Dec. 16, 1952 R. S. RUSSELL 2,621,446

GRIT BLASTING DEVICE FOR CLEANING PIPES AND THE LIKE

Filed April 16, 1952 3 Sheets-Sheet 1

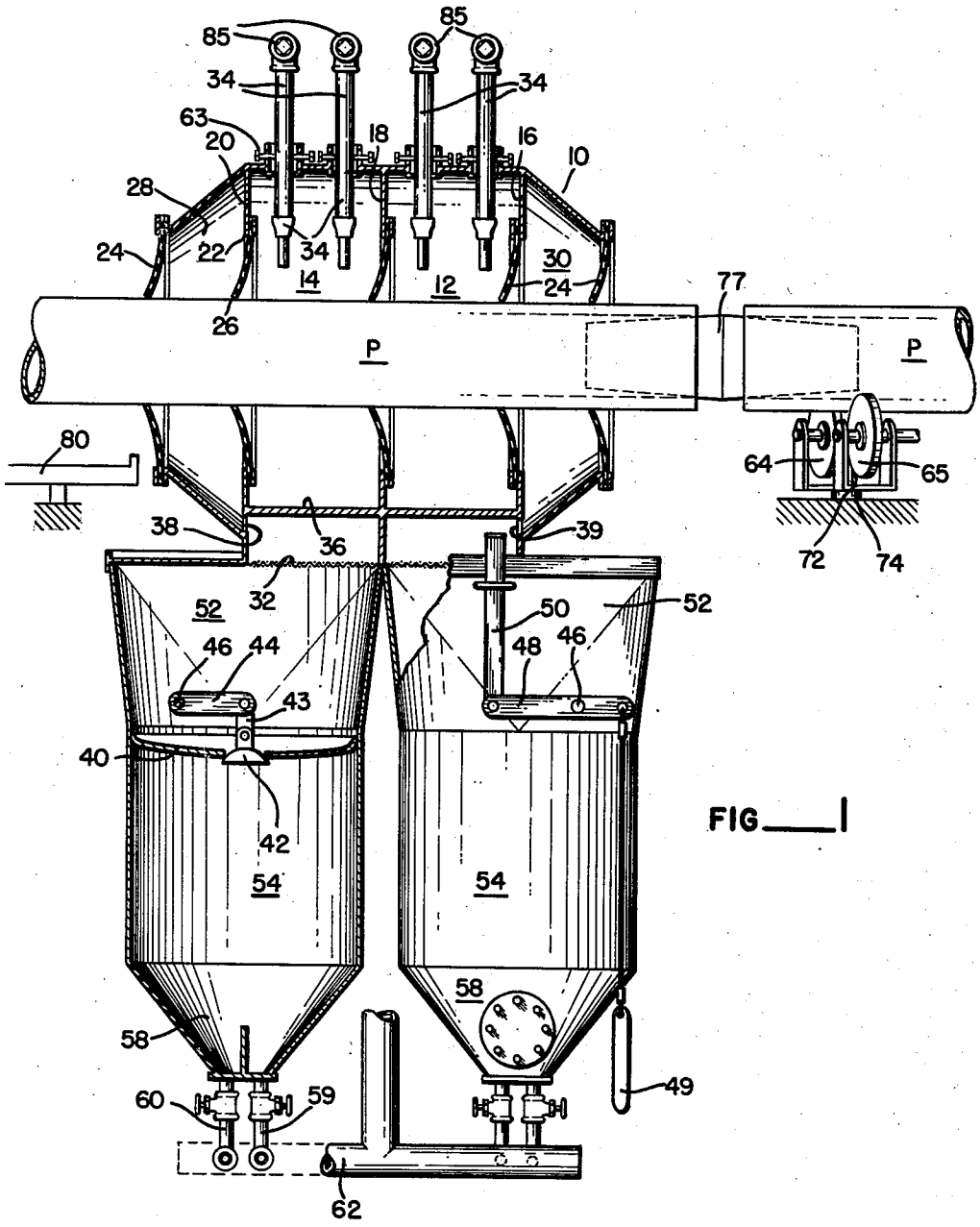


FIG. 1

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GRIT