for carrying out a multistage pickling process. The first stage **10** is a cleaning stage, the next **11** is a rinsing stage which is followed by two pickling stages **12** and **13**, and then one cold rinse stage **14** and a hot rinse stage **15**. The treatment unit includes a generally rectangular frame **16** which is built up from angle or box section material and the frame provides support for the seven treatment drums **17**, support for the drive means of the drums **17** and for a hood **18** which extends over the apparatus or unit. At each of the treatment stages or stations **10, 11, 12, 13, 14** and **15**, there is supported from the frame **16** a tank **19** in which the appropriate treatment solution is contained, the tanks **19** being in register with the treatment drums or vessels **17**. The arrangement is such that the lower portion of each drum or vessel dips into the solution contained in the corresponding tank **19**. Each tank **19** is provided with pipe and valve work indicated generally at **20** whereby the solution in each tank can be recirculated, passed to waste or passed for regeneration as may be desired.

Each drum **17**, with the exception of the two drums at the first station **10**, is connected to the preceding and succeeding drums by means of a hollow spindle **21**, there being a loading chute or hopper **22** at the inlet end of the apparatus and a discharge chute **23** at the other or discharge end of the apparatus. Some or all of

the spindles 21 are provided externally with a groove or track 24 which is adapted to locate on a pair of supporting rollers 25, one roller of each pair being itself supported from each side of the frame of the apparatus, as will presently be described, and means are provided for adjusting the position of the rollers 25 so as to enable axial alignment of the drums to be achieved and maintained.

During the course of treatment it is necessary for the drums 17 to be both oscillated and rotated and, to this end, between stations 10 and 11 and between stations 14 and 15, the hollow spindles 21 each have secured thereto a sprocket wheel 26. Each sprocket wheel 26 is adapted to receive a driving chain driven by driving sprockets 27 secured on a driving shaft 28 which extends along one side of the apparatus and which is driven by a hydraulic motor, operation of which is controlled by an electric timing unit mounted in a control cabinet 29 which has a control panel 29*a*.

The hood 18 includes a number of transparent panels 30 provided with handles 31 so that not only can operation of the apparatus be seen through the hood but an individual panel can readily be removed if it is desired to carry out adjustments to the apparatus. Associated with the hood 18 is a vent 32 adapted to be connected to a suitable extractor or to a flue whereby fumes, steam or other gaseous media can be withdrawn.

The purpose of providing two drums 17 mounted in direct side-by-side relationship at the cleaning station 10 is to enable the workpieces to be subjected to the cleaning medium in the tank at station 10 for twice the length of time that they are subjected to any of the successive treatment media.

As will be seen from FIGS. 2 and 3, each drum includes a pair of octagonal side walls 33 each of which is provided with a central opening 34 in register with which is secured the associated hollow spindle 21 so that there is an axial through passage throughout the whole of the apparatus. Secured between the side walls 33 of each drum is a circumferential wall 35 which is made up from eight generally rectangular metal plates welded to each other and to the side walls 33. As shown in FIG. 1, each part of the circumferential wall 35 is of perforate form so as to enable the treatment media to enter that part of the drum 17 which dips into the liquid in the corresponding tank. FIG. 2 of the drawings shows a drum 17 in the position relative to which it oscillates during the major part of the treatment process. In that part of the drum which is uppermost during the major part of the treatment cycle there is a pick-up plate 36 shown in a vertical position and a relatively inclined scavenger plate 37. Associated with the pick-up plate 36 and the scavenger plate 37 is a downwardly inclined discharge plate 38, the plate 38 being in register with an inclined feed plate 39 mounted in the spindle 21 on the discharge or outlet side of the drum 17. A similar feed plate 39 is mounted in the spindle 21 on the feed or input side of the drum 17 and this will, of course, be in register with the inclined plate 38 of the preceding drum. A breaker plate 39*a* is positioned within each drum in register with the feed plate 39 so that articles fed into the drum from the preceding feed plate 39 fall onto the breaker plate 39*a*.

