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3,413,764

DEBURRING MACHINE

Filed Dec. 3, 1966

2 Sheets-Sheet 1

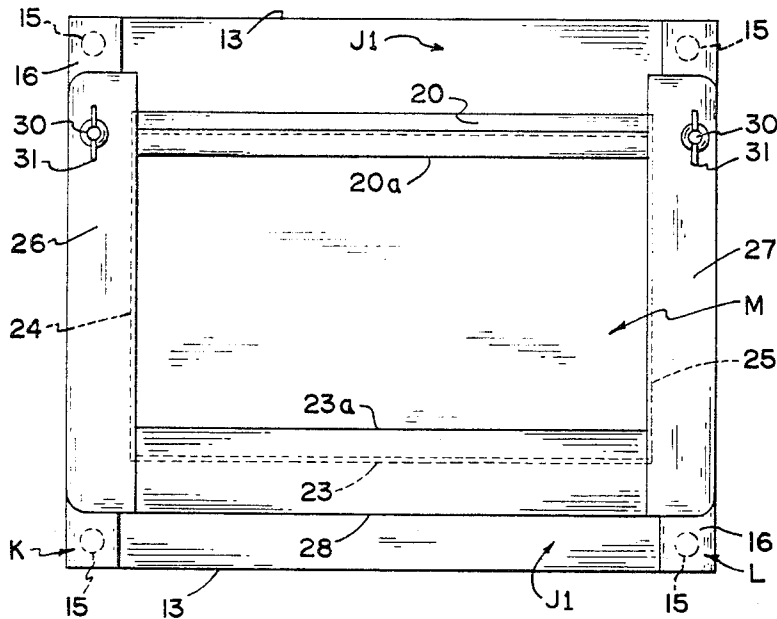


Fig. 2

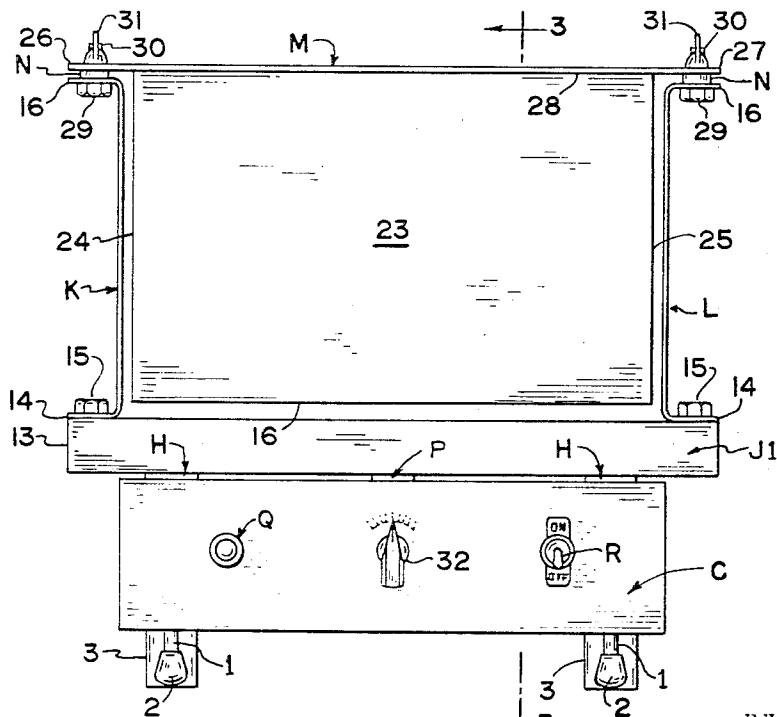


Fig. 1

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2 Sheets-Sheet 2

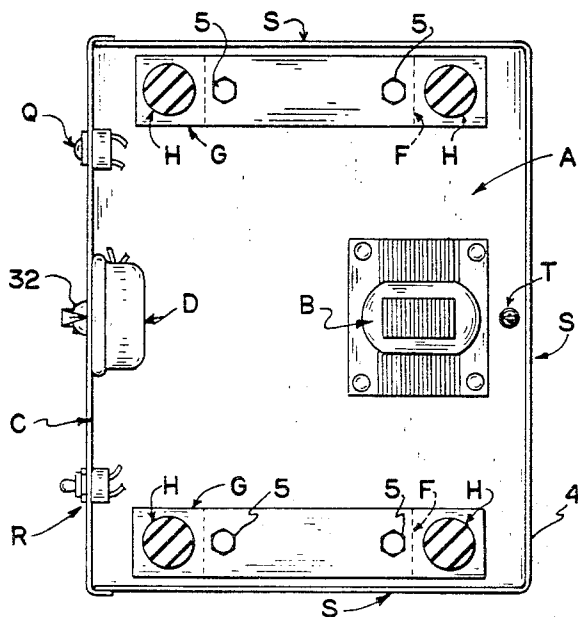


Fig-4

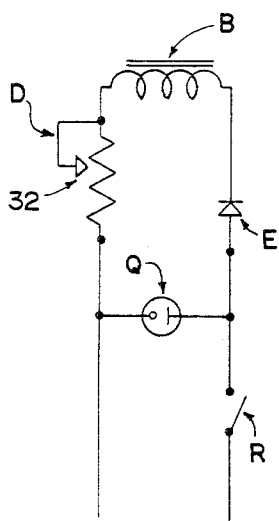


Fig-5

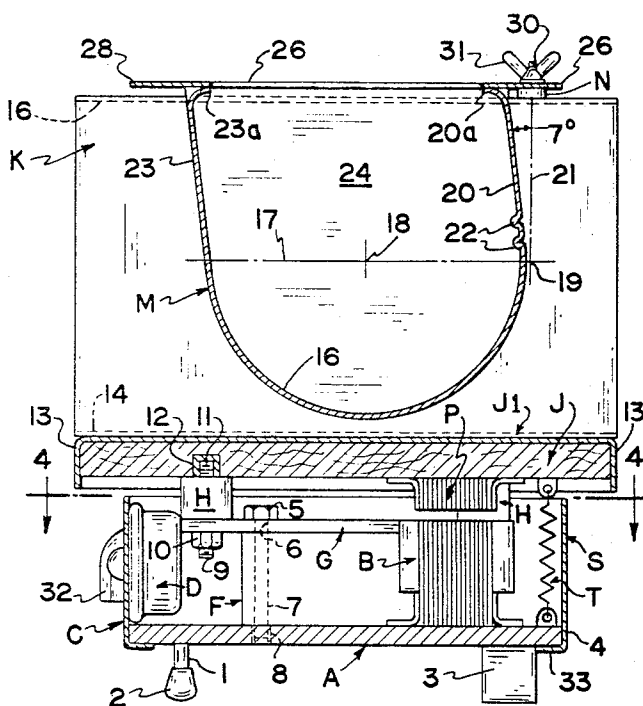


Fig-3

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3,413,764
DEBURRING MACHINE
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The present invention relates to improvements in a portable deburring machine and it consists in the combination, construction and arrangement of parts hereinafter described and claimed.

A vibratory type of deburring machine has advantages over the tumbling barrel type. In the vibratory type the process can be carried out in an open tank that is always ready for inspection. Also every cubic inch of the load in a vibratory type deburrer is in continuous work motion while in a tumbling barrel the work motion affects only a fraction of a given load at a time. During the vibratory deburring process the load is in partial suspension due to the vertical vibration. This partial elimination of gravity pressure makes possible the successful processing of extremely fragile parts which could be damaged in a tumbling barrel.

The work container or open tank may be provided with a resilient liner to protect the parts which might conceivably be damaged or otherwise be affected by the metallic surface of the tank. One or more horizontal and inwardly extending ribs may be provided in the tank to afford traction to the material being deburred, this traction aiding in the continual turn-over of the material in the tank.

