United States Patent [19]

Snyder

[11] **3,877,175**

[45] **Apr. 15, 1975**

[54] **MOBILE SURFACE TREATING APPARATUS**

[75] Inventor: **Clyde A. Snyder,** Mishawaka, Ind.

[73] Assignee: **Wheelabrator-Frye Inc.,** New York, N.Y.

[22] Filed: **May 24, 1973**

[21] Appl. No.: **363,723**

[52] **U.S. Cl.** ..... **51/9 M**

[51] **Int. Cl.** **B24c 3/06**

[58] **Field of Search** ..... 51/8, 9, 273, 270, 274, 51/9 M; 15/345, 346, 340; 404/75, 94

[56] **References Cited**

UNITED STATES PATENTS

2,064,344	12/1936	Good	15/345 X
2,181,487	11/1939	Khuen-Kryk	15/345
3,004,279	10/1961	Ringer	15/346 X
3,007,191	11/1961	Braun	15/346 X
3,380,196	4/1968	Mabille	51/9
3,691,689	9/1972	Goff	51/9
3,756,377	9/1973	Goff	51/9 X
R27,314	3/1972	Codina	51/8

Primary Examiner—Donald G. Kelly

[57] **ABSTRACT**

A mobile apparatus for the surface treatment with a particulate material thrown onto the surface at high speed, which includes a housing which encloses a projecting means and means for restraining passage of particulate material from within the enclosure as well as means for removal of particulate material and waste from within the enclosure comprising a suction nozzle extending across the rearward end of the enclosure adjacent the surface and a blower nozzle which projects a stream of air onto the surface immediately below and/or behind the suction nozzle for sweeping particulate material and waste forwardly in advance of the suction nozzle.

