# United States Patent

[11] 3,604,158


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[21] Appl. No. **798,370**
[22] Filed **Feb. 11, 1969**
[45] Patented **Sept. 14, 1971**



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[54] **APPARATUS FOR TREATING CYLINDRICAL WORKPIECES**
**8 Claims, 8 Drawing Figs.**


[52] **U.S. Cl.** ..... **51/15**
[51] **Int. Cl.** ..... **B24c 3/14**
[50] **Field of Search** ..... 51/14, 9, 15



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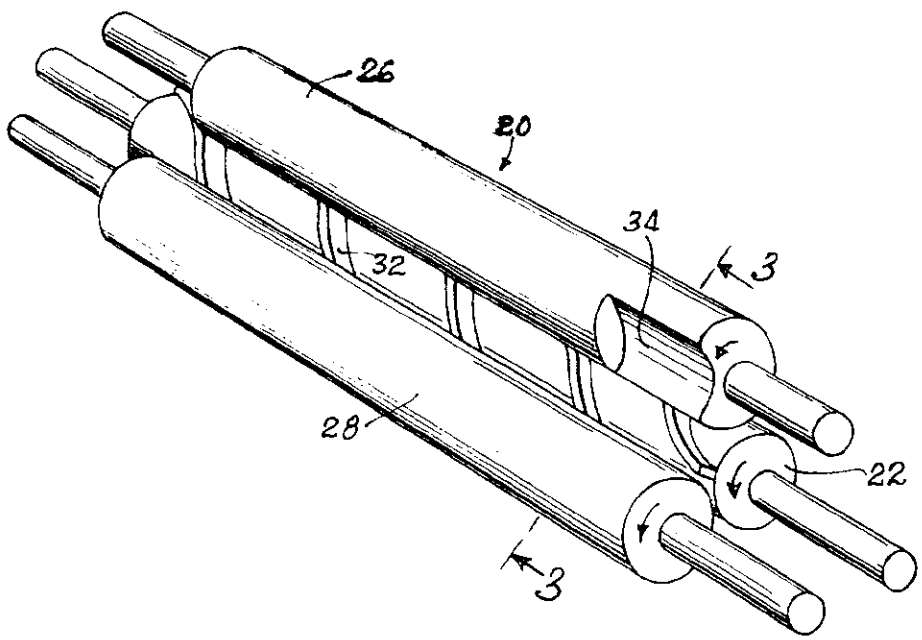
**ABSTRACT:** In order to provide for the complete surface treatment of cylindrical workpieces a surface-treating machine is provided with a roll cluster including a feed roll and guide rolls extending through a treatment chamber. The feed roll has a screw flight having a pitch a little greater than the length of a workpiece and workpieces are deposited in one pitch length of the screw flight by a contoured portion in one of the guide rolls.

# APPARATUS FOR TREATING CYLINDRICAL WORKPIECES

## BACKGROUND OF THE INVENTION

This invention relates to the apparatus for the surface treatment of cylindrical workpieces. More particularly, it relates to improvements in that portion of such apparatus for handling such workpieces during the treatment process.

While this invention is described with particular reference to the blasting of the surfaces of cylindrical workpieces, such as coil springs, with dry abrasive or other particular material for surface cleaning, shot peening the surface, for surface hardening, or for producing a matte or the like surface on the workpieces, it will be understood that the described means for exposure of the surfaces of the workpieces to the blast of particulate materials can be employed in other processes or procedures for surface treatment.

In treating processes and apparatus of the type described it is important that the entire surface of a workpiece undergoing treatment be exposed to the action of the treating material. In some instances the prior art has sought to effect this result by placing the workpieces in a tumbling device wherein they are rotated with the expectation that over a period of time the entire surface of each workpiece will be sufficiently exposed to the action of the treating material in order to complete the operation. This is not completely satisfactory inasmuch as it is sometimes necessary to prolong the treating operation longer than is desired in order to do the complete job. This approach is particularly subject to difficulty where the cylindrical workpieces are coil springs, in which case they tend to become tangled and one or more will lock together, thus preventing the entire surface of each workpiece from having the desired exposure to the treating material. Another approach has been to use conveyor rolls in conjunction with a means to push the workpieces along the rolls. In prior art devices of this type, as before, tangling of coil springs is very likely to occur and very frequently the end of one workpiece contacts the ends of other workpieces, thus preventing the exposure of the ends to the action of the treating material. In addition, such end contact may result in pileups or jams, further interfering with the ability of the apparatus to provide a smooth and continuous surface treatment.

