United States Patent

Altenstaedter

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[54] APPARATUS FOR THE VIBRATORY FINISHING OF WORKPIECES

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **51/7,** 51/17, 51/317

[51] **Int. Cl.** **B24b 19/00,** B24b 1/00

[58] **Field of Search** 51/7, 17, 18, 19, 163, 164, 51/317, 318

[56] **References Cited**

UNITED STATES PATENTS

3,371,449	3/1968	Olson et al.	51/7
3,539,117	11/1970	Sjogren	51/7
3,464,163	9/1969	Ferrara	51/7
2,997,813	8/1961	Brandt	51/7
2,720,730	10/1955	Kroger	51/7
2,891,357	6/1959	Davidson	51/7
2,921,413	1/1960	Kay	51/7
2,921,412	1/1960	Kay	51/7
2,803,093	8/1957	Diehl et al.	51/7
2,480,238	8/1949	Hammond et al.	51/19
569,090	10/1896	Cox et al.	51/19
2,337,453	12/1943	Corey et al.	51/6
392,556	11/1888	Harris	51/6
2,600,282	6/1952	Strong	51/164
2,682,732	7/1954	Hanrahan et al.	51/164
471,284	3/1892	Walters et al.	51/19

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[57] **ABSTRACT**

A work container is filled with a polishing or grinding medium and workpieces are mounted to an auxiliary device which transports the workpieces into, through and out of the medium. A vibrator is mounted to the container for vibrating the polishing medium and circulating it in a predetermined direction through the container. The auxiliary device can be moved by the circulating medium or by independent drive means. A secondary work container can be mounted to the interior of the main container and a mixture of small workpieces and polishing medium can be fed through the secondary container while large pieces are carried through the main container by the auxiliary device.