A vibratory process is designed to perform specific cleaning, fine finishing and polishing to the product in the tank. Surface treatment of metal parts, ceramics and plastics is possible. The vibration is accomplished by an electro-magnet into which a direct current pulse is sent. An armature is vibrated by the magnetic pulses and in turn vibrates the tank. A rheostat controls the amplitude of vibration. Uncontrolled vibration cannot be described as usable or workable amplitude.

One of the objects of my invention is to support the open-top tank adjacent to its rear wall. The greatest amplitude of vibration is applied at the rear wall and there is a progressive damping effect of the amplitude of vibrations from the rear to the front wall so that the vibration at the front wall is practically zero. This will cause the material in the tank to be vibrated more at the rear of the tank than at the front with the result that the material will move upwardly at the back of the tank creating a continuous back to front rotation of the material in the tank. All of the material will be in partial suspension because of the vertical vibrations and a deburring of all of the material will continually take place. Since only the rear of the tank is supported and since the vibrations to the tank are only applied at its rear, the front of the tank is free to remain at substantially zero vibration or to generate its own frequency period.

A further object of my invention is to provide a portable deburring machine that is simple in construction and is durable and efficient for the purpose intended.

Other objects and advantages will appear as the specification continues and the novel features of the invention will be set forth in the appended claims.

DRAWINGS

For a better understanding of my invention, reference should be made to the accompanying drawings, forming a part of this application, in which:

FIGURE 1 is a front elevation of the portable deburring machine.

FIGURE 2 is a top plan view.

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FIGURE 3 is a transverse section through the portable deburring machine and is taken along the line 3—3 of FIGURE 1.

FIGURE 4 is a horizontal section through the portable deburring machine and is taken along the line 4—4 of FIGURE 3.

FIGURE 5 is a wiring diagram.

While I have shown only the preferred form of my invention, it should be understood that various changes, or modifications, may be made within the scope of the annexed claims without departing from the spirit thereof.

DETAILED DESCRIPTION

In carrying out my invention, I provide a steel base plate indicated generally at A in FIGURES 3 and 4. The base plate is supported by a pair of front legs 1, see also FIGURE 1 that have non-compressible feet 2, mounted at their lower ends. Near the rear of the base plate there are mounted neoprene feet 3 that have a heavy compression ratio. An electromagnet B is mounted on the base plate A and near the rear edge 4 thereof for a purpose hereinafter described.

A front panel C is secured to the base A, see FIGURES 1, 3 and 4, and extends along the front edge of the base. A rheostat D is mounted on the inner surface of the panel C and a wiring diagram in FIGURE 5, illustrates how the rheostat is electrically connected to the electro-magnet B, and to an alternating current source. A diode E is connected into the circuit so as to block one half of the alternating cycle to induce current that is fed into the electro-magnet B. The rheostat D controls the voltage entering the electro-magnet. The electric circuit will be described more in detail at a later place in the specification.

Referring to FIGURES 3 and 4, it will be seen that I mount two steel blocks F—F on the base plate A and near the two side edges of the plate. Mounting straps G—G are placed on top of the blocks and cap screws 5 extend through holes 6, in the straps and these holes are aligned with bores 7, provided in the steel blocks F. The lower ends of the cap screws 5 are threaded into bores 8, provided in the base plate A.

The ends of the mounting straps G—G extend beyond the ends of the steel blocks F—F, as is clearly shown in FIGURES 3 and 4. I provide four rubber mounts H and secure two of these to the ends of each of the mounting straps G. FIGURE 3 shows one of the rubber mounts with a depending threaded shank 9 that extends downwardly through an opening near an end of the mounting strap G, and a lock nut 10 is mounted on the shank for securing the rubber mount in place. Each rubber mount H also has an upwardly extending threaded shank 11 that is screwed into a threaded socket 12, the latter being mounted in a wooden platform or base J. Four of the sockets 12 are mounted in the wooden platform and in this way the platform is resiliently supported by the mounting straps G. A metal cover plate J1 extends over the wooden platform J and it has depending flanges 13 that extend downwardly on all four edges of the platform and project below the underside thereof as shown in FIGURE 3.

