United States Patent

Murray et al.

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[54] VACUUM TYPE DEBRIS COLLECTOR WITH SCRAPER BLADE

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[52] **U.S. Cl.** **15/340,** 15/355, 15/375

[51] **Int. Cl.** **E01h 1/08**

[58] **Field of Search** 15/340, 401, 354, 355, 368, 15/375, 415, 83, 358, 362

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[57] **ABSTRACT**

A cleaning attachment to the suction hose or intake conduit of a debris collector includes a blade for scraping the ground and lifting debris into the suction path, the blade being adjustably supported in a shroud in a position to form a path for high velocity air at both the front and rear of the shroud to assist in conveying debris to the suction hose or conduit and a debris receiver. The cleaning attachment includes ground contacting members to facilitate movement over a surface to be cleaned and is pivotally mounted on a vehicle so that it can be raised to avoid obstacles and for rapid transit.

13 Claims, 6 Drawing Figures

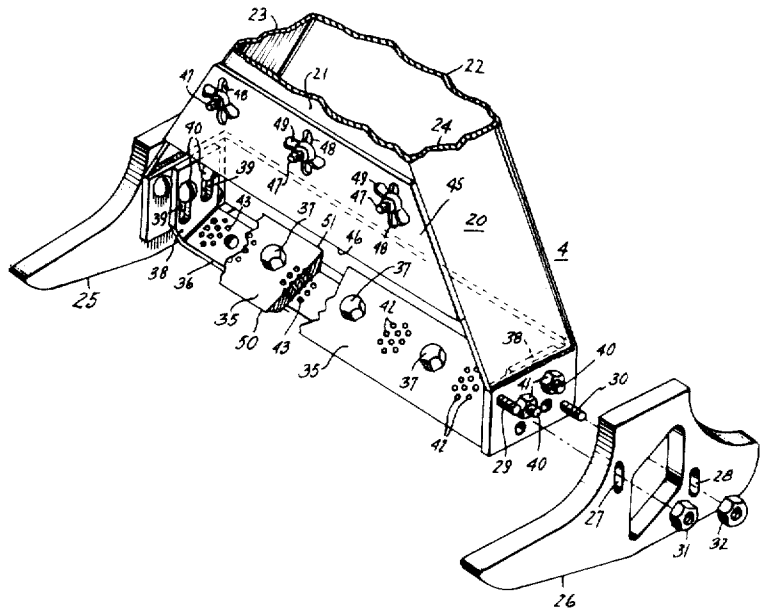


Fig. 1.