13 Claims, 10 Drawing Figures

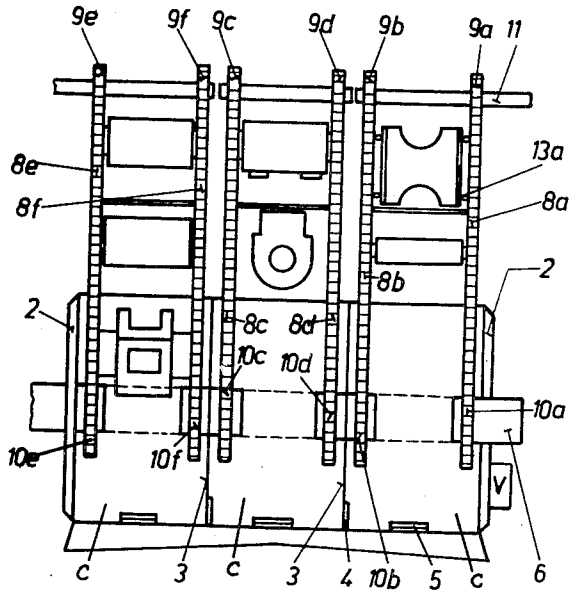

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Fig. 2

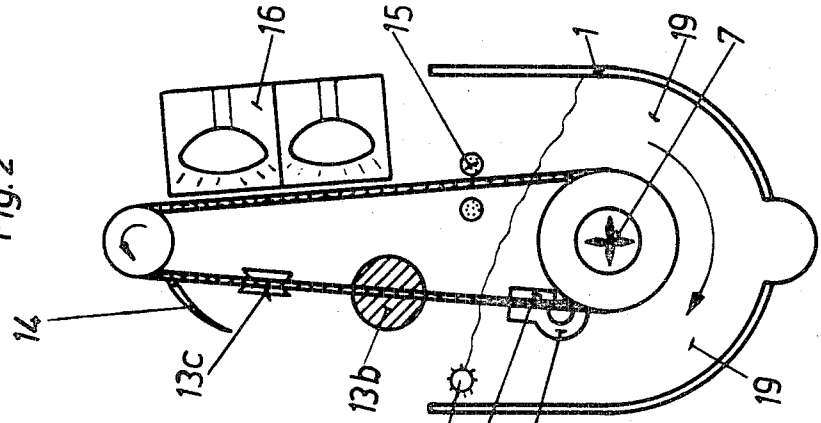

Fig. 1

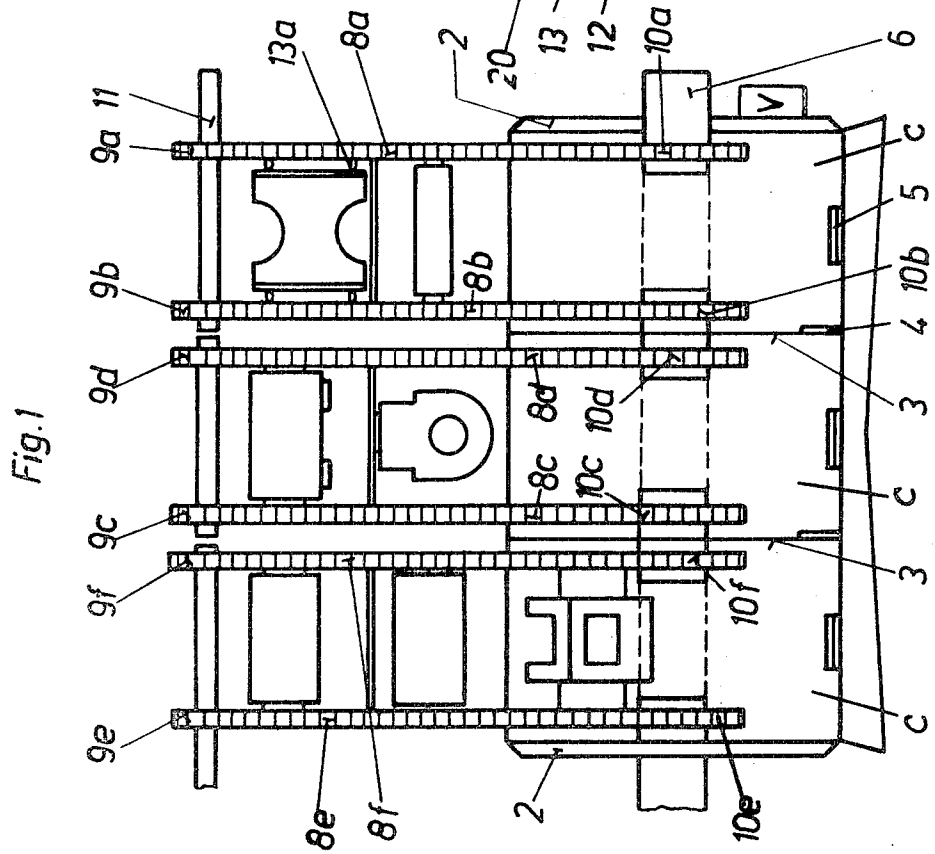

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Fig.4

