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54 **Waste collection.**

57 Waste collection apparatus 10 comprises a first fluid duct 12 having an inlet at 14. A fan 16 creates a first fluid flow path 18 to draw waste material into the inlet 14, for collection. A second duct 20 directs air back along the periphery of the flow path 18 to deflect waste material up into the main path 18. Rotating air jets 32 are located near the inlet 14 to sweep an area to either side of the vehicle, to deflect waste material in to the path 18.

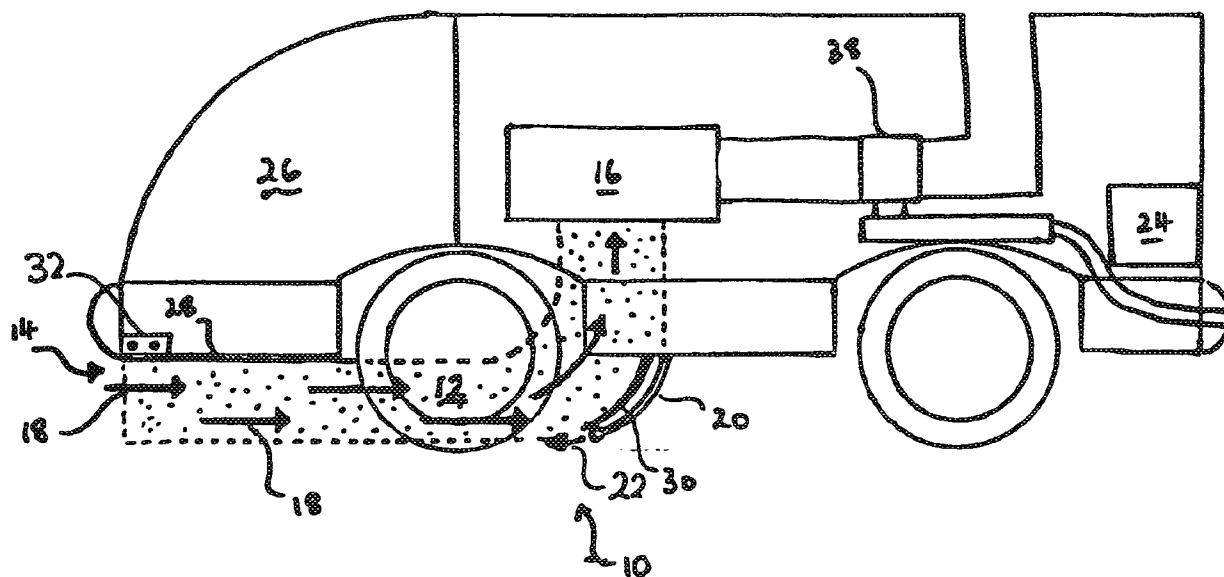


Fig 1.

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The present invention relates to waste collection and to waste collection apparatus.

Efficient, rapid and economic techniques for waste collection are becoming increasingly desirable, in view of the increasing litter problem in many countries. It has previously been proposed to modify vehicles for collecting waste and litter, by providing brushes to sweep the surface over which the vehicle is moving, to deflect litter to a collecting scoop which brings the litter into the vehicle where it is stored for transport to a disposal location. Increasing amounts of litter are very light, some being highly coloured articles such as fast food containers, making the problem clearly visible. Other natural articles such as leaves, are bulky but not heavy. Litter of this sort is commonly referred to as "wind blown" litter because it is easily moved by light wind. Consequently, wind blown litter is easily scattered over a wide area, including areas which are inaccessible to conventional waste collection apparatus, often because the weight of a vehicle when full of litter is so great that the vehicle must be confined to firm surfaces such as metalled or paved areas. Moreover, it is found that brushes on these vehicles do not always deflect wind blown litter towards the collection scoop, but the first contact of the brushes with the litter may deflect the litter away from the vehicle so that an unacceptable proportion of this litter remains uncollected. Brushes are also found to scour away sand or other loose material, and so may loosen flagstones.

The present invention seeks to obviate or mitigate these and other disadvantages of the prior art.

