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SHOT BLASTING MACHINES

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This invention relates to apparatus for treating the surface of metal articles, particularly pipes. While in its broader aspects, the invention may be useful for cleaning or polishing metal surfaces, as by means of a blast of sand, or other abrasive, it is specifically designed for and will be described as apparatus for shot blasting or shot peening the surface of a piece of pipe, as, for example, drill pipe used in connection with oil wells.

An object of the invention is to provide a complete portable, self-contained apparatus which may be transported to the oil fields and there operated to shot peen or blast drill pipe, as required.

Another object of the invention is to provide an improved means for hoisting the pipe from the ground and placing it in position to be treated.

Still another object of the invention is to devise means for simultaneously shot blasting both the inside and outside surfaces of a piece of pipe encased within a blast chamber or cabinet.

Yet another object of the invention is to provide a blasting nozzle and supply pipe means of a length at least equal to that of the pipe being treated, and to cause such to enter and move along the inside of the pipe at the same time that the blasting unit travels along the outside thereof.

In connection with the blast unit which travels back and forth along the length of the pipe, as above mentioned, a further object is to provide improved means for automatically replenishing the supply of shot in such blast unit each time it reaches the starting point.

Still another object of the invention is to devise improved means for collecting the expended shot and returning it to the blast unit.

With the above and other objects in view, and to improve generally on the details of such apparatus, the invention consists in the construction, combination and arrangement of parts hereinafter described and claimed, and illustrated, by way of example, in the accompanying drawings, forming part of this specification, and in which:

Figs. 1 and 1a together constitute a side elevation view of the complete apparatus, parts being broken away; Figs. 2 and 2a together constitute a complete plan view of the apparatus shown in Figs. 1 and 1a, parts being broken away and a different position of some of the parts being indicated in dotted lines; Fig. 3 is a perspective view of the apparatus, parts being shown in section, parts being broken away, and some parts being omitted for the sake of clearness; Fig. 3a is a fragmentary similar perspective view, parts being broken away and parts shown in section; Fig. 4 is a perspective view of the rear end of the apparatus, parts being shown in section, parts being broken away, and one of the parts being shown in a different position in dotted lines; Fig. 5 is a fragmentary rear elevation of the machine, parts being in section and parts being shown in dotted lines; Fig. 6 is a transverse section substantially on the line 6—6 of Fig. 1, looking in the direction of the arrows, parts being omitted for the sake of clearness and parts being shown in dotted lines; Fig. 7 is a transverse section substantially on the line 7—7 of Fig. 1, looking in the direction of the arrows, parts being omitted for the sake of clearness and parts being shown in dotted lines; Fig. 8 is a fragmentary transverse section substantially on the line 8—8 of Fig. 1 looking in the direction of the arrows, parts being broken away and parts omitted for the sake of clearness; Fig. 9 is a transverse section on an enlarged scale substantially on the line 9—9 of Fig. 1 looking in the direction of the arrows, the boom being shown in operative position; Fig. 10 is a fragmentary sectional view substantially on the line 10—10 of Fig. 9 looking in the direction of the arrows, parts being in elevation; Fig. 11 is a fragmentary side elevation showing the end portion of one of the booms as it appears when in operative position; Fig. 12 is a fragmentary transverse section similar to Fig. 7 but on a somewhat enlarged scale, parts being omitted for the sake of clearness; Fig. 13 is a fragmentary side elevation on a somewhat enlarged scale of the upper part of the elevator shown at the left of Fig. 1a; Fig. 14 is a rear elevation of the same, parts being shown in section and parts broken away; Fig. 15 is a fragmentary transverse section on an enlarged scale, substantially on the line 15—15 of Fig. 4 looking in the direction of the arrows; Fig. 16 is a fragmentary perspective view, partly in section, showing some of the parts illustrated in Fig. 15; Fig. 17 is a side elevation on an enlarged scale of the delivery spout shown in Fig. 4; Fig. 18 is a longitudinal section substantially on the line 18—18 of Fig. 17 looking in the direction of the arrows; Fig. 19 is a fragmentary view showing the parts illustrated at the extreme left of Fig. 2a; and Figs. 20 and 21 are diagrammatic views showing the hydraulic system and air system respectively, which I employ.

