July 7, 1970 J. V. HAIDER ET AL 3,518,795

WORKPIECE TREATING APPARATUS

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Fig. 1.

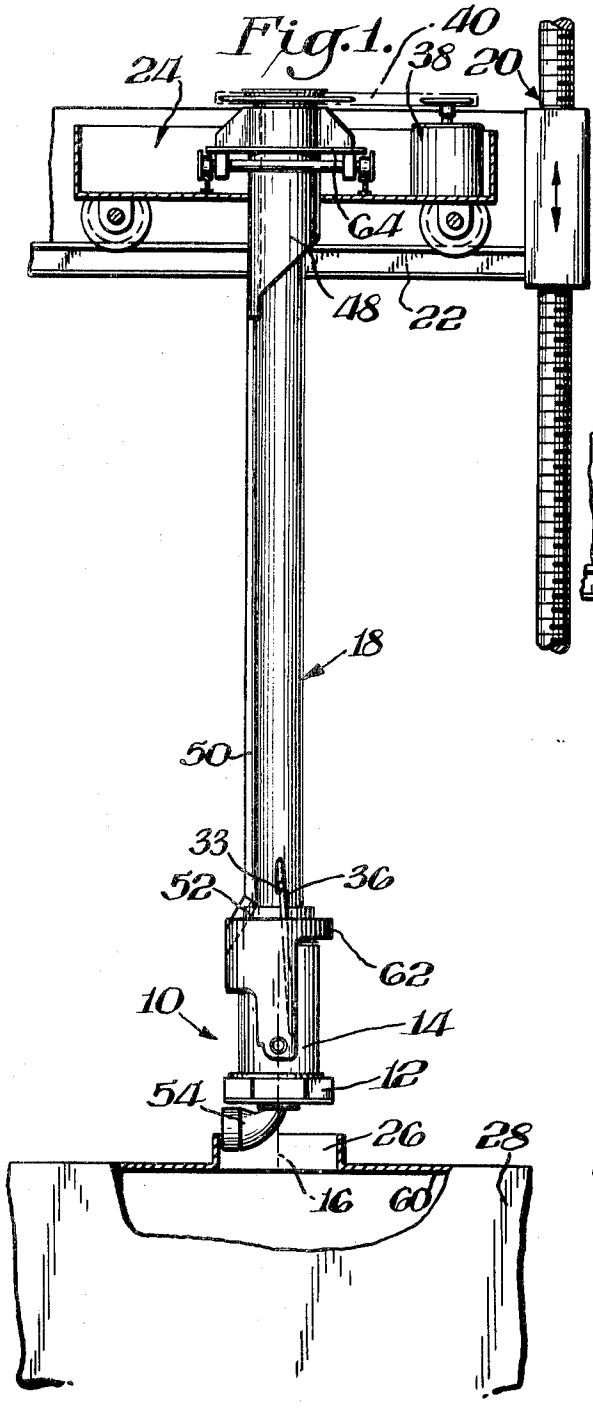


Fig. 3.

