United States Patent [19]

Seiwert

[11] **3,754,559**

[45] **Aug. 28, 1973**

[54] **DRUM TYPE WASHER FOR METAL BORINGS AND THE LIKE**

[75] Inventor: **Paul J. Seiwert,** Cincinnati, Ohio

[73] Assignee: **The Macleod Company,** Cincinnati, Ohio

[22] Filed: **Jan. 31, 1972**

[21] Appl. No.: **222,109**

[52] **U.S. Cl.** **134/65,** 134/104, 134/153, 134/154

[51] **Int. Cl.** **B08b 3/02,** B08b 3/06

[58] **Field of Search** 134/65, 104, 132, 134/153, 154

[56] **References Cited**

UNITED STATES PATENTS

1,251,073	12/1917	Maloney	134/65 X
2,198,597	4/1940	Baer	134/65 X
2,427,388	9/1947	Curran	134/132
2,628,461	2/1953	Heyman	134/132 X
2,652,588	9/1953	Harris	134/153 X
2,733,723	2/1956	Whitcomb	134/104 X

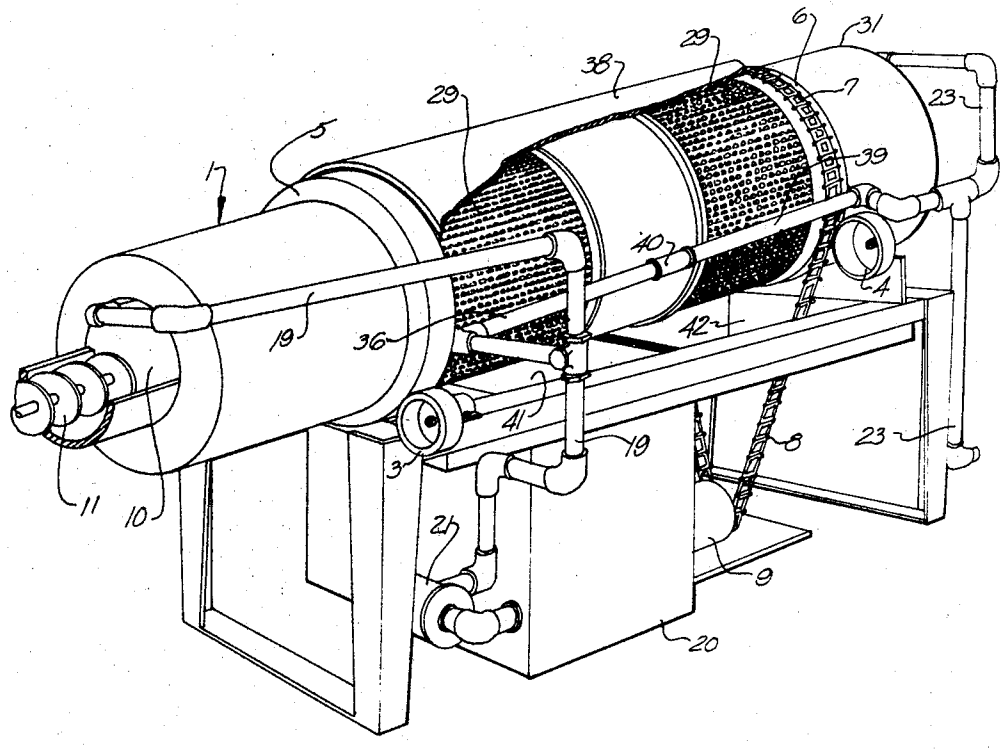
Primary Examiner—Robert L. Bleotge

Attorney—John W. Melville, Albert E. Strasser et al.

[57] **ABSTRACT**

An elongated drum type washer for metal borings, cuttings and fines having a continuous helical vane for advancing the materials to be cleaned from one end of the drum to the other, the drum being divided longitudinally into a plurality of zones for selectively spraying the materials being cleaned with a liquid and then draining them, the draining zones being provided with spaced apart perforated openings in the periphery of the drum for discharging liquid therefrom, the openings lying between contiguous convolutions of the helical vane with laterally disposed baffles overlying the openings, the baffles being arranged to direct the materials being cleaned away from the openings as the drum is rotated while permitting the liquid to be discharged through the openings.