Referring to the drawings in detail and more particularly first to Figs. 1 and 1a and 2 and 2a the invention comprises a complete self-contained portable apparatus including a tractor A having the usual wheels B, exhaust pipe C and a semi-trailer D mounted on wheels E. The semi-trailer is also provided with suitable landing gear F as indicated in Fig. 1, so that the trailer can be supported in operative position when uncoupled from the tractor.

At the forward end of the trailer is a control house or tower 1 having doors 2. The main body of the trailer, however, is made up of an elongated cabinet 3. Extending along and projecting outwardly from this cabinet are a pair of running boards or cat walks 4. Mounted on the trailer, in the forward part of it and in full lines in Figs. 2 and 2a, by virtue of their pivotal mounting in the sockets 7 and 7' these booms can be swung outwardly into the position shown in dotted lines in Figs. 2 and 2a, in which position they extend transversely of the trailer.
In order to support the booms when in their extended dotted line position, I provide at their ends a suitable jack comprising telescoping sections 6, 8 and 9, and a traverse extending base 10, as best shown in Fig. 11.

Mounted on these booms in such a way as to travel along the same are carriages 11 and 11', and depending from each such carriage is a chain hoist or other suitable lifting device 12, as shown in Fig. 11.

It will be understood that these booms and hoists are for the purpose of lifting pieces of pipe from the ground and placing them in position to be treated in the cabinet.

The cabinet 3 is closed on one side by a door 13, extending substantially the full length of the cabinet and hinged along its lower edge as at 14 to swing about a horizontal axis as indicated in dotted lines in Fig. 7.

This door is operated by means of a plurality of hydraulic cylinders 15 having piston rods 16 pivotally connected to brackets 17 on the door, these cylinders being pivotally mounted at their lower ends at 18 on suitable supporting brackets 19. On the inside of the door are mounted a plurality of cradles 20 as perhaps best shown in Fig. 3.

When the door 13 is shut the cabinet is completely closed except for a slot 21 extending along the top throughout substantially the full length thereof.

A blast unit 22 is mounted on top of the cabinet in such a way as to deliver its blast down through the slot 21 into the cabinet. While any suitable type of pneumatic blast unit may be employed, if desired, I have illustrated a blast unit of the centrifugal throwing wheel type, one commercial unit of the type being known as a "Rotoblast" unit. The throwing wheel is driven by an air motor 23 through a belt 25, and the unit carries a shot hopper 24 for supplying shot to the wheel.

This "Rotoblast" unit is mounted on wheels 26 and 28 adapted to travel along rails 27 and 29 supported on the cabinet (see Fig. 8). As shown in Fig. 4, suitable wipers 30 are preferably attached to brackets 28 on which the wheels 28 are mounted, the purpose of these wipers being to clear the track rails of any spent shot which might lodge thereon.

The slot 21 in the top of the cabinet is normally closed by means of a heavy flexible belt 31 which extends the full length of the slot. This belt is anchored at one end at 32, as shown in Fig. 2, and at the other end is fastened to a bar 33 secured to a fixed bracket 33 by means of bolts and nuts 34. By turning up these nuts it will be obvious that the tension of the belt may be adjusted as desired (see Fig. 4).

As shown in Figs. 1 and 4, the blast unit carries at each end adjacent the slot 21 a roller 36 and also at the upper part of the unit a pair of rollers 36'. The belt 31 passes under the rollers 36 and over the rollers 36' thus being looped around the unit. From the foregoing it will be seen that as the unit moves along it passes continuously under the belt 31. The blast wheel of course is constructed and arranged to deliver its blast through the slot 21, this slot being normally closed by belt 31 at every point except the point of delivery of the blast. In other words, as the blast unit travels along the slot is progressively opened or uncovered in advance of the unit and progressively closed or covered again behind the unit.

The blast unit is moved back and forth along the rails 27 and 29 by means of a cable 37. This cable is anchored at one end to one side of the unit as shown at 38 in Fig. 8 and is anchored at its other side of the unit as indicated at 38' in Fig. 1. The cable 37 extends from the anchorage 38 forwardly and around a sheave 39 driven by an air motor 40. The cable thence extends to the rear of the machine where it passes around a pulley 41 and is then anchored to the unit at 38'. It will be seen that the motor 40 will cause the blast unit to move one way or the other in accordance with the direction of rotation of the motor.

Carried by the blast unit is a trip rod 42 which is designed to engage and move a control lever (not shown) on the motor 40 to either stop such motor or reverse it as may be desired, when the blast unit reaches that end of its travel.

