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 particular 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 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 treatment 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 to 5 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 ., while the balder 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 centrifugally treating material falls by a conveyor (not shown) to an elevator 14. It is then carried upwardly by the elevator 14 and through a conveyor duct 16 to a separator 18 which is employed to separate the treating material from undispersed broken shot, dust, dirt, and other material removed from the treated surfaces of the workpieces and which operates to return the treating material to the feed hopper 8 for reuse. The apparatus thus described is similar to that shown and described in greater detail in the U.S. Patent to H. F. Schulte et al., No. 3,383,803 which is assigned to the same assignee as 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 roller 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 roller cluster also includes 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 work-
pieces take the form of coil springs they will not become tan-
gled 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 sur-
face 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 por-
tion 34 provided at that end of the guide roll 26 which is
depicted 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 as that the guide roll
26 rotates along with the guide roll 28, an opening will be pro-
vided once every revolution which will be large enough to per-
mit a workpiece to pass between the guide rolls and deposited in
the screw flight 22 between pitches of the flight ribbons.  

In these figures illustrated by dotted lines are the end views of
two workpieces 36 and 38 shown in different positions depict-
ing the path of a workpiece in the act of being deposited in
the screw flight. In FIG. 3a a workpiece 36 has just been delivered
from the delivery shoot 42 of a device for holding such work-
pieces and delivering them to 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 26. FIG. 3b illus-
trates 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. 3c 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 work-
pieces between pitches of the screw flight rather than on the
top of the screw flight. The mechanism for accomplishing this
synchronized rotation is, of course, well known.

The workpieces may be delivered individually to the con-
cave 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 in-
cludes 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 so
as to engage the guide rolls function as hold down rolls and keep the work-
pieces from bouncing off the screw flight and feed roll. In addi-
tion, 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 plu-
rality of roll clusters 20, in order to accommodate workpieces
of different dimensions in the same treating apparatus simul-
taneously.

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 34 after it has passed between 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 pro-
vide 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 con-
veyor chain. The fingers 50 are dimensional in the vertical
direction also so as to engage the bottom of a workpiece and ad-

c

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, as especially 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 work-
pieces 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 por-
tion of this peripheral and means for feeding workpieces to
said one end of guide roll to deposit workpieces in said con-
cave 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 longitudi-

dal 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
therethrough and impinge upon the entire surface of a work-

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