18 Claims, 5 Drawing Figures



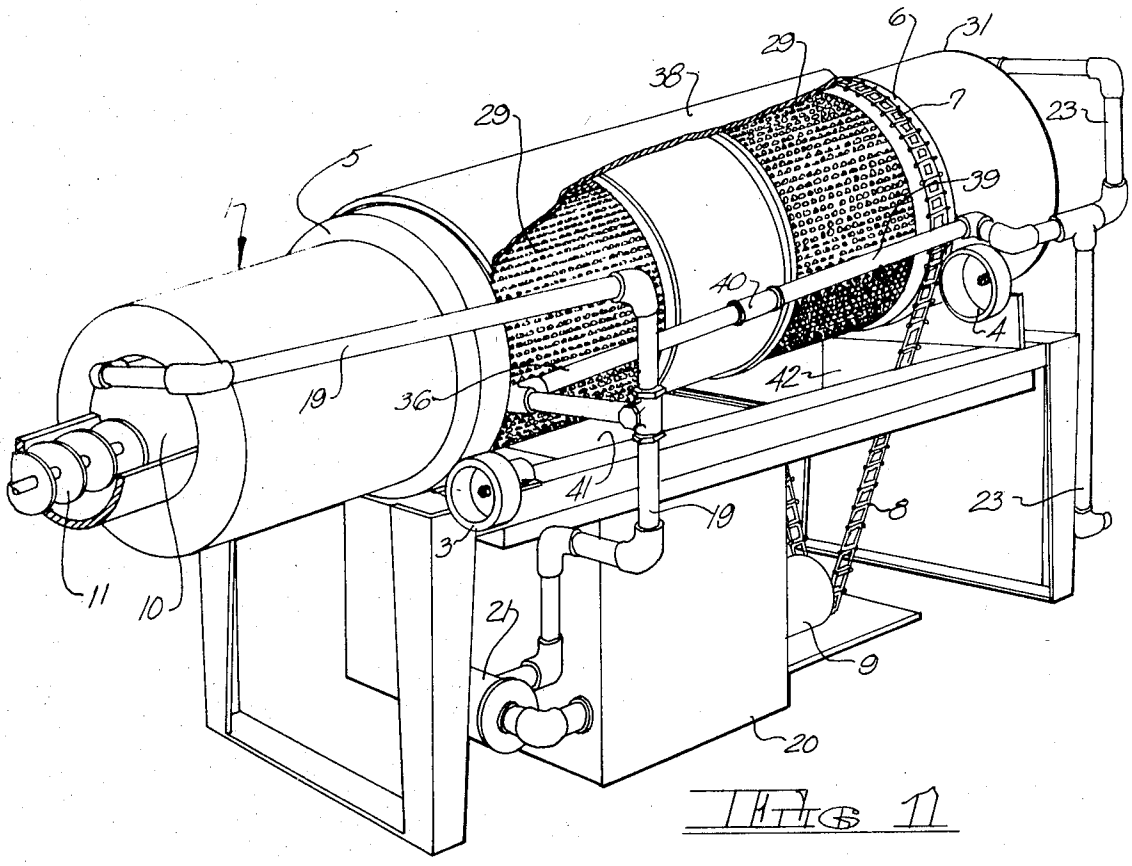

6
31
29
38
29
7
23
5
39
1
40
4
19
36
42
41
19
8
23
3
11
10
21
9
20

FIG 1

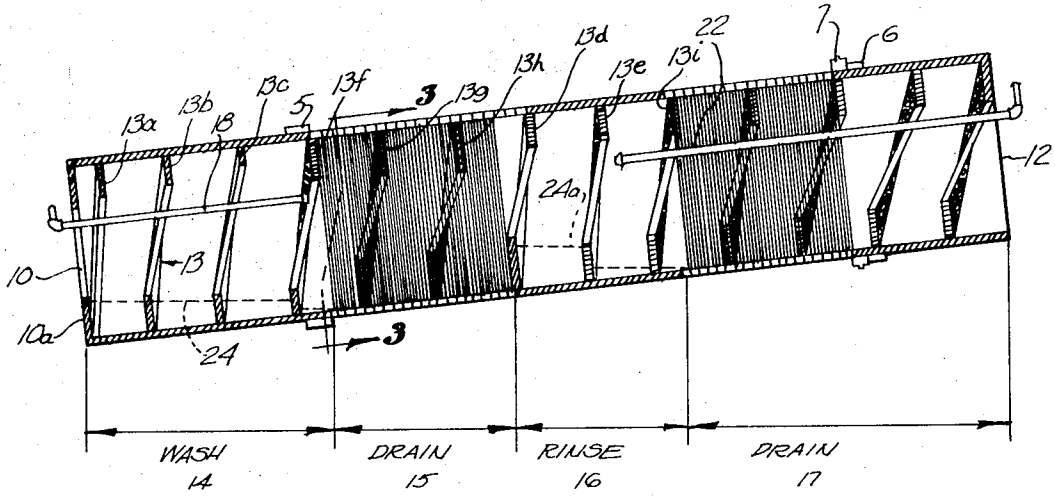

13d
22
7
6
13h
13e
13i
13a
13b
13c
5
13f
3
13g
18
12
24a
13
10
10a
24
3
WASH
14
DRAIN
15
RINSE
16
DRAIN
17