BLASTING DEVICE FOR CLEANING PIPES AND THE LIKE

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FIG. 2

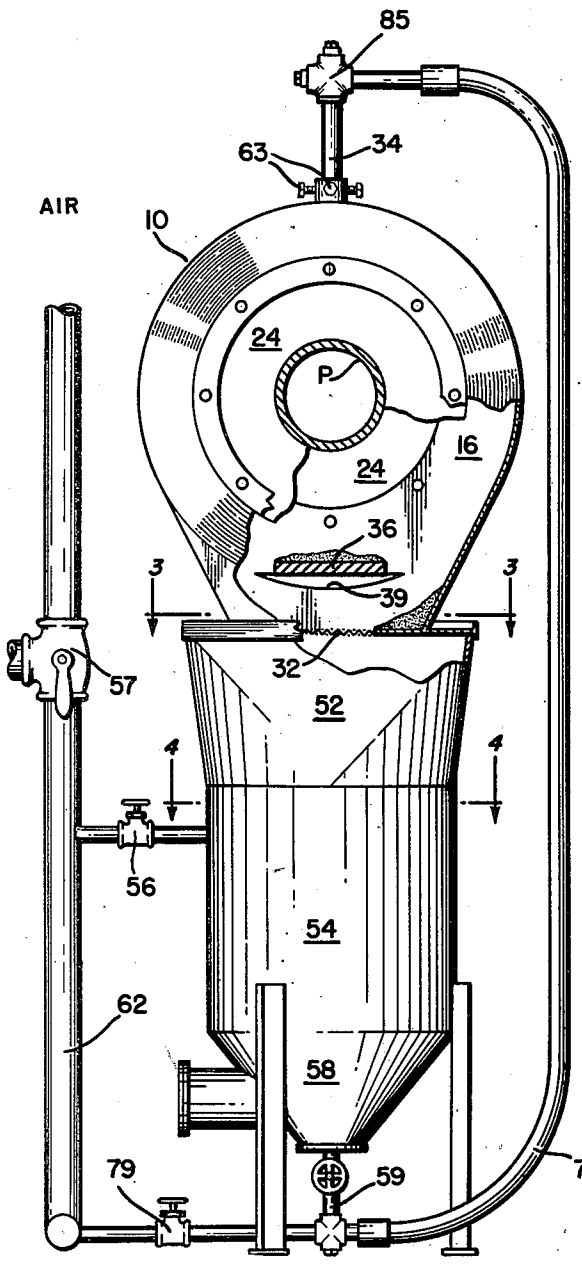


FIG. 3

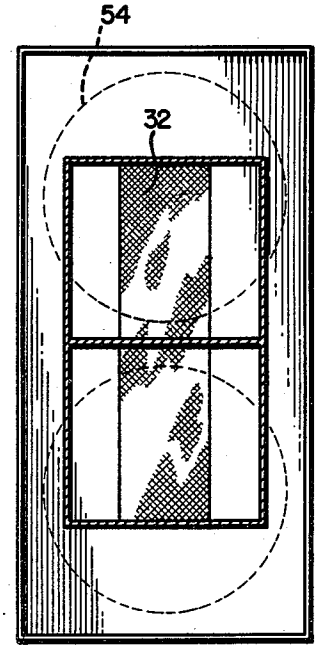
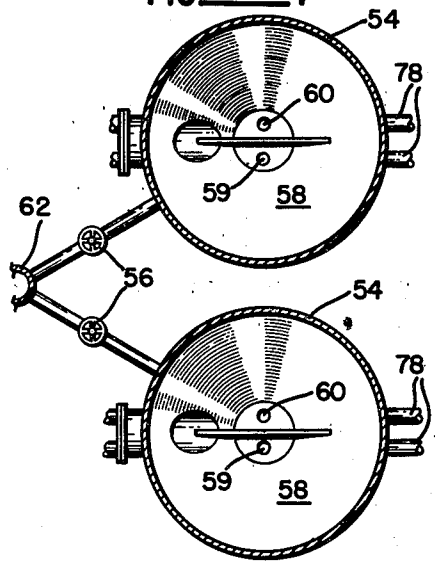


