

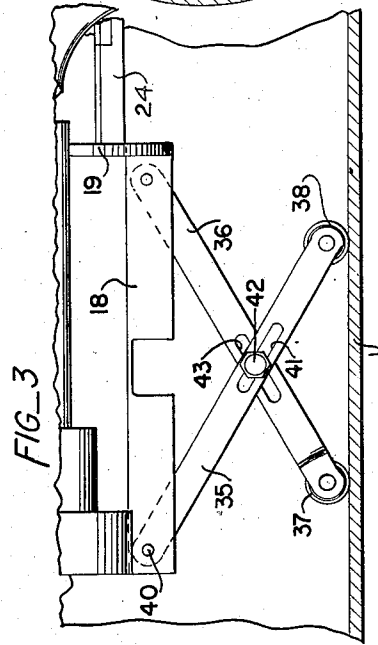
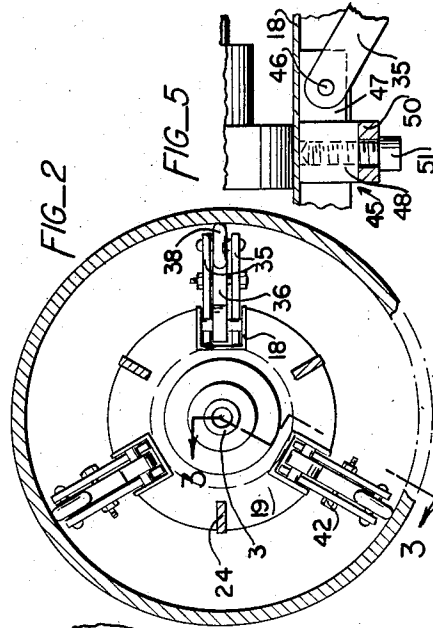
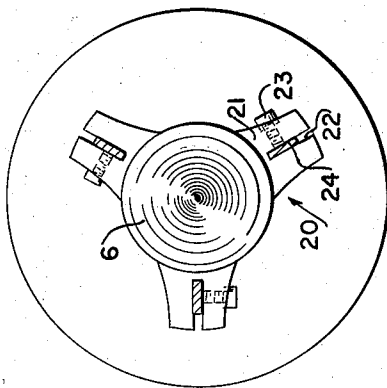
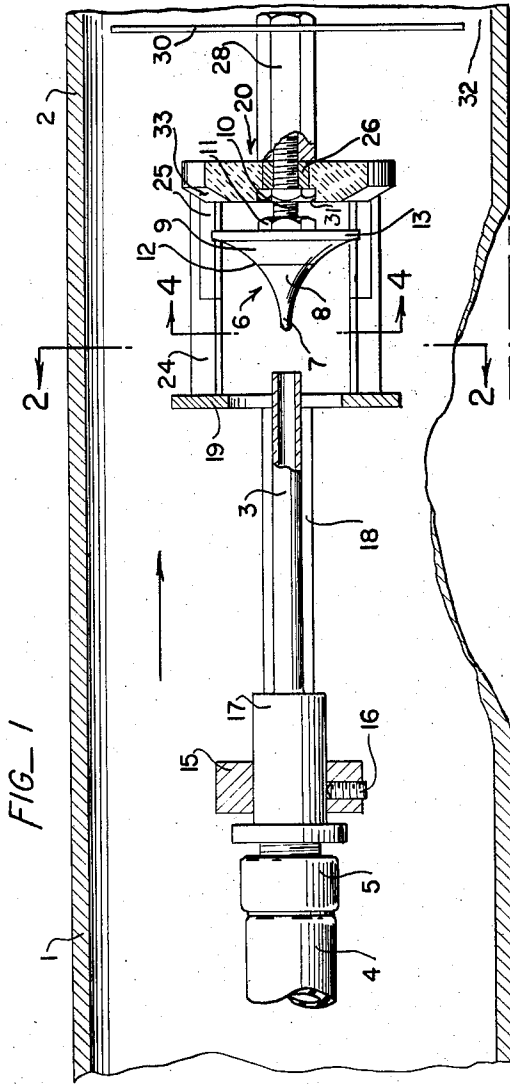
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M. E. FRITZE ET AL

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SANDBLASTING TOOL AND METHOD

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INVENTORS

MARVIN E. FRITZE

BY JOHN W. SMITH

Baylen, Mohler & Wood

ATTORNEYS

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SANDBLASTING TOOL AND METHOD

Marvin E. Fritze, Enumclaw, Wash., and John W. Smith, Redwood City, Calif.; said Smith assignor to J. C. Fennelly Company, San Francisco, Calif.