11 Claims, 2 Drawing Figures

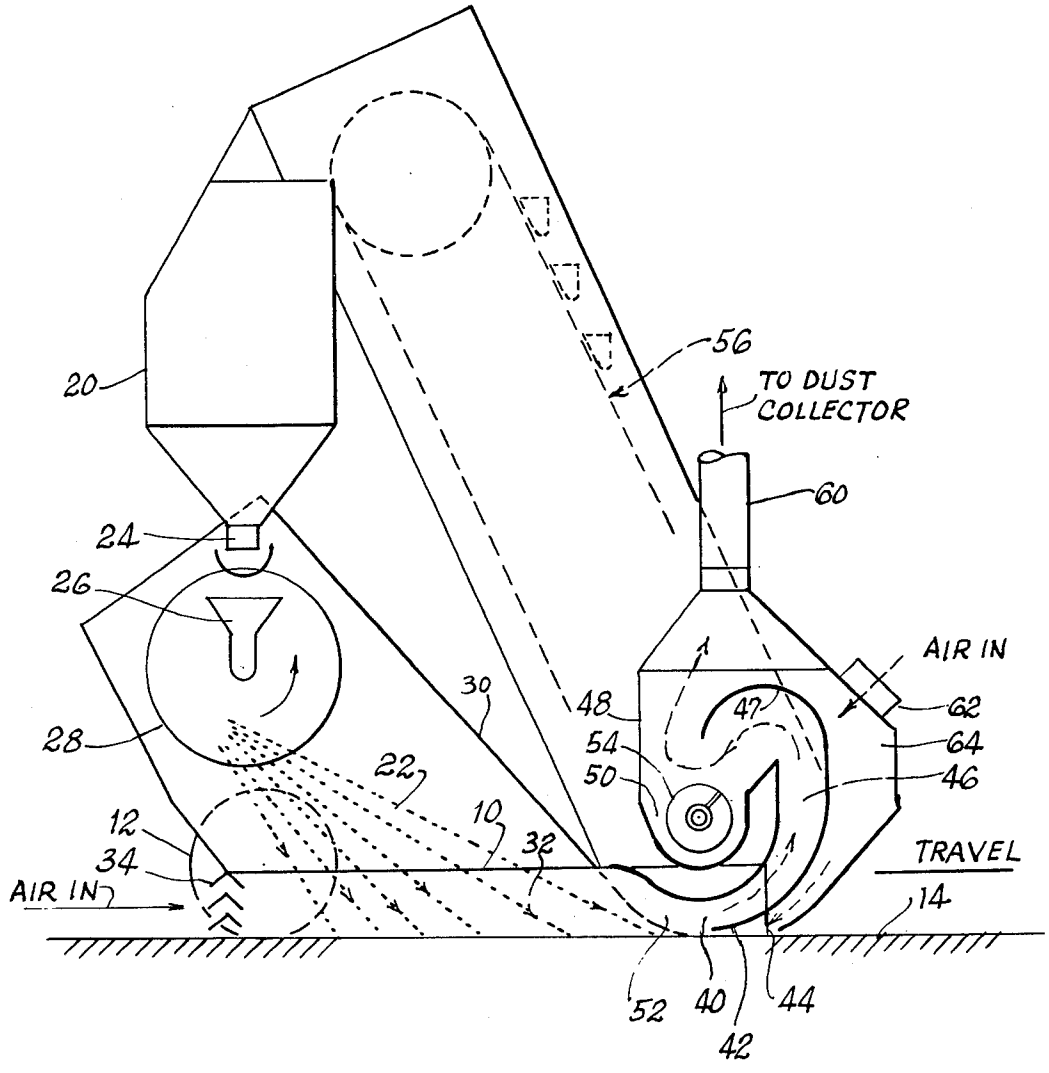


FIG. 1

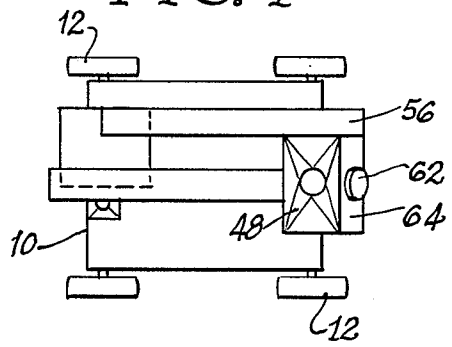
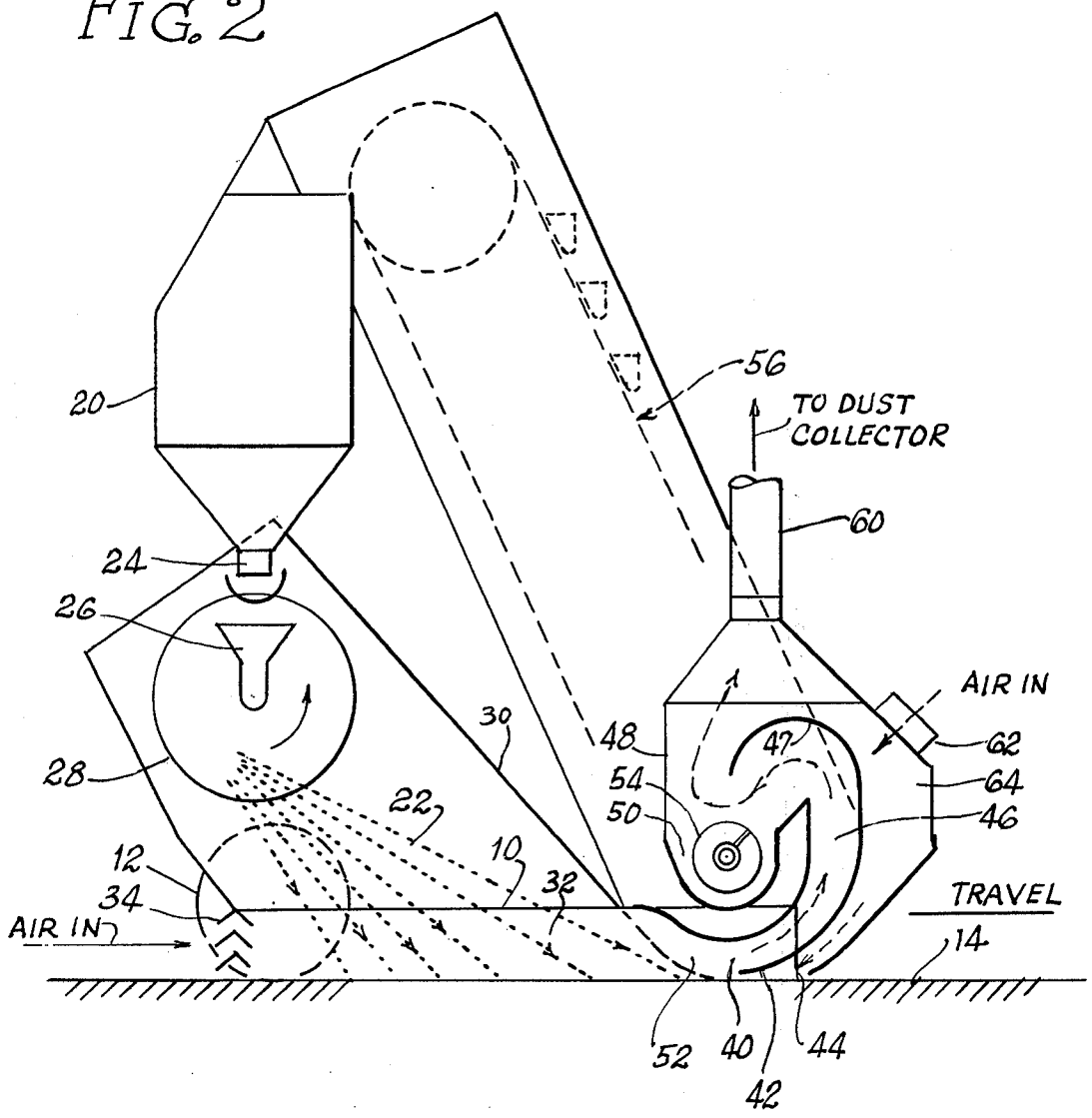

