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Brenneisen et al.

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[54] **APPARATUS FOR CLEANING METALLIC ARTICLES**

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

[58] **Field of Search** ..... 134/57 R, 58 R, 133, 134/135, 140, 141, 157, 159, 160; 51/164

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[57] **ABSTRACT**

A housing accommodates a body of cleaning liquid. An apertured drum is rotatably mounted above the level of the liquid and provided with an inlet and outlet opening for metallic articles to be cleaned. An actuating arrangement is provided for displacing the drum with reference to the housing to and from a position in which at least a portion of the drum periphery is immersed in the body of cleaning liquid. A drive rotates the drum at least when the same is in the aforementioned position.

19 Claims, 7 Drawing Figures

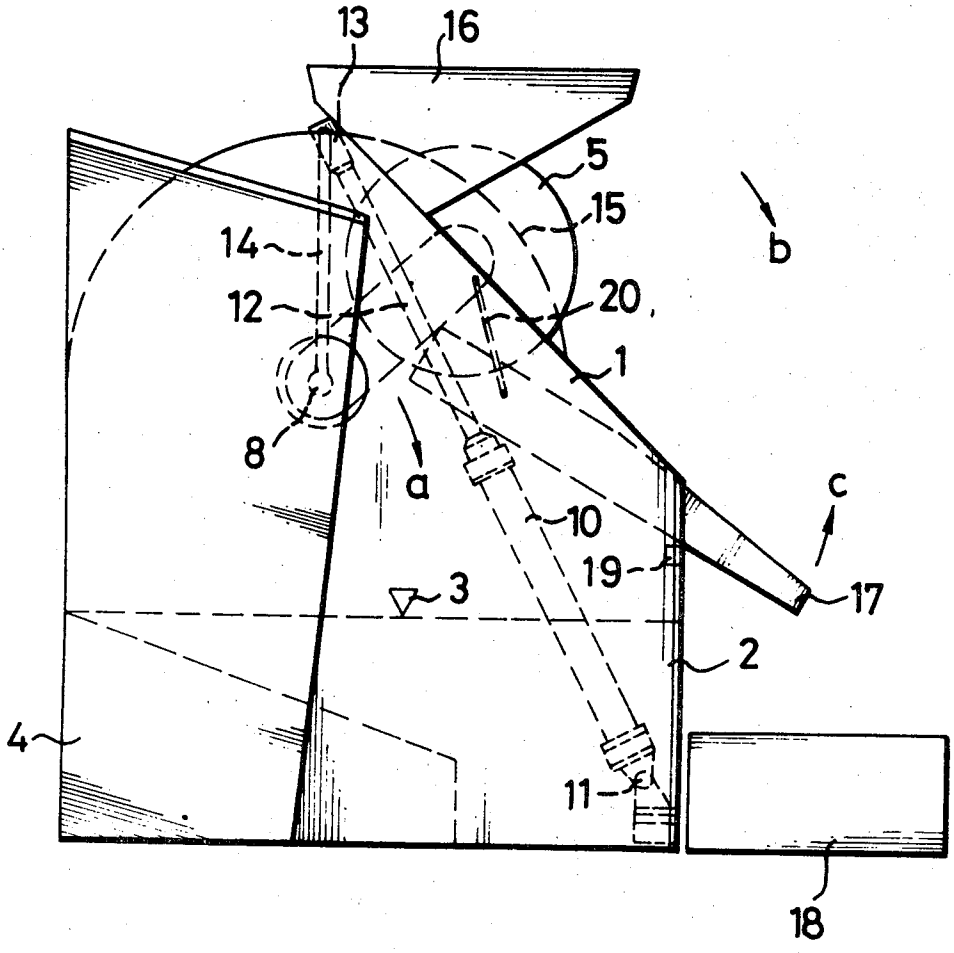
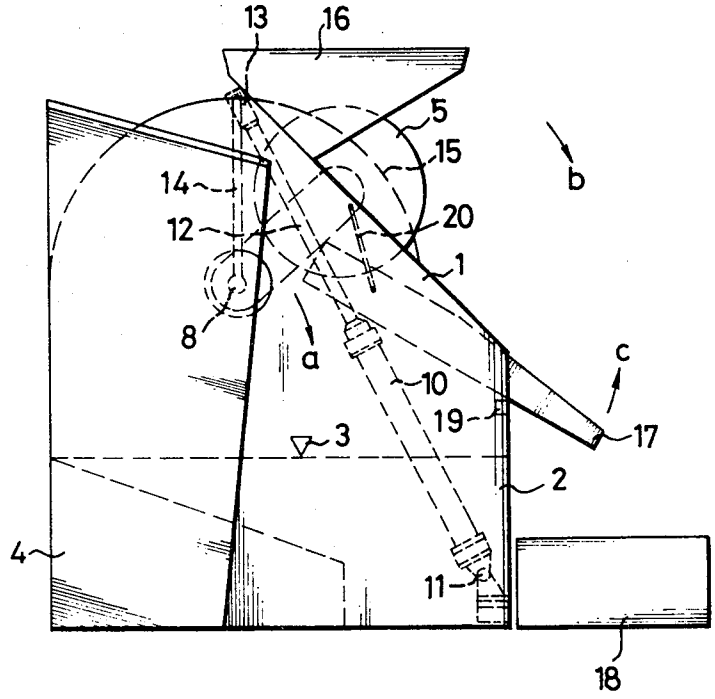