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This invention relates to a sandblasting tool of the type disclosed in United States Letters Patent No. 2,739,424 issued March 27, 1956, and has for one of its objects the provision of a tool adapted to more uniformly and more efficiently clean the interior of pipe or tubing than heretofore and to accomplish the cleaning operation more rapidly and more economically than in the past.

In explanation of the above, pipe is often rusted, corroded or coated interiorly, and it is tedious and expensive to remove the rust, scale and other material deposited on the inside surface. The removal of interior deposits and formations by sandblasting has been attempted, but due to the highly abrasive nature of the abrasive employed, such as sand, mineral shot, etc., the tools in the forms heretofore used have quickly worn away. Moreover, since the prior forms have, for the most part, been in the general nature of nozzles in which the sandblast material is directed angularly with respect to the axis of the pipe along which the material is delivered, the sand impinges the interior of the pipe at one point only. This has heretofore made it necessary to either rotate the pipe or the nozzle in order to clean the entire interior area of the pipe. If the nozzle is rotated relative to the pipe, this must be done in a reasonably accurately controlled manner, otherwise areas within the pipe will be unevenly sandblasted. When the jet is rotated mechanically or by hand, it must be supported for rotation in bearings which must, of necessity, be located close to the nozzle where bearings are inevitably subjected to the abrasive effect of the sandblast material and of the dust created by its use. Under such circumstances the bearings quickly deteriorate, and the method is so slow and is so uncertain as to uniformity in result that such tools and method have been abandoned.

If the pipe is rotated relative to the jet, such a step requires handling the pipe, which is often heavy, and special rigging must be used to support it during a sandblasting operation and to traverse it so that it is sandblasted its whole length. This is difficult, expensive and tedious, and it precludes the possibility of sandblasting the interior of pipe stacked in the pipe yard or on racks or fixed in an installation. Thus where pipe must be rotated, each pipe length must be supported for rotation and individually handled. Because of the foregoing difficulties this procedure has proven unsatisfactory.

It is an object of the present invention to provide a tool and a method of sandblasting the interior of pipes that avoids the difficulties mentioned and that enables the cleaning of the interiors of pipes evenly, accurately, thoroughly, and yet quickly and cheaply.

It is also an object of the invention to provide such a tool in which there are no parts movable relative to each other during the sandblasting operation, such as a discharge nozzle relative to its mounting.

Another object of the invention is the provision of a tool of the nature, and for the purpose indicated, that will be subjected to the minimum of wear when in operation, and which, at the points of maximum wear, will

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be formed of quickly replaceable material that is highly resistant to abrasion by the sandblasting material.

A further object of the invention is to provide a tool in which the point of impingement of the sandblasting material on certain parts of the tool may be quickly changed without altering the effectiveness of the tool, so as to prolong the time of use of the tool before said parts must be replaced.

Another object of the invention is the provision of a sandblasting tool that is of the nature and for the purpose indicated that is provided with means for insuring removal of the loosened deposits and sandblasting material from within the pipe as the deposits and formations are loosened from the interior of the pipe without stopping the operation of the sandblasting tool or impairing its efficiency.

A still further object of the invention is to provide a sandblasting tool that can be drawn or pushed by hand or by a simple feed mechanism through a pipe from end to end, and which tool is provided with means for holding it axially centered within different sizes of pipe.

An additional object is the provision of a tool that is adapted to use sand, mineral shot, or any of the available abrasives or it is adapted to use agricultural products such as rice hulls, fruit pit material or any suitable polishing materials with equal facility for polishing the interior of a pipe.

Another object of the invention is the provision of a combination of separable parts of different materials such as parts formed of steel, tungsten carbide and a ceramic in a sandblasting tool, and in an arrangement that will materially contribute to lengthening the life of the tool at a cost that is substantially less than where the hardest metals only are used, and without loss in efficiency.