12
56
62
64
48
10
12

FIG. 2


20
56
TO DUST COLLECTOR
60
24
26
30
48
47
AIR IN
62
28
54
64
50
46
22
12
10
34
32
TRAVEL
AIR IN
14
52
40
44
42

MOBILE SURFACE TREATING APPARATUS

This invention relates to a mobile apparatus for surface treatment with 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 the recently issued 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 rebound, have been employed as described in the following: U.S. Pat. No. 3,034,262 (Paulson); U.S. Pat. No. 3,380,196 (Mobille), and U.S. Pat. No. 3,448,544 (Cordon). 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 abrasive or other particulate material, thrown at high velocity onto the surface during the surface treating operation, which makes use of suction means for removing spent abrasive and for cleaning the treated surface, in which the suction means is assisted by an air blast for enabling substantially complete removal of the spent particulate material and dirt from the treated surface, 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, in which -

FIG. **1** is a schematic top plan view of a surface treating device embodying the features of this invention, and

FIG. **2** 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 FIG. **1**, the surface treating apparatus of this invention is mounted on a frame **10** having wheels **12** journalled 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. Instead, 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 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 other than abrasives, such as metal shot, metal grit, inorganic or organic powders and the like.

Referring now to FIG. **2** of the drawing from a detailed description of the cleaning apparatus, the numeral **20** indicates a storage bin from which the abrasive particles **22** are fed gravitationally downwardly from an outlet **24** at the bottom into a funnel **26,** which channels the 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 (not shown). 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-Frye Inc. of Meshawaka, Indiana. 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 others from injury from abrasive particles traveling at high speed, the blast area, including the area from the wheel to the surface engaged by the abrasive particles, is enclosed within a guard housing **30** which terminates a short distance above the surface and is open at the bottom side so as to expose the surface for engagement by the particulate abrasive thrown at high velocity from the wheel. For this purpose, the wheel **28** is mounted in the upper portion of the housing, 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 terminates a short distance above the surface. The intervening space between the housing and surface is sealed off by resilient skirts **32** 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.