Within the cabinet 3 near the bottom thereof, is a perforated pan or trough 42 (see Fig. 3) extending longitudinally a substantial distance. Above this pan or trough are mounted a pair of shafts 43 journalled in bearings 44 carried by transverse beams 45 and 45'. Mounted on these shafts at each end thereof adjacent the beams 45 and 45' are pairs of rollers 46, the rollers of each pair being disposed in close proximity to each other and constituting means for supporting and rotating the pipe to be treated. The upper part of the beams 45 and 45' is recessed as at 47 to accommodate the pipe.

In alignment with and coupled to the shafts 43 are a pair of augers or screw conveyors 48 extending from the beam 45' forwardly. Over each of these augers is an inverted V-shape shield 49 (see Figs. 3 and 6), and between the conveyors is an inverted V-shaped rib 50.

The shafts of the screw conveyors pass through the front wall of the cabinet and have rigidly secured thereto sprocket wheels 51. A sprocket chain 52 engages both of these sprocket wheels and around a third sprocket wheel 53 secured to a shaft 54, on which shaft is also secured a larger sprocket wheel 55. A sprocket chain 56 passes around the sprocket wheel 55 and around another sprocket wheel 57 driven by an air motor 58. Thus when this air motor runs the augers or screw conveyors are rotated, and with them the pairs of rollers 46. The sides of the floor of the cabinet 3 slope downwardly toward the drift pan 42 as best shown in Fig. 3a so as to direct the shot into this pan.

Positioned beneath the drift pan 42 is an endless conveyor belt 59 passing around a pulley 60 at the rear of the machine and around a pulley 61 toward the forward end of the machine. This pulley 61 is mounted in movable bearings 62, the position of which may be adjusted by means of a screw and nut 62' (see Fig. 1). The roller 69 is mounted in bearings 65. It will be understood that the belt 59 works closely between walls 63 as shown in Figs. 3 and 5 so that the shot are confined thereon, it being understood that the shot pass down through the slots in the drift pan 42 onto the belt 59. The roller 60 is driven by an air motor 64 through a shaft 65 (see Fig. 5). The belt 59 delivers the shot which it carries into a chute 67 and 70 and delivers the shot into the bottom of an elevator casing.

This casing is made up of two telescoping sections, a lower fixed section 68 and an upper movable section 69. Secured to the section 69 is a crosshead 70 to the ends of which are attached piston rods 71 of hydraulic cylinders 72. By admitting motive fluid to these cylinders the upper section 69 of the elevator casing may be raised and lowered as desired.

A pulley 73 is mounted near the bottom of the fixed section 68 and a pulley 74 is mounted near the top of the movable section 69 and around these pulleys passes an endless belt elevator having buckets 76. The pulley 74 is driven by a sprocket wheel 77 by means of a sprocket chain 78 which passes around another sprocket 79 driven by an air motor 80 to which air is supplied through pipes 81 and 82 (see Figs. 13 and 14).

A divider plate 83 has an inclined upper portion 83a disposed adjacent the path of movement of the buckets 76, and a vertical portion which is positioned between the wall of the section 69 and the wall of an auxiliary enclosure 69a. As the buckets containing shot travel upwardly and pass over the pulley 74 the shot are dumped or discharged, part passing down one side of the divider or partition 83 into a chute 84, while part passes down...
into another chute 86 communicating with the enclosure 69. Thus the spent shot brought up by the elevator is divided into two separate streams, one passing from the chute 84 into a hopper 85, and the other passing from the chute 86 into a hopper 87. The shot falling into hopper 87 flow downwardly through a hose 88 into the top of a continuous pressure tank designated in its entirety by the numeral 89. This pressure tank is a well-known commercial unit made by manufacturers of abrading equipment such as the Parent Co., American Wheelabrator, Sunstrant, etc. The exact details of this unit are not important. As shown it comprises a shot receiver 90, and a hopper 91, at the lower end of which is a mixing valve 94. Compressed air is supplied to the unit from a compressor or other suitable source through hose 93. The mixing valve at 94 is an adjustable device for controlling the amount of shot delivered to the air stream, and the mixture of air and shot is discharged through hose 95. The unit is shown as provided with inspection windows 96 through which the operation of the device may be observed.