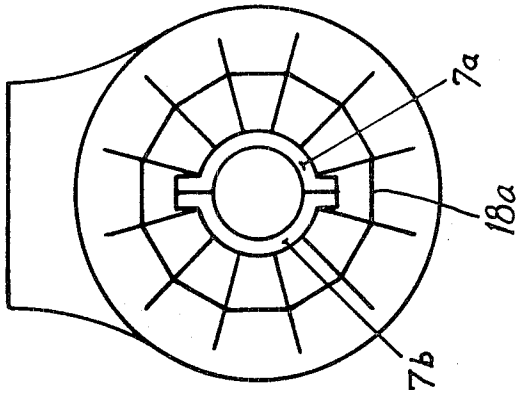

Fig.3

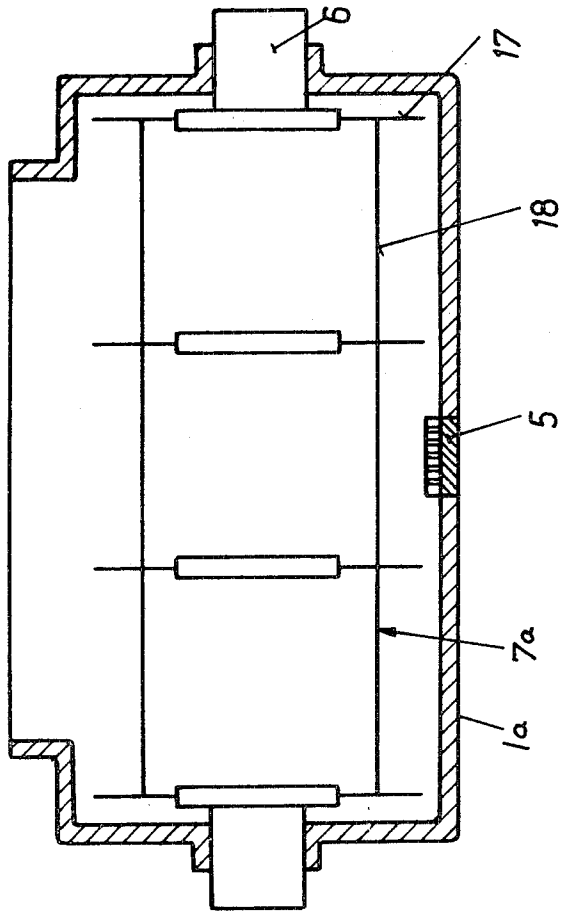

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Fig. 5

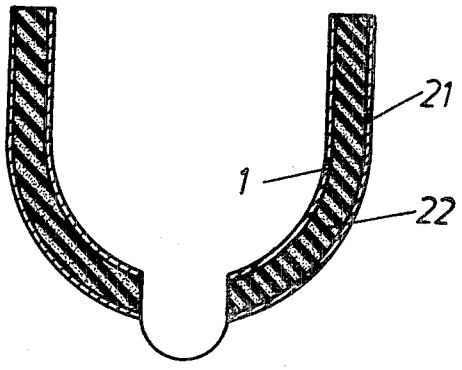


Fig. 6

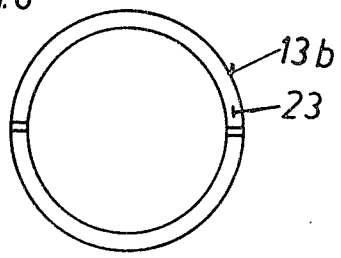
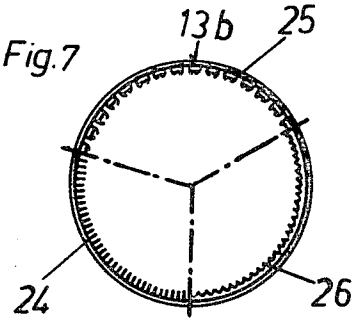