Fig. 1



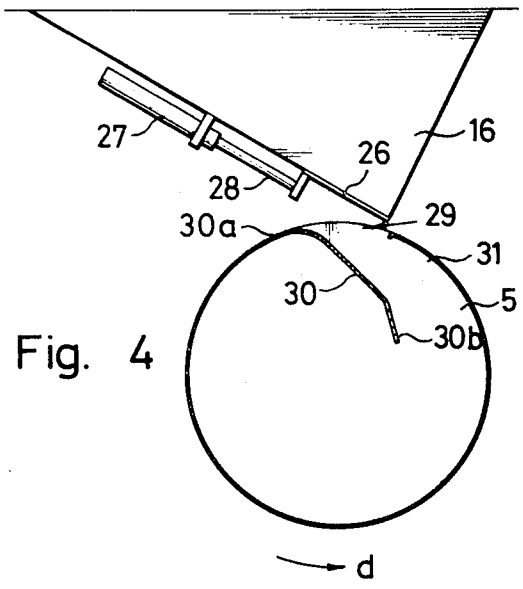


Fig. 4

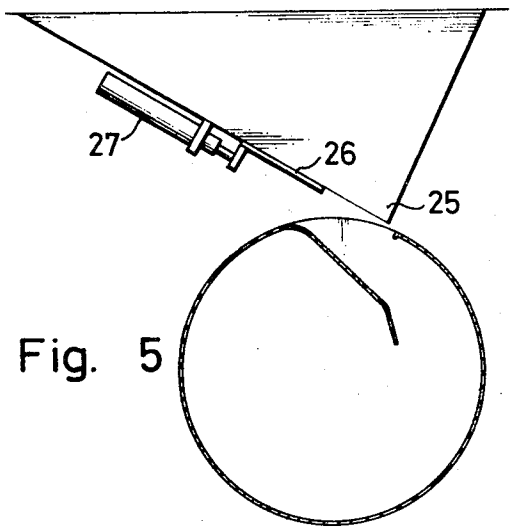
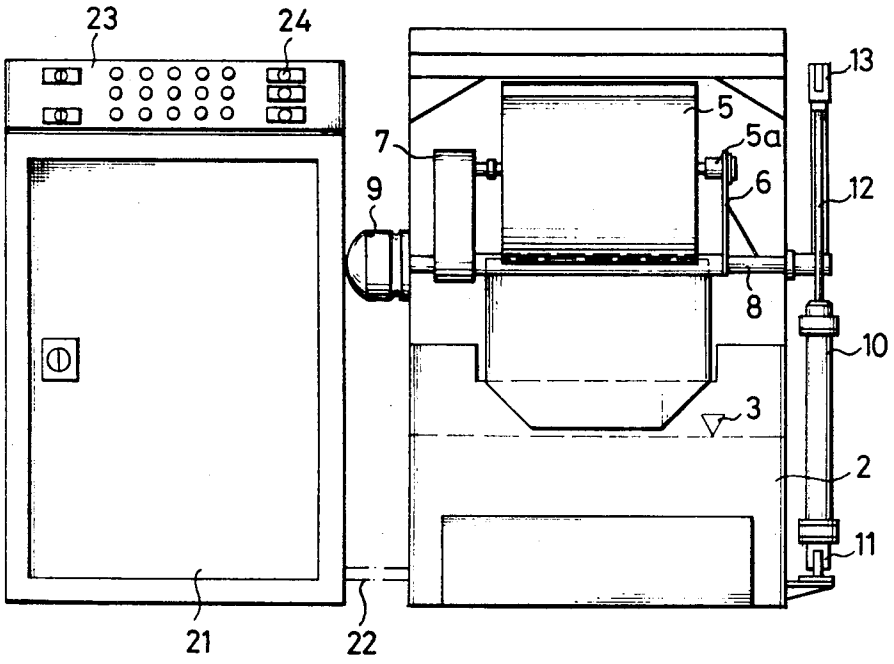