Therefore, it is an object of this invention to provide surface-treating apparatus for cylindrical workpieces in which there is a continuous progression of the workpieces through the treating area and in which each workpiece is advanced, spaced from any other workpiece, in such a manner as to obtain complete exposure of the entire surface of the workpiece to the action of the treating material.

These and other objects are achieved by the provision of a surface-treating apparatus in which there is a conveyor constructed to receive spaced-apart workpieces and to advance them through a treating chamber in such a way as to maintain their spaced-apart condition and at the same time to rotate them on the surface of the conveyor so as to expose their entire surfaces to the action of the treating material.

## BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of this invention will hereinafter appear and for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawings in which:

FIG. 1 is a view of a surface-treating apparatus in accordance with this invention, partially isometric and partially cut away, to illustrate the conveyor system in accordance with this invention;

FIG. 2 is an isometric view of conveyor apparatus in accordance with this invention;

FIGS. 3*a* to 3*c* are views along the lines 3—3 of FIG. 2 illustrating the manner in which workpieces are delivered to the conveyor to be transported thereby;

FIG. 4 is a partial side view of the conveyor embodying the invention illustrating workpieces in transit thereon;



FIG. 5 is an end view of an alternative apparatus embodying the invention; and

FIG. 6 is a side view of a means for advancing the workpieces in the embodiment of FIG. 5.

## DETAILED DESCRIPTION

FIG. 1 illustrates a treating apparatus constructed in accordance with this invention. This apparatus comprises a treating chamber 2 provided with an entry opening 4 and an exit opening 6 at its opposite ends, so that a workpiece may enter through the opening 4, proceed through the treating chamber, and leave at the exit opening 6 to be deposited in a suitable receptacle or further conveyor for transportation away from the treating apparatus.

The particular treating apparatus shown takes the form of means for causing small steel shot to be propelled against the surface of the workpiece for shot peening the surface. The steel shot is maintained in a feed hopper 8 which is provided with one or more feed tubes 10. The feed tubes 10 enter the side of housings 12 in which are mounted for rotation and driven by suitable drive means (not shown) centrifugal blasting wheels. The centrifugal blasting wheels are of conventional construction so that their detailed description is deemed to be unnecessary. As is well known, they may comprise bladed wheels having a plurality of blades extending radially outward from a central feed trough through which the particular treating material, such as steel shot, is introduced onto the ends of the al., while the balded wheel is rotated rapidly about its axis, whereby the treating material travels rapidly outwardly to the ends of the blades and is thrown centrifugally from the blades onto the surfaces of the workpieces. After impinging upon the surfaces of the workpieces, the treating material falls to the bottom of the treatment chamber 2 where it is transported by a conveyor (not shown) to an elevator 14. It is then carried upwardly by the elevator 14 and through a conveyor duct 18 to a separator 16 which is employed to separate the treatment material from undersized broken shot, dust, dirt, and other material removed from the treated surfaces of the workpieces pieces and which operates to return the treating material to the feed hopper 8 for reuse. The apparatus thus described may be similar to that shown and described in greater detail in the U.S. Pat. to H. F. Schulte et al., No. 3,383,803 which is assigned to the same assignee as is this application.