The hose 95 extends rearwardly from the machine and is connected at its end with an elongated shot blast means 97 comprising a length of pipe or tubing having a suitable nozzle mounted at one end thereof. The rear end of the cabinet 3 is provided with an opening 30 (see Fig. 2) in line with the pipe 95 (see Fig. 7), and the shot blast means 97 is inserted through this opening, being freely supported on a roller 98 as clearly shown in Figs. 1 and 5. The shot blast means, which must be as long as the length of the pipe being treated, is supported on a grooved wheel 99 mounted on a shaft having at its ends 100 which are supported and roll freely on a runway comprising pair of rails 101, preferably made of pipe. These rails are tied together at their rear end by a brace 102 and are supported at suitable intervals by brackets or jacks, as shown in Figs. 1 and 2. Each of these jacks comprises a pair of legs connected by a cross bar 103, each leg consisting of upper and lower telescoping sections 102 and 104, the lower sections being provided at their ends with suitable feet 105 which rest on the ground.

The rear end of the shot blast means 97 is rigidly secured to a truck or carriage 106 having at its ends rollers 107 which also travel on the rails 101.

An endless cable 108 secured to the carriage 106 as shown at 109 in Fig. 19 passes around a pulley 110 mounted on a bracket 111 supported by the track rails, and at the other end passes around a pulley 112 (see Fig. 5) mounted on a shaft 113. This shaft carries a sprocket wheel and a sprocket chain 115 passes around this sprocket wheel and around a sprocket 114 mounted on the shaft 41 which also carries the pulley 41, heretofore referred to. It is thus obvious that when the cable 37 passes around the pulley 41 and turns the shaft 41, the pulley 112 will also be turned and the endless cable 108 caused to travel. As this cable moves in one direction, it will pull the carriage 106 toward the machine thus moving the shot blast means 97 in through the opening 30 into the inside of the pipe x being treated, and as the cable travels in the other direction, the lance will be withdrawn.

Referring now to Figs. 4 and Figs. 15 to 18, inclusive, it will be seen that a shot delivery spout 116 is pivotally mounted at 118 on the lower end of hopper 85. Rigidly carried by the spout 116 is a cylindrical member 119 having a therethrough therethrough. Rigidly with the hopper 85 is a hollow cylindrical casing 120 having ports 119 therethrough, so positioned as to register with the ends of the slot 118, one of the ports 119 permanently registering with a discharge opening 121 at the bottom of the hopper 85. The rear end of the bottom wall of the chute 116 is curved around the cylindrical casing 120 as shown at 116.

When the parts are in the position shown in Fig. 15 it will be seen that discharge of shot from the hopper is prevented. When, however, the delivery spout 116 is swung to dotted line position so that the slot 118 registers with the ports 119, these ports and slot serve to conduct shot from the hopper 85 into the spout 116. As shown in Figs. 4 and 17 the spout 116 carries near its pivot end a roller 122 mounted on a depending bracket 123, and also carries at a point further from its pivot a depending cam bracket 124.

The spout is normally maintained by friction in its uppermost position as shown in Figs. 4 and 17, but when the blast unit moves rearwardly the hopper 24 assumes the position shown in dotted lines in Fig. 4 and its edge engages the roller 122 and swings the spout downwardly as indicated by the dotted arrows in Fig. 4. As above explained in connection with Fig. 15, this downwardly swinging movement permits the discharge of shot from the hopper 85 through the spout 116 into the hopper 24 and this flow of shot will continue until the level in the hopper 24 is built up to a point where further flow of the shot is blocked. Then when the blast unit begins its travel in the other direction, the cam 124 rides up on the edge of the hopper 24 thus again lifting the spout to its elevated position in which the flow of shot is cut off.

Referring now to Figs. 20 and 21 I have diagrammatically illustrated the hydraulic and air systems which may employ. To operate the hydraulic cylinders 15 for manipulating the cabinet door 1 I employ an air motor 125 driving a hydraulic pump 126 connected to the oil reservoir or tank 127. The elements shown at 128 in Fig. 21 are orifices used to supply the necessary oil to the air motors.

An air compressor 129, which is preferably mounted on a separate vehicle or truck, supplies compressed air through hose 130 and 93 to the pressure tank 89, and through hose 131 to a manifold 132 from which it is distributed to the various air motors. A hose 133 serves to deliver compressed air from the air compressor to the air motor 23 of the traveling blast unit 22. The supply of air to the various motors 58, 64, 80 and 125 is controlled by levers 134 located in the control tower 1.