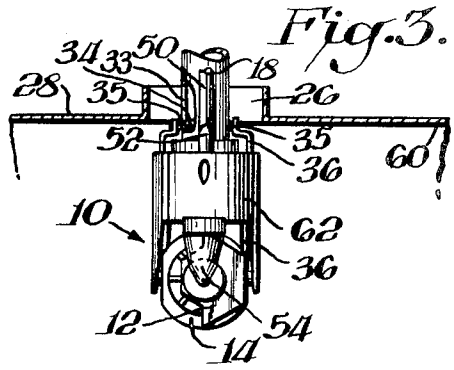
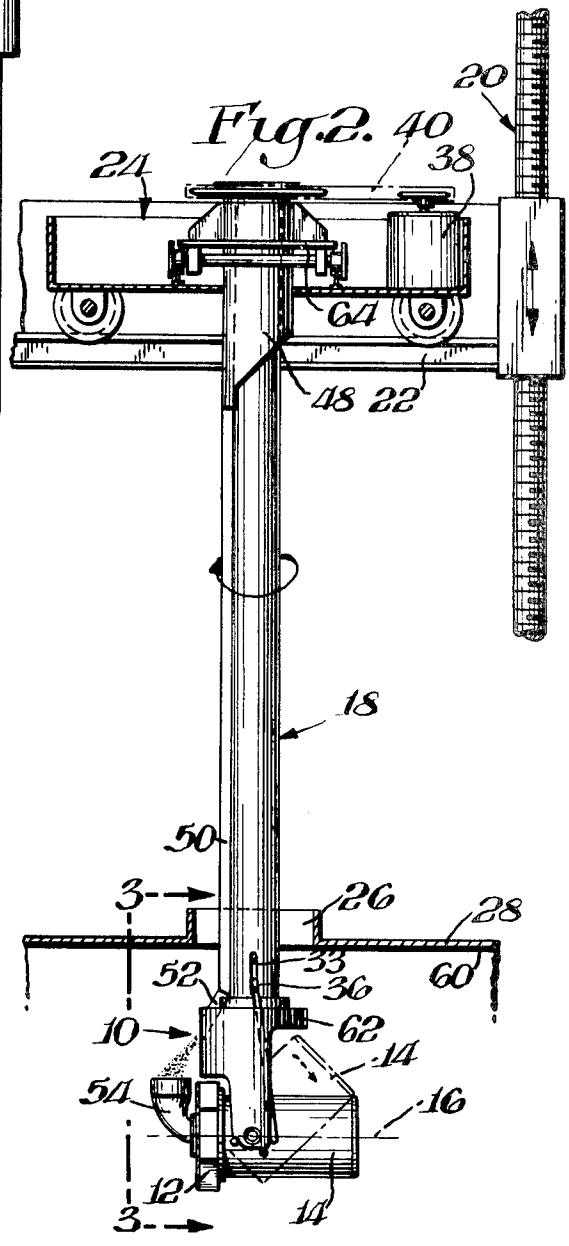


Fig. 2.



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WORKPIECE TREATING APPARATUS

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Fig. 4.

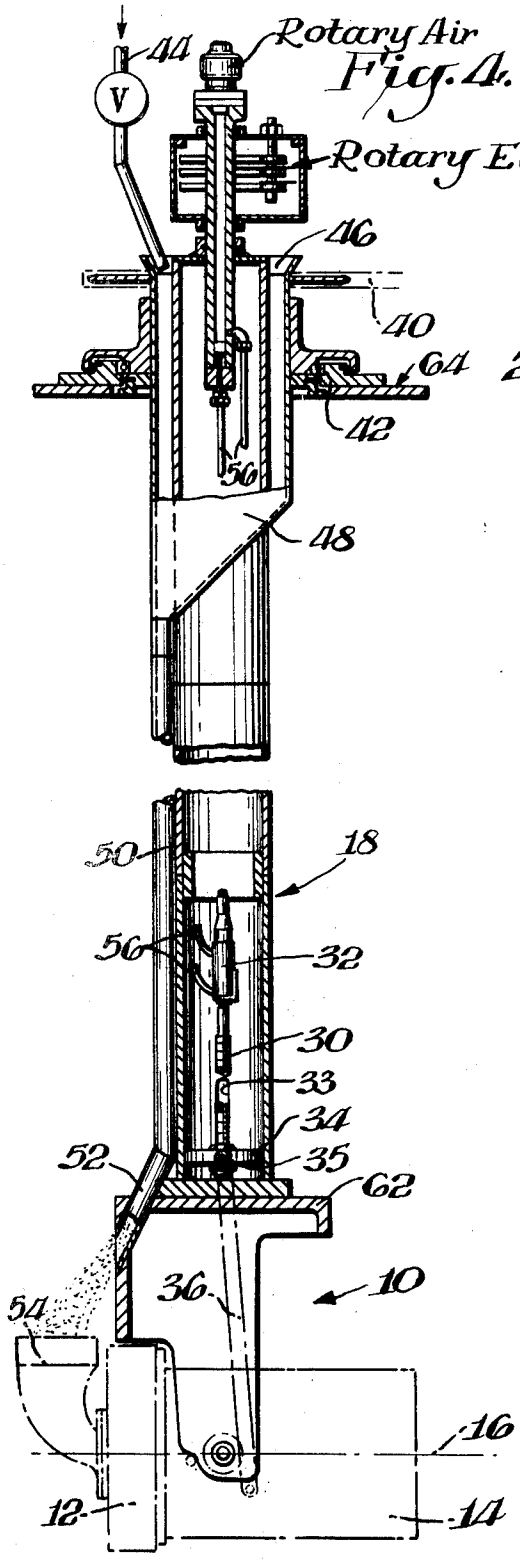
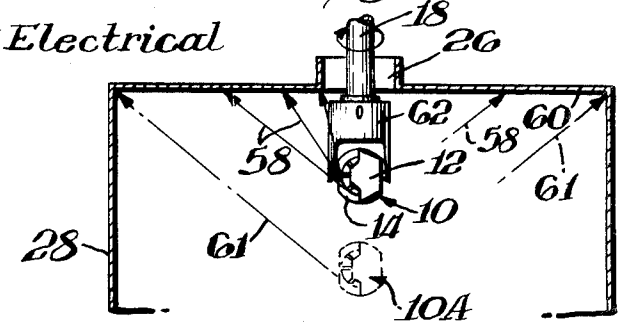