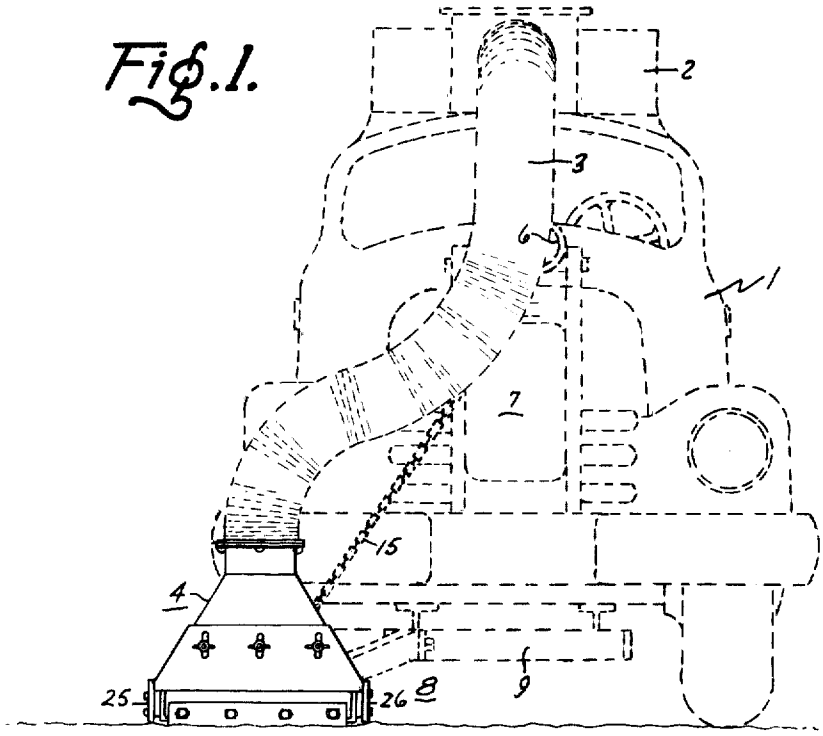
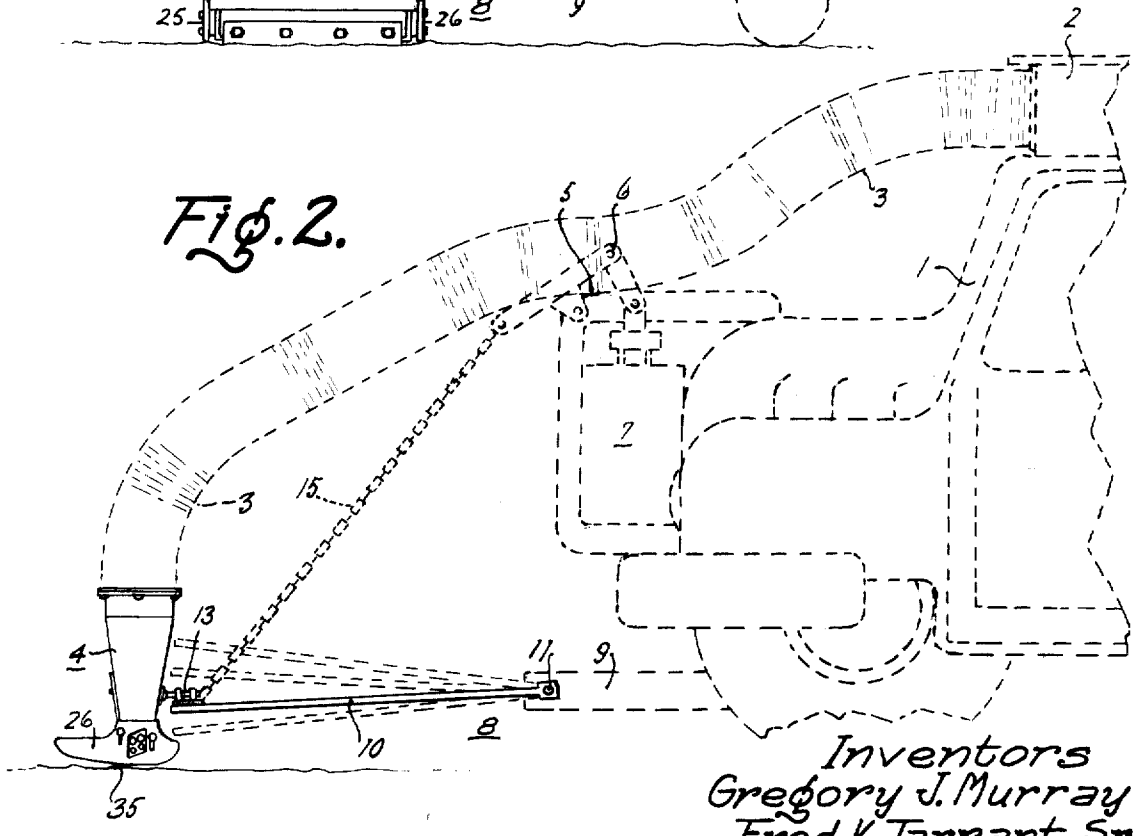


Fig. 2.



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Fig. 3.