Fig. 7



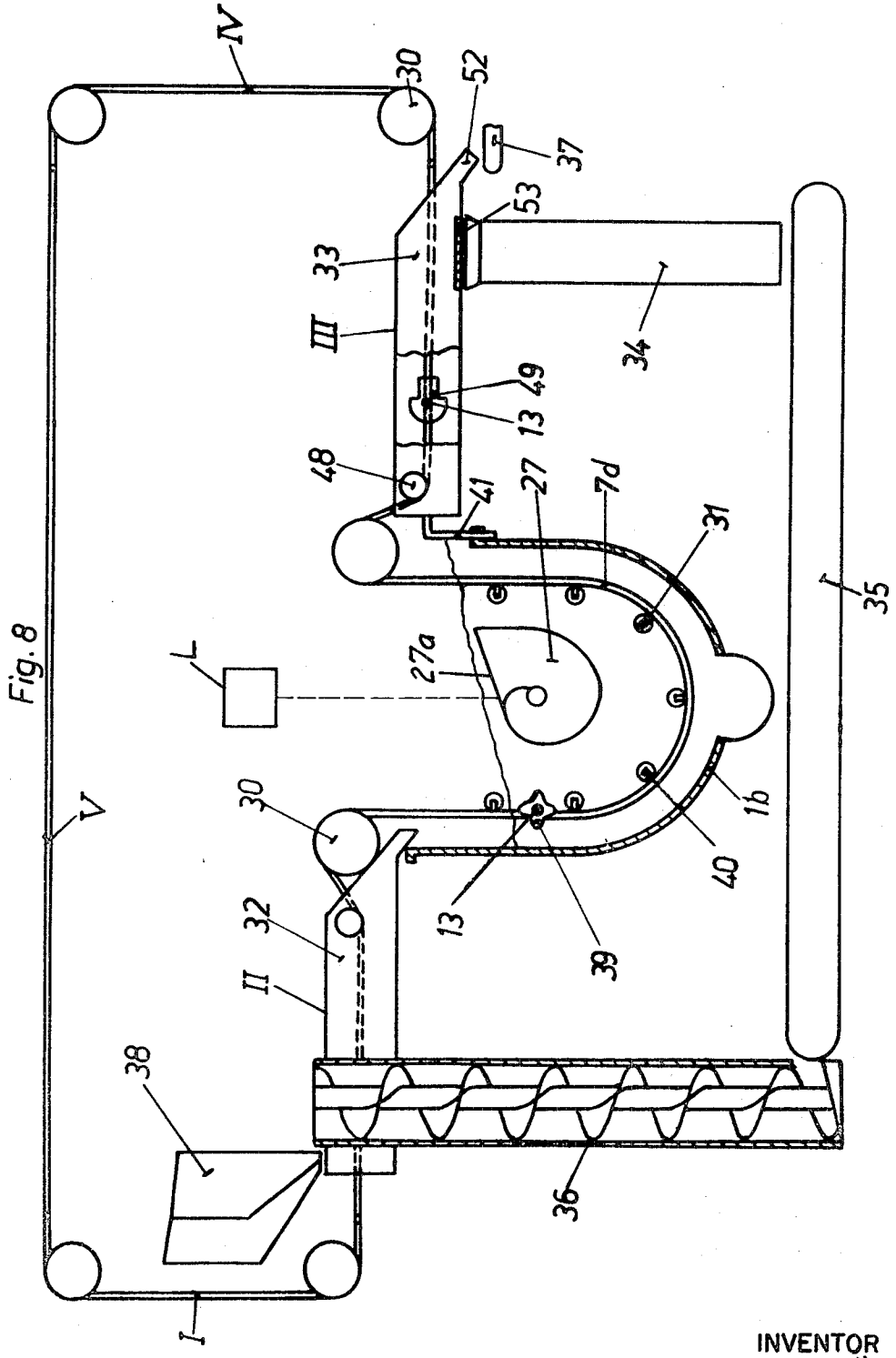


Fig. 8

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Fig. 9

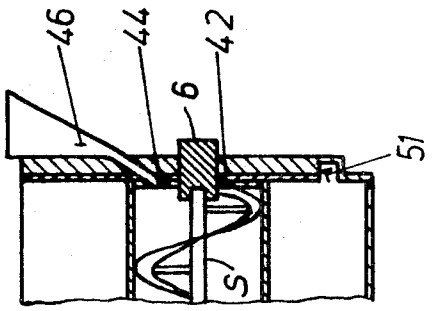
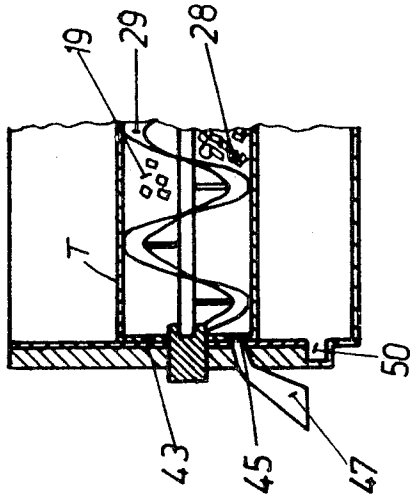


Fig. 10



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APPARATUS FOR THE VIBRATORY FINISHING OF WORKPIECES

BACKGROUND OF THE INVENTION

The invention relates to devices for vibratory barrelling or finishing of workpiece surfaces whereby relatively large, or a combination of small and large workpieces can be processed simultaneously.

Vibratory barrelling machines hitherto used do not satisfy the varied requirements in the processing of parts of different size, shape and material, such as are generally encountered in every factory.

Thus, it is time-wasting and tedious to remove small parts from large containers by separating them from the polishing or abrasive grinding medium after processing. The separation of the workpieces from the grinding or polishing media after processing, outside the container, with large-scale magnetic separators or screening devices requires costly equipment, and causes high operating costs and expensive maintenance of the auxiliary equipment.

It is a further disadvantage that large and bulky parts, insofar as these can be processed at all with vibratory finishing machines, can only be introduced in small numbers per charge to prevent them from colliding with each other, from being damaged and from jamming in the containers which would impair the normal circulation of the parts and the polishing medium. In addition, container linings provided for reducing the noise level are frequently damaged or destroyed which can lead to further damage of the parts when they strike unprotected inner walls of the container during their circulation whereby they can become distorted and/or unusable. The use of workpiece positioning or clamping devices is undesirable because each workpiece requires its own, individually formed device. In addition, a displacement of the center of gravity is frequently caused by the use of such clamping devices which can lead to a premature wear of the machine.

Furthermore, such machines no longer assure the circulation of the grinding or polishing media so that uniform processing of the entire surface of the workpieces is imperiled. A further disadvantage of prior art methods is that large workpieces can only be inserted and removed while the container is empty. This means that for each operation, which may require repeated positioning to assure the uniform processing of the whole workpiece, valuable time for the repeated emptying and filling of the container must be provided which significantly increases the cost of finishing the surfaces of workpieces.

SUMMARY OF THE INVENTION

It is an object of the invention to overcome the above shortcomings and to provide a device whereby relatively large parts of irregular shape, or a combination of small and large parts, can be simultaneously processed by a vibratory finishing process without damaging the parts. Other objects are to enable the mounting and removal of the parts without emptying the work container and to eliminate a time-wasting and tedious separating of small parts from the grinding or polishing media.

According to the invention, this is achieved by mounting an auxiliary device to stub shafts extending into the work container. The auxiliary device is provided with attachments for the mounting of variously shaped workpieces. The circulating polishing medium, or an independent drive, move the auxiliary device and the workpieces through the container. Thus the direction of rotation of the auxiliary device can be determined so as to coincide with or be counter to the direction of the continuously circulating polishing medium.

The auxiliary device can be driven via one or more drive shafts and a variable drive gear to enable speed variations of the device for use with different polishing media and/or workpieces of varying shapes and sizes.

In one embodiment of the present invention the auxiliary device comprises pairs of endless roller chains which extend from a sprocket on the drive shaft into the polishing medium and which are looped over suitable chain pulleys rotatably mounted on the stub shafts disposed within the polishing medium. Various mounting devices for holding the workpieces and guiding them through the polishing medium are disposed between cooperating chain pairs.

In another embodiment of the invention the workpieces are mounted to a frame which is rotatable about the stub shafts and which are defined by radially outwardly extending bars that are interconnected by suitable transverse stiffeners. The container for the polishing medium is preferably divided into a plurality of chambers by removable baffle walls. Alternatively, the baffle walls can be fixedly mounted to the container and provided with closable openings to permit the circulation of the polishing medium through some or all chambers. With the help of the closable openings scouring materials and chemical polishing agents can be distributed through all chambers. A screen is mounted to the lower end of each polishing chamber to separate small, fragmented particles of the polishing medium from non-damaged particles.