Fig. 5

Fig. 2



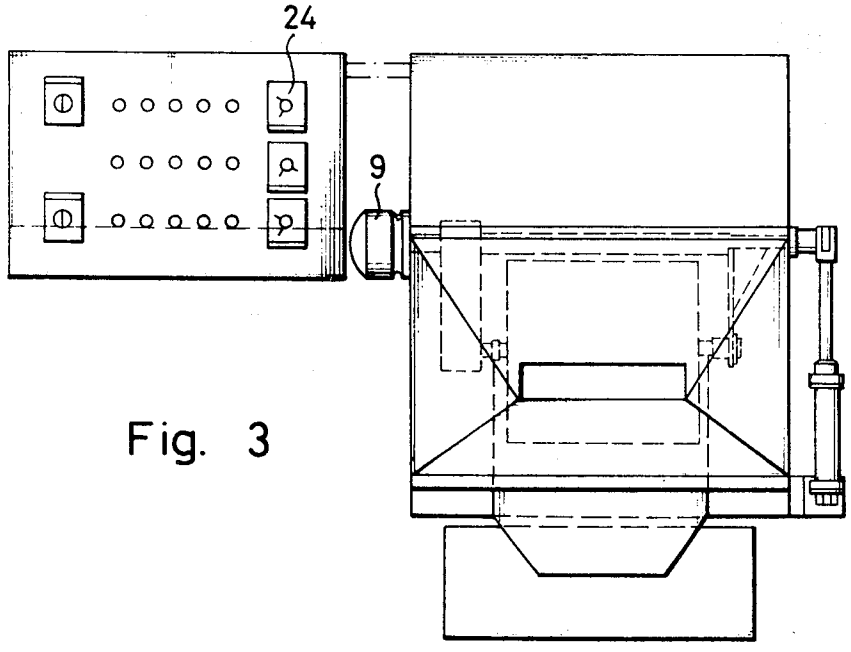


Fig. 3

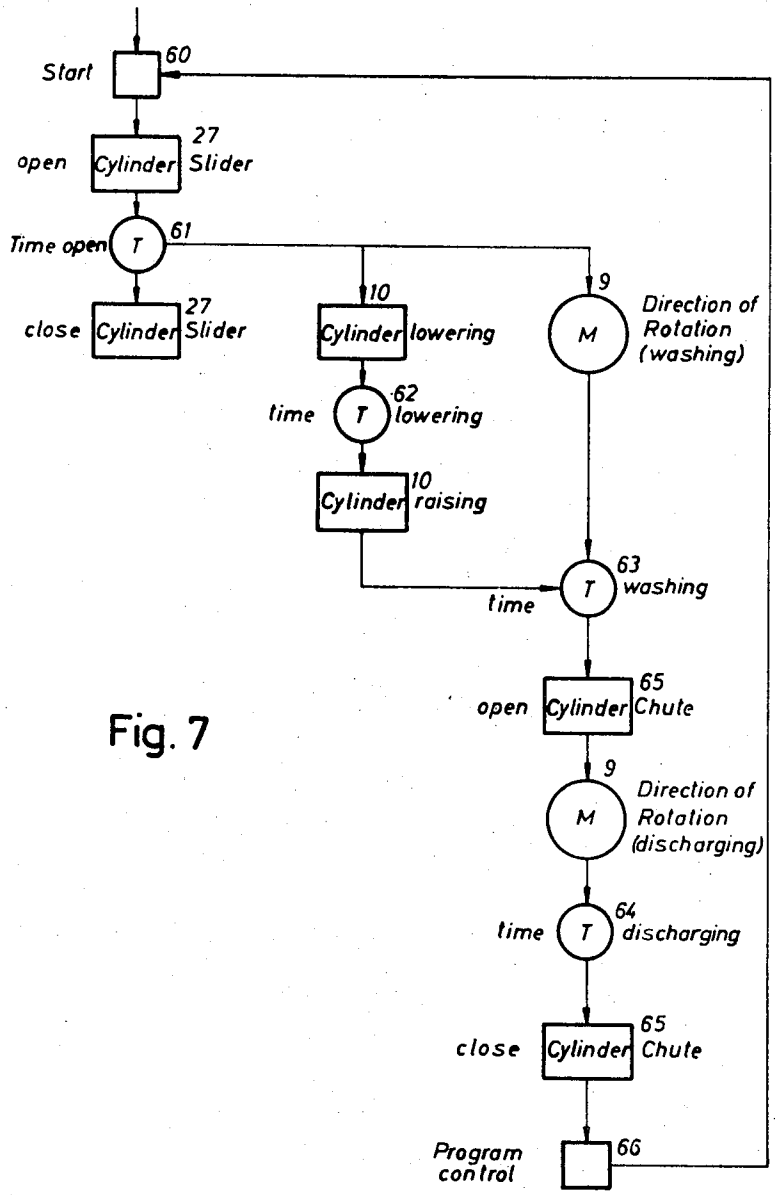

Start
60
open
Cylinder
27
Slider
Time open
T
61
close
Cylinder
27
Slider
10
Cylinder
lowering
time
T
62
lowering
Cylinder
10
raising
9
M
Direction of Rotation (washing)
T
63
washing
time
open
Cylinder
65
Chute
9
M
Direction of Rotation (discharging)
time
T
64
discharging
close
Cylinder
65
Chute
Program control
66

Fig. 7

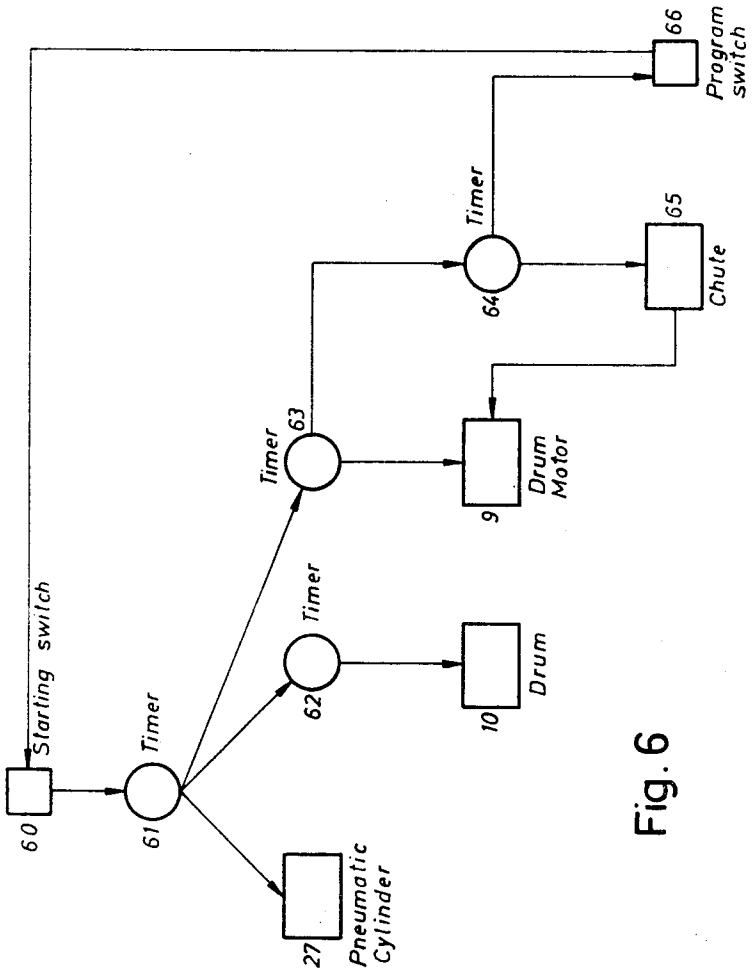

66
Program switch
Timer
65
Chute
64
Timer
63
Drum Motor
9
Timer
62
Drum
10
Starting switch
Timer
60
61
Pneumatic Cylinder
27

Fig. 6

APPARATUS FOR CLEANING METALLIC ARTICLES

BACKGROUND OF THE INVENTION

The present invention relates generally to cleaning apparatus, and more particularly to apparatus for cleaning metallic articles.

Certain articles in the metal working industry such as milled, punched, turned and otherwise produced metallic articles, must be subjected to cleaning operations. Apparatus is already in existence for such purpose, and requires either for the articles to be cleaned to be manually immersed into a bath of cleaning liquid, or utilizes a conveying arrangement which immerses the articles in the cleaning liquid. After a certain dwell time which the articles spend in the cleaning liquid, they are again removed therefrom and depending upon the requirements of a given circumstances, they are sometimes supplied to a drying arrangement where they are dried. Among the apparatus utilizing conveying arrangements it is known to use conveyor conveying arrangements it is known to use conveyor belts, conveyor baskets, buckets, conveyor grids or the like. It is also known to use a conveying screw one end of which is immersed in the bath of cleaning liquid and in response to whose rotation the articles are transported into or through the bath.