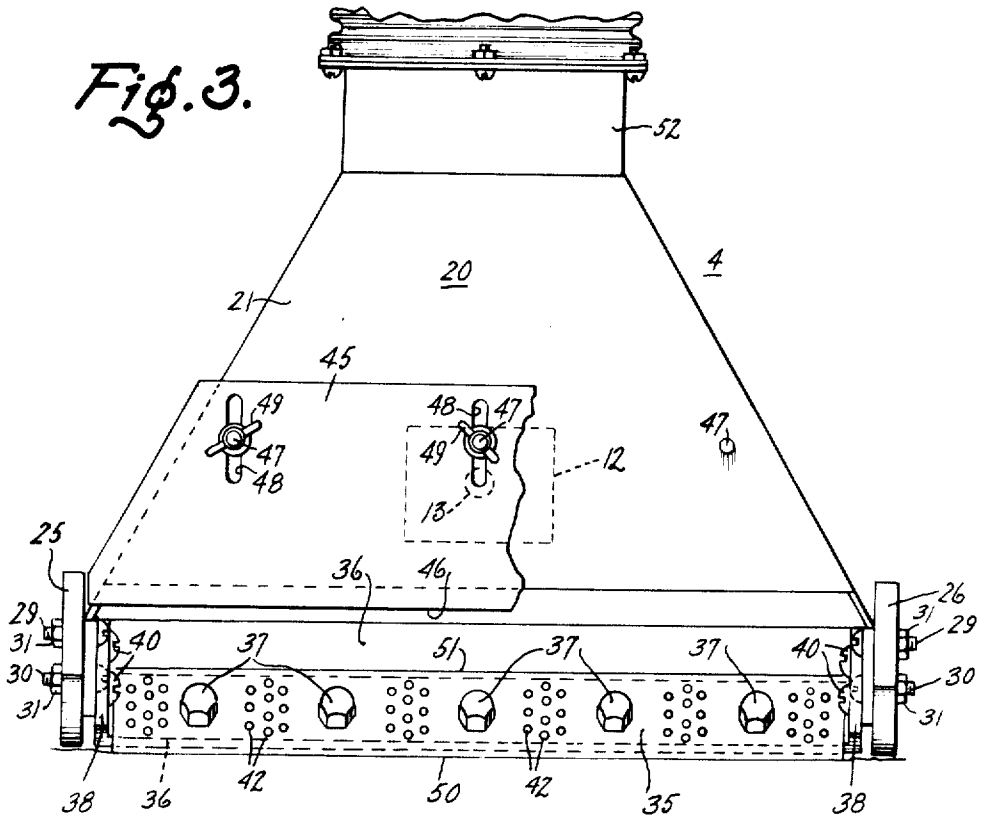
