

[54] **MOBILE SURFACE TREATING APPARATUS**  
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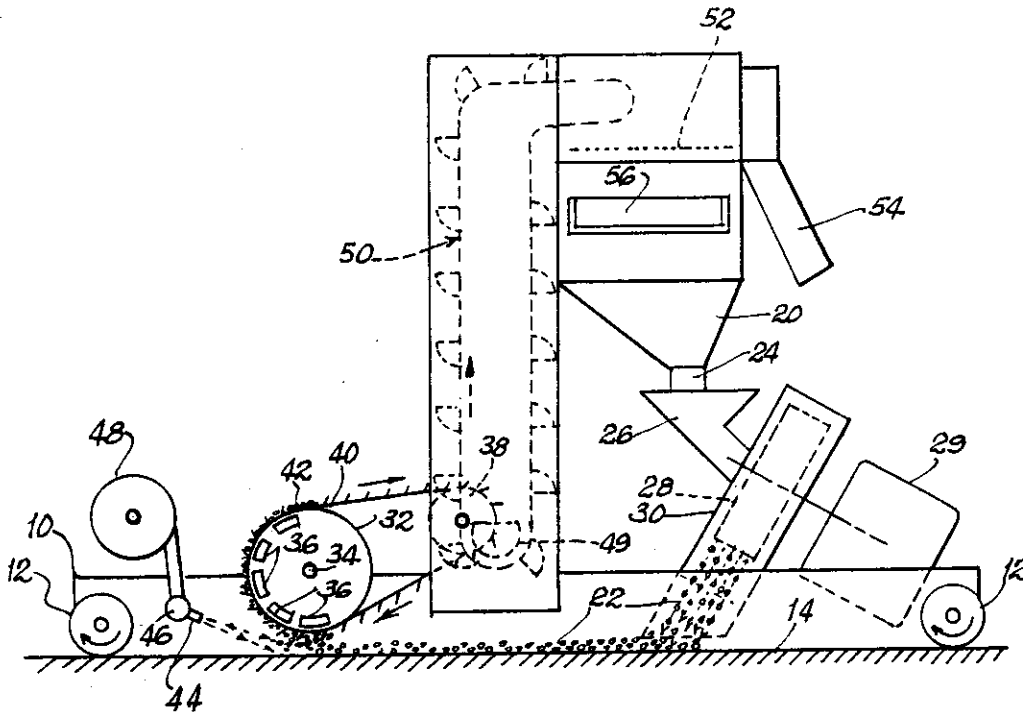
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[57] **ABSTRACT**

A mobile apparatus for the surface treatment with ferromagnetic particulate material thrown onto the surface at high speed, includes a housing which encloses a device for projecting the material onto the surface. Elements are provided for removal of the particulate material from the surface including air jets for slightly lifting the material, a magnetic drum and a conveyor for attracting the ferromagnetic material and conveying it for subsequent reuse.

[56] **References Cited**  
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12 Claims, 1 Drawing Figure



## MOBILE SURFACE TREATING APPARATUS

This invention relates to a mobile apparatus for surface treatment with ferromagnetic particulate or abrasive material projected at high velocity onto the surface and it relates more particularly to means for removal of the particulate material and dust from the surface for cleaning the treated surface and recovery of the particulate material for recycle.

In U.S. Pat. No. 3,691,689, description is made of a mobile apparatus for cleaning surfaces with a particulate abrasive material, wherein the abrasive particles are thrown centrifugally, at high velocity, downwardly through the bottom open side of a housing enclosing the exposed surface to be cleaned. The particulate material, thrown onto the surface at high velocity, is prevented from ricocheting into the atmosphere by an apron of resilient material which reaches down to the surface, but is sufficiently flexible to enable the spent particulate material and dust to pass under the apron for subsequent removal from the surface by a rotating brush. The brush sweeps the particulate material and dust into an elevator which raises the dust and particulate material to a dust separator whereby the recovered particulate material is returned as feed to the throwing wheel.

The brush pickup and recovery means associated therewith represents an extra piece of equipment which materially increases the size of the machine and the cost of operation due to the additional power and equipment required as well as the excessive wear on the brush, requiring frequent replacement. Further, the rotating brush failed as an effective pickup of the particulate material and dust, especially when operating over rough and uneven surfaces.

Other methods of pickup which utilize magnetic means, vacuum means or which have employed rebound are described in the following: U.S. Pat. No. 3,034,262 (Paulson); U.S. Pat. No. 3,380,196 (Mabille), and U.S. Pat. No. 3,448,544 (Cardon). Such means have not been found sufficient to effect clean removal of the spent particulate material and dust. As a result, additional, separate surface cleaning is required to be performed with additional cost as well as corresponding loss of particulate abrasive.