While there is thus no scarity of devices for the purpose at hand, it is well-known in the industry that they suffer from certain disadvantages. Thus, they are rather complex in construction and relatively bulky. This is not only disadvantageous with respect to the frequently limited space availability, but also makes of course for an expensive construction. On the other hand, it has been found that the existing devices for this purpose do not guarantee a complete cleaning of metallic articles, particularly when these have blind bores, recesses which are very fine or recesses which are very deep. It hs been found that particularly in the blind bores and recesses contaminants, metallic slivers or even air are retained which prevent proper entry and cleaning by means of the cleaning liquid. Therefore, it is frequently necessary for such parts to be not only cleaned with cleaning liquid but subsequently to be further treated, for instance by directing compressed air against them to remove residual contaminants. Evidently, this is expensive and time-consuming and therefore precluding the treatment of articles which are to be mass produced.

SUMMARY OF THE INVENTION

It is, accordingly, an object of the present invention to overcome the above-mentioned disadvantages.

More particularly it is an object of the present invention to provide a cleaning apparatus for metallic articles which is not possessed of these disadvantages.

Still more particularly it is an object of the present invention to provide such a cleaning apparatus which is not only rather simple in its construction but highly reliable and which avoids the retention of residual contaminants during and subsequent to the cleaning operation.

In pursuance of the above objects, and others which will become apparent hereafter, one feature of the invention resides in an apparatus for cleaning metallic articles which, briefly stated, comprises a housing and a body of cleaning liquid accommodated in the housing.

An apertured drum is rotatably mounted above the level of the liquid in the housing and provided with inlet and outlet means for metallic articles to be cleaned. Actuating means is provided for displacing the drum with reference to the housing to and from a position in which at least a portion of the drum periphery is immersed in the body of cleaning liquid. Drive means serves for rotating the drum at least when the same is in its aforementioned position.

The drum, of course, is apertured so that the cleaning liquid can have access to the metallic articles accommodated there within. The feeding of articles into the drum, and their removal from it, is particularly simple if when the drum is mounted for rotation about a substantially horizontal axis, the circumferential wall of the drum is provided with an axially extending inlet and outlet opening and the drum is of substantially convoluted or snail-like interior cross-sectional configuration, with the direction of rotation of the drum being reversible. In such a construction the articles to be cleaned are preferably introduced into the opening of the drum via a hopper or funnel-shaped inlet arrangement. If now the drum is rotated oppositely its convolution or snail-like configuration, then the material to be cleaned accumulates in its interior. It is therefore not necessary to close the opening of the drum with a special door or the like. On the other hand, the removal of material is accomplished very simply by reversing the direction of rotation of the drum.

In a most simple manner the drum can be constructed in the desired manner by providing it with a circumferential wall provided with the inlet and outlet opening, and providing within the drum a baffle extending substantially coextensive with the elongation of the drum and being connected to one edge of the inlet and outlet opening projecting towards the axis of rotation of the drum. Thus, this baffle will prevent—in one direction of rotation of the drum—the articles or material from falling out of the opening but will permit and in fact guide the articles to the opening for evacuation from the drum when the latter is rotated in the opposite direction.

As mentioned before, it is advantageous that the introduction of articles into the drum is accomplished via a hopper or funnel-shaped supply arrangement. According to a further concept of the invention the outlet of the hopper can be closed with a slide, a flap or generally a door-like arrangement, thus making it possible to refill the hopper with another load of articles to be cleaned while the preceding load is still undergoing cleaning in the rotating drum. This considerably increases the utilization of the capacity of the apparatus. It is further advantageous in accordance with another embodiment of the invention, that a chute be provided which is so connected with the axis about which the drum rotates that it will automatically move out of the way when the drum is lowered so as to be at least in part immersed in the body of cleaning fluid, whereas when the drum is raised one end of the chute will be located underneath the drum to receive cleaned articles which issue from the outlet of the drum.

It will be appreciated that the apparatus according to the present invention may be controlled either manually or automatically. If the control is to be effected automatically, then there is advantageously provided a control console containing the various control devices for automatically regulating the operation of the appa-

ratus. If the device is fully automated, then the door closing the outlet opening of the hopper is automatically opened and closed, the drive for rotating the drum is automatically energized and deenergized, the drum is automatically lowered into and raised out of the body of cleaning liquid, the rotation of the drum—that is the direction of rotation of the drive therefor —is automatically reversed, the drive de-energized and the drum turned into its starting position with its inlet and outlet opening facing upwardly. The automatic control arrangement may be provided with one or more timers which control the individual operating steps as to the time which they are to take. This time of course can be varied at will.

Under certain circumstances it may be desirable that the control console is not directly mechanically connected with the remainder of the apparatus. In this case the control console may be separate entity entirely which is connected with the remainder of the apparatus only by means of suitable electrical conduits, such as cables or the like.