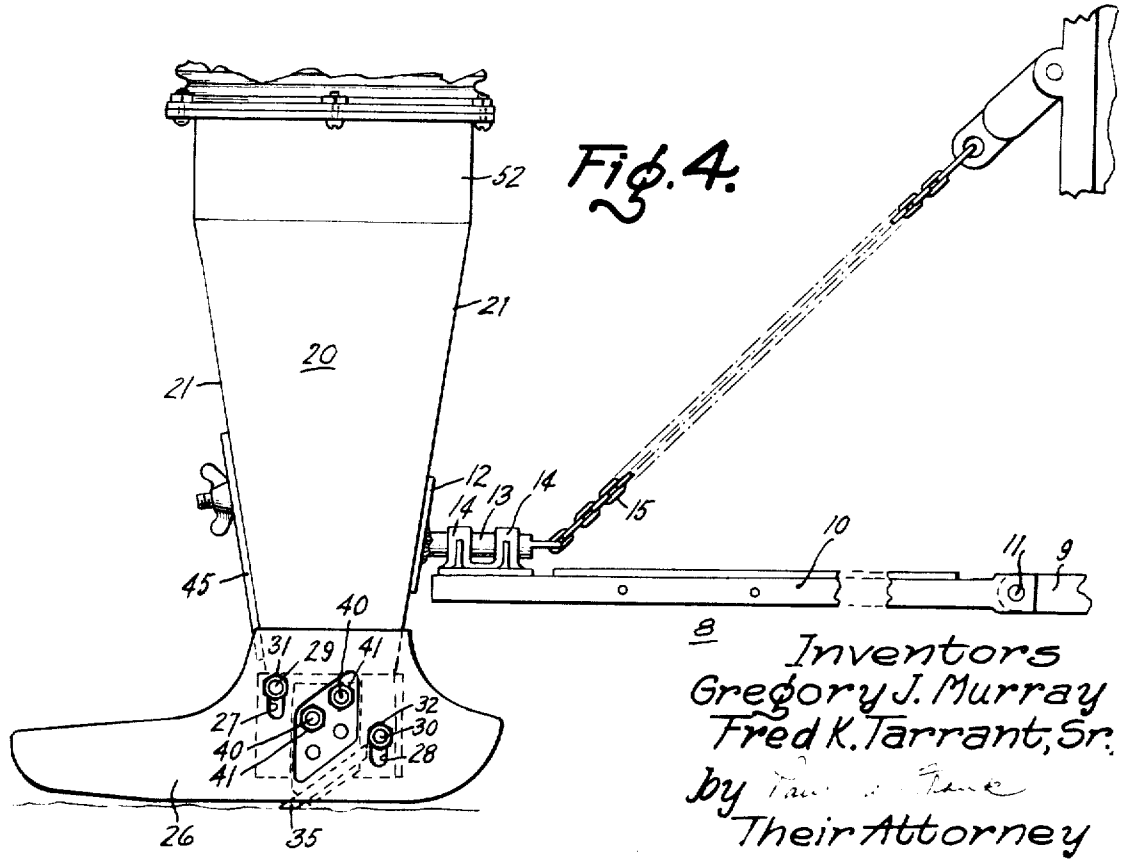