By reference to Fig. 20 it will be seen that motive fluid from the hydraulic pump 126 is delivered by pipe 137 to control mechanism through which, by means of levers 135 and 136 it may be delivered to cylinder 15 and 72. While fluid is being delivered through pipes 139 and 140 to one end of these cylinders the exhaust fluid escapes through pipes 141 and 142 and pipe 138 back to the tank 127.

The general operation of the apparatus is as follows. When it is desired to treat a piece of pipe which is lying on the ground the booms 5 and 5' and the hoisting devices 12 are brought into operation to lift the pipe from the ground and convey it to the cabinet. At the same time the door 13 is swung open into the position shown in dotted lines in Fig. 7 and the pipe is laid in the cradles 20. By the means of the hydraulic cylinders 15 the door 13 is then closed, thus dumping the pipe from the cradles 20 on to the rollers 46 as shown in dotted lines in Fig. 7. The air motor 58 then being in operation, the augers 48 and the rollers 46 are turned, whereby the latter cause the pipe to continuously rotate. While the pipe is rotating, air is admitted to the motor 40 in such a way as to cause the blast unit 22 to travel along the top of the cabinet, and the hopper 24 having been filled with shot by the spout 116, the rotating wheel will deliver a blast of shot down through the slot 21 on to the rotating pipe thus treating or peening the outer surface of the pipe at the same time, and in synchronism with the movement of the blast unit, the shot blast means 97 is caused to enter the end of the pipe and, a mixture of shot and air being supplied thereto from the pressure tank 89 through hose 95, under high pressure, the said blast means discharges.
a stream of shot into the inside of the pipe and against the inner surface thereof, thus treating or peening such inner surface. When the motor 40 is reversed the shot blast means is withdrawn, and the blast unit travels back to the rear to receive another charge of shot.

The spent shot issuing from the end of the pipe being treated and also the shot delivered from the blast unit toward the forward end of its travel are fed rearwardly by the augers 48 on to the drift pan 42, from which they fall through the openings in the pan on to the conveyor belt 59, by which the shot is delivered into the chute 67 and thence to the elevator, where it is elevated to the top of the machine and then divided, part going into the pressure tank 89 for the slot blast means and the other part going into hopper 85 for the blasting unit.

An important feature of the invention is the provision of means for raising and lowering the upper section of the elevator casing or housing. When the machine is in operation it is obviously necessary for the upper end of the elevator and the hoppers 85 and 87 to be at such a height that the hopper 24 of the blasting unit may pass under the hopper 85 to receive charges of shot therefrom. This height however is sometimes too great to pass under bridges or the like, when the machine is being transported from place to place, and, consequently, when thus transported, the upper section of the elevator housing may be lowered by means of the cylinders 72 sufficiently to pass under any bridge or other obstruction. When the upper section is raised to its operative position as shown in the drawings, the elevator belt 75 is stretched tightly around the upper and lower rollers. When, however, the upper section of the elevator is lowered, this belt is slackened and may even fall into loose folds, but without any damage to itself.

While in the specification and claims I have used the word "shot," it will be understood that this term is intended to include any kind of blasting or abrasive material, such as sand, steel grits, etc.

From the foregoing it will be seen that I have provided a portable self-contained apparatus which is capable of being transported to any desired point and of operating on drill pipe or the like at such point, and it is thought that the many advantages of the invention will be readily appreciated with those familiar with such matters.

What I claim:

1. Portable self-contained shot blasting apparatus comprising a tractor and semi-trailer, a cabinet carried by said semi-trailer to enclose the article being treated, a blast unit mounted on said cabinet, and means or said semi-trailer for collecting the spent shot and returning it to said blasting unit, said means comprising an elevator having a collapsible housing made up of upper and lower telescoping sections, and hydraulic means whereby the upper section may be lowered relative to the lower section to reduce the over-all height of the apparatus to enable it to pass under bridges and the like.

2. Shot blasting apparatus comprising an elongated horizontally disposed cabinet, closed except for a slot extending longitudinally along the top thereof, a blast unit of the throwing wheel type movably mounted on said cabinet and adapted to travel along the same, said unit being constructed to deliver its blast downwardly into said cabinet through said slot, means normally closing said slot, and means for progressively opening said slot in advance of said throwing wheel as the unit travels along, and progressively closing said slot behind said throwing wheel.