Fig. 5.



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WORKPIECE TREATING APPARATUS

John V. Haider, Pittsburgh, Pa., and James H. Carpenter, Jr., Hagerstown, Md. (both % The Pangborn Corporation, Hagerstown, Md. 21740)

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U.S. Cl. 51—9 10 Claims

ABSTRACT OF THE DISCLOSURE

A workpiece treating apparatus includes a throwing wheel which is driven about a first axis and which with its drive means is pivotally connected to a boom in such a manner that it is movable to and from a vertical position and a horizontal position. The boom can be raised and lowered and can also be rotated about an axis perpendicular to the axis of rotation of the wheel.

BACKGROUND OF INVENTION

The industry has long recognized the need for cleaning relatively inaccessible areas such as interiors of tanks, hoppers, railroad cars, etc. A recently developed apparatus has answered some of the needs of the industry, in the provision of a boom mounted wheel which is very effective in cleaning vertical or angular surfaces. With this apparatus, however, horizontal surfaces such as the roof of a hopper or the top inside surface of the tank cannot be cleaned.

SUMMARY OF INVENTION

An object of this invention is to provide a blasting wheel which can be inserted through small openings and can blast for example the inside horizontal surfaces of hopper cars, tanks, and similar shapes.

A further object of this invention is to provide such a wheel which can fulfill the above functions without requiring motion of the part being cleaned.

In accordance with this invention the wheel and its drive are mounted on the end of a boom with the drive capable of rotating the wheel about a first axis. The wheel-drive unit is pivotally connected to the boom for movement between the vertical position and the horizontal position it assumes during use. The boom in turn is connected so as to raise and lower the unit and the unit is also capable of rotation about a second axis perpendicular to the first axis.

In an advantageous form of this invention an air motor is mounted within the boom with a screw rotated by the air motor. A nut is positioned on the screw for movement up and down the screw in accordance with the rotation of the screw. Additionally, the nut is connected to the wheel-drive unit by links so that the vertical movement of the nut is translated into rotational movement of the unit. An added feature is to provide such an air motor which stalls when the unit is in the vertical or horizontal position to hold the unit in its respective position.

The apparatus may also include a ring shaped feed tube in the boom for continuously receiving particles during the rotation of the boom. The ring shaped tube may terminate in an inclined tube which is disposed toward a feed spout on the wheel with an air gap between the tube and spout.

THE DRAWINGS

FIG. 1 is an elevational view partly in section of one embodiment of this invention in one phase of operation;

FIG. 2 is a view similar to FIG. 1 showing later phases of operation;

FIG. 3 is a cross-sectional view taken through FIG. 2 along the line 3—3;

FIG. 4 is a cross-sectional view in elevation similar to FIG. 2; and

FIG. 5 is a fragmentary view of the apparatus shown in FIGS. 1–4 in different phases of operation.

DETAILED DESCRIPTION

As shown in FIG. 4, unit **10** which comprises a particle throwing wheel **12** is connected to its drive **14** for rotation about horizontal axis **16**. The unit is arranged, as later described, for movement between the horizontal position shown in FIG. 4 and the vertical position shown in FIG. 1, and is secured to the end of a boom **18**.