In explanation, the use of tungsten carbide at all points in the present tool subjected to the blast of the abrasive and air is very expensive, and attempts were made to substitute hard but cheaper steel at points where the abrasion is not as severe as at points of direct impingement by the abrasive. This substitution was not entirely satisfactory for the reason that channels formed in the softer steel causing the abrasive to follow set paths. It was discovered that by substituting ceramic parts for the softer steel, such as parts made from steatite ceramic, this difficulty was entirely overcome and such ceramic parts would wear down evenly and longer than adjacent parts made from tungsten carbide, but which latter parts received the direct blast of sandblast material.

Other objects and advantages will appear in the description and in the drawings.

In the drawings, Fig. 1 is a vertical, cross-sectional fragmentary view showing the sandblast tool supported within a pipe; said tool being partly in section and partly in elevation.

Fig. 2 is a cross sectional view taken along line 2—2 of Fig. 1.

Fig. 3 is a fragmentary, sectional view showing one of the adjustable tool supports within a pipe, the latter being shown in cross section.

Fig. 4 is a cross sectional view taken along line 4—4 of Fig. 1.

Fig. 5 is a fragmentary view of a modification of the structure of Fig. 3.

The pipe is indicated at 1, which pipe is illustrated (Fig. 1) as having been cleaned at the left hand end with the portion 2 at the right hand end still to be cleaned. The arrow indicates the direction of movement of the sandblasting tool.

The tool illustrated comprises a nozzle 3 to which the abrasive is conveyed by air under pressure through a suitable hose 4 or tube of indeterminate length re-

movably connected to the nozzle by coupling 5. The nozzle is preferably of very hard, abrasion-resisting material, such, for example, as tungsten carbide, and it is straight and is disposed coaxially with the hose or tube 4 and the pipe 1. The function of the nozzle is to confine the blast material, but not to change its direction.

Spaced a suitable distance beyond the end of the nozzle, and in axial alignment with it, is a deflector generally designated 6.

The deflector 6 is of generally conical shape with its vertex 7 nearest the exit or discharge opening of nozzle 3, and may be spaced from say approximately $\frac{1}{4}$ to 6 inches from the latter, according to the size of the tool and other considerations.

While this deflector may be made entirely of tungsten carbide steel, it is preferably made in two parts with the portion 8 having the vertex being of sintered tungsten carbide, preferably of grade .883 or .999 or having a Rockwell C hardness of between 80 and 90 and the remainder 9 being of ceramic material. A "Steotite" ceramic having a hardness comparable to a Rockwell C hardness of from 75 to 80 has been found to be satisfactory. This ceramic portion 9 of the deflector may have a central threaded bushing, and a threaded stub shaft 10 centrally secured to and projecting from the portion 8 of the nozzle may threadedly extend through said bushing. A lock nut 11 on said shaft 10 releasably locks the portions 8, 9 of the deflector together against relative movement.

The surface of deflector 6 is preferably formed along a curve, as indicated at 12 (portions 8, 9 being considered as one), so that tangents to this curve at successive points from the vertex towards the base 13 and lying in a radial plane, are successively steeper with relation to the axis of the conical deflector 6. Preferably, but not necessarily, the curve 12 may be formed as the arc of a circle struck approximately from a point located on a line which is at an angle of approximately sixty degrees to the axis of the cone, and outwardly of a projection of the margin of the cone's base at 13, and likewise outwardly of its vertex 7.

Releasably secured to said nozzle for movement to adjusted positions along the latter is a collar 15. One or more set screws 16 may extend through said collar and engage the nozzle for rigidly holding the collar on the nozzle at any desired point along the latter. In some sizes the collar may be supported on and secured to a thickened end portion 17 of the nozzle, as indicated in the drawing, but this is not essential since the nozzle may have a uniform external diameter with the collar mounted thereon. The important feature is that in most sizes of tools the collar should be adjustable to different positions therealong.

Secured at one of their corresponding ends to the outer periphery of collar 15 and at three equally spaced points therearound are three corresponding arms 18. These arms may be channel strips positioned with the channel in each directed outwardly and with the web or bottom of the channel secured to the collar 15 in any suitable manner.

The ends of arms 18 opposite to collar 15 are suitably and rigidly secured to an annular plate 19 that is coaxial with the nozzle 3 and with collar 15.