FIG. 4



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FIG. 5

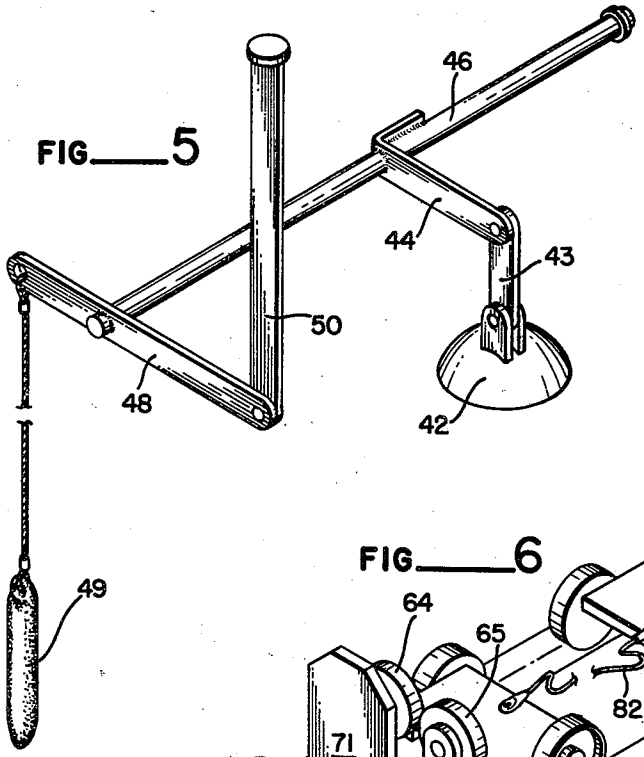
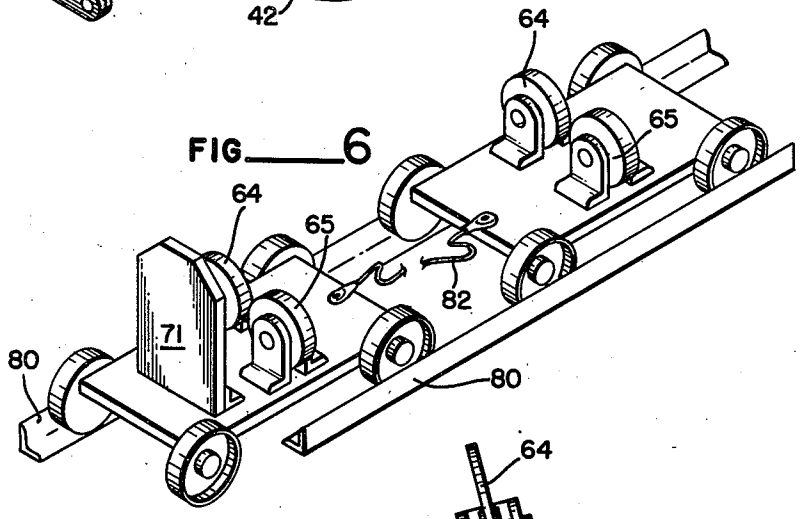


FIG. 6



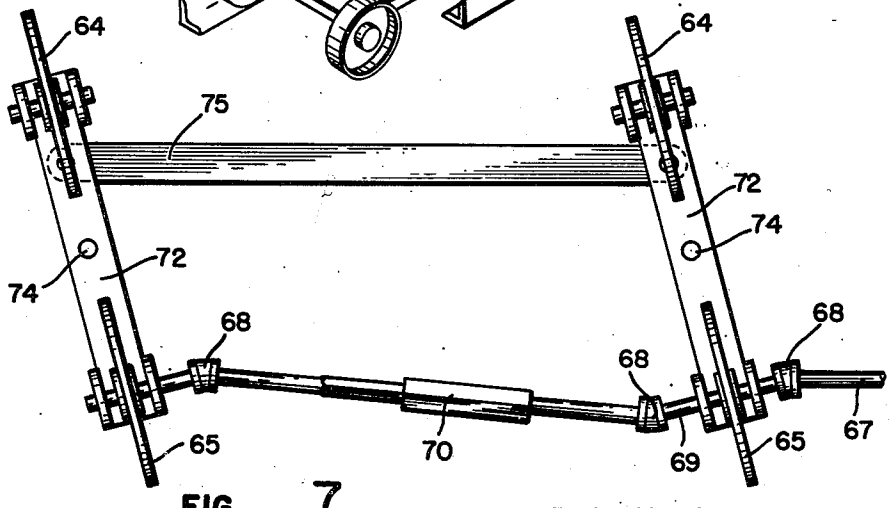


FIG. 7

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Patented Dec. 16, 1952

2,621,446

UNITED STATES PATENT OFFICE

2,621,446

GRIT BLASTING DEVICE FOR CLEANING PIPES AND THE LIKE

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Application April 16, 1952, Serial No. 282,521