The wooden platform J and cover plate J1, support two spaced apart side brackets K and L, see FIGURES 1, 2 and 3. Both side brackets have lower outwardly extending flanges 14 that are fastened to the cover plate J1 and wooden platform J by any means desired such as by wood screws 15 or bolts. The tops of the side brackets K and L are also provided with outwardly extending flanges 16.

A tank M or material tumbler is mounted between the two side brackets K and L and is supported in a novel manner. The tank has a bottom 16 curved in substantially the shape of a half cylinder, see FIGURE 3. A horizontal

plane indicated by the dot-dash line 17 and extending through the longitudinal axis 18 of the half cylindrical bottom 16, cuts through the half cylindrical bottom at 19. At this juncture 19, the rear wall 20 of the tank extends upwardly and forwardly making an angle of 7° with a vertical plane indicated by the dot-dash line 21, this vertical plane being tangent to the half cylindrical portion 16. The top 20a of the rear wall is curved inwardly a slight distance and the rear wall may have one or more inwardly extending ribs 22. The ribs preferably extend horizontally across the back wall 20 of the tank and additional ribs, not shown, may be provided in the curved bottom portion 16 of the tank.

The front tank wall 23 preferably parallels the rear wall 20 and is tangent to the front of the half cylindrical portion 16. FIGURE 3 illustrates the upper front edge of the front wall 23 being curved inwardly a slight distance as indicated at 23a. The tank has flat side walls 24 and 25 that are spaced inwardly from and lie parallel to the side brackets K and L, respectively. At the tops of the side walls 24 and 25, the tank M is provided with outwardly extending flanges shown at 26 and 27, respectively in FIGURE 2. Also at the front and top of the tank, a transversely extending lip or forwardly projecting flange 28 interconnects the two outwardly extending side flanges 26 and 27.

I previously stated that the tank M was supported between the side brackets K and L in a novel manner. Note from FIGURES 1 and 3 that the upper flanges 16 of both side brackets have spacing washers or shims N and these are placed near the rear ends of the flanges 26 and 27 for the tank M. The shims N are preferably disc-shaped and about one-eighth inch thick with a center hole therein. The flanges 16 of the side brackets K and L have cap screws 29, whose heads are welded or otherwise secured to the undersides of the flanges and whose threaded shanks 30 extend upwardly through aligned openings in the flanges 16, the shims N, and the tank flanges 26 and 27, see FIGURE 2. Wing nuts 31 are mounted on the threaded shanks 30 and secure the tank flanges 26 and 27 to the top flanges 16 of the side brackets K and L.

Note from FIGURE 3 that the tank flange 26 is spaced above the top flange 16 of the side bracket K, and that the connection between the tank and the side bracket is disposed near the rear wall 20 of the tank. Also in the same figure it will be seen that the electro-magnet B is disposed beneath the rear portion of the half cylindrical bottom 16 of the tank M. An armature P is mounted under the wooden platform J and is positioned directly above the electro-magnet. Therefore when the magnet is energized, it will attract the armature and the latter will pull downwardly on the wooden platform J in the area directly below the rear portion of the half cylindrical bottom 16 of the tank. The electro-magnet is intermittently energized in a manner presently to be described and this will cause the armature P to deliver a vertical vibratory action on the platform J and side brackets K and L, near the rear portion of the tank. It is at the rear portion of the tank that the cap screws 29 make the connections between the side brackets and the flanges 26 and 27 of the tank.