FIG 2

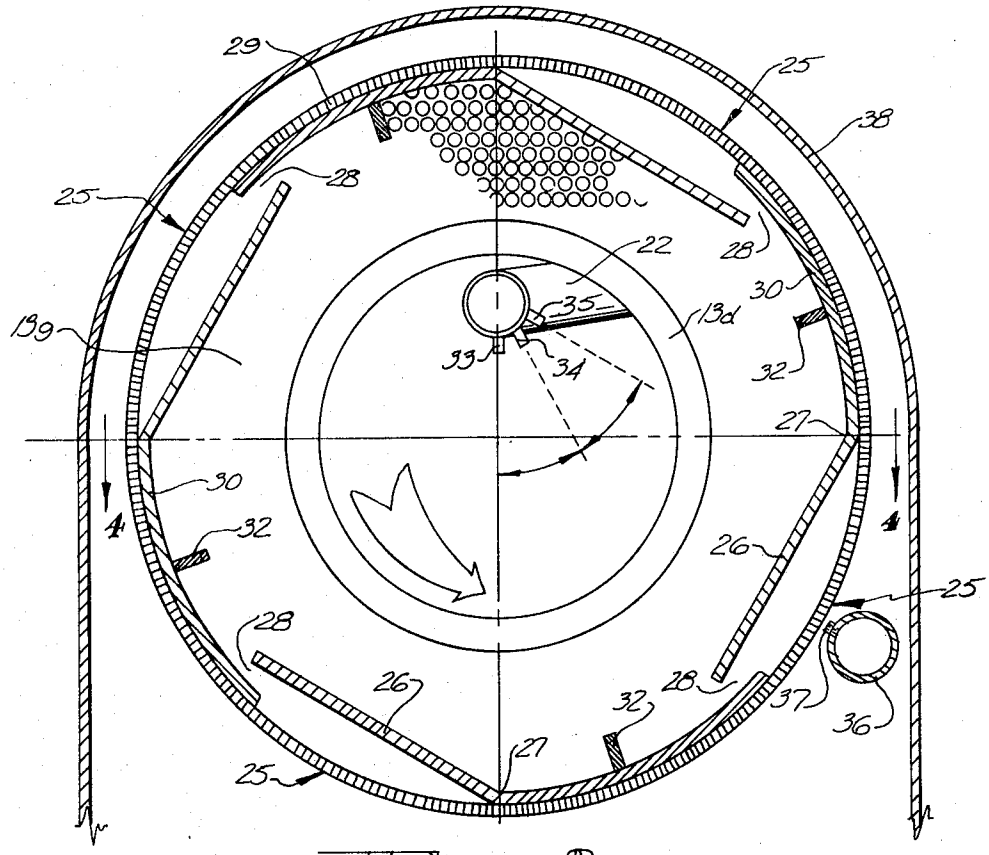


FIG 3

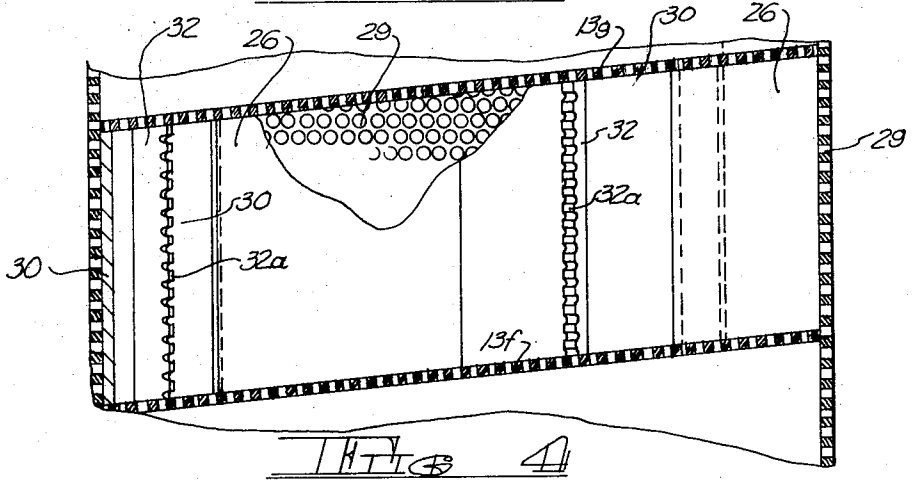


FIG 4

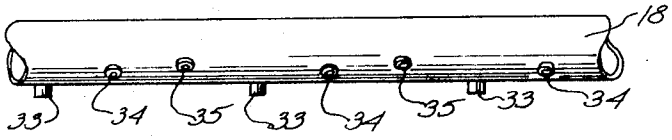


FIG 5

DRUM TYPE WASHER FOR METAL BORINGS AND THE LIKE

BACKGROUND OF THE INVENTION

The present invention relates to metal cleaning equipment and more particularly to a drum type washer for cleaning metal borings, turnings, cuttings and fines, all of which are relatively small in size. Such materials are by-products of boring, milling and other machine shop operations. In these operations, cooling and lubricating oils are employed, and this oil adheres to the cuttings, along with other contaminants. If the cuttings are to be salvaged for recycling or other uses, the oil and other contaminants must be removed. A conventional way of cleaning such materials is to burn the oil therefrom and then cool the materials by passing them through a cooling chamber wherein they are usually cooled by water. Such burning procedure is subject to a number of disadvantages, including air pollution and undesirable oxidation resulting from the wide variations in temperature between burning and cooling. In addition, unless the operation is carefully controlled in accordance with the quantity of oil present, the oil content may not be reduced to a satisfactory low level and a relatively low production rate may result.