Fig. 4.



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Fig. 5.

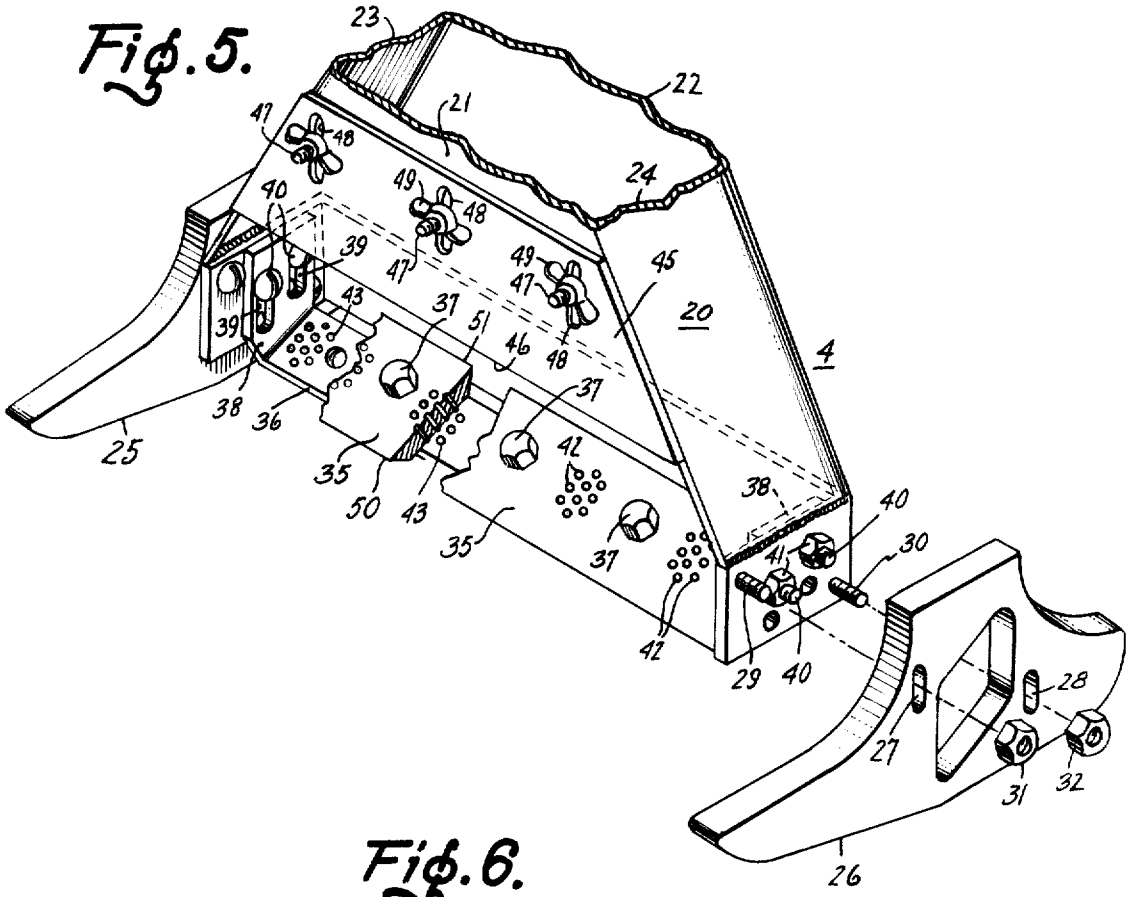
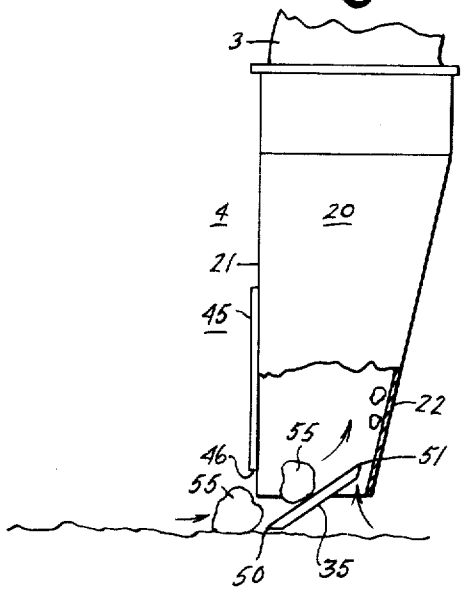


Fig. 6.



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VACUUM TYPE DEBRIS COLLECTOR WITH SCRAPER BLADE

This invention relates to apparatus employing a vacuum for picking up and removing trash and litter, including sand, cinders, and snow and ice control abrasives, from roads and other surfaces and in particular to an attachment for such apparatus to facilitate the removal of either wet or dry foreign material from surfaces to be cleaned.

Several types of movable cleaners have been employed for collecting litter and debris from streets, roads, and the like. One conventional type employs rotating brushes to sweep the surface and a vacuum to collect the material and debris raised by such brushes. Several known disadvantages are found with such types of cleaners. Such sweepers employ brooms made either from steel strands or strands made of synthetic materials such as polypropylene. Such brooms are not only expensive but have relatively short lives. For example, a polypropylene broom may last no longer than two or three weeks depending upon the time of year and type of pavement being cleaned. An undesirable effect of the broom type cleaner is that the rapidly rotating brushes create dust or smoke screens and contaminate the atmosphere. Another disadvantage is that such sweepers cannot be used on wet days and likewise cannot be operated if there is too much water in the material to be removed because such brushes will not pick up a slurry type material.

Another type of apparatus for removing trash litter from highways employs a vacuum and a manually operated nozzle. In such apparatus the nozzle is connected at the lower end of the suction hose and is moved over the area of the street or surface being cleaned by a man alongside the truck.