The spaced relation at the front of the housing is provided with a louvered member **34** to present a barrier to the passage of particulate abrasive therethrough, while permitting air to enter through the louvered section into the interior of the housing. Instead of a louvered or grill section **34,** use can be made of a strip of resilient material, corresponding to the skirts **32** since sufficient air can be drawn in under the skirts.

A vacuum nozzle **40** extends crosswise of the housing in the area between the bottom edge of the rear wall of the housing and the surface, with the bottom wall of the nozzle spaced a short distance above the surface. When measured from the effective bottom of the device, the bottom wall **42** of the nozzle should normally be within the range of ¼ to ¾ inch from the bottom or the surface, the distance depending somewhat on the particle size and weight of the particulate material to be removed from the surface through the vacuum nozzle.

Cooperating with the vacuum nozzle and immediately rearward thereof is a blower nozzle **44** arranged to direct a blast of air forwardly in the direction of movement of the portable unit and through the space provided immediately below the vacuum nozzle whereby the air blast engages the surfaces in the immediate vicinity of the vacuum nozzle to blow the dust, dirt and particulate material from the surface into position to be received by the vacuum nozzle. The air blast is also effective to return any dust, dirt or particulate material, left by the vacuum nozzle, into the confined space for subsequent pickup by the vacuum means. For this purpose, the air nozzle is positioned to engage the surface immediately following the vacuum nozzle for a substantial distance, with the nozzle extending close to the bottom for effective engagement with the surface.

The vacuum nozzle leads into an upwardly extending passage **46** which terminates in a curvilinear baffle **47** which guides the effluent into a downwardly direction into a separator housing **48** wherein, in response to centrifugal force and reduced speed of air flow, particulate material separates from the air stream while the fine dust and dirt particles remain entrained therein. The heavier particles of abrasive fall to the bottom of the separator housing **48** for collection in a trough **50** which extends crosswise of the housing and into the well **52** of a bucket elevator **56** which is located alongside of the separator. The trough is fitted with a screw **54,** having a dribble valve to provide an air lock at the end of the screw within the housing, for displacement of the collected particulate abrasive laterally from the separator housing into the well of the bucket elevator which communicates at the upper end with the storage bin and which operates to convey the separated particulate material upwardly for release of the recovered particulate material into the storage bin for re-use.

In the separator, the dust laden air can be exhausted through the outlet **60** to a dust collector (not shown) operating with fans or blowers wherein the dust is removed before the air is exhausted into the atmosphere or in part returned as clean pressurized air to the blower as hereinafter described. For purposes of economy and efficiency in operation, it has been found possible to make use of a portion of the cleaned air withdrawn into the separator, as high pressure air fed to the air nozzle **44** for blowing the particles and dust from the surface in the immediate vicinity of the vacuum nozzle. Thus, the energy employed to effect the withdrawal of air through the vacuum nozzle and dust collector is utilized to supply high pressure air to the blower. It is desirable to bleed off a portion of the air from the separator for processing through the dust collector to effect dust removal, whereby the amount of recycle can be within the range of 0 to 80 percent of the air withdrawn, and preferably in an amount within the range of 20 to 75 percent. The difference between the amount withdrawn and the amount recycled is made up by air which enters through the louvered front wall portion of the housing or under skirt seals **32,** which air provides dust control for the operation.

In the absence of recycle, or in addition thereto, air under high pressure can be introduced through the inlet **62** in communication with the pressure box **64,** to the air nozzle **44,** for blowing onto the surface to be cleaned.

Thus, pickup and removal of dust and particulate material is effected by the combination of blowing and vacuum applied simultaneously to substantially the same surface for lifting the material into the vacuum nozzle for removal, while sweeping any left-over forwardly for re-entry into the effective area of the vacuum nozzle. The described "Blow-Vac" system is capable of accomplishments as follows:

1. Light weight abrasive can be cleanly removed from the surface at traveling speeds up to 200 FPM without leaving stray materials.