Referring to FIG. 2, in addition to FIG. 1, in order to provide for the transportation of workpieces through the treating chamber 2 and at the same time maintain the workpieces in a spaced-apart condition and to insure the exposure of their entire surfaces to the action of the treating material, this embodiment of the invention provides a roll cluster 20 which includes an elongated feed means 22 which is shown extending horizontally through the treatment chamber 2 and is mounted at each of its ends for rotation about its horizontal axis by suitable fixed-bearing supports 24. The roll cluster also includes in the illustrated embodiment a pair of guide rolls 26 and 28 which are mounted in a common horizontal plane a slight distance above the feed roll 22 which distance is slightly less than the diameter of a workpiece being transported. The guide rolls 26 and 28 are likewise mounted at their ends in fixed-bearing supports 30 for rotation about their horizontal axis. Suitable motor drive means (not shown) are provided for all the rolls in roll cluster. As may be seen from the arrows indicating direction of rotation on the feed roll 22 and guide rolls 26 and 28 in FIG. 2, these rolls are all arranged to be driven in the same direction.

In order to transport the workpieces, the feed roll means 22 is associated with a means to move them which in this embodiment takes the form of a screw flight 32 extending along the length of its periphery. The pitch of this screw flight is selected to be slightly greater than the length of a cylindrical workpiece being transported, so that an individual workpiece may be deposited in a manner to be described hereinafter within a single pitch of the screw flight and advanced by the rotation of

the feed roll. In this manner the end of one workpiece will not contact another, so that ends will be continuously exposed to the action of the treating material, and in the event the workpieces take the form of coil springs they will not become tangled with each other, causing pileups or jams.

In order to provide for the spaced deposition of individual workpieces in the screw flight on the feed roll **22**, the guide rolls **26** and **28** are spaced a distance apart which is less than the diameter of a workpiece but which is at the same time wide enough to permit the treating material propelled by the blasting wheels to enter from the top, impinge upon the surface of the workpiece to effect its treating function, and exit to the bottom of the treatment chamber **2** to be removed therefrom. The means further provided to effect the function of depositing the workpieces individually in the screw flight comprises the provision of a cutout contour or concave portion **34** provided at that end of the guide roll **26** which is deposited adjacent to the entry openings **4** of the treatment chamber. This concave portion is shaped to conform to the surface of a workpiece and its dimensions and distance from the feed roll **22** is selected to be such that as the guide roll **26** rotates along with the guide roll **28**, an opening will be provided once every revolution which will be large enough to permit a workpiece to pass between the guide rolls and deposited in the screw flight **32** between pitches of the flight ribbon.

FIGS. 3*a*–3*c* illustrate the manner in which this is done. In these figures illustrated by dotted lines are the end views of two workpieces **36** and **38** shown in different positions depicting the path of a workpiece in the act of being deposited in the screw flight. In FIG. 3*a* a workpiece **36** has just been delivered from the delivery shoot **42** of a device for holding such workpieces and delivering them in a spaced-apart fashion. The workpiece **36** is resting on top of guide rolls **26** and **28** prior to the arrival of concave portion **34** on guide roll **36**. FIG. 3*b* illustrates the workpiece **36** in the process of passing through the guide rolls **26** and **28**. Rotation of the guide rolls advances the concave portion **34** toward the workpiece and allows it to engage the concave portion and pass through vertically downward between the guide rolls. A second workpiece **38** is held in the delivery shoot **42** ready to be deposited on to guide rolls **26** and **28**. In FIG. 3*c* workpiece **36** has passed through the guide rolls and, resting in the screw flight **32** it has been advanced along the surface of the feed roll **22** into the plane of the paper as shown in the drawing. The workpiece **38** is now delivered onto the guide rolls **26** and **28** and duplicates the loading positions of workpiece **36** during the next revolution of the roll cluster **20**. Of prime importance is the necessity for the proper timing of the rotation of concave portion **34** relative to the screw flight **32** in order to insure deposit of workpieces between pitches of the screw flight rather than on the top of the screw flight. The mechanism for accomplishing this type of synchronized rotation is, of course, well known.

The workpieces may be delivered individually to the concave portion **34** by a feeding device capable of aligning and spacing the working piece. Such devices are well known in the art and one such is sold under the trade name "Syntron." This device is represented schematically at **44** in FIG. **1** and includes the delivery chute **42**. In order to provide for spaced-apart delivery of the workpieces the delivery chute may be provided with a controlled release or escapement devices. Such devices are commercially available with feeding devices of the type suggested.