The present invention further contemplates the provision of cleaning and drying means outside and above the polishing medium. The cleaning and drying means are preferably automatically actuated each time a workpiece that is being removed from the polishing medium passes. In this manner the workpieces can be finished, i.e., cleaned and dried, before they are removed from the auxiliary device. A subsequent handling of the workpieces is thereby eliminated and substantial cost savings accrue.

Aside from the above referred-to workpiece mounts any one of a number of pick-up devices are mounted to cooperating chain pairs to remove workpieces which are not attached to a mount and which are polished while they float within the body of polishing material. Such pick-up devices can comprise screens, grills, magnets and the like.

It has been discovered that the use of glass beads or balls enhances the quality of the finished surfaces of the workpieces. Relatively large indentations in the surfaces of the finished articles, as are formed when steel balls are used as a polishing medium, are thereby eliminated.

To increase the capacity of the vibrating polisher of the present invention, a second container can be placed inside the main work container. The second container is constructed so that it has a vibration frequency which coincides with that of the main container. While some, say large workpieces are passed through the polishing medium in the exterior of the second container a mixture of preferably small workpieces and a polishing medium is continuously or intermittently fed into and withdrawn from the second container. Means for decelerating the flow of the mixture through the second container, such as a continuous spirally shaped member can be placed inside the second container to vary the time period during which the workpieces in the mixture are subjected to the polishing action.

The present invention also provides means for automatically inserting and removing workpieces into and from the main container. Such means comprises an endless belt conveyor or the like to which the workpieces are attached. The belts are suitably guided and pass with the workpieces mounted thereon continuously or in increments through the polishing medium in the main container. It is preferred to construct the belt conveyor and supporting structures so that the belt passes through various, integrated work positions such as mounting, preconditioning, finishing, removal, inspection and cleansing positions. At the preconditioning and finishing stations the belt conveyor can be guided through vibratory conveyors or shakers containing workpieces to be guided to and to be removed from the belt conveyor before and after barrel polishing to increase the cost savings provided by the present invention.

The present invention further contemplates the means for changing the relative position of the workpieces on the auxiliary device to enhance the grinding and polishing action on the surfaces of the workpiece. The mounts for the workpieces

are so constructed that they permit rotation of the workpieces thereon by engaging intermittently spaced detents protruding from the walls of the container or some other suitably positioned structure. In this manner substantially all surfaces of large workpieces face in their direction of movement through the polishing medium for a part of the time they are subject to the polishing action whereby the quality of the finish of the surfaces is increased irrespective of the size of the workpieces.

To control the time periods during which workpieces are subjected to polishing action an adjustable barrier can be mounted to the container. The barrier is particularly useful in instances where a mixture of small workpieces and the polishing medium is discharged into a vibrating conveyor trough. Intermittent removals of relatively large quantities of such workpieces by suitably lowering the barrier are thereby possible.

Endplates of the preferably trough-shaped second container can include intake and outlet chutes or the like to facilitate the stocking and the withdrawal of the second container with grinding or polishing media and/or with relatively small workpieces. Moreover, if the continuous insertion and withdrawal of controlled medium and workpiece quantities is for some reason undesired or not practical the second container can be mounted so that it can be raised to a level where the mixture can be readily discharged.

The invention will be explained in more detail below with reference to three examples of embodiments. In the accompanying drawings:

FIG. 1 shows the front view of a first embodiment of the invention;

FIG. 2 shows a side view of the embodiment illustrated in FIG. 1;

FIG. 3 shows a front view of a second embodiment of the invention;

FIG. 4 shows a side view of the embodiment illustrated in FIG. 3;

FIG. 5 shows a section through the work container;

FIG. 6 is a diagrammatic illustration of a drum as shown in FIGS. 1 and 2;

FIG. 7 is a diagrammatic illustration of the inner face of a drum as shown in FIGS. 1 and 2, including some modifications;

FIG. 8 shows, diagrammatically, a third embodiment of the invention in conjunction with preceding and following processing stages;

FIG. 9 shows a section through one end of the work container illustrated in FIG. 8; and

FIG. 10 shows a section through the other end of the work container illustrated in FIG. 8.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1 and 2, the numeral 1 designates the work container of a vibratory barrelling or polishing device for workpieces. The container is filled in a known manner with a grinding or polishing medium 19 and is oscillated at the required frequency by means of a schematically illustrated vibrator V. Depending on the length of work container 1, it is provided with one or more open or closed partitions 3 each of which may have a slide 4 disposed adjacent the lower end of the container for the opening and closing of an opening communicating adjacent chambers C defined by the partitions.

The faces of the vibrators, particularly the end walls 2, and of the partitions 3 preferably include bosses or chequered plates so that workpieces, particularly those having relatively large flat surfaces, do not adhere to and concentrate at the faces to assure their participation in the normal operational circulation. Stationary stub axles 6, which are axially aligned with one another and on which an auxiliary device 7 is mounted, are provided in the end walls 2 and/or the partitions 3. A continuous shaft can be substituted for the stub axles 6.