As indicated in FIGS. 1 and 2, boom **18** is mounted for movement up and down by any suitable means such as screw drive **20** which is connected to platform **22** upon which is mounted car **24** with the boom **18**, in turn, being connected to car **24**. Thus by manipulation of vertical drive **20**, boom **18** with unit **10** may be moved up and down so that ,for example, the unit **10** can be lowered through a small opening such as a 20 inch diameter opening **26** in hopper car **28**. The vertical movement of the boom takes place with the unit **10** having its center line or axis **16** vertical.

FIG. 4 shows the details of moving the unit from its vertical position to its horizontal position. As indicated therein a screw **30** is actuated by an air motor **32** mounted within the boom casing **18**. The screw nut **34** is in turn connected to arms on the wheel unit by links **36** with the ends of the links **36** being pivotally attached to the nut **34** and unit **10** respectively. The nut is prevented from rotational movement and thus moves only up and down by means of guide pins **35** connected to nut **34** and riding in slots **33**. In this manner the vertical movement of the nut **34** upon screw **30** is translated into rotational movement (as shown in FIG. 2) of the wheel unit **10**. When the unit reaches maximum horizontal or vertical positions, the air motor **32** stalls and the stalled torque holds the wheel unit **10** in position.

The boom **18** is mounted not only for movement up and down, but also for rotational movement so that the entire unit **10** may also be rotated. The rotational movement may be had by any suitable means such as motorized drive **38** connected to the boom by chain **40**. Rotation about this vertical axis is facilitated by suspending boom **18** on a four point ball ring bearing **42** (FIG. 4). This bearing is designed to take thrust, radial, and moment loads.

The hollow boom is advantageously used to feed abrasive, electricity, and air to the unit. For example as shown in FIG. 4 the abrasive particles may be fed from a remote source through tube **44** and into a single feed tube **46**. Feed tube **46** is ring shaped at its upper end to insure continuous uninterrupted reception of the abrasive particles fed by tube **44** throughout the rotational move-

ment of boom **18**. Feed tube **46** then includes a funnel section **48** which terminates in a single longitudinal tube section **50** which in turn terminates in an inclined tube section **52** disposed toward feed spout **54** of the throwing wheel **12**. As indicated in FIGS. 2 and 3 the particles are fed from tube section **52** into feed spout **54** through an air gap.

As also indicated in FIG. 4 the electrical and air connections **56** are likewise housed within tube **18**.

The operation of the unit **10** may best be understood by reference to FIGS. 2 and 5. The unit is lowered while in its vertical position until it is beneath the opening **26**, whereupon unit **10** is moved to the horizontal position shown in solid in FIG. 2 and in FIG. 5. Particles are then fed to wheel **12** and the wheel is rotated about axis **16** to project the particles. Simultaneously boom **18** is rotated so that the resultant blast pattern which is indicated by the arrows **58** (FIG. 5) cleans a portion of the top interior surface **60** of hopper **28**. When this portion has been sufficiently cleaned, the boom for example is lowered to the position **10A** shown in FIG. 5 to clean a further area of top surface **60**, indicated by arrows **61**.

Since the wheel unit **10** can be retracted and lowered into the horizontal position, for the first time a wheel can be inserted through, for example a 20 inch diameter hole, and then blast a horizontal overhead surface. During the lowering of wheel unit **10** and while the wheel unit is in its vertical position, the unit is conveniently housed in shell **62**. As is apparent from an inspection of the drawings, the wheel unit **10** is thus merely approximately as wide as the boom **18** and the shell **62** actually constitutes the widest portion of the part of the apparatus which must be lowered through the small opening.

The type of blast patterns achieved, which are schematically shown in FIG. 5, can be conveniently controlled by for example programming, such as by connecting motorized drive **38** for programmed variable speed to give variable rotation, to dwell, to slow down, or to apply more blast to hard to clean surfaces.

For still further versatility of the unit **10**, the boom **18** is mounted for movement in horizontal directions by the inclusion of self-motorized car **24** which enables the boom to move with the car in for example the Y direction i.e. from right to left and left to right in FIGS. 1 and 2 or by mounting the boom to a second car **64** which in turn moves in a horizontal plane within car **24** and perpendicular to the direction of movement of car **24**, in, for example the manner described.