It is also a standard practice to clean metallic parts and the like contaminated with oil by passing them through a drum type washer wherein the parts are selectively subjected to washing and rinsing operations, the parts being first washed with a solution which will remove the oil, the washing solution drained, and the parts then rinsed with water to remove the residual washing solution. Following rinsing, the parts are dried to prevent them from rusting. No particular problem is encountered in draining the washing solution and rinse water from the drum since the appropriate sections of the drum are perforated for such purpose, the perforations being substantially smaller than the parts being cleaned so that the liquid may be drained while retaining the parts in the washer. However, where the materials being washed are of extremely small size, as in the case of borings, cuttings and the like, a problem is encountered in draining the wash and rinse solutions from the drum. If the perforations in the drum are too large, the borings and cuttings will be discharged along with the liquid; and if the perforations are small enough to prevent discharge of the materials, they will readily clog and hence prevent the discharge of the liquids intended to be removed. Consequently, to date there has been no satisfactory apparatus for continuously washing and rinsing metal borings, cuttings and the like.

RESUME OF THE INVENTION

In accordance with the present invention, an elongated drum type washer is provided through which borings, cuttings and the like may be continuously moved and selectively subjected to one or more washing, draining and rinsing operations, inclusive of the discharge of the washing and rinsing liquids at the desired locations without losing any significant amount of the materials being cleaned.