The tank M will therefore vibrate more at its rear portion than at its front wall 23 because the amplitude of vibration will be damped out gradually from the rear wall to the front wall of the tank. One of the novel features of the invention is that the tank flanges 26 and 27 are spaced above the top flanges 16 of the side brackets K and L. The only connections between the flanges are the cap screws 29 and the spacing shims N. Since the tank flanges 26 and 27 are free of the side brackets K and L except for their points of connection at the cap screws 29, the damping effect of the vibrations toward the front of the tank will be independent of any damping effect of the vibrations on the side brackets from the rear positions to the front portions of these brackets.

OPERATION

From the foregoing description of the various parts of the device, the operation thereof may be readily understood. The front panel C supports the rheostat D and a control knob 32 is provided for the rheostat and extends in front of the panel, see FIGURES 1, 2 and 3. A signal light Q is also mounted on the front panel and the wiring diagram in FIGURE 5 shows that when the ON-OFF switch R is closed, the light Q will be energized and will indicate the machine is operating.

The material to be deburred or cleaned is placed in the tank M. A lining, not shown, may be applied to the inner surface of the tank if desired. All kinds of items may be deburred, cleaned or polished, such as metallic and rubber parts, plastics, ceramics or elastomers, i.e., items that can stretch and will return to original form. The material may be operated in a wet or dry condition. Delicate parts may be handled. The abrasive used may vary in size and shape. Silicon carbide, aluminum oxide or a Carborundum material may be used.

When the switch R is closed, the alternating current will energize the light Q, see the wiring diagram in FIGURE 5. The diode E blocks one half of the alternating cycle to induce a pulsating D.C. current that will be fed to the electro-magnet B. The rheostat D will control the voltage. The pulsating direct current will provide sufficient "dwell" periods between pulsations to permit the rubber mounts H to restore themselves and to return the wooden platform J and tank M back to normal position, ready for the next pulse.

The resilient support feet 3 at the back of the machine and the rubber mounts H at the back of the platform J permit the greater amount of the vibration to remain at the rear of the tank M. The electro-magnet B and the armature P are positioned under the rear portion of the tank M for the same purpose. The damping effect of the vibrations toward the front of the tank is independent of any damping effect of the vibrations toward the front portions of the side brackets K and L because the tank front is held clear of the front portions of the brackets. The tank front will therefore have its amplitude reduced substantially to zero and this will depend on what type and weight of material are in the tank and whether the mixture is dry or wet. The operator turns the rheostat knob 32 to cause the electro-magnet B and the armature P to deliver the proper amplitude of vibration to the tank M for the material being treated.

FIGURES 3 and 4 illustrate how the various parts may be assembled on the base plate A and the front panel C. Then the parts on the base plate may be enclosed in a three-sided panel S that extends around the back and two sides of the base plate. The three-sided panel S has inwardly extending flanges 33 on all three sides that are placed under the bottom of the base plate and are secured thereto by screws, not shown, or other suitable fastening means. One or more tension springs T interconnect the base plate A, with the wooden platform J, see FIGURE 3.

The greater vibration at the rear of the tank M, than at the front, will cause the material in the tank to slowly revolve in a counterclockwise direction when looking at FIGURE 3. The horizontal ribs 22 on the rear wall 20 of the tank will aid in the traction of the material on the tank wall. The forwardly inclined rear tank wall 20 will cause the top material to move toward the front of the tank and this will aid in revolving the material in a counter-clockwise direction while the material is being vibrated.

The container or tank M is usually provided with a liner, not shown, as protection to parts which might conceivably be damaged or otherwise be affected by coming into contact with the metal surface of the tank.

Uncontrolled amplitude of vibrations cannot be described as usable or workable amplitude. Therefore a rheostat is used to control the amplitude of vibrations.

The media used in the tank M can be of two types—abrasive and non-abrasive. The manufactured media may be fused aluminum oxides, abrasive "chips" or "nuggets." The media may also be preformed. Four kinds of compounds may be used and these are: abrasive compounds; 5 burnishing compounds; cleaning or non-abrasive compounds; and deburring or descaling compounds.