It is also desirable under some circumstances, particularly if the cleaning liquid involved is flammable or has properties deleterious to health, if the apparatus particularly the housing with the drum and the body of cleaning liquid contained therein, can be hermetically closed or sealed. In this case there is preferably provided a door which is opened only for the purpose of removing the cleaned articles and which preferably is combined with the chute so as to operate in dependence upon the operation of the latter.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a diagrammatic side-elevational view of an apparatus according to the invention;

FIG. 2 is a front-elevational view, also diagrammatically shown, of the apparatus shown in FIG. 1;

FIG. 3 is a top-plan view of the apparatus in FIGS. 1 and 2;

FIG. 4 is a diagrammatic sectional detail view of portions of the apparatus shown in FIG. 1, with the door for the hopper in closed position;

FIG. 5 is a view similar to FIG. 4 but showing the door of the hopper in open position.

FIG. 6 is a block diagram showing the operation of an automatic sequencing control; and

FIG. 7 is a similar block diagram, but showing the operation of the apparatus during one complete operating cycle.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing now the drawing in detail, and firstly FIG. 1 thereof, it is emphasized that this shows in diagrammatic form the principle of the construction of an apparatus according to the present invention. Reference numeral 1 identifies a housing the lower portion whereof contains a body 2 of cleaning liquid. The upper level of the cleaning liquid is identified with the arrow 3. In the lower portion of the housing, partly surrounded by the body 2 of cleaning liquid, there is provided a space 4 which is fluid-tight with respect to the body 2 and contains various armatures and components, including a pump for withdrawing and/or introducing the cleaning liquid if desired. Furthermore, the presence of this space 4 reduces the volume in the lower portion of the housing 1, so that the housing 1 can have the desired exterior size which is dictated by considerations of the desired drum size, but requires less cleaning liquid 2 than would otherwise be necessary, so that the utilization of the cleaning liquid is thereby enhanced.

The cleaning drum 5 is arranged above the level 3 of the liquid 2 in the housing 1. It is mounted at its opposite axial ends by pivoting arms 6 and 7 which are rigid with a shaft 8 (see FIG. 2) and pivot at the same turns. Reference numeral 9 identifies a drive motor for the drum which is mounted on the shaft and drives the drum 5 via a suitable drive which is not illustrated, but which should be understood to be of any suitable type, such as a belt drive, or a gear drive.

The drum 5 is moved between an upper position and a lower position in which it is at least partly immersed in the bath 2 by turning of the shaft 8. This is accomplished in the illustrated embodiment by means of pneumatic cylinder 10 which is connected with the housing 1 via a joint 11. The piston rod 12 of the cylinder 10 is similarly connected with the free end of a lever 14 which is mounted on the shaft 8 fast therewith, and the connection between the piston rod 12 and th lever 14 is articulated. When the piston rod 12 is withdrawn in the direction of the arrow *a*, the shaft 8 and thereby the drum 5 is pivoted in the direction of the arrow *b*. When this takes place, the articulate connection 13 moves through the arc 13 shown in broken lines. Of course, when the piston rod 12 moves out of the cylinder 10, the movement is reversed. Thus, the drum 5 can be lowered into and lifted out of the body 2 of cleaning fluid.

A hopper 16 is arranged above the drum 5 for introducing articles to be cleaned into the latter. An inclined chute 17 is provided whose other end is located beneath the drum 5 and whose lower end is arranged above a box 18, another receptacle, a conveyor or the like. The chute 17 is turnable about the axis 19 and connected with the arm 7 by means of a chain 20 or analogous means. Thus, when the drum 5 is lowered into the bath or body 2 of cleaning liquid, the chute 17 is similarly moved downwardly with its outer end being upwardly tilted in the direction of the arrow *c* so that, when the drum 5 has reached its lowermost position, the chute 17 extends substantially vertically. While this had not been separately illustrated it is to be understood that the movement of the chute 17 can be combined with a door provided in the housing 1 so that, when the chute 17 is in vertical position and the drum is immersed into or in the body 2 of cleaning liquid, the door is closed and the interior of the container 1 is hermetically sealed, with the door opening only when the chute moves to operative position to receive articles which have been cleaned from the drum which has been moved upwardly out of the body of cleaning liquid 2.

As already pointed out, the apparatus according to the present invention can be fully automated in its operation. The necessary control devices, which are well known per se and therefore are not though to require

detailed discussion, are advantageously accommodated in a control console **21** which may be combined with the remainder of the apparatus to form a compact unit. However, it may also be desirable to have the control console **21** be separate from the remainder of the apparatus and free from any mechanical connection. This is illustrated in FIGS. **2** and **3** where the control console **21** is connected with the remainder apparatus exclusively by means of electrical conductor means **22.** The various switches, buttons, indicating devices and the like which are associated with the control console **21** are all combined in a control board **23,** which is also provided with timers **24** by means of which the duration of the individual operating steps of the apparatus can be set and varied at will.