Normally the plate 19 is approximately at the outer or discharge end of the nozzle 3, and the internal opening in the plate 19 is greater than the outside diameter of said nozzle so that the nozzle is spaced within the central opening in the plate.

Spaced axially outwardly of plate 19 and outwardly of the discharge end of nozzle 3 is a ceramic member generally designated 20. This member 20 is formed with three equally spaced radially outwardly extending legs 21 (Fig. 4) each of which may be formed with an

opening 22 adjacent to its outer end for receiving an end of an arm or metal strip 24. A set screw 23 extends through each leg 21 to the opening 22 for engaging each arm 24. The other end of each arm 24 is rigidly secured to the plate 19 in any suitable manner.

The arms or strips 24 are positioned with their flat sides substantially in radially extending axial planes relative to the axis of the nozzle 3, and the radially inwardly disposed portion 25 of each strip adjacent to the ceramic member 20 is preferably of tungsten carbide steel of the same character as the tip of the deflector, and the portion 8 of the deflector is also of the same hardness. Preferably the legs 21 at each side of each arm 25 is bevelled as indicated best at 33 (Fig. 1).

The threaded shaft 10 that carries the deflector threadedly extends through a central bushing 26 in the member 20 and past said bushing so as to project from the side of the member 20 that is opposite to the deflector (Fig. 1).

The projecting end portion of the shaft 10 is threadedly connected with one end of a rod 28 that is coaxial with nozzle 3 and into which end the projecting end portion of shaft 10 extends.

Secured to the outer end of the rod 28 is a circular plate 30 coaxial with said rod. The diameter of the plate 30 is less than the inside diameter of the pipe to be cleaned, thus providing an annular passageway between the edges of the plate and the inside of the pipe 1. Preferably the rod 28 is poly-sided in cross sectional contour so as to be tightened or loosened with a conventional wrench, and it acts as a nut for engagement with the member 20 to releasably lock the rod to the member. A recess 31 may be formed in member 20 at the opposite side of the rod 28 for receiving the nut 11 when the deflector is tight against the member 20.

The foregoing structure provides for supporting the deflector 6 for movement axially of the nozzle 3 toward and away from the latter and relative to the arms 24.

As the particulate abrasive or polishing material, which is discharged along the axis of the pipe from the discharge opening, at the outer end of nozzle 3 strikes the portion 8 of the deflector, it is diverted radially outwardly in the form of a conical sheet and impinges the inner side of the pipe, or the deposits that are on said inner side, removing said deposits. This conical sheet will tend to wear the radially inwardly disposed portions 25 of arms 24, and ultimately the arms must be replaced. However, by reason of the shaft 10, the deflector can be moved to different positions along the axis of the nozzle 3 so that a new part of portions 25 will be impinged, and the time required for replacement of the arms may be greatly lengthened.

Since the distance between the outlet of nozzle 3 and the deflector 6 should be one in which the maximum efficiency for the particular type of deposit and size of pipe is obtained, it will be seen that when the deflector 6 is moved relative to the nozzle, the collar 15 should then be moved a corresponding distance so as to preserve the correct spacing between the nozzle outlet and the deflector.

After the conical sheet of particulate material and air strikes the inside of the pipe, in the larger sized pipes this material would normally tend to build up within the pipe ahead of the movement of the tool. However, the provision of circular plate 30 forms an annular passageway 32 where the air velocity is accelerated to a degree that the particulate material is carried out of the pipe. Instead of turbulence and eddies being created ahead of the tool, the air and particulate material is moved axially of the pipe in a generally annular path past said plate 30.

In smaller sized tools for small diameter pipes of say less than four inches in diameter, supports similar to arms 18 are adequate to slidably support the tool within a pipe for movement axially thereof. However, where the pipe may be from four inches in diameter and up-

ward, it is preferable that the tool have an adjustable support to support it for movement within the pipe and that such support have pipe engaging rollers to facilitate movement of the tool.

One type of such support would be the provision of legs 35, 36 (Fig. 3). The legs 35 are arranged in spaced opposed pairs and a leg 36 extends between each such pair. One of the ends of each leg 36 extends between the sides of each channel arm 18 at the end of the latter that is secured to plate 19, while the other end of each such leg is forked to pivotally carry a roller 37 between each fork.