According to the invention, there is provided waste collection apparatus comprising a first fluid duct having an inlet and means operable to create a fluid flow along the first duct from the inlet, whereby waste material may be drawn into the inlet by the fluid flow and thereafter collected, the first duct being partly defined, in use, by the surface over which the apparatus is moving, and partly by a duct-defining surface or surfaces of the apparatus, and wherein the duct extends generally horizontally from the inlet in a direction generally opposite to the forward direction of the apparatus, the fluid flow means, in use, causing wind blown litter to be drawn across the surface over which the apparatus is moving and along the duct to a location at which the duct turns upwardly into the body of the apparatus, and is thereafter defined entirely by duct-defining surfaces of the apparatus.

The cross-section of the duct may reduce between the inlet and the said location, to cause fluid flowing along the duct to accelerate. Preferably the apparatus further comprises at least one second fluid duct means having an outlet so located and arranged as to create a second fluid flow path which is at the periphery of the first path and is generally oppositely directed to cause waste material which, in use, is being drawn along the periphery of the first path to be

deflected into the main stream of fluid flowing along the first path.

The or one of the second fluid duct means may comprise at least one outlet located in the region of the duct inlet. The second fluid duct means may comprise at least two outlets located opposite one another in the region of the duct inlet. The apparatus may further comprise means for re-orienting the or each outlet at the duct inlet, in relation to the duct, whereby the second flow path can be re-oriented in relation to the first flow path. The or each outlet may be pivotally or rotatably mounted, whereby the second flow path may sweep through a region at the periphery of the first flow path. A plurality of pivotally or rotatably mounted outlets are preferably operable to create respective second flow paths which sweep in succession as aforesaid. The apparatus may comprise means for supplying fluid to the outlet in pulses.

According to a second aspect of the invention, there is provided waste collection apparatus comprising a first fluid duct having an inlet, means operable to create a first fluid flow path towards and into the duct inlet whereby waste material may be drawn into the inlet by the fluid flow and thereafter collected, and wherein the apparatus further comprises at least one second fluid duct means having an outlet so located and arranged as to create a second fluid flow path which is at the periphery of the first path and is generally oppositely directed to cause waste material which, in use, is being drawn along the periphery of the first path to be deflected into the main stream of fluid flowing along the first path.

The apparatus is preferably adapted to move over a surface and the duct is partly defined by the surface and partly by a duct-defining surface of the apparatus, and the or one of the second fluid duct means may have an outlet in the region of an edge of the duct-defining surface adjacent to the surface over which the apparatus is moving, and the second path may be so directed to deflect waste material from leaving the duct between the edge and the surface over which the apparatus is moving. The portion of the duct which is defined in part by the surface over which the apparatus is moving is preferably generally horizontal and turns upwardly in the region of the said edge, to draw waste material up from the surface.

Preferably the duct inlet is the widest part of the duct, whereby fluid accelerates as it travels along the first path. The or one of the second fluid duct means may comprise at least one outlet located in the region of the duct inlet. The second fluid duct means may comprise at least two outlets located opposite one another in the region of the duct inlet. The apparatus may further comprise means for re-orienting the or each outlet at the duct inlet, in relation to the duct, whereby the second flow path can be re-oriented in relation to the first flow path. The or each outlet may be pivotally or rotatably mounted, whereby the second

flow path may sweep through a region at the periphery of the first flow path. A plurality of pivotally or rotatably mounted outlets are preferably operable to create respective second flow paths which sweep in succession as aforesaid. The apparatus may comprise means for supplying fluid to the outlet in pulses.

Preferably the same fluid flows along both paths. The fluid is preferably air or water.

In a third aspect, the invention provides fluid filter apparatus comprising a filter element, means operable to move the filter element to describe a closed path including first and second positions at which fluid to be filtered passes through the filter element, and fluid guide means operable to define a path for fluid to be filtered, the path passing through the filter element in a first direction at the first position and the fluid guide means guiding at least some of the filtered fluid to the second position at which the fluid may pass through the filter element in the opposite direction, and the apparatus further providing an intermediate cleaning position on the closed path between the first and second positions, the filter element being cleaned as it passes the intermediate position.