The primary objective of the invention is accomplished by providing one or more drain zones having openings in the periphery of the drum at spaced apart intervals, each such opening being covered by an inclined baffle arranged to direct the materials being cleaned away from the openings as the drum rotates,

the trailing edges of the baffles defining outlet ports which permit liquid discharge.

The invention also contemplates that the elongated drum will be inclined upwardly from its leading end to its trailing end, and that the materials being cleaned will be conveyed through the drum as it rotates by means of a continuous helical vane projecting inwardly from the periphery of the drum.

It is further contemplated that the convolutions of the vane lying within zones in which a washing or rinsing operation is performed will be of imperforate character and of varying heights so as to effectively provide reservoirs of liquid through which the materials being cleaned are forced to pass, the portions of the helical vane within the drain zones being perforated to facilitate the draining operations.

The invention also contemplates the provision of kicker bars extending between the adjoining convolutions of the vane to cause the materials being washed to cascade in a direction opposite to the direction of rotation of the drum to enhance both the washing and draining operations, the kicker bars in the drain zones being positioned between successive drain openings and their overlying baffles, the kicker bars thus serving to cascade the materials onto the baffles for diversion away from the liquid discharge ports defined by the trailing edges of the baffles.

While the number of zones within the drum may be varied as desired, each wash and rinse zone will be provided with spray means within the drum for spraying the materials being cleaned as they are caused to cascade, thereby further enhancing the washing or rinsing action. In addition, spray means are provided externally of the drum in the areas of the drain zones for backwashing the perforated drain openings to clear the openings of any materials which may have been washed into the perforations through the drain ports defined at the trailing edges of the baffles.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view with parts broken away of a washer in accordance with the present invention.

FIG. 2 is a schematic vertical sectional view taken lengthwise of the washer illustrating the various zones defined therein.

FIG. 3 is a vertical sectional view taken along the line 3—3 of FIG. 2 illustrating the baffles employed in the drain zones to discharge fluid while retaining the materials being cleaned.

FIG. 4 is a fragmentary sectional view taken along the line 4—4 of FIG. 3.

FIG. 5 is an enlarged fragmentary elevational view illustrating the orientation of the nozzles employed in the wash and rinse zones.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIG. 1 of the drawings, the washer comprises an elongated drum 1 rotatably mounted on a base 2 by means of sets of rollers, such as the rollers 3 and 4, which coact with corresponding rollers lying on the opposite side of the base 2, to cradle the drum, the drum having annular tracks 5 and 6 positioned to contact the sets of rollers. The track 6 is additionally provided with a sprocket 7 engaged by drive chain 8 connected to a prime mover 9, such as an electric motor. Actuation of the prime mover will cause the drum

to rotate so as to cause materials being washed to be passed from one end of the drum to the other in the manner to be hereinafter described.

At its leading end the drum is provided with an inlet opening **10** by means of which the materials to be washed, such as metal borings, cuttings and the like, may be introduced into the drum, as by means of a screw conveyor **11** or similar material feeding means. At its discharge end, as seen in FIG. **2**, the drum is provided with a discharge opening **12**; and it will be understood that suitable means (not shown) will be provided to receive the materials discharged from the drum. For example, a chute may be provided to direct the washed materials to a drying unit.

The materials are conveyed through the drum by means of a continuous helical vane **13** extending inwardly from the inner cylindrical wall surface of the drum, the initial convolution of the vane commencing at the inlet opening **10**, with the final convolution terminating at the discharge opening **12**. The continuous helical vane will rotate with the drum and hence will convey the materials being cleaned through the drum.

In the embodiment illustrated, the drum is effectively divided into four zones — a wash-soak zone **14**, a drain zone **15**, a rinse zone **16**, and a drain zone **17**. The washing solution is sprayed on the materials being cleaned by means of a spray conduit **18** extending inwardly through the wash zone **14** from the inlet end of the drum. The spray conduit **18** is connected to an external conduit **19** which communicates with a storage tank **20** in which a supply of washing solution is maintained, a pump **21** being provided to draw washing solution from the storage tank and pump it under pressure to the spray conduit **19** for discharge. Similarly, a spray conduit **22** extends inwardly into the drum from the discharge end thereof, the spray conduit **22** being operatively connected to an external conduit **23** adapted to be connected to a source of rinse solution (not shown) which is usually water.