A roller 38 is between one of the ends of each pair of legs 35 being pivotally connected to said ends, and the other ends of each pair of legs 35 have a spacer block between them and a pivot 40 extends through said legs, the spacer and the sides of the channel arm 18 at the end of each of the latter that is remote from the plate 19.

Corresponding slots 41 formed in the pairs of legs 35 and a bolt 42 extends through slot 43 in each arm 36 and the slots 41 in arms 35 for locking the legs in an adjusted position of the rollers outwardly of the arms 18.

If desired, the legs 35, 36 may be simultaneously adjusted by a structure illustrated in Fig. 5 in which a sliding shoe 45 is substituted for each spacer block. Each such shoe has arms 35 pivoted at 46 to the spacer portion 47 of block 45, while the remainder 48 of the block slidably fits between the sides of channel arm 18 and projects above the sides of the channel for securement to a band 50 that encircles the tool. A set screw 51 extends through band 50 and one of the shoes for engagement with the bottom of channel arm 18 so as to secure the legs 35, 36 in adjusted position. In this form of invention the legs are not slotted, but are connected by an ordinary pivot.

The arms 18 in this form of invention are longer than arms 18 in Fig. 1 since the blocks 45 must slide in the arms longitudinally of the latter when they are adjusted for fitting in pipes of different diameters.

We claim:

1. A tool for sandblasting the interior of a pipe and the like comprising: a straight, rigid, open-ended, tubular nozzle adapted to be positioned within the pipe to be cleaned coaxially therewith, means for connecting one end of said nozzle with a source of sandblasting material and with air under pressure for discharge of said air and material from the opposite end of said nozzle, a generally conical deflector in a position coaxial with said nozzle spaced outwardly of said opposite end and having its vertex directed toward said opposite end, a deflector mounting means connecting said nozzle with said deflector supporting the latter in said position including a member supporting said deflector for movement toward and away from said nozzle, a circular plate coaxial with said nozzle and said deflector spaced from said deflector at the side of the latter that is remote from said nozzle, and means connecting said plate with said deflector mounting means for holding said plate coaxial with said nozzle and said deflector and in its spaced relation to the latter, the diameter of said plate being less than the diameter of the pipe to be cleaned.

2. In a sandblasting tool having a nozzle provided with a circular discharge opening for discharge of sandblast material along the axis of said opening, a generally

conical deflector coaxial with said opening spaced outwardly of said opening with its vertex directed toward said opening and with its base remote from the latter, means including arms disposed around said nozzle and extending generally axially thereof connected with said nozzle at one of their ends, a deflector supporting member secured to the other ends of said arms and extending across said axis, means connected with said member and with said deflector supporting said deflector between said member and said opening for movement of said deflector to different positions on said axis toward and away from said opening, means connecting said one of the ends of said arms to said nozzle for supporting said arms and said thereof as a unit axially of said axis, a circular plate coaxial with said deflector spaced from the latter at the side of the latter that is remote from said opening, means connecting said plate with said member for supporting the plate for movement with said plate upon said movement of said arms generally axially of the axis of said opening.

3. In a sandblasting tool having a nozzle provided with a circular discharge opening for discharge of sandblast material along the axis of said opening, a generally conical deflector coaxial with said opening spaced outwardly of said opening with its vertex directed toward said opening and with its base remote from the latter, means including arms disposed around said nozzle and extending generally axially thereof connected with said nozzle at one of their ends, a deflector supporting member secured to the other ends of said arms and extending across said axis, means connected with said member and with said deflector supporting said deflector between said member and said opening for movement of said deflector to different positions on said axis toward and away from said opening, means connecting said one of the ends of said arms to said nozzle for supporting said arms and said member including said deflector for bodily movement thereof as a unit axially of said axis, a circular plate coaxial with said deflector spaced from the latter at the side of the latter that is remote from said opening, means connecting said plate with said member for supporting the plate for movement with said plate upon said movement of said arms generally axially of the axis of said opening, said means connecting said deflector with said member being a threaded stub shaft projecting from the base end of said deflector and rigid with said deflector, said shaft threadedly extending through said member and projecting from the side of said member that is opposite to said deflector, and the said means connecting said plate with said member including the projecting end of said shaft that projects from said opposite side of said member and an element carried by said plate into which said projecting end threadedly extends.

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