In the first embodiment of the invention, the auxiliary device 7 consists of three chain pairs 8*a*–8*b*, 8*c*–8*d*, and 8*e*–8*f* which run over pairs of chain sprockets 9*a*–9*b*, 9*c*–9*d*, 9*e*–9*f* mounted to drive shafts 11 and pairs of chain wheels 10*a*–10*b*, 10*c*–1010*e*–10*f* idling on the stub shafts. A single drive shaft may be provided for all three sprocket pairs or independent drive shafts — one for each sprocket pair — can be driven by independently adjustable speed changers to enable the chain pairs to operate at differing speeds. The chain wheels can be replaced by appropriately constructed guide members.

The workpieces 12 are suspended between the chain pairs 8*a*–8*b*, 8*c*–8*d*, 8*e*–8*f* through appropriately constructed work receiving attachments or mounts 13, and are thus conveyed through the grinding or polishing medium 19 as the chains are driven. To permit the universal use of the auxiliary device 7, the work receiving attachments 13 may be constructed in the form of attachment elements 13*a*, such as eyes, springs, angle members or transverse bars, as screen drums 13*b* or as magnets 13*c*.

The rotating chain pairs 8*a*–8*b*, 8*c*–8*d*, 8*e*–8*f* are preferably provided with pick-up devices 14 such as screens, grates or the like which, together with magnets 13*c*, serve to pick-up smaller workpieces, freely disposed in the polishing medium 19, and remove them from the grinding or polishing medium.

Screen drums 13*b* are intended to receive small and miniature parts. The drums are rotatably secured to and between the chain pairs 8*a*–8*b*, 8*c*–8*d*, 8*e*–8*f*. The mesh size of screen drum 13*b* may be selectively enlarged or reduced so that the grinding or polishing medium 19 present in the work container 1 can pass through the screen drum 13*b*. Alternatively, if the drums are closed grinding and polishing medium is separately introduced into the drums and remains therein to act on the workpieces. Thus, the screen drum can be fully closed and separated from the polishing medium and the polishing particles can be provided with additional cutting surfaces or the like to increase their polishing action and to better utilize their working capacity.

Those grinding or polishing particles which have become too small, as a result of fracture or splitting, are removed through screening inserts mounted to the bottom of work container 1.

If the partitions 3 are open, there is a common chamber in work container 1. If they are closed, however, and consequently serve as partitions, then there are three chambers. In both cases, the oscillations produced by the vibrator V are transmitted to the contents of the container — the grinding or polishing medium and the workpieces 12 — and impart to them the required circulatory motion by appropriate matching of the frequency and the amplitude of the vibrations. As a result of the separate drive, for each of the chain pairs 8*a*–8*b*, 8*c*–8*d* and 8*e*–8*f*, they can be given different driving speeds, to obtain variable grinding and polishing capacities. By deactivating spraying and drying devices 15, 16, one or more chain pairs can be driven in an opposite direction to obtain a counterflow between the circulation of the grinding or polishing medium and the moving workpieces.

Referring to FIGS. 3 and 4, a second embodiment of the invention provides an auxiliary device 7*a* defined by a frame rotatably mounted on stub axles 6 or on a continuous axle (not shown). The frame comprises rods 17 which extend radially from a hub 7*b*, substantially in the form of a star, and which are connected to one another by means of axial transverse rods 18 and circumferentially arranged rods 18*a* situated in the plane of radial rods 17 to thereby increase the rigidity of the frame. Work receiving attachments 13 are secured to rods 17, 18 and 18*a* and, as in the first example, preferably comprise attachment members 13*a*, screen drums 13*b* or magnets 13*c* (not illustrated in FIGS. 3 and 4). Although the auxiliary device 7*a* is illustrated as comprising a unitary frame it can be constructed as a plurality of independently mounted, smaller frames. The frame is disposed inside container 1*a* and is rotated about the stub shafts by the circulating motion of the polishing medium or it is power driven with a separate drive (not shown).

Referring to FIG. 1 and 2, agglomeration of the parts is counteracted by providing a longitudinally grooved roll 20 or

the like, preferably constructed of rubber or plastics, which is rotatably mounted in the two end walls **2** of the container and/or in the partitions **3**. The circulation of the polishing medium rotates the roll whereby the above referred-to agglomeration is prevented.

Referring to FIG. **5**, work container **1** can be surrounded by a jacket **21** and a sound-absorbing medium **22** in the cavity between the container wall and the jacket. A mixture of foam rubber and latex may be used as such medium for example, which can be cured or vulcanized after the foamed structure has been positioned to provide a permanent acoustic insulation.