Basic operation of the apparatus is thus as follows. With the selected load of workpieces in a drum these will, of course, be resting in the lower portion thereof and will thus be in the treatment media. Each drum is oscillated through a pre-selected arc which can be up to as much as 150° on either side of the position shown in FIG. 2. Normally, however, the drum will be oscillated up to 90° on either side of the position shown in FIG 2. During this period of oscillation the workpieces will be tumbled in the treatment media due not only to the oscillation of the drum but due to the agitating or tumbling effect obtained when the workpieces are caused to move from a position supported on one part of the circumferential side wall 35 to the adjacent relatively inclined part of said side wall. At the end of the predetermined treatment period the drum is caused to rotate through a complete revolution in the direction indicated by the arrow in FIG. 2 and, during the course of such rotation, the plates 36 and 37 will move into a lower position and, as they pass through such lower position, the plate 36 will pick up the workpieces and convey them upwardly whilst they are supported upon the plate until the drum approaches its previous vertical position. As the plate 36 approaches its vertical position the workpieces thereon, will fall by gravity onto the inclined plate 38 and will thus be discharged from the drum onto the inclined feed plate of the outlet spindle from which they will pass into the next succeeding drum or, in the case of the final treatment station, to the discharge chute 23. In order to ensure that all workpieces are discharged from each treatment station, rotation of the drum can be reversed for a short angular distance after the plate 36 has reached a vertical position and thereafter restored to the vertical position so as, in effect, to jerk free any workpieces that may have become lodged on the plate 36.

The scavenger plate 37 directs fluid drained through the pick-up plate 36, whilst moving upwards to the discharge position, outside the barrel. This ensures that the fluid drained through the pick-up plate 36 does not fall back into the barrel thus ensuring that the fluid contained in the barrel is relatively clean.

With all of the treatment drums secured together this oscillatory movement followed by rotational movement applies, of course, throughout the apparatus so that one achieves a successive through-put of workpieces from one stage to another.

In the form of the invention illustrated, the drums are made of stainless steel and with each drum having a dimension measured between opposed flat faces thereof of the order of 3 feet, each drum can carry a load of more than 50 pounds of workpieces so that, with a cycle time of 30 seconds at each treatment station a throughput of some 2 to 3 tons of workpieces per hour can be achieved.

The loading hopper or chute 22 can be hinged adjacent its lower end to the frame 16 and is provided with spring or like support means whereby there can be obtained some visual or other indication that a given work load has been placed in the loading chute 22 so that an operator will know that a full work load is ready for loading into the machine.

Alternatively the loading chute can be arranged to be raised and lowered by coupling it to the hydraulic mechanism of the apparatus so that it can be moved between a "work receiving" position in which it is filled with workpieces and a "work feeding" position in

which it feeds workpieces into the first drum at station **10** in timed relationship to the operation of the apparatus as a whole.

As pointed out above, the driving sprockets **27** are mounted on a main driving shaft **28** which is driven by an electric motor controlled through a suitable hydraulic circuit from the electric timer or control unit housed in the control cabinet **29**. The control unit consists basically of a cam whose movements both by way of oscillation and by way of rotation correspond to the desired movements of the drums, the cam operating during the course of its angular movements four microswitches which are angularly spaced around the path of travel of the cam, these switches controlling the sequential operation of the hydraulic motor and the position of at least two of these switches being adjustable so as to enable one to select the degree of arc through which oscillation of the drums shall take place. As the construction of the control unit forms, however, no part of the present invention, the construction thereof is not shown in the accompanying drawings but it is considered that the operation thereof will be apparent to those skilled in the art from the brief description given above.