3. Shot blasting apparatus comprising an elongated horizontally disposed cabinet, closed except for a slot extending longitudinally of the top thereof, a blast unit movably mounted on said cabinet and adapted to travel along the same, said unit being constructed to deliver
flows therethrough and through said spout into said blast unit hopper until the latter is filled to a predetermined level, and means whereby, when said blast unit hopper moves away, it automatically returns said spout to normal position.

9. Shot blasting apparatus comprising an elongated, horizontal cabinet, closed except for a slot extending longitudinally along the top thereof, a pair of rails mounted on said cabinet, a carriage having wheels supported on said rails, a blast unit on said carriage constructed to deliver its blast downwardly into said cabinet through said slot, means for causing said carriage to travel along said rails, a flexible belt overlying and normally closing said slot, and means whereby said belt is caused to progressively pass up and over said carriage, to locally open said slot beneath said carriage as the latter travels along.

10. Shot blasting apparatus comprising a movable vehicle having an elongated chamber, means for supporting a piece of pipe to be treated within said chamber, said chamber having an opening in its end wall in alignment with said pipe, an elongated shot blast means adapted to be inserted through said opening into said pipe, a runway extending from the end of said chamber, vertically adjustable means for supporting said runway from the ground at the height of said opening, means for movably mounting said shot blast means on said runway, a flexible hose connected at one end with the free end of said shot blast means and at the other end with a source of mixture of shot and air under pressure, and cable means, operated from said vehicle, for causing said shot blast means to travel along said runway.

11. A portable, self-contained shot blasting apparatus for treating lengths of drill pipe and the like in the field, comprising the combination of a wheeled vehicle, an elongated cabinet mounted on and extending longitudinally of said vehicle and being of such size as to enclose all parts of the length of pipe or the like to be treated, a shot blasting unit movable with respect to said cabinet and operatively associated therewith to treat a length of pipe or the like when the same is contained within said cabinet, said cabinet having a side opening via which a length of pipe or the like can be moved sidewise into position to be treated by said blasting unit, hoisting means adjustable mounted on said vehicle and movable between a stored position and a position in which the hoisting means is operative to engage a length of pipe or the like at a point on the ground beside the vehicle, said hoisting means being operative to hoist such length of pipe or the like and convey the same to a position adjacent the opening in said cabinet, and means at said last-mentioned position disposed to receive the length of pipe or the like from said hoisting means and move the same sidewise into said cabinet.

12. An apparatus in accordance with claim 11 and wherein said hoisting means comprises two booms each mounted, adjacent a different end of said cabinet, for swinging movement about an upright axis, a hoisting device dependent from each of said booms, and means mounting each such hoisting device on its associated movement lengthwise of the boom in both directions.

13. In a shot blasting apparatus for treating elongated work, the combination of an elongated cabinet closed except for an open, longitudinally extending slot disposed in one wall thereof, a shot blasting unit disposed to deliver its blast into said cabinet through said slot, means mounting said unit for movement longitudinally of the cabinet along said slot, and means operative to effectively close said slot, as said blast unit travels therealong, at all points except the point occupied by the blast unit, said means comprising a single, elongated, flexible belt disposed outside of said cabinet and fixed at each end with respect to said cabinet, said belt extending over and along said slot to said blast unit, thence over said blast unit, and thence again over and along said slot.

14. A portable, self-contained shot blasting apparatus for treating lengths of drill pipe and the like in the field, comprising a wheeled frame, an elongated cabinet mounted on said frame and defining a blast chamber, an elevator mounted on said frame at one end of said cabinet, shot delivery means communicating between said one end of said chamber and the bottom of said elevator, means operative to support the pipe or the like to be treated in a position extending longitudinally of said chamber, means for introducing a blast of shot and compressed air into the end of the pipe or the like adjacent said elevator, whereby the shot is discharged from the other end of the pipe or the like and means operatively mounted within said chamber and including a substantially horizontal endless conveyor for collecting the spent shot and transferring the same to said shot delivery means.

15. Apparatus in accordance with claim 14 and wherein said horizontal endless conveyor is shorter than the pipe or the like to be treated, said apparatus including means disposed within said chamber operative to deliver the spent shot from said other end of the pipe or the like to said endless conveyor.

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