A principal object of our invention is to provide a new and improved vacuum type debris collector which may be employed to remove either wet or dry litter from a surface to be cleaned.

Another object of the invention is to provide a debris collector which employs a cleaning attachment carried at the front of a movable vehicle and which may be controlled by the operator of the vehicle.

Still another object of the invention is to provide a cleaning attachment for a vacuum debris collector which employs a scraper blade to assist the suction of the collector in rapidly and thoroughly removing compacted debris and other material that may be adhering to a surface to be cleaned.

One of the features of our invention is an attachment for the intake conduit of a vacuum debris collector which includes a scraper blade supported in a shroud carried in front of the vehicle to loosen material from a surface to be cleaned and facilitate its removal by suction, the blade being so positioned with respect to the walls of the shroud that a high velocity flow of air is established at both the front and rear of the blade to assure that debris raised by the blade is carried to a debris receiving container. The scraper blade is adjustable both angularly and vertically within the shroud and cooperates with valve means in the front wall of the shroud so that the attachment may be employed to collect debris varying over a wide range of sizes.

Further objects of the invention will be apparent from the following specification taken in connection with the drawings which form a part of this application and in which:

FIG. 1 is a front elevation view of a debris collector embodying the invention.

FIG. 2 is a side view of a portion of the debris collector of FIG. 1.

FIG. 3 is a front elevation view, partly in section, of a cleaning attachment of the debris collector of FIG. 1.

FIG. 4 is a side view of the attachment of FIG. 3.

FIG. 5 is a perspective view, partly in section and partly exploded, illustrating details of the attachment of FIG. 3.

FIG. 6 is a sketch showing operational characteristics of apparatus embodying the invention.

The debris collecting apparatus of FIGS. 1 and 2 employs a self propelled vehicle 1 with which is associated an enclosed vacuum tank or debris receiver 2 and conventional apparatus

(not shown) for establishing a vacuum in tank 2. The details of this portion of the apparatus form no part of this present invention and conventional commercially available vacuum apparatus and debris receivers may be employed. An intake conduit 3 which may be either a rigid conduit with flexible joints and couplings or a flexible corrugated hose, as illustrated, has its outlet attached to an inlet to receiver 2. A cleaning attachment 4 of our invention is attached to the other or inlet end of the conduit.

Intake conduit 3 extends to the front of vehicle 1 and is supported at a point 5 intermediate its length by means of a bracket 6 attached to a hoist 7 supported at the front of vehicle 1. Cleaning attachment 4 is supported by arrangement 8 which extends from the front of vehicle 1 and which comprises a fixed member 9 attached to the frame of the vehicle and a movable member 10 connected to fixed member 9 by means of a rotatable coupling 11. A support 12 attached to cleaning attachment 4 is carried at the front end of movable member 10 and is arranged for rotation about an axis extending longitudinally of member 10 by means of rod 13 and bearings 14. A chain 15 connected between movable member 10 and bracket 6 provides means whereby the front end of conduit 3 and attachment 4 may be raised and lowered with respect to a surface to be cleaned. Hoist 7 may be of the type conventionally employed on snow plows and may be arranged to raise attachment 4 and its associated shroud 20 to a suitable height for over-the-road travel without disconnecting it from conduit 3.

Details of our cleaning attachment 4 are illustrated in FIGS. 3–5. Attachment 4 comprises shroud 20 formed by trapezoidal shaped front and rear walls 21, 22 having connecting sidewalls 23, 24. Sidewalls 23, 24 diverge outwardly to form with walls 21, 22 an enlarged inlet for the shroud. Shroud 20 may be formed of sheet material bent to a desired shape. Thus it may have an elliptical or oval cross-section at its lower end or inlet and taper to a circular cross-section at its point of connection to conduit 3. Attached to the lower ends of sidewalls 23, 24 respectively are ground or surface contacting members, such as runners or skids 25, 26. Alternatively, rollers may be used. Each member or skid contains a pair of slots 27, 28 through which pass bolts 29, 30. A member may be adjusted both vertically and tilted angularly with respect to its side wall by means of nuts 31, 32 which engage bolts 29, 30. The ground contacting members preferably are formed of a material having a long life when subjected to the abrasive action of the surface over which they pass and may be formed of hardened surfaced steel or suitable non-metallic materials with abrasion resisting characteristics, such as, for example, urethanes or polyolefins.