Coming to FIGS. **4** and **5** it will be seen that these are detail illustrations on an enlarged scale, showing the construction and arrangement of the drum **5** and the hopper **16.** The latter is provided in its lower region with an opening **25** which can be closed with a door, here identified as a slider **26.** The latter is actuated by a pneumatic cylinder **27** mounted on the underside of the hopper **16** and connected with the slider **26** by means of its piston rod **28.** In FIG. **5** the opening **25** is shown in open condition with the slider **26** retracted, whereas in FIG. **4** the slider **26** is advanced so as to close the opening. Of course, other means instead of the slider **26,** and other actuating means instead of a pneumatic cylinder **27** can also be provided.

The drum is of generally convoluted interior cross-section, that is of snail-like cross section. This is a significant feature of the present invention. It will be seen that the circumferential wall of the horizontally arranged drum **5** is provided with an axially extending opening **29** constituting inlet and outlet means for articles to be cleaned. In the simplest embodiment of the construction of the drum, a baffle **30** is arranged within the drum beneath the opening **29,** with one edge **30***a* of the baffle **30** being secured to one edge of the opening **29,** whereas the other edge **30***b* extends into the interior of the drum towards the axis of rotation thereof. The resulting cross-section of the drum is roughly analogous to that of a snail housing, with a space **31** being defined through which the articles to be cleaned enter into the interior of the drum when they issue from the hopper **16.** When the drum is rotated in the direction of the arrow *d*, the material accumulates at the inner side of the baffle **30** which as far as the material or articles to be cleaned is concerned, closes the opening **29** and prevents the articles from falling out. When, on the other hand, the drum **5** is rotated in opposite direction, the articles can issue through the opening **29.**

The operation of the apparatus here illustrated and described will be obvious from what has been set forth above. Articles to be cleaned are introduced into the hopper **16** and as soon as the automatic program of the apparatus is started—or as soon as the operation of the apparatus is initiated manually by an operator—the pneumatic cylinder **27** retracts the slider **26** so that the articles can issue from the hopper **16** through the opening **25** and enter through the opening **30** into the interior of the drum **5.** The drum now rotates and simultaneously is moved to a position where it is partially or completely immersed in the cleaning liquid **2.** The time for which it remains so immersed can be selected at will with the timers **24.** When the time has expired, the drum is lifted by means of the pressure cylinder **10** and returned to its starting position which is illustrated in FIG. **1.** The drum advantageously continues to rotate, and the rotation may indeed be speeded up if desired, so that the liquid still remaining in the interior of the drum and any openings in the articles contained therein, can completely leave the drum through the apertures provided in the circumferential wall thereof. Of course, the direction of rotation at this time is the same as the direction of rotation while the drum was immersed in the cleaning liquid, and the period of time for which the drum continues to rotate when it has been raised out of the cleaning liquid **2** can also be adjusted by means of the timers **24.** Once this periods has expired, the direction of rotation of the drum **5** is automatically or manually reversed, and now the baffle **30** serves as a guide which guides in the drum to and out of the opening **30** so that they fall onto the upper end of the chute **17** and from there move into the receptacle **18** or analogous means.

It will be appreciated that with the apparatus accordin to the present invention the cleaning of metallic articles of the type under discussion is greatly simplified. Not only is the apparatus itself less complicated than the arrangements provided heretofore for this purpose, and therefore less expensive, but also it provides for a significantly more intense cleaning of the articles in question. Because the drum with the articles to be cleaned is direclty immersed into the cleaning liquid, complicated conveying arrangements for the articles to be cleaned, and expensive and complicated pumps for the cleaning liquid are avoided. Furthermore, the same drum which serves to move the articles through the cleaning liquid can also be used for drying the articles.

In addition it is emphasized that the apparatus according to the present invention can also be used for polishing and de-burring of articles which have been punched, milled or turned. To make this possible at least one additional drum is provided, and the cleaning drum with its apertured circumferential wall is releasably mounted in the apparatus so that the additional drum can be put in its place. Such additional drums are usually of polygonal cross-section, for instance of six-sided or eight-sided cross-section. The articles to be deburred or polished are introduced into the additional drum once the same has been mounted in the apparatus in lieu of the drum used for washing purposes, and if desired polishing or grinding materials of well-known type are added. It is also possible to carry out wet polishing operations in which case the cleaning liquid **2** is replaced with a suitable polishing liquid and the auxiliary drum with the articles to be polished is then lowered into this polishing liquid in the same manner as described above with respect to the washing drum.