6 Claims. (Cl. 51—14)

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This present invention relates generally to the class of devices used in grit and sand blasting of materials it is desired to clean preparatory to further processing. More specifically this invention consists of a plurality of aligned nozzles directed downwardly so as to engage the upper surface of a pipe or shaft employing substantially the conventional form of sand or grit-blast nozzles. Means are further provided to move the pipe through the blasting area and to revolve the same as it passes it through so that the plurality of nozzles normally disposed in a longitudinal plane above the work, will be able to fully cover every particle of the surface of the pipe or shaft under treatment. Means are then provided to confine the grit material so that it may be directed downwardly for ultimate recovery and reuse and at the same time permitting the lighter materials, dust and small particles of paint and rust to be forced out along the pipe under treatment and, finally means are provided for the recovery and reconditioning of the grit or sand and to reintroduce the same into the high pressure air stream to the end that the grit can be used repeatedly, thus eliminating one of the costly factors of such processes which maintains when an adequate means for recovering and reconditioning the grit is lacking.

Sand blasting in which sharp sand is projected, against a surface to be cleaned, by high pressure air streams is a very old art. The older methods of sand blasting, however, were very harmful to human life due to silicosis and other similar ailments caused by breathing of the small particles of sand so it is now most common to so enclose the work, wherever it is possible to do so, in order that the operators are not subject to this hazard. With the technique developed for the production of steel grit as a substitute for the sand such housing-in of the work is very essential in that the small grit particles act much like bullets because of their high velocity and the fact that they rebound much more than is common with the sand particles. It has been found however that the grit made of steel is very expensive in comparison with the sand formerly used and it is therefore essential that the housing-in of the work will further provide means for recovery and reconditioning of the grit material so that it can be reused. In the past many attempts have been made to produce equipment serving these various purposes. Those observed however have been characterized by very intricate constructural features which made the equipment very expensive in the first cost and the maintenance of the equipment in most cases is a severe expense item. In my present equipment I believe I have overcome the deficiencies noted in former equipment provided for this particular use, the resulting structure can be constructed economically and it has a very minimum of maintenance cost.

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The principal object of my present invention is to provide a grit blasting machine which is characterized by its simplicity of construction and the provision of means to insure its long useful life with a minimum of replacements or maintenance.

A further object of my invention is to provide a grit blasting machine employing a minimum of blast nozzles and to move the pipe or shaft through the device and at the same time revolving it so that all the mill scale, rust and foreign materials, on its surface, will be removed adapting the pipe to further protective treatment or other use.

A further object of my invention is to provide in a grit blasting machine a plurality of carriages which will guide a pipe or shaft through the grit blasting machine area and will revolve the works at the same time so that a minimum of blast nozzles can clean quickly the entire surface of the work.

A further object of my invention is to provide means for recovering the grit blasting particles, separating the scale, rust, dust and the like from the grit material and making the same available for reuse in further blast cleaning operations.

A further object of this invention is to provide means whereby a pipe or shaft can be quickly fed through the blasting area so that a succession of pipes can be passing through the machine as substantially a continuous operation.

A further object of the invention is to provide sealing means in the form of a plurality of zones each having a diaphragm-like yieldable separator which are distortable around the pipe to, on one hand, collect the grit material and direct it downwardly and permitting the lighter materials, dust, scale and the like, to be blown out along the pipe due to the positive air pressure built up by the blast jets.

Further objects, advantages and capabilities will be apparent from the description and disclosure in the drawings, or may be comprehended or are inherent in the device.

In the drawings:

Figure 1 is a vertical, longitudinal sectional view through a grit blasting device made after the teachings of my present invention;

Figure 2 is an end elevation of the machine in Figure 1;

Figures 3 and 4 are cross sectional views, taken along similarly numbered lines of Figure 2;

Figure 5 is a fragmentary perspective view showing the grit control valve and the operating means therefor;

Figure 6 is a fragmentary perspective view illustrating the type of carriages employed to move the pipe and like material through the grit blast area;

Figure 7 is a top plan view in fragmentary form showing the means employed to revolve and translate the pipe through this device.