My deburring machine is portable. The tank M and the side brackets K and L are so designed that when the machine is lifted, the operator must grasp the flanges 16 which are a part of the side brackets. The side flanges 26 and 27 of the tank M are spaced only a slight distance above the side bracket flanges 16 and therefore it is impossible to lift the machine by only the tank flanges 26 and 27. 10

When changing tank loads, it is a simple matter to free the wing-nuts 31 from the threaded shanks 30 and lift the tank M from between the side brackets K and L, after which another tank M may be mounted on the side brackets. 15

I claim:

1. A deburring machine comprising:

- (a) a tank for holding the material to be deburred;
- (b) said tank having a substantially half cylindrical bottom and a rear wall extending upwardly from the back portion of said bottom, said rear wall being inclined forwardly at an angle to a vertical plane that lies tangent to the arcuate bottom; 25
- (c) means for supporting said tank only at its rear; and
- (d) means for applying a vibratory force only at the rear of said tank, the amplitude of vibration being gradually damped from the rear to the front of said tank; 30
- (e) whereby the material in said tank will be vibrated and the mass of material that contacts with the rear tank wall and with the portion of the rounded bottom disposed adjacent to said wall will be moved upwardly and then forwardly at the top of the material for causing the entire mass to slowly revolve in said tank. 35

2. The combination as set forth in claim 1 and in which

- (a) at least one longitudinal rib extends in to the interior of said tank at the rear portion thereof to aid in traction between the material and the inner surface of the tank for revolving the material in said tank while the material is being vibrated. 45

3. The combination as set forth in claim 1 and in which 50

- (a) said tank has an open top and the upper edge of said rear wall is curved forwardly to direct any material forwardly into said tank that contacts with said upper edge.

4. The combination as set forth in claim 1 and in which 55

- (a) said means for supporting said tank includes
- (b) a pair of side brackets arranged along the sides of and spaced from the adjacent sides of said tank, the tops of said side brackets having outwardly extending flanges; 60

(c) said tank having side walls whose upper edges have outwardly extending flanges that overlie said bracket flanges; and

(d) connections between each bracket flange and its associated tank flange at a point near to the rear of the tank, the connection spacing the tank flange above its associate bracket flange so that said tank is free to vibrate independently of said brackets except at their point of connection.

5. The combination as set forth in claim 4 and in which

- (a) a platform supports said side brackets and extends under said tank;
- (b) said vibratory means includes
- (c) an armature mounted on said platform and disposed near to the rear of said tank;
- (d) means for resiliently supporting said platform; and
- (e) an electro-magnet for attracting said armature for vibrating said platform each time said electro-magnet is energized. 15

6. The combination as set forth in claim 5 and in which

- (a) electrical control means is connected to said electro-magnet and to a source of current for controlling the voltage to said electro-magnet for varying the amplitude of the vibrations of said armature.

7. The combination as set forth in claim 4 and in which

- (a) each bracket flange and its associate tank flange form a natural handgrip for the hand of a person who desires to transport the machine, the weight of the machine being carried by the bracket flanges rather than by the tank flanges.

8. The combination as set forth in claim 4 and in which

- (a) the connections between each bracket flange and its associated tank flange includes
- (b) a threaded shank extending upwardly from the bracket flange and removably received in an opening in the associated tank flange;
- (c) a spacing washer mounted on said shank for spacing the tank flange above its associated bracket flange; and
- (d) a wing nut removably mounted on said shank for connecting the tank to the bracket, the washer spacing the remainder of said tank flange above its associate bracket flange;
- (e) whereby said tank can be quickly disconnected from said brackets by removing the wing nuts and lifting the tank from said shanks. 60

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HAROLD D. WHITEHEAD, *Primary Examiner.*