As may further be seen in FIG. **3**, the lower surfaces of the guide rolls **26** and **28** are spaced from the feed roll **22** by a distance slightly less than the diameter of the workpiece **36** so as to engage its upper surfaces. By virtue of this engagement the guide rolls function as holddown rolls and keep the workpieces from bouncing off the screw flight and feed roll. In addition, they contribute to the rotation of workpieces so as to effect the exposure of the entire surface of the workpiece to the action of the treating material as it passes between the guide rolls.

Obviously, the relative dimensions of the screw flight **32**, the feed roll **22**, guide rolls **26** and **28**, and their spacing can be varied in order to accommodate workpieces of varied sizes. In addition, a single treating machine can be provided with a plurality of roll clusters **20**, in order to accommodate workpieces of different dimensions in the same treating apparatus simultaneously.

The roll cluster **20** may take a number of different forms. In one such form instead of using a feed roll **22** and screw flight **32**, a pair of spaced support rolls **46** and **48** may be provided to receive a workpiece **36** after it has passed through the guide rolls **26** and **28**. As may be seen in the drawing, these rolls are spaced a distance apart to support the workpiece and to provide access for the spaced fingers **50** on a conveyor chain **52**. The conveyor chain **52** is mounted on sprockets **54** and **56**, one of which may be driven to cause movement of the conveyor chain. The fingers **50** are dimensional in the vertical direction also as to engage the bottom of a workpiece and advance it through the treatment chamber They are spaced apart a sufficient distance to accommodate the length of the workpiece. This embodiment operates in a similar fashion to that previously described except that the workpiece is deposited between the fingers **50** instead of in the pitch of a screw flight. The rollers **46** and **48** may be driven in order to insure rotation of the workpiece and treatment of its entire surface. As before, the rotation of the concave portion **34** of the guide roll **36** must be synchronized with the movement of the fingers **50** in order that the workpiece be deposited between those fingers rather than on top of them.

It will be apparent from the foregoing that the invention provides apparatus for transporting spaced-apart workpieces which are transported in such a manner as to insure uniform exposure of their entire surfaces to the action of the treating material without running the risk of pileups, and yet at the same time permits a continuous treating process to be carried out.

It will be understood that changes may be made in the details of construction, arrangement, and operation without departing from the spirit of the invention, especially as defined in the following claims.

What I claim and desire to secure by Letters Patent of the United States is:

**1**. An apparatus for the surface treatment of cylindrical workpieces including a treatment chamber, means for introducing treating material into said chamber and removing said material therefrom, the improvements comprising: means disposed in the treatment chamber for transporting workpieces therethrough comprising means for moving the workpieces in a spaced-apart relationship through said chamber and elongated guide rolls rotatable about an axis parallel to the path of the workpieces; said guide rolls spaced a distance from each other less than the diameter of a workpiece; one of said guide rolls having at one end thereof a concave portion conforming to the periphery of a workpiece formed in a portion of this periphery; and means for feeding workpieces to said one end of guide roll to deposit workpieces in said concave portion whereby said guide rolls are rotated a workpiece is moved in said concave portion and deposited on said means for moving the workpieces and then advanced through said chamber.