Referring to FIG. **6**, thermoplastic or molded rubber workpieces are preferably placed into double walled, so called Dewar vessels for their surface finishing. A gap **23** between the two walls is vacuumized to thermally insulate the interior of the drums. The plastic or molded rubber parts are supercooled before they are placed in the drums and remain in that state as a result of the drum's insulating effect. Such an arrangement is necessary since the deburring and surface finishing of plastic and molded rubber parts by vibratory barrelling is only possible if they are in the supercooled state because only then do the parts have the necessary brittleness. If plastic parts are to have a non-glossy or matt finish, the inner wall of the drum may be roughened, for example by providing it with a lining **24** similar to a file cleaner, a lining **25** similar to a reaming tool, or a kind of sandpaper **26** (FIG. **7**).

The linings **24**, **25** or **26** prevent the formation of a high gloss surface finish of the plastic parts as they glide past the linings.

Referring to FIG. **8**, a third embodiment of the invention comprises a work container **1***b* of a vibratory barrelling or polishing apparatus and forms part of a system which includes an auxiliary device **7***d*, a processing container **27** and other special equipment as more fully set forth hereinafter. The entire system consists of, apart from work container **1***b*, an assembly stage I, a pretreatment stage II, a finishing stage III, a dismounting stage IV and a control and cleaning stage V. Within this entire system, transport and guide means **34** to **38** ensure a continuous, uninterrupted flow of grinding or polishing medium as is necessary in a closed production line.

The assembly-line type auxiliary device **7***d* is mainly for handling large workpieces, comprises belts, chains or the like, is guided over guide members or pulleys **30**, guide and tensioning pulleys **31** and idler pulleys **48** and permits the interruption or repetition of the processing steps in accordance with particular requirements for the workpieces being processed. Work receiving attachments **13** are provided for securing individual workpieces to auxiliary device **7***d* for conveying the larger workpieces economically to and through the processing sections. Grooves **50** and **51** disposed in the end plates of the container (see FIGS. **9** and **10**) guide the belts or chains of the auxiliary device through work container **1***b*.

The work receiving attachments **13** on the auxiliary device **7***d* preferably include indexing members **39** which, on contact with stops **40** mounted to work container **1***b*, cause a rotational movement of the attachments and thereby positively change the position of workpieces **49** secured thereto. The workpiece holding attachments may comprise magnetic carriers which can be magnetized at a given point to receive and hold a workpiece and demagnetized at another point to release the processed parts.

Adjustable shaker or vibrating conveyor troughs **32** and **33** are mounted upstream and downstream of work container **1***b* and are disposed at such elevations that the auxiliary device **7***d* runs through them. At the entry to shaker trough **32**, there is provided a guide device or chute **38** which can supply a mixture of workpieces **28** of relatively small dimensions and grinding or polishing medium **19**. The mixture enters work container **1***b* via vibration conveyor trough **32** of the preprocessing stage II, through vibratory action, and is transferred to the vibratory conveyor trough **33** at the finishing stage III over the adjustable overflow bar **41**. A screen **53** positioned at the end of trough **33** separates the grinding or polishing medium **19** from workpieces **28** and the latter are discharged through a chute **52**. The separated grinding or polishing medium **19** drops through an upright, tubular conveying device **34** onto a belt conveyor **35** and it is returned to vibrating conveyor trough **32** by a vertical worm transport device **36**. Workpieces **28** discharged by trough **52** are removed by a belt conveyor **37**. If desired, screen **53** can be replaced by a magnetic separator.

Referring to FIGS. **8–10**, apart from the auxiliary device **7***d*, a second processing container **27** which has a generally snail shape configuration is mounted in work container **1***b*, preferably on its stub axles **6**. The processing container **27** is provided with a closing cover **27***a* which separates the contents of the processing container **27** from the other contents of work container **1***b* and, at the same time, acts as a bridging means during the emptying of the contents of the processing container **27** into the vibrating conveyor trough **33** when the processing container is elevated to its uppermost position by suitable lifting means L. The processing container **27** may be provided with one or more partitions (not illustrated) for the processing of workpieces requiring differing processing conditions.

To increase the capacity and economy of the polishing apparatus illustrated in FIGS. **8–10**, a horizontal cylindrical tube T can be installed instead of processing container **27**. The tube is secured to work container **1***b* with its ends **43** and **44** carried by stub axles **6**, and includes intake and discharge chutes **46**, **47**, respectively, for placing a mixture of small workpieces **28** and polishing medium into and removing it from tube T. The cylindrical tube can be provided with a fixed shaft S which rigidly mounts a spiral-shaped insert **29**. The firmly mounted insert **29** and the vibration ensure that the parts-polishing medium mixture advances relatively slowly from the adjustable intake chute **46**, through an aperture **44**, the cylindrical tube T, an aperture **45**, and out through discharge chute **47**.

To enable the processing of very small parts, the inner wall of cylindrical tube T can be equipped with a helical, inwardly protruding strip (not shown). In this case, in contrast to the previously described modification, the cylindrical tube is open ended so that small cylindrical containers (not shown) having helical grooves in their outer walls can be inserted in the cylindrical tube. As a result of the vibration and of the matching pitch of the helical band in the cylindrical tube and the helical groove on the cylindrical containers, they travel slowly through the cylindrical tube while a rotating action is imparted to them.