As will be evident from FIG. **2**, the drum is inclined upwardly from its leading to its trailing end, such inclination of the drum serving to enhance both the washing and draining of the materials. To this end, the helical vanes in the wash zone of the drum are of varying depth, the convolutions **13*a***, **13*b*** and **13*c*** successively decreasing in depth, the said convolutions together with the end wall **10*a*** at the inlet end of the drum effectively defining the reservoir **24** for washing solution through which the materials being washed must pass as they are advanced through the drum. Similarly, the convolutions **13*d*** and **13*e*** in the rinse zone **16** are imperforate, with the convolution **13*d*** being of greater depth than convolution **13*e***, thereby effectively providing a reservoir for rinsing solution, as indicated by the dotted line **24*a***.

In the drain zone **15**, the convolutions **13*f***, **13*g*** and **13*h*** of the vane are either wholly or partially perforated so that residual washing solution may drain back toward the wash-soak zone **14**. The size of the perforations may be varied as desired, although in the exemplary embodiment they are 5/32 inch in diameter and spaced on approximately 3/16 inch staggered centers throughout the depth of the convolutions which, in the illustrated embodiment, are of equal depth. Similarly, the convolutions in the drain zone **17**, commencing with convolution **13*i*** are perforated in like manner and, in the illustrated embodiment, have a uniform depth.

In accordance with the invention, and as possibly best seen in FIG. **3**, a series of spaced apart openings **25** are provided in the cylindrical wall of the drum in the drain zones **15** and **17**, each such opening extending between adjoining convolutions of the helical vane and covered by an inclined baffle **26** having its leading edge **27** positioned to close the leading edge of the opening **25** in the direction of rotation of the drum. The trailing edge of each baffle is spaced from the inner surface of the drum by a short distance, such as ¾ to 1 inch, to define an outlet port for the solution being drained. While the number of outlet openings **25** does not constitute a limitation on the invention, four such openings for each 360° of circumference of the drum surface in the drain zones, as defined by adjacent convolutions, provides excellent results. As in the case of the convolutions of the helical vanes lying within the drain zones, the openings **25** will be perforated, and perforations having a diameter of 5/32 inch have been found to be particularly suited for borings, cuttings, and the like, it being understood, of course, that the diameter of the perforations may be varied as desired depending upon the size of the materials being washed. As a practical matter in the design of the drum, the entire circumference of the drum in the area of the drain zone **15** and in at least part of the drain zone **17** may be perforated, as possibly best seen at **29** in FIG. **1**, the areas between the openings **25** being closed by plates **30** lying to the inside of the perforated cylindrical sections of the drum. Obviously, however, the openings **25** could be cut in the cylindrical wall surface of an imperforate drum and the openings covered with perforated sheets of metal or screening of the desired size.

As will be seen in FIG. **4**, the baffles **26** preferably extend between adjacent convolutions of the helical vane with their opposite side edges welded or otherwise secured to the convolutions of the vane, thereby effectively closing the sides of the baffles. While the helical convolutions in the drain zones are perforated to facilitate the draining operation, there is minimal exchange of the materials being cleaned through the perforations in the convolutions of the vane due to the fact that the rotation of the drum effectively moves the materials in a path of travel generally paralleling the convolutions. If desired, the openings **25** and the overlying baffles may be of lesser width than the distance between adjoining convolutions, in which event side plates will be provided to close the opposite sides of the baffles.

In order to effectively cascade the materials being cleaned over the baffles in counterflow to the direction of rotation of the drum, kicker bars **32** project inwardly from the inner surface of the drum intermediate adjacent baffles, the kicker bars also preferably extending the full distance between adjacent convolutions. As seen in FIG. **4**, the free outermost edge of each kicker bar is preferably toothed, as indicated at **32*a***, to more effectively cascade and tumble the materials being cleaned. Similar kicker bars may also be employed at spaced intervals in the wash and soak zone **14** and in the rinse zone **16** to tumble the materials to obtain maximum exposure to the wash and rinse sprays as well as to the reservoirs of solution built-up in the bottom of the drum at **24** and **24*a***.