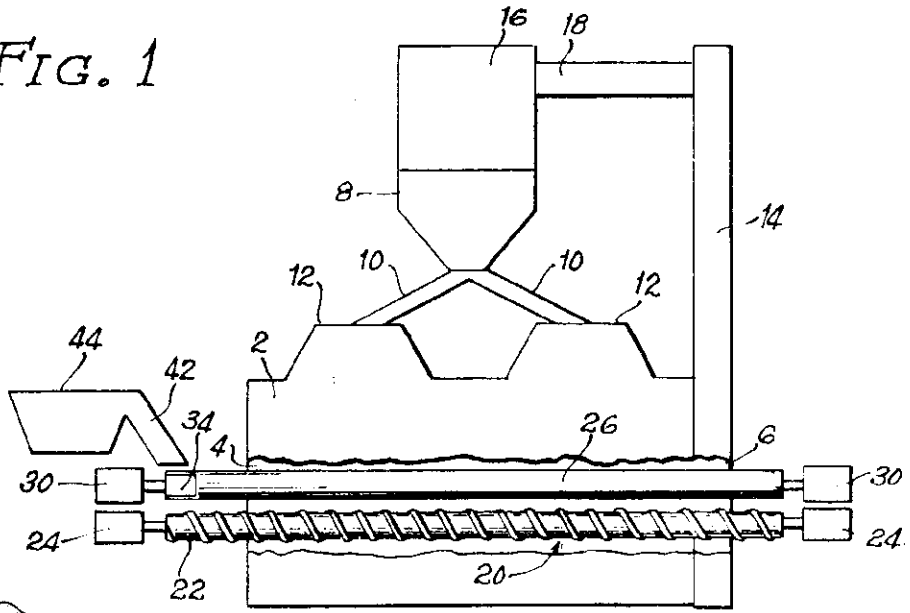
**2**. The apparatus of claim **1** wherein said moving means includes a feed roll having a screw flight on the periphery with a pitch slightly greater than the length of a workpiece.

**3**. The apparatus of claim **2** wherein said guide rolls engage a workpiece in said screw flight and rotate it about its longitudinal axis as it advances through said treatment chamber.

**4**. The apparatus of claim **1** wherein said guide rolls are spaced apart whereby treating material may pass therebetween and impinge upon the entire surface of a workpiece as it advances through said treatment chamber.

**5**. The apparatus of claim **1** wherein said means for transporting workpieces extends horizontally and comprises a pair of guide rolls and a feed roll means disposed beneath said guide rolls.

FIG. 1



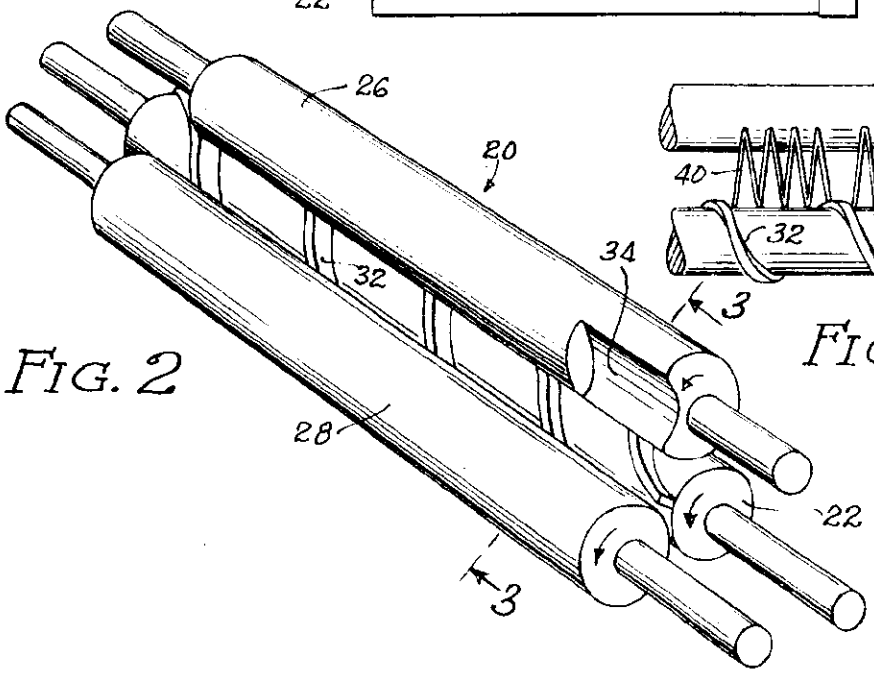




FIG. 2




FIG. 4

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6. The apparatus of claim 3 wherein said guide rolls are spaced apart whereby treating material may pass therebetween and impinge upon the entire surface of a workpiece as it advances through said treating chamber.