A scraper blade 35 attached to a U-shaped member 36 by means of a plurality of bolts 37 is adjustably supported within shroud 20. Each upwardly extending end 38 of U-shaped member 36 is provided with a plurality of slots 39. Bolts 40 pass through slots 39 and cooperating holes in each side wall of the shroud and provide means for adjusting vertically and angularly the position of U-shaped member 36 and scraper blade 35. Nuts 41 are utilized to secure member 36 in its adjusted position. Both scraper blade 35 and U-shaped member 36 may have one or more overlapping openings or slots 42, 43 to permit air to flow therethrough and assist in lifting debris raised by the scraper blade into conduit 3. The number of such openings is correlated to the amount of vacuum employed.

We provide valve means to control the size of objects which may be admitted into shroud 20 and which comprise an adjustable shutter 45 attached to front wall 21 of the shroud. The position of the lower edge 46 of the shutter with respect to the pavement or ground may be adjusted by means of a plurality of screws 47, which pass through slots 48 provided in shutter 45, and associated wing nuts 49.

Scraper blade 35 preferably is made of steel which is forged and then heat treated to provide a long life. Alternatively, scraper blade 35 may be formed of a suitable nonmetallic material having good abrasion resistance characteristics such

as a urethane or a polyolefin. Likewise it is provided with two scraper surfaces **50**, **51** so that if one becomes worn or damaged the blade may be reversed and use continued. We also provide an abrasion resistant collar **52**, made preferably of a material such as stainless steel, at the restricted outlet portion of the shroud, i.e., the junction of shroud **20** with conduit **3**.

In operating our vacuum type debris collector using scraper blade **35**, we have found that a great amount of litter may be picked up without creating smoke or dust and whether the litter is dry or wet. Use of the attachment with the scraper blade permits picking up left over sand, abrasives, bottles, cans, and large objects. It also is extremely useful for routinely removing litter from highways, cloverleaves, underpasses, ramps, bridges and similar places where litter tends to collect.

The operation of the cleaning attachment **4** may best be explained by reference to FIG. **6**. As illustrated in this figure, front edge **50** of the blade is substantially in contact with the surface to be cleaned. Rear edge **51** however is spaced from rear wall **22** of the shroud. In this manner the vacuum apparatus attached to conduit **3** is able to create a flow of high velocity air between the rear edge **51** and the inner surface of wall **22** as well as between front edge **50** and the bottom of shutter **45**. By so doing any large object such as the object **55** which is picked up by scraper edge **50** is carried to the debris receiver associated with the vehicle. The front edge **50** of scraper **35** serves to loosen all debris from the surface to be cleaned so that air passes beneath the litter and permits the vacuum established by hose **3** to pick up the litter and carry it to the receiving tank. Blade **50** thus overcomes the inertia of the material and the air stream carries the material upward to the receiving tank. The high velocity air flow between rear edge **51** and rear wall **22** assures that any litter which passes over blade **35** is carried to the tank and will not fall back to the ground. When the attachment encounters a large amount of debris and tends to be choked thereby the flow of air through openings **42**, **43** assists in preventing such choking. Instead of choking the entrance such debris is raised rapidly toward conduit **3**. We have found this action to be a particular advantage of debris collecting apparatus using the attachment of our invention. This feature of our invention thus overcomes a shortcoming of currently available debris collecting apparatus. The size and number of openings **42**, **43** should be correlated with the vacuum employed to assure that both the debris will be carried into conduit **3** and choking action prevented and also that small objects, such as stones, do not fall through the openings.