In order to more effectively introduce the washing and rinsing solutions into the drum, the spray conduits **18** and **22** are provided with staggered sets of nozzles extending axially of the drum, the nozzles being ar-

ranged to spray the materials as they are cascaded toward the bottom of the drum by the kicker bars **32.** To this end, and as best seen in FIG. **3,** the spray bars are positioned above and in vertical alignment with the axis of rotation of the drum, the conduits each being provided with repetitive sets of nozzles **33, 34** and **35** oriented to discharge either washing or rinsing solution downwardly onto the cascading or tumbling materials at varying angles of inclination. Thus, as seen in FIGS. **3** and **5,** the nozzles **33** project vertically downwardly, with the nozzles **34** inclined at an angle to the nozzles **33** in the direction of rotation of the drum, and with the nozzles **35** inclined at a still greater angle in the direction of rotation of the drum, the preferred angle between adjacent nozzles in each set being 15°. Such arrangement insures thorough washing or rinsing of the materials being cleaned. The number of nozzles employed does not constitute a limitation on the invention, although a preference is expressed for at least several sets of the nozzles between each adjoining convolution of the helical vane. In this connection, it is also preferred to slightly increase the distance between adjoining convolutions from the leading to the trailing end of the drum, either progressively or in a series of incremental steps.

Provision is also made to backwash the perforations **29** to assist in removing residual cuttings and the like which have worked their way beneath the baffles **26;** and to this end, a branch conduit **36** is connected to the external conduit **19** supplying washing solution, the branch conduit lying in close external proximity to the perforated section **29** of the drum in drain zone **15.** Thus, in the first drain zone, the washing solution is used to backwash the perforations, the solution being ejected by a series of nozzles **37,** as seen in FIG. **3,** arranged to impinge on the perforations so as to dislodge materials which may have become entrapped in the perforations. The backwash conduit is positioned to spray the perforations as the perforations move upwardly; and hence the materials as they are dislodged tend to fall downwardly for return to the inner surface of the drum through the outlet ports **28.** The backwash spray is effectively contained by means of a hood **38** which surrounds the perforated sections of the drum. The perforated section in the drain zone **17** is also backwashed, in this instance by a branch conduit **39** connected to conduit **23** which supplies the rinsing solution. As a matter of convenience, and for mounting purposes, the branch conduits **36** and **39** may be interconnected intermediate the perforated sections, as by means of a coupling **40** which serves to plug the adjacent ends of the branch conduits.

A drain tank **41,** mounted on the base **2,** underlies the drain zone **15** for receiving washing solution discharged from the drum; and the drain tank **41** may be connected to the underlying washing solution storage tank **20** for recycling of the washing solution. A similar drain tank **42** underlies the drain zone **17** for receiving rinse water discharged from the drum.

As should now be apparent, the instant invention provides an effective means for continuously washing and rinsing extremely small materials, including the continuous draining of the materials to remove the washing and rinsing solutions without concurrent discharge of the materials being cleaned. The device is effectively self-purging and capable of continuous operation for long periods of time without clogging of the drains. It will be understood, of course, that the materials upon being discharged from the washer will be introduced into a dryer and dried to remove residual moisture. Such dryer may be of conventional construction and may comprise a drum type unit wherein the materials are dried by heated air as they are advanced through the dryer.