7. The apparatus of claim 1 wherein said transporting means includes a pair of spaced apart rolls and wherein said moving means includes driving means positioned between said spaced rolls having spaced elements engageable with the workpieces.

8. The apparatus of claim 7 wherein said driving means comprises an endless chain having a plurality of fingers extending upwardly between said spaced-apart rolls and spaced from each other a distance greater than the length of a workpiece.

FIG. 3a

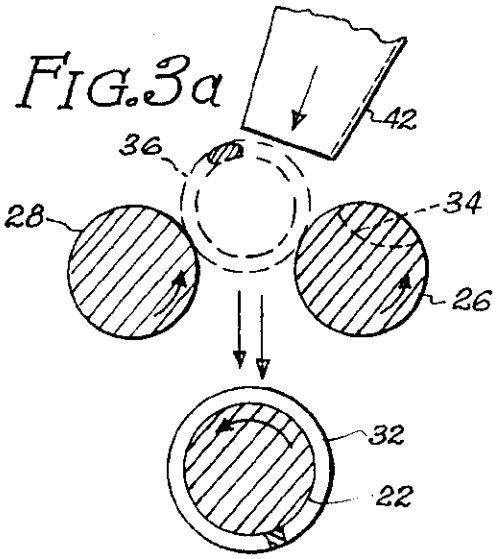


FIG. 3b

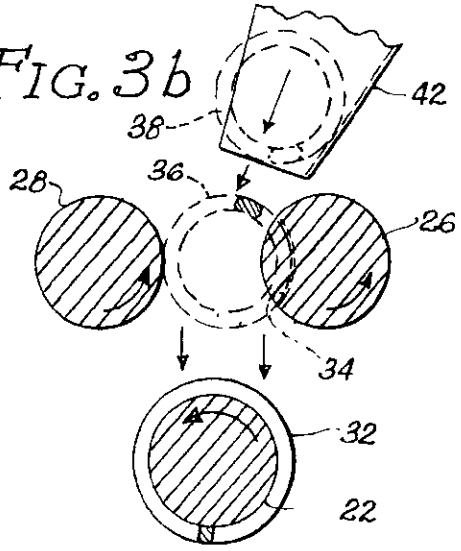


FIG. 3c

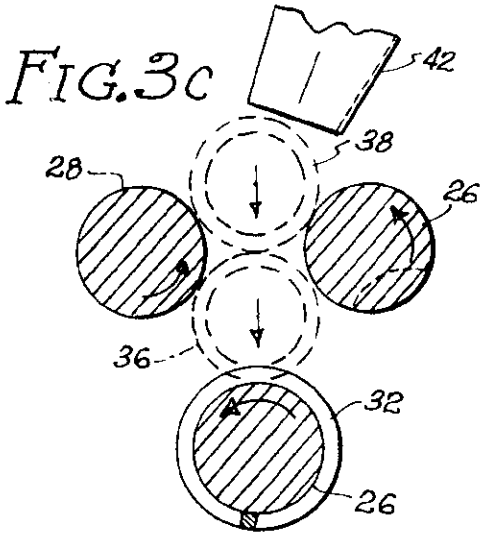


FIG. 5

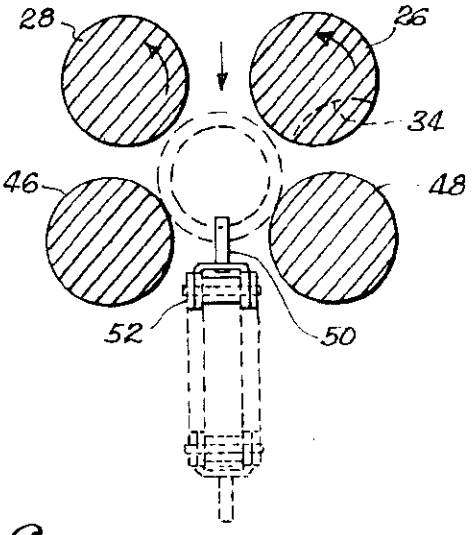


FIG. 6