The rotary drive connection for boom **18** may be any suitable drive means **38**, **40** such as chain and sprocket, gears, or similar devices driven by electric, hydraulic or air means. Additionally, as indicated above the rotation can be continuous or uniform or, by the use of variable speed drive, the rotation can be programmed to dwell or slow down in areas that are hard to clean. Additionally, as illustrated in FIG. 5 the area coverage can be increased by simply lowering the wheel farther into the part **28** being cleaned.

Obviously many modifications and variations of this invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than specifically described.

What is claimed is:

1. A workpiece treating appartus comprising a particle throwing wheel, drive means for rotating said wheel to eject particles therefrom, said wheel and said drive means being a wheel unit, an overhead boom, said unit being pivotally connected to the lower end of said boom for movement about a first axis, position control means in said boom connected to said unit for moving said unit to and from a first generally vertical position and a second generally horizontal position, actuating means remote from said unit for controlling the actuation of said position control means, means for raising and lowering said unit, and means for rotating said unit about a second axis perpendicular to said first axis.

2. A workpiece treating apparatus comprising a particle throwing wheel, drive means for rotating said wheel to eject particles therefrom, said wheel and said drive means being a wheel unit, a boom, said unit being pivotally connected to said boom for movement about a first axis, position control means in said boom connected to said unit for moving said unit to and from a first generally vertical position and a second generally horizontal position, means for raising and lowering said unit, means for rotating said unit about a second axis perpendicular to said first axis, said position control means including driving means, vertical moving means actuated by said driving means, and transmission means connected to said vertical moving means and to said unit for converting the vertical movement of said vertical moving means into pivotal movement of said unit.

3. A workpiece treating apparatus comprising a particle throwing wheel, drive means for rotating said wheel to eject particles therefrom, said wheel and said drive means being a wheel unit, a boom, said unit being pivotally connected to said boom for movement about a first axis, position control means in said boom connected to said unit for moving said unit to and from a first generally vertical position and a second generally horizontal position, means for raising and lowering said unit, means for rotating said unit about a second axis perpendicular to said first axis, said position control means including air motor means in said boom, a screw rotated by said air motor means, a nut rotated up and down on said screw in accordance with the rotation of said screw, link means pivotally connected to said nut and to said unit for moving said unit to and from said vertical and horizontal positions in accordance with the position of said nut, and said air motor means stalling when said unit is in said vertical and horizontal positions to hold said unit in its respective position.

4. A workpiece treating apparatus comprising a particle throwing wheel, drive means for rotating said wheel to eject particles therefrom, said wheel and said drive means being a wheel unit, a boom, said unit being pivotally connected to said boom for movement about a first axis, position control means in said boom connected to said unit for moving said unit to and from a first generally vertical position and a second generally horizontal position, means for raising and lowering said unit, means for rotating said unit about a second axis perpendicular to said first axis, said unit including a feed spout for receiving particles and directing them to said wheel, a particle feed tube being in said boom disposed for directing particles into said feed spout when said unit is in said horizontal position, and an air gap being between said feed tube and said feed spout when said unit is in said horizontal position.

5. An apparatus as set forth in claim **4** wherein said feed tube terminates at its upper end in an open ring which funnels downwardly and ends in an inclined tube directed toward said feed spout.

6. An apparatus as set forth in claim **5** including means for moving said boom back and forth and from side to side.

7. An apparatus as set forth in claim **6** wherein said position control means includes air motor means in said boom, a screw actuated by said air motor means, a nut rotated up and down on said screw in accordance with the rotation of said screw, link means pivotally connected to said nut and to said unit for moving said unit to and from said vertical and horizontal positions in accordance with the position of said nut, said air motor means stalling when said unit is in said vertical and horizontal positions to hold said unit in its respective position, and all of the drive components for said air motor means being housed in said boom.

8. An apparatus as set forth in claim **7** wherein an open shell is mounted at the end of said boom for receiving said unit when said unit is in its vertical position.

9. An apparatus as set forth in claim 8 wherein said unit is approximately as wide in its widest dimension when said unit is in its vertical position on said boom.

10. An apparatus as set forth in claim 9 wherein said boom is mounted on bearings, said means for rotating said unit being motorized means for rotating said boom on said bearings, said means for moving said boom back and forth including a movable car, said boom being secured to said car, and said motorized means being mounted in said car.

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LESTER M. SWINGLE, Primary Examiner