Numerous modifications may be made in the invention without departing from its spirit and purpose, and various modifications have already been set forth and it should be readily apparent that various additional changes and modifications may be made in the structural details of the washer within the scope of the appended claims. It is to be understood that the size of the washer does not constitute a limitation in the invention and that its size and the dimensions of its parts may vary depending upon capacity requirements. Similarly, the number and arrangement of the washing, draining and rinsing sections may be varied depending upon the anticipated operating conditions. For example, certain types of contaminates may require one or more washes and one or more rinses to obtain the desired degree of cleanliness, and in some instances it may be preferred to have side-by-side washing or rinsing operations with or without an intervening draining operation.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A washer for extremely small materials such as metal borings, cuttings and the like, comprising an elongated cylindrical drum having an inlet end and a discharge end, means mounting said drum for rotation in one direction, a continuous helical vane extending lengthwise of said drum with its convolutions projecting inwardly from the inner cylindrical surface thereof and oriented to convey the materials being cleaned from the inlet end to the discharge end of said drum, said drum having at least one liquid spraying zone followed by a liquid draining zone, spraying means within said drum in said liquid spraying zone, a plurality of spaced apart openings in the cylindrical surface of said drum in the liquid draining zone, said openings extending between adjacent convolutions of said helical vane, each said opening having a leading edge and a trailing edge relative to the direction of rotation of said drum, an inclined baffle overlying each of said openings, each of said baffles having its leading edge secured to said drum along the leading edge of said opening with its trailing edge extending to at least the trailing edge of said opening and lying in spaced relation thereto to define a slot-like outlet port between the trailing edge of said baffle and the trailing edge of the underlying opening, whereby when said drum is rotated, the baffles will deflect the materials being cleaned away from said outlet ports while permitting spraying liquid accumulated on the undermost inner surface of the drum to flow through said outlet ports for discharge.

2. The washer claimed in claim **1** wherein said openings are each defined by a plurality of perforations.

3. The washer claimed in claim **2** wherein a spraying means is mounted outside said drum in said draining zone and positioned to backwash said perforated openings.

4. The washer claimed in claim **1** wherein some at least of the convolutions of said helical vane in the draining zone are perforated.

5. The washer claimed in claim 1 wherein successive convolutions of the helical vane in the liquid spraying zone are of different depths, with the deepest convolution nearest the leading end of the drum and with a plurality of successive convolutions of successively decreasing depth.

6. The washer claimed in claim 5 wherein said drum is inclined upwardly from its inlet end to its discharge end.

7. The washer claimed in claim 1 wherein the spraying means within said drum comprises an elongated conduit extending lengthwise of said drum, wherein said conduit has a plurality of nozzles projecting outwardly therefrom, and wherein successive nozzles are staggered relative to each other to direct liquid onto the inner cylindrical surface of said drum at different angles.

8. The washer claimed in claim 7 wherein successive nozzles are staggered relative to each other in sets, with the first nozzle in each set positioned to spray vertically downwardly, with the succeeding nozzles in each set positioned to impinge on the inner cylindrical surface of said drum in the direction of its rotation.

9. The washer claimed in claim 8 wherein there are three nozzles in each set, and wherein said nozzles are staggered relative to each other at angles of about 15°.

10. The washer claimed in claim 1 wherein a kicker bar extends between adjacent convolutions of the helical vane in advance of the leading edge of each of said openings.

11. The washer claimed in claim 10 wherein there are four equally spaced apart openings between two adjoining convolutions within said draining zone, and wherein said kicker bars are equally spaced between adjacent openings.

12. The washer claimed in claim 1 wherein said washer has a first liquid spraying zone at the leading end of said drum for introducing a washing liquid, and a second liquid spraying zone for introducing a rinsing liquid, said first and second spraying zones being separated by a washing solution draining zone.

13. The washer claimed in claim 12 wherein said second spraying zone is followed by a second draining zone for said rinsing solution toward the discharge end of said drum.

14. The washer claimed in claim 13 wherein a spraying means is mounted outside said drum in each of said draining zones and positioned to backwash said openings, said openings each being defined by a plurality of perforations, the openings in the first draining zone being backwashed with washing liquid and the openings in the second draining zone being backwashed with rinsing liquid.

15. The washer claimed in claim 14 wherein the convolutions of the helical vane are perforated in the draining zones and imperforate in the liquid spraying zones.

16. The washer claimed in claim 15 wherein said liquid spraying means comprises elongated conduits extending lengthwise of said drum and positioned above the axis of rotation thereof, said conduits each being provided with a plurality of spaced apart nozzles arranged to direct liquid downwardly onto the materials in said drum.

17. The washer claimed in claim 16 wherein the conduit for introducing washing liquid projects inwardly into said drum from the inlet end thereof, and wherein the conduit for introducing rinsing liquid projects inwardly into said drum from the discharge end thereof.

18. The washer claimed in claim 17 wherein the spraying means for backwashing the openings in said first draining zone and said conduit for introducing washing liquid are connected to a common source of washing liquid.

* * * * *