Although a detailed specific description of the control console appears unnecessary because it is not in itself a part of the inventive concept, its operation is discussed hereafter for a better understanding, based upon the block diagram shown in FIG. **6.** As shown, the starter switch **60** activates the timer **61.** The latter controls pneumatic cylinder **27** of slider **26,** as well as the timer **62** which in turn governs operation of cylinder **10.** In addition, timer **61** controls a further timer **63** which controls energization of the drum drive motor **9.**

The timer **63** has the additional function of controlling a timer **64** which in turn cooperates with a separate cylinder **65** (which may but need not be provided for lifting and lowering the chute **17**). If the cylinder **65** is

present, it will cooperate with motor 9 so that the direction of rotation of the latter is automatically reversed when the chute 17 is in discharge position. Timer 64 also cooperates with program switch 66 which in turn is electrically connected with switch 60. Switch 66 may be set to cause shut-down of the apparatus upon completion of a cycle, or to effect continuous repetition of the cycles.

FIG. 7, finally, is a block diagram showing a complete operating cycle of the apparatus to facilitate understanding of its operation. Self-explanatory legends have been employed, and in addition we have shown reference numerals which refer to the corresponding components discussed with reference to the preceding figures. FIG. 7 is believed to be self-explanatory, requiring no further comment.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the type described above.

When the invention has been illustrated and described as embodied in an apparatus for cleaning of metallic articles, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can be applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and rang of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

I claim:

1. An apparatus for cleaning metallic articles, comprising in combination, a housing; a body of cleaning liquid accommodated in said housing; an apertured drum mounted above the level of said liquid in said housing for selective rotation in mutually opposite directions, said drum having a peripheral wall provided with an axially elongated opening for inlet and outlet of metallic articles to be cleaned, said drum further having an inner cross-sectional contour so configurated that articles in said drum are directed to and through said opening in response to rotation of said drum in one predetermined direction; actuating means for displacing said drum with reference to said housing to and from a working position in which at least a portion of the drum periphery is immersed in said body of cleaning liquid; drive means for rotating said drum at least when the same is in said position; and a chute having an end portion and being mounted for movement to a first operating position in which said end portion is located beneath said drum in response to displacement of the latter from said working position; and to a second operating position in which said end portion is laterally withdrawn from beneath said drum in response to displacement of the latter to said working position.

2. An apparatus as defined in claim 1, said drum being mounted for rotation about an at least substantially horizontal axis, and said actuating means comprising a pair of arms having first end portions secured to respective opposite axial ends of said drum and second end portions mounted for pivotal movement to and from said position about a pivot axis.

3. An apparatus as defined in claim 2, said actuating means comprising a shaft constituting said pivot axis and being rigid with said second end portions; and said actuating means further comprising displacing means for pivotably displacing said arms to and from said position.

4. An apparatus as defined in claim 3, said displacing means being mechanical means.

5. An apparatus as defined in claim 3, said displacing means being electrical means.

6. An apparatus as defined in claim 3, said displacing means being hydraulic means.

7. An apparatus as defined in claim 3, said displacing means being pneumatic means.

8. An apparatus as defined in claim 3, said displacing means comprising a cylinder, a fluid-operated piston displaceable in said cylinder, a piston rod projecting from said cylinder, a lever fixed with said shaft, and articulated connecting means connecting said piston rod and said lever.

9. An apparatus as defined in claim 1, and further comprising a baffle received in said drum at least substantially co-extensive with the axial elongation thereof, said baffle being secured to an edge bounding said opening and projecting inwardly towards the axis of rotation of said drum.

10. An apparatus as defined in claim 1; further comprising a feed hopper arranged above said drum and having an outlet aperture; and closure means for closing said outlet aperture when desired.

11. An apparatus as defined in claim 1; further comprising a control console for controlling the functions of said apparatus.

12. An apparatus as defined in claim 11; further comprising timer means associated with said control console for timed control of said functions.

13. An apparatus as defined in claim 11, said control console being a discrete entity; and further comprising electrical conductor means constituting the sole connection between said control console and the remainder of said apparatus.

14. An apparatus as defined in claim 1; further comprising closure means for hermetically closing at least said housing and drum.

15. An apparatus as defined in claim 1; further comprising a door in said apparatus and being operable for discharge of cleaned articles.

16. An apparatus as defined in claim 15, said door being operable in response to movement of said end portion beneath said drum.

17. An apparatus as defined in claim 1, said drum being removable; and further comprising at least one additional different drum connectable with said apparatus in place of said drum.

18. An apparatus as defined in claim 17, said additional drum being of polygonal inner cross-section.

19. An apparatus as defined in claim 1; further comprising manual control means for manually controlling operation of said apparatus.

* * * * *