Referring more particularly to the disclosure in the drawings, the numeral 10 designates generally the hood or housing in which the grit blasting is confined. Housing 10 consists of usually a plurality of transversely disposed compartments as 12 and 14. These are largely circular in cross section except at the very bottom. This exact form is probably best illustrated in Figure 2. Compartments as 12 and 14 are formed within housing 10 by transversely disposed plates at 16, 18 and 20. These plates have an opening which is concentrically disposed about the longitudinal axis of the housing. The size of these openings 22 should be sufficient so that the largest size pipe or shaft, which is intended to be cleaned within the machine, may pass freely through the same. The most preferred proportion is probably that shown in Figure 1 in which there is a general clearance around pipe P. This clearance is closed by flexible diaphragms 24. These diaphragms are preferably made from non-metallic materials such as rubber sheeting, possibly reinforced, or any of the various synthetic materials that are yieldable so that as the pipe or shaft progresses from right to left, as shown in Figure 1 by the directional arrow, these diaphragms will be dished in one direction substantially as illustrated. When so arranged it will be apparent why the flexibility is so desirable in order to provide a reasonably tight closure around the pipe P to the end that the metallic grit will be deflected by the same and directed downwardly, while, at the same time, the dust and light materials such as scale and rust which have been blasted off the pipe will be carried outwardly with the air that will pass out through openings 26 in diaphragms 24. Here again is an illustration of the desirability of the flexible membrane or baffle. Disposed on each end of housing 10 are additional collecting chambers as 28 and 30. These are preferably formed as frustums of cones, the bases of which join housing 10 at its largest diameter and then taper toward the center stopping at a point where the diameter of openings 22 then make it desirable to form a flange to hold additional diaphragm members 24. These chambers do not have any jets in them and their main purpose is to further assist in collecting grit which might be blown out of the adjacent blast chambers, and after collecting the same, it is directed down onto a separation screen 32.

In order to protect screen 32 against being hit by the grit from blast nozzles 34, at such times as there may be an opening between adjacent pipes being fed through the device, a baffle member 36 is provided. This is formed of heavy plate and extends only far enough transversely to accept the full force of the jet substantially after the showing of Figure 2. The grit collected in chambers 28 and 30 is discharged out through vents 38 and 39 so that they will drain naturally into the grit collecting pot disposed below screen 32.

It has been found desirable to have the grit collecting pots divided into two pressure chambers. These chambers are provided by the downwardly dished head 40 so that the pressure developed by the jets 34 while they are in operation will not extend down below head 40. This pressure is not constant principally due to the fact that relatively high pressures are discharged from nozzle 34 but this pressure is reduced to just slightly above atmospheric pressure by the free escape of air with its included scale dust and the like through the central openings in diaphragms 24.

Disposed immediately below the upper flared portion 52 of the pot is the cylindrical portion 54. This chamber periodically receives the grit collected in chamber 52 through the manual opening of dump valve 42.

It then follows that if grit is to be passed down into the lower chamber 54, pressure must be released from chamber 54 before the dump valve 42 may be opened. This is accomplished by turning valve 57 so that it shuts off the pressure air in line 62 and vents the contained pressure to atmosphere. Transfer of the grit is then possible through dumping valve 42 positioned in the lower part of head 40. The operation of this valve is probably best illustrated in Figure 5 in which valve 42 is connected by link 43 to arm 44. This arm is fixedly secured to a rockable shaft 46. At one end shaft 46 has secured to it lever 48 which effects both the opening and closing of the valve. The valve is normally retained in the closed position, not considering the pressures involved, by weight 49. The valve is opened by force applied to the upper end of the guided rod 50.

The lower end of chamber 54 is provided with a tapering or funnel-like bottom portion 58. In the same lower portion are connecting pipes 59 and 60 each equipped with suitable valves so that grit can be admitted into the air line 78 in a controlled amount. After entering into line 78, which is a fast moving column of air when the jets are in operation, the grits are carried along and finally discharged out through nozzles 34. A secondary use of pipes 59 and 60 is to introduce air into pot 58 in order to break up any bridging over or compacting of the grit and cause it to again flow in the intended manner.

In order to keep the construction of this equipment to its simplest form it has been found most convenient to provide that the single jet or preferably a plurality of jets 34 be at the top of the hood or housing 10 and in the same radial plane which plane passes substantially through the longitudinal center of the housing. The jets are capable of limited adjustment by means of set screws 63 both for distance from the pipe and angularity. The high speed operation of equipment of this order, which is very much desired, means that if the jets are all set in a single line, it is then necessary to revolve pipe P at the same time it is being passed longitudinally through the axis of the housing. A preferred arrangement for achieving these two purposes, in addition to positioning the pipe accurately within the housing, is to provide two sets of carriages substantially after the showing of Figure 6. These carriages may be distinguished in that those that feed the pipe into the machine may be considered in-feed carriages and a similar set on the opposite side of the machine which carry the