One advantage of our invention is that because the cleaning attachment is located in front of the truck or vehicle, the driver can easily lift shroud **20** by means of the hoist to avoid any obstruction such as a raised manhole cover or the like. The driver thus can control the height of blade **35** so that edge **50** either scrapes the ground, engages the ground lightly, or passes over it completely, all as desired. The ground contacting members follow the contour of the surface at all times because of the mounting which provides rotation of attachment **4** about both transverse and longitudinal axes. In moving from spot to spot the driver furthermore can hoist the entire shroud to the full height of the hoist lift so that the truck can be moved rapidly between places where it will be employed.

In employing our invention in debris collecting apparatus we prefer to use a high vacuum, for example, of the order of 36 inches of water, so that rocks and large objects can easily be removed. Adjustable shutter **45** permits varying or controlling the size of the opening to the shroud in accordance with the size of objects to be picked up. Thus when sand is to be removed from a surface, shutter **45** may be in its lowermost position so that complete cleaning of the surface is obtained.

In the foregoing we have shown certain specific embodiments of our invention. However it is apparent that alterations in the construction and location of the components may be made. Thus, for example, while we have shown conduit **3** as attached to the front of the debris receiver, this suction point may be attached at any convenient spot on the receiver. It is evident therefore that the invention is capable of modification and changes in its construction and arrangement of parts without departing from the spirit and scope of the invention as covered by the following claims.

What we claim as new and desire to secure by Letters patent of the United States is:

1. An attachment for a vacuum debris collector of a type comprising a vehicle, a debris receiver associated with said vehicle, and a flexible suction conduit attached to said receiver, said attachment comprising a shroud having an outlet portion attachable to such conduit and an inlet portion, members attached to said inlet portion for contacting a surface to be cleaned and over which said shroud is moved, and a scraper blade supported by said shroud, said blade having a front edge spaced from the lower edge of the front of said inlet and forming therewith an opening for receiving debris to be collected, said blade having a rear edge spaced from the rear of said inlet to form therewith a path for high velocity air to assist in conveying debris contacted by said scraper blade to said conduit and debris receiver, said scraper blade containing one or more openings to facilitate raising debris lifted by said blade to said conduit.

2. The attachment of claim **1** in which the spacing of the front edge of said blade with respect to the lower edge of said front wall is adjustable to control the size of said opening in accord with the size of the particles of debris to be collected.

3. The attachment of claim **1** in which said scraper comprises a hardened steel blade.

4. The attachment of claim **1** in which said scraper comprises a non-metallic member having abrasion resisting characteristics.

5. The attachment of claim **1** in which said blade is reversible.

6. The attachment of claim **1** in which said surface contacting members comprise wear resistant surfaces and are adjustable relative to said shroud.

7. The attachment of claim **6** in which said surfaces are adjustable both angularly and vertically relative to said lower edge of said shroud inlet.

8. The arrangement of claim **1** in which a bracket is attached to the front of the vehicle, said attachment is connected to said bracket and is rotatable about transverse axes in a plane substantially parallel to the surface over which the shroud is moved.

9. The arrangement of claim **8** which includes means supporting said bracket to control the pressure of said surface contacting members on the surface over which they move.

10. The arrangement of claim **8** in which said bracket is pivotally attached to the front of the vehicle and which includes means for raising said bracket and said attachment as a unit to permit rapid travel of the vehicle.

11. The attachment of claim **1** in which said shroud has a front wall and valve means are attached to said front wall to control the size of the opening formed by said front wall and said scraper blade whereby said attachment may be employed to collect debris of different sizes.

12. The attachment of claim **11** in which said valve means comprises an adjustable shutter whereby the distance of the lower edge of said front wall relative to the ground may be varied.

13. The attachment of claim **1** in which said openings are of a size small enough to prevent objects raised by said scraper blades from passing through such openings.

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