It is an object of this invention to provide a surface treating mechanism of the type described which makes use of means for cleaning or otherwise treating relatively flat surfaces with ferromagnetic abrasive or other ferromagnetic particulate material, thrown at high velocity onto the surface during the surface treating operation, which makes use of magnetic recovery means for removing spent abrasive in which the means is assisted by an air jet for lifting the spent particulate material and dirt from the treated surface which may itself be ferromagnetic and in which the elements are combined within a compact assembly for movement over the surface to be treated, and in which use is made of a minimum number of parts which cooperate one with another for operation in a simple and efficient manner, without the need for highly skilled or experienced labor.

These and other objects and advantages of this invention will hereinafter appear, and for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawing, which is:

A side elevational view, partially in section, showing the essential elements of the surface treating device embodying the features of this invention.

As illustrated in the FIGURE the surface treating apparatus of this invention is mounted on a frame 10 having wheels 12 journaled thereon for movement over substantially flat surfaces 14 to be cleaned or otherwise treated. The movement of the portable unit can be effected by hand, or the unit can be motorized, as a self-powered unit, for movement over the surface with suitable steering mechanism controlled by an operator seated on or otherwise working with the unit. Additionally, the unit can be rolled over the surface by a suitable towing mechanism or machine.

The invention will be described with reference to a cleaning device which makes use of ferromagnetic abrasive particles as a surface cleaning agent. However, it will be understood that the inventive concepts are applicable to portable apparatus for treatment of surfaces other than for cleaning, such as for abrading, peening, polishing, and the like, and wherein use is made of particulate material such as metal shot or metal grit.

The numeral 20 indicates a storage bin from which the ferromagnetic abrasive particles 22 are fed gravitationally downwardly from an outlet 24 at the bottom into a funnel 26 which channels the ferromagnetic abrasive particles into the central cage of an airless centrifugal blasting wheel 28 which is rotated at high speed, as by means of a motor 29. The abrasive particles are thrown in a pattern with high centrifugal force from the periphery of the wheel onto the underlying surface 14.

Centrifugal blasting wheels of the type described are well known to the trade and are marketed under the trade name "Wheelabrator" by Wheelabrator-Frye, Inc. of Mishawaka, Ind. The invention is not restricted to the use of such airless centrifugal blasting wheels for propelling the abrasive particles at high velocity onto the surface, since other well known means for projecting particles at high speed can be used, such as an air blast, vapor blast and the like, using suitable nozzles.

In order to confine the dust, dirt and particulate abrasive in a manner to prevent contamination of the atmosphere and to protect personnel from injury from abrasive particles traveling at high speed, the blast area is enclosed within a guard housing 30 which terminates a short distance above the surface 14 and is open at the bottom side so as to expose the surface for engagement by the particulate abrasive thrown from the wheel. For this purpose, the wheel 28 is mounted in the upper portion of the housing 30 in spaced relation above the surface, and adjusted to throw the abrasive particles in a pattern to engage the surface rearwardly of the wheel at a slight angle with reference to the direction of movement of the portable unit.

Since the surfaces to be treated are often uneven or rough, the lower edge of the protective housing 30 terminates a short distance above the surface. The intervening space between the housing and surface is sealed off by resilient skirts (omitted for purposes of clarity) which depend from the side walls of the housing to the bottom level of the device whereby the resilient skirts engage the surface in a manner to accommodate any unevenness.

After the magnetic abrasive material has been thrown onto the surface 14, it is recovered for reuse by means now to be described. Located rearwardly of the

abrasive discharge housing 30 is a drum 32 formed of non-magnetic metal. The drum rotates about a horizontal axis 34. Disposed along a portion of the internal circumference of the drum in a fixed position are a series of permanent magnets 36. The magnets may be placed about the circumference in a variety of configurations; however, the semicircular arrangement illustrated in the figure is preferred. Entrained about the drum 32 and an idler pulley 38 is a non-magnetic flexible belt 40. During operation of the apparatus the drum and pulley are rotated by a motor (not shown) to cause the belt entrained thereon to rotate in the direction indicated by the arrows. The abrasive material is attracted to the drum onto the nonmagnetic belt 40. The belt carries the abrasive material out of the magnetic field of the drum in pockets formed between a plurality of ribs 42 to a dumping point on the idler pulley 38.

An alternate drum construction wherein the drum itself is magnetic is possible. In such case the internal fixed magnets 36 are unnecessary. This construction, however, has the disadvantage of applying magnetic force to the abrasive material around the entire circumference of the drum and therefore tends to interfere with the action of the belt 40 in carrying the abrasive material attracted by the drum away from the drum's force field. Also, a large magnetic drum is more expensive and more difficult to fabricate.