pipe along sufficiently so that it will clear the machine are the out-feed carriages. This is most simply achieved by having the pipe rest on a minimum of two sets of rollers 64 and 65. Roller 64 which normally would take on the form of wheels in that they are preferably of limited length and of substantial diameter are dead rolls and merely revolve upon their individual axis. Rollers 65 however are driven rollers, driven, for instance, by the means illustrated in Figure 7. In the drive means, power is applied to the rotating shaft 67 and transmitted to the first set of driven rollers 65 through means of suitable universal or flexible joints 68. Similarly the second, or subsequent, driven rollers 65 are driven by shafts connected to shaft 69 which supports the first roller 65 by means of suitable flexible or universal joints with possibly a spline coupling 70 as illustrated in Figure 7, joining the units.

Longitudinal movement of the pipe through the machine is achieved by skewing bolsters 72 about pivots 74 as by means of the connecting link 75. The angularity of these rollers with the longitudinal axis of the pipe will determine the speed with which the pipe is driven through the machine. It is this skewing of the rollers that calls for the universal joints 68 in power line 67, and it also accounts for the need of having relatively narrow wheels or rolls 64 and 65. Bolsters may be mounted on fixed bases if means is provided to place the pipe on the rollers or they may be mounted on companion carriages similar to the outfeed carriage shown in Figure 6, except the abutment 71 would not be used.

Throughout this specification reference has been made to pipe P. This is to be understood as being nominally pipe but it could likewise be shafting or any elongated cylindrical stock.

Method of operation

To use this device, a length of pipe to be cleaned is loaded upon the two in-feed carriages of the general type shown in Figure 6. These are coupled together by a flexible link or cable 82 so as to maintain a proper spacing. Under certain conditions it may be desirable to move the carriages along the coacting rails 80 until the end of pipe P is entered through membrane 24 of the end chamber 30. In other instances it may be convenient to have the in-feed carriage fixed in position and to rely for endwise movement of the pipe entirely upon the angular disposition of bolster 72, as illustrated in Figure 7. When power is applied through shaft 67 the pipe will be moved longitudinally into the machine, and at the same time be revolved. As soon as the pipe enters chamber 12, it is met by the high velocity grit blast issuing from nozzles 34. As the pipe progresses fully into the housing, it is finally met by the grit blast from the four jets 34, considering the form as shown in Figure 1. The four jets in their particular arrangement, as illustrated in this application, have been found very satisfactory for the full range of pipe on which they have been used, normally from four to twenty-four inches. It is necessary in constructing a machine of this order to have a definite relationship between the speed of longitudinal travel of pipe 5, through the housing, the rotative speed of the pipe, and the number of jets employed together with their spacing longitudinally of the pipe. The basic requirement of this arrangement is that there will be sufficient grit blast effect upon the pipe surface to fully clean it to the degree required for the instant purpose.

In Figure 5 is shown a connecting wedge plate 77, or preferably a double coned connector which is tapered both ways from the transverse central line so that the tapered ends can be entered into the ends of substantially abutting pipes. This insures full rotative effect to the pipe and also serves to guide the incoming pipe so that it will be presented in axial alignment with housing 10. When the connector has passed through the housing it can be removed by convenient means.

The grit that has been directed at pipe P by the various nozzles 34 is normally deflected by the same and rebounds against the walls of chambers 12 and 14 until its velocity is spent and it drops to the bottom of the chamber, then ultimately through screen 32 into the grit collecting pot disposed below the screen. It follows that in such an operation, there may be times when the jets are operating with no pipe in place and to guard against the grit being driven without interference into screen 32 a baffle plate 36 is disposed above the screen. This is best illustrated in Figure 2.

When in the course of the operation one of the upper chambers 52 of the grit collecting pot becomes fully charged with grit, it is then necessary to open dump valve 42 so that the grit will fall into chamber 54 disposed below the same. Now to understand the functioning of this transfer operation it must be remembered that aside from the leakage of air out through diaphragm 24, there is considerable air pressure being built up within the chambers 12 and 14 and the upper portion 52 of the pot due to the high pressure air that has been introduced through jets 34. There is another consideration. If the grit is going to flow out of the lower portion 54 of the pot through the connecting pipes 59 and 60 into the jet supply lines 78, then chamber 54 must have the same air pressure on it as is present in air supply line 62 and this is normally achieved by means of valve 56 and the pipes connecting it with chamber 54 and the main air supply pipe 62. This places considerably more pressure in chamber 54 than is present in chamber 52 and consequently the valve 42, of relatively large area, is held firmly in its closed position and in order to open valve 42 it is necessary that this pressure be dissipated. This can be achieved by keeping valve 56 open, and then turning the three-way valve 57 into the position whereby it will on one hand shut off the high pressure in this line coming from the source of pressure air and vent the pot to atmosphere. The valves in lines 59 and 60 normally remain partially open at all times as their function is to regulate the supply of grit. When this is done pressure on rod 15 is sufficient to open valve 42 and thus permit the transfer of the grit over to the lower pot.