2. Shot, grit or abrasive can be lifted with an exhaust volume from the suction nozzle of about 630 CFM/ft of width with 390 CFM/ft being returned to the pressure box **64** feeding the blower or air nozzle **44.**

3. The described system conforms to surfaces such as crowned surfaces, rippled surfaces, and surfaces having low spots and the like, regardless of the width of the area to be treated. For wide surfaces, it is desirable to subdivide the nozzle portions into separated adjacent segments which are aligned to span the width but which may be separately suspended for independent movement to adjust to the underlying surfaces to be treated.

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 strips or other markings applied to the 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 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, sealing means extending between the bottom edges of the enclosure and the surface for restraining passage of particulate material from within the enclosure, means for removal of spent particulate material, dust and dirt from the surface, and separating means for separating reusable particulate material from the remainder of the material removed from the surface, the improvement wherein the

means for removal of spent particulate material, dust and dirt from the surface comprises:

one or more suction nozzles extending crosswise along the rearward edge of the enclosure with the bottom wall of the nozzle spaced a short distance above the surface;

a blower positioned to project an air stream in a forwardly direction through the space between the bottom wall of the nozzle and the surface whereby particulate material, dust and dirt remaining on the surface is swept forwardly by the air stream into a position to be exposed to the suction nozzle for removal; and

means for cleaning and recycling a part of the suction air to the blower.

2. A surface treating apparatus as claimed in claim **1** which includes a dust collector and a circulating air fan having an inlet and an outlet with the inlet communicating with the suction nozzle and the dust collector and the outlet communicating with the blower for supply of cleaned recycled air under pressure to the blower.

3. A surface treating apparatus as claimed in claim **1** in which the suction nozzle comprises a single elongate nozzle which extends continuously across the rearward end of the enclosure.

4. A surface treating apparatus as claimed in claim **1** in which the blower comprises a nozzle immediately rearwardly of the suction nozzle.

5. A surface treating apparatus as claimed in claim **4** in which the blower nozzle has a common wall with the bottom wall of the suction nozzle.

6. A surface treating apparatus as claimed in claim **1** in which resilient means comprising a resilient side apron extends from the bottom side edges of the enclosure into resilient engagement with the surface.

7. A surface treating apparatus as claimed in claim **1** in which the sealing means is provided with a vent communicating the interior of the enclosure with the outside atmosphere for enabling air flow from the outside atmosphere into the enclosure.

8. In a mobile apparatus for surface treatment with 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, sealing means extending between the bottom edges of the enclosure and the surface for restraining passage of particulate material from within the enclosure, means for removal of spent particulate material, dust and dirt from the surface, and separating means for separating reusable particulate material from the remainder of the material removed from the surface, the improvement wherein the means for removal of spent particulate material, dust and dirt from the surface comprises one or more suction nozzles extending crosswise along the rearward edge of the enclosure with the bottom wall of the nozzle spaced a short distance above the surface, and a blower positioned to project an air stream in a forwardly direction through the space between the bottom wall of the nozzle and the surface whereby particulate material, dust and dirt remaining on the surface is swept forwardly by the air stream into a position to be exposed to the suction nozzle for removal wherein the means for separating reusable particulate material from the material removed from the surface comprises a curvilinear centrifugal baffle passage through which the stream of air and particulate material passes from the suction nozzle for separation of the larger and heavier material from the remainder which remains suspended in the air stream.

9. A surface treating apparatus as claimed in claim **8** which includes a conveyor means for returning the separated particulate material to the feed for the projecting means.

10. A surface treating apparatus as claimed in claim **1** in which the particulate material is projected into the surface within the enclosure in a downwardly and rearwardly direction.

11. A surface treating apparatus as claimed in claim **10** in which the projecting means comprises a bladed wheel mounted for rotational movement at high speed for projecting particulate material centrifugally onto the surface.

* * * * *