As a further alternative embodiment of the invention, stub axles **6** of the work container can be constructed as cylindrically hollow stub shafts which communicate to the exterior of the container and mount a suitable rotary drum which can thus be placed into the interior of the work container. Suitable means, such as one of the chain pairs **8***a*–**8***b* through **8***e*–**8***f*, or independent drive means, can be provided for rotating the drum. This has the advantage that in addition to the vibratory barrelling of the workpieces, the workpieces are also subjected to a rotary surface finishing action. Better surface finishing and/or a higher capacity is thereby obtained. In this embodiment the above described helical, inwardly protruding strip and cylindrical throughput containers having matching helical grooves to control and vary the speed with which the workpieces move through the rotating drum can be included.

Although only indicated above, nevertheless, it is within the scope of the invention for smaller closable containers to be introduced into the processing container **27** as well as for the processing container **27** to be replaced either by a cylindrical tube with a helical insert **29** for the purpose of the axial throughput of the mixture of parts and grinding or polishing medium or the cylindrical containers can be axially conveyed, by force, through the cylindrical tube which is then open. The entire system may, of course, also be extended so that further processing stations are included between the described processing stages I to V, or, for example, for the additional machining of workpieces **49** and **28**.

What is claimed is:

1. Apparatus for treating surfaces of workpieces comprising: a container for receiving a fluid surface treating medium, the container including partition means forming a plurality of work chambers, and means for establishing communication between adjacent chambers across the partition means, means for subjecting the medium to vibrations for circulating the medium in the container, means movable into and out of a container portion receiving the medium and mounted to the container, means for mounting workpieces to the movable means, whereby the workpieces can move through the vibrating medium and be removed therefrom, and screen means mounted at the bottom of each chamber for separating damaged particles of the medium from the remainder of the medium.

2. Apparatus according to claim 1 wherein the workpiece mounting means comprising drums, magnets and means for mechanically securing the workpieces to the movable means.

3. Apparatus according to claim 1 including at least one elongate member having a plurality of sharp, longitudinally extending exterior edges and means for rotatably mounting the member to the container and within the container portion holding the medium to prevent the agglomeration of workpieces floating in the medium.

4. Apparatus according to claim 1 wherein the workpiece mounting means comprises closed drums including means forming a vacummized, airtight, temperature-insulating jacket around an interior of the drum to enable the surface treating of thermoplastic materials under low temperatures.

5. Apparatus according to claim 1 wherein the workpiece mounting means comprises drums having roughened interior surfaces of a hardness exceeding the hardness of the workpieces for obtaining dull surface finishes on the workpieces.

6. Apparatus for treating surfaces of workpieces comprising: a first container for receiving a fluid surface treating medium, means for subjecting the container to vibrations for transfer of the vibrations to the medium to thereby circulate the medium in the first container, a second container disposed interiorly of and connected to the first container for receiving a mixture of relatively small workpieces and a surface treating medium, means for introducing the mixture into the second container and for withdrawing the mixture therefrom, the second container having a configuration whereby the vibration frequency of the first container causes a movement of the mixture through the second container, and an auxiliary device movably carried by the first container and including means for mounting relatively larger workpieces for moving the larger workpieces into, through and out of the medium in the first container.

7. Apparatus according to claim 6 including vibrating troughs disposed adjacent the first container, and means for guiding the workpieces carried by the auxiliary device through the troughs for further treating the surfaces of the relatively larger workpieces.

8. Apparatus according to claim 6 wherein the auxiliary device includes band means carrying the workpiece mounting means, and further including guide means for the band means for guiding the band means in an endless loop through a plurality of additional work stations for completing additional process steps on the larger workpieces.

9. Apparatus according to claim 6 wherein the workpiece mounting means comprises conveyor means, workpiece holding means, means for rotatably connecting the holding means to the conveyor means and projection means fixedly connected to the first container for rotating the holding means and intermittently repositioning the workpieces with respect to their direction of movement.

10. Apparatus according to claim 6 wherein the auxiliary device includes conveyor means, and including barrier means disposed adjacent a portion of the conveyor leaving the first container for raising and lowering the level of the medium in the first container.

11. Apparatus according to claim 6 wherein ends of the second container include openings for admitting and withdrawing the mixture to and from the second conveyor, and including chute means aligned with the second container and mounted to end walls of the first container for admitting the mixture into the second container from the exterior of the first container and for withdrawing the mixture from the second container to the exterior of the first container.

12. Apparatus according to claim 6 including means for raising the second container from its normal working position to a position adjacent a workpiece withdrawal opening in the first container to permit the placement of the mixture in and the withdrawal of the mixture from the second container.

13. Apparatus according to claim 6 including hollow shaft means mounted to the first container, means for suitably mounting the second container to the hollow shaft means, and means for rotating the second container about the shaft means to additionally subject the mixture to rotary motions and the workpiece surfaces to rotary drum finishing.

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