Due to the irregular shape of the steel grit preferably used in this type of equipment, there are occasions when the same may become bridged over or compacted to the extent that it will not flow either out the feed pipes 59 or 60 through valve 42 or in some instances, become lodged on screen 32. Under such conditions it is desirable to have high pressure air available to be introduced under this compact mass and this is achieved by the valving arrangement, probably best illustrated in Figure 2. The first requirement of this operation is to vent the air pressure within the pot. This is normally best achieved by placing valve 57 in the exhausting position and in which the supply of air in pipe 62 is interrupted from its source. Then with valve 56 open, the built-up air pres-

sure is quickly vented, more quickly than it would vent out through the impacted mass of grit. Valve 56 should then be closed and valve 42 opened. At that time the valves 79 which normally control the amount of air flowing through the jet supply air lines 78 can be opened to give a quick rush of air through the pot and this has been found usually sufficient to loosen up any impaction that may have occurred. The valves are then restored to their normal operating position and blasting can then be continued. It has been found desirable to use a cross tee 85 in lines 78 so that the unused openings normally closed by screw plugs can be opened and rods passed either vertically down through the jet pipes 34 or horizontally to loosen up any lodgment that may have occurred in the horizontal portion of the supply line.

It is believed that it will be clearly apparent from the above description and the disclosure in the drawings that the invention comprehends a novel construction of a grit blasting device for cleaning pipe and the like.

Having thus described the invention, I claim:

1. A grit blasting device for cleaning pipe and the like, comprising: a housing enclosing a work area having annular entrance and exit openings aligned generally on a horizontal line; means for moving such pipe on a path through said entrance and exit openings while rotating the same; annular flexible diaphragm members positioned in covering relationship to said entrance and exit openings, said flexible members being dished in the direction of travel of such pipe and having openings therein to permit such pipe to pass therethrough; a series of nozzles positioned at the top of said housing and directed downwardly to spray on such pipe; a plurality of annular flexible diaphragm members, similar to said first-mentioned annular members, positioned between said entrance and exit openings and dividing said housing into a plurality of compartments separating various of said nozzles; said housing having openings in its bottom and screen means positioned therein to remove large particles of material passing therethrough; a baffle positioned between said nozzles and said screen to prevent material from passing directly therebetween; a hopper positioned below said screen to receive material passing therethrough; said hopper having a discharge opening in its bottom; a pressure chamber positioned below said hopper to receive material dropping through said discharge opening; a valve on said discharge opening operative to close said discharge opening when said chamber is pressurized and said pressure chamber being sealed when said valve is closed; manually controlled means for opening said valve; said chamber having a hopper shaped bottom with an egress opening at its apex; a pressure line passing below said egress opening and a connecting line connecting said egress opening and said pressure line; a manually controlled valve in said connecting line; said pressure line having a branch opening into the upper portion of said chamber to provide air pressure above materials in said hopper shaped bottom and a manually controlled valve on said branch; and a source of high pressure air for said pressure line on one side of said egress opening and said pressure line connecting with said nozzles on the other side of said egress opening.

2. A grit blasting device for cleaning pipe and the like, comprising: a housing enclosing a work area having entrance and exit openings aligned generally on a horizontal line; means for moving such pipe on a path through said entrance and exit openings while rotating the same; said housing having means at said entrance and exit openings for sealing the space between the exterior surface of such pipe and the edges of said openings; a plurality of nozzles positioned in the upper portion of said housing and directed downwardly to spray on such pipe; said housing having openings in its bottom and screen means positioned therein to remove large particles of material passing therethrough; a baffle positioned between said nozzles and said screen to prevent material from passing directly therebetween in absence of such pipe blocking such action; a hopper positioned below said screen to receive material passing therethrough; said hopper having a discharge opening in its bottom; a pressure chamber positioned below said hopper to receive material dropping through said discharge opening; a valve on said discharge opening operative to close said discharge opening when said chamber is pressurized and said pressure chamber being sealed when said valve is closed; said chamber having a hopper shaped bottom with an egress opening at its apex; a pressure line passing said egress opening and said egress opening connecting with said pressure line in position to deposit material therefrom by gravity feed; said pressure line having a branch opening into the upper portion of said chamber to provide air pressure above materials in said hopper shaped bottom; a source of high pressure air for said pressure line on one side of said egress opening and said pressure line connecting with said nozzles on the other side of said egress opening.