In order to facilitate axial alignment of the drums and to provide means for adjustment to compensate for wear on the rollers **25** and to facilitate replacement of the rollers, each drum-supporting roller **25** is mounted, as shown in FIG. **4**, for rotation upon a spindle **41** either is provided with squared ends **42** which seat in square slots in the side walls **43** of a roller-carrying block **44** which is mounted on one end of a shaft **45** which passes through a member of the frame **16** and which is in threaded engagement with a collar **46** adjustable by means of a screw **47**. The free end of the screw **47** is provided with suitable flats for engagement by a spanner or like means whereby it can be rotated. By rotating the screw **47**, the housing **43** and the roller **25** carried thereby can be moved either towards or away from the longitudinal center line of the apparatus so that, if both rollers **25** of a pair are adjusted inwardly, they will raise the associated drum spindle **24** or if they are moved away from one another, the associated drum spindle **24** will be lowered. Accurate alignment of all the drums can thus be achieved.

By withdrawing one roller **25** and its supporting housing **23** from contact with the associated drum spindle, the roller can readily be replaced by just lifting it out of its housing **43** and putting a fresh one in position. If wear takes place on a roller, the wear can be compensated for and the axial alignment of the drum spindle restored by moving the roller **25** inwardly towards the center line of the machine.

To facilitate removal of the tanks **19** containing the treatment media, each tank **19** is provided, as shown in FIG. **5**, with an apertured lug **48** which is adapted to receive the lower end of a rod **49** the upper end **50** of which is screw-threaded. An internally threaded rotatable collar **51** is mounted on the upper end portion **50** of the rod **49** and is associated with a block **52** which includes a hook formation **53** whereby it can be mounted over a part of the frame **16**. The tanks **19** rest on supporting brackets (not shown) which are readily detachable from the frame **16** so that, when it is desired to remove a tank **19** for maintenance purposes or for cleaning, a rod **49** and its associated components is engaged with the lug **48** at one side of the tank **19** and another rod **49** and its associated components is engaged with the lug **48** at the other side of the tank **19**. The blocks **52** are then located on the frame **16** and the threaded nuts **51** rotated to raise the tank **19** clear of its supporting brackets. With the tank thus clear of the supporting brackets and suspended by the rods **49**, the brackets can be removed and the nuts **51** can then be rotated in the opposite direction and the tank **19** lowered onto the floor or other supporting surface and then withdrawn laterally from under the apparatus.

Although, in the form of apparatus described above, the treatment drums **19** are formed of steel, these could well be formed of a suitable plastics material and drums formed of polypropylene would be of advantage for carrying out electroplating operations. Alternatively the drums may be formed of steel with a plastic coating applied thereto.

What I claim then is:

1. Liquid treatment apparatus including

1. an elongate frame;
2. a plurality of aligned workpiece treatment vessels supported from said frame, each vessel being of drum-like form with a perforate circumferential wall supported between two side walls,
   a. each side wall being of polygonal form and having a central aperture,
   b. the circumferential wall including a plurality of relatively inclined wall members;
3. each side wall having secured thereto, in register with the aperture therein, a hollow spindle adapted, on the one hand, to receive workpieces from a preceding station and to feed them into the vessel and, on the other hand, to receive workpieces from the vessel and discharge the same therefrom;
4. means for supporting liquid treatment media for the workpieces in operative relation to said vessels;
5. drive means arranged to effect limited oscillatory angular movements of said vessels and to effect complete rotation of the vessels,
   c. the shaping of the circumferential wall of each drum serving to ensure agitation of the workpieces within the vessels upon oscillation thereof; and
6. means within each vessel whereby, on complete rotation thereof, the workpieces therein are directed into a respective one of the spindles for discharge from the vessel.

2. Treatment apparatus according to claim **1** wherein the means for effecting discharge of the workpieces in response to complete rotation of the vessels includes, in each vessel, a pick-up plate disposed within the vessel and extending between the side walls thereof into abutting relationship with the circumferential wall of the vessel, a discharge plate being mounted in operative relationship with the pick-up plate to guide the workpieces towards the appropriate hollow spindle, a scavenger plate being located, relative to the direction of rotation of the vessel, rearwardly to the pick-up plate.

3. Treatment apparatus according to claim **1** wherein each vessel is of octagonal cross-section.

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