Positioned rearwardly of the drum are a plurality of air jets 44 mounted on a manifold 46 which is supplied by an air pump 48. The air jets are directed in a manner so as to slightly lift the abrasive material off the surface 14 in the vicinity of the drum 32. Additional jets may be utilized to blow stray abrasive material into the path of the drum.

As will be apparent from the foregoing, as the rotating drum approaches the magnetic abrasive material the jets of air lift the material slightly off the surface 14. This allows the abrasive to be attracted to the drum onto the nonmagnetic belt 40 due to the magnets 36 positioned inside the drum. Use of air jets to lift the abrasive material allows the invention to be used for abrasive recovery even from a surface which is itself magnetic. By lifting the abrasives off the surface, magnetic interference from a ferromagnetic surface is avoided. The levitated magnetic abrasive material is attracted to the drum and as the drum rotates, the material is seated in the pockets formed between the ribs 42 on the belt 40. The belt conveys the abrasive material from the rotating drum and out of its magnetic field to the idler pulley where it discharges the material into the boot 49 of a belt and bucket elevator 50.

The belt and bucket elevator 50 is indicated schematically only as such elevators are well known to those skilled in the art. The abrasives are carried upwardly on the elevator and deposited onto a rotary screen 52 for removal of trash and large particles which are commingled with the abrasive material. A receptacle 54 receives the trash while the abrasive material passes downwardly into an air wash separator 56 for removal of fine abrasives which are no longer useful, and of sand, dust and other particulate material which may detrimentally affect the component wear of the system.

The magnetic drum will pick up ferromagnetic abrasive and waste material commingled therewith leaving little or no residue along the surface directly beneath the drum. Abrasive material which has spread outside the path of the drum but is still within the flexible seals

of the machine may be blown into the path of the drum by positioning additional air jets, as mentioned, in a suitable manner depending upon the particular application for which the machine is employed.

The apparatus described finds beneficial use for cleaning or treatment of surfaces, such as ships' decks, metal tank roofs, metal tank walls, concrete or asphalt highways and sidewalks, parking lots, driveways, aircraft runways, landing strips, building floors, and roadway stripes or other markings applied to highways.

It will be understood that changes may be made in the details of construction, arrangement and operation, without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. In a mobile apparatus for surface treatment with ferromagnetic particulate material, an enclosure having an open bottom side through which the surface to be treated is exposed, means mounting the enclosure for movement over the surface, projecting means within the enclosure for directing particulate material through the open bottom side onto the surface to be treated, means for removal of spent ferromagnetic particulate material from the surface, and means for recovering reusable particulate material; the improvement wherein the means for removal of spent particulate material from the surface comprises:

air jets positioned to direct an air stream at the surface to elevate the particulate material slightly above said surface;

means for magnetically attracting the elevated particulate material; and

belt means for transferring the attracted particulate material to the beams for recovering.

2. The apparatus of claim 1 wherein said means for magnetically attracting includes a rotating drum of non-magnetic metal and a plurality of permanent magnets placed at fixed locations along the inner circumference of said drum whereby said magnets attract said particulate matter to the outer circumference of said drum.

3. The apparatus of claim 2 wherein said magnets are placed at fixed locations along only a portion of the inner circumference of said drum.

4. The apparatus of claim 2 wherein said belt means is entrained about said drum and the particulate material is attracted onto the belt means.

5. The apparatus according to claim 1 wherein the belt means is formed of flexible nonmagnetic material having a plurality of ribs on its outer periphery.

6. The apparatus according to claim 1 wherein the air jets are mounted on a manifold and supplied by an air pump.

7. The apparatus according to claim 1 wherein the means for recovering includes:

a bucket and belt elevator for carrying the particulate material,

a rotating screen receiving the particulate material from said elevator for separating coarse waste materials from reusable abrasives; and

an air wash separator receiving the particulate material from said screen for separating reusable abrasive from sand, grit and spent abrasive.

8. A surface treating apparatus as claimed in claim 1 further including a resilient side apron extending from the bottom side edges of the enclosure into resilient engagement with the surface.

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9. The surface treating apparatus of claim 1 in which the particulate material is projected onto the surface within the enclosure in a downwardly and rearwardly direction.

10. The surface treating apparatus of claim 1 in which the projecting means comprises a bladed wheel mounted for rotational movement at high speed for projecting particulate material centrifugally onto the surface.

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11. The apparatus of claim 1 where said means for magnetically attracting includes a rotating magnetic drum whereby said drum attracts said particulate material to its outer circumference.

12. The apparatus of claim 11 wherein said belt means is entrained about said drum and the particular material is attracted onto the belt means.

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