3. The subject matter of claim 2 in which there is a frusto-conical collecting chamber at each end of said housing covering said entrance and exit openings, said collecting chambers; each collecting chamber having an opening therein aligned with said entrance and exit openings and have an annular flexible diaphragm positioned in covering relationship thereto, said diaphragms being dished in the direction of travel of such pipe and having openings therein to permit such pipe to pass therethrough.

4. A grit blasting device for cleaning pipe and the like, comprising: a housing enclosing a work area having entrance and exit openings aligned generally on a horizontal line; means for moving such pipe on a path through said entrance and exit openings while rotating the same; a plurality of nozzles positioned in the upper portion of said housing and directed to spray on such pipe; said housing having an opening in its bottom and a screen positioned therein to remove large particles of material passing therethrough; a hopper positioned below said screen to receive material passing therethrough; said hopper having a discharge opening in its bottom; a pressure chamber positioned below said hopper to receive material from said discharge opening; a dump valve on said discharge opening and said pressure chamber being sealed when said valve is closed; said chamber having a hopper shaped bottom with an egress opening at its apex; a pressure line passing said egress opening and said egress opening connecting with said pressure line in position to deposit material therefrom by gravity feed; a source of high pressure air for said pressure line and said pressure line being connected with said nozzles; and means connecting with the upper portion of said chamber to provide air pres-

sure above materials in said hopper shaped bottom.

5. A grit blasting device for cleaning pipe and the like, comprising: a housing enclosing a work area having entrance and exit openings aligned generally on a horizontal line; means for moving such pipe on a path through said entrance and exit openings while rotating the same; a plurality of nozzles positioned in said housing and directed to spray on such pipe; said housing having openings in its bottom and screen means positioned therein to remove large particles of material passing therethrough; a hopper positioned below said screen to receive material passing therethrough; said hopper having a discharge opening in its bottom; a pressure chamber positioned below said hopper to receive material dropping through said discharge opening; a dump valve on said discharge opening operative to close said discharge opening when said chamber is pressurized and said pressure chamber being sealed when said dump valve is closed; said chamber having a hopper shaped bottom and having a vertical baffle dividing said hopper shaped bottom into two sections, each section having an egress opening in its lower portion; a pressure line passing said egress openings and a connecting line connecting each egress opening with said pressure line, a manually controlled valve on each connecting line; said pressure line having a branch opening into the upper portion of said chamber to provide air pressure above materials in said hopper shaped bottom; a source of high pressure air for said pressure line on one side of said egress openings and said pressure line connecting with said nozzles on the other side of said egress opening.

6. A grit blasting device for cleaning pipe and the like, comprising: a housing enclosing a work area having entrance and exit openings aligned generally on a horizontal line; means for moving such pipe on a path through said entrance and exit openings while rotating the same; a series of nozzles positioned at spaced apart points

between said openings and directed toward said path; said housing having a pair of openings in its bottom at opposite sides of the middle thereof; screen means positioned in said openings to remove large particles of material passing therethrough; a hopper positioned below each screen to receive material passing therethrough; each hopper having a discharge opening in its bottom; a pressure chamber positioned below each hopper to receive material dropping through said discharge openings; a dump valve on each discharge opening operative to close the same when said chamber is pressurized and the associated pressure chamber being sealed when said dump valve is closed; manually controlled means for opening each of said dump valves; each chamber having a hopper shaped bottom with an egress opening at its apex; a pressure line passing below each of said egress openings and a connecting line connecting each egress opening and its pressure line; a manually controlled valve in each connecting line; each pressure line having a branch opening into the upper portion of its associated pressure chamber to provide air pressure above materials in the hopper shaped bottoms and a manually controlled valve on each branch; a source of high pressure air for said pressure lines on one side of said egress openings and said pressure lines joining each other and connecting with said nozzles on the other side of said egress openings.

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