The closed path is preferably substantially circular. The filter element may be cylindrically shaped and the drive means may rotate the filter element around the cylindrical axis. The filter element may be flat and the drive means may rotate the filter element around an axis perpendicular to the plane of the filter element. The filter element may extend continuously around the whole of the closed path.

In a fourth aspect, the invention provides waste collection apparatus comprising conveying apparatus for conveying collected waste to an outlet, and constriction means operable to constrict the path of waste to the outlet while the conveying apparatus is in operation, thereby compressing the waste.

The conveying apparatus may be a screw conveyor and/or comprise a ram. The constriction means may be selectively operable to close the outlet. The constriction means may be resiliently biased to close the outlet, thereby compressing waste until the biasing is overcome.

In a fifth aspect, the invention provides waste collection apparatus comprising means operable to form collected waste into packets which are deposited from the apparatus for subsequent collection.

The packets may be bound in a covering material, or placed in a container such as a bag or sack. The waste may be bound to form bails.

A sixth aspect of the invention provides an elongate flexible article comprising a wall which defines within it a space, and a passage within the wall and to which fluid may be supplied at a pressure which is variable to control the flexibility of the article.

The passage may have a fluid inlet and a fluid outlet, whereby fluid is constantly driven through the passage in use, the flexibility being determined by the

fluid pressure at the inlet.

The space may be a fluid conveying conduit. The passage may be formed in a wall of the conduit. The conduit is preferably circular in cross-section, and the passage is preferably annular around the conduit. There may be a plurality of passages within the wall. The conduit may have an open end, the or each passage being open at the open end of the conduit.

Embodiments of apparatus according to the invention will now be described in more detail, by way of example only, and with reference to the accompanying drawings in which:

Fig. 1 is a schematic diagram of the side view of waste collection apparatus according to the present invention;

Fig. 2 is a plan view similar to Fig. 1;

Fig. 3 is a schematic plan view illustrating the operation of rotating collecting jets;

Figs. 4 and 5 are schematic perspective views of filtering apparatus for use in the apparatus of Figs. 1 to 3;

Fig. 6 is a schematic diagram of a litter compression arrangement for use in the apparatus of Figs. 1 to 3;

Fig. 7 is a schematic diagram of the end of an elongate article according to the present invention; and

Figs. 8A and 8B illustrate the elongate article of Fig. 7 in use.

Turning to Figs. 1 and 2, there is shown waste collection apparatus 10 comprising a first fluid duct 12 having an inlet at 14, means in the form of a fan 16 operable to create a first fluid flow path illustrated by arrows 18 towards and into the duct inlet 14, whereby waste material may be drawn into the inlet 14 by the fluid flow and thereafter collected. The fan 16 is not shown in detail in Fig. 2, for clarity. The fan could be located at any convenient position along the flow path. The apparatus further comprises second fluid duct means 20 having outlets so located and arranged as to create a fluid flow path indicated by arrows 22 and which is at the periphery of the first path 18 and is generally oppositely directed to the path 18. This causes waste material which, in use, is being drawn along the periphery of the first path 18 to be deflected into the main stream of the fluid flowing along the first path.

In more detail, the apparatus is a wheeled vehicle having an engine 24, for instance a rear engine, and a cab 26 for a driver. The cab 26 is located and arranged to minimise obstructions to the view of the driver. Under the front of the vehicle 10, duct-defining surfaces 28 provide a roof and side walls for the duct 12, the floor of which is the surface over which the vehicle is moving. The duct 12 is generally horizontal and is at its widest at the inlet 14, at the front of the vehicle, and narrows in the horizontal direction back towards the middle of the vehicle, underneath the fan 16. The duct then rises generally vertically into the ve-

hicle so that the fan 16 can act to create a draught of air along the duct 12 and up into the vehicle 10. This draught causes litter within the duct to be accelerated back towards the location at which the duct 12 turn upwards. Litter can be carried along by this air flow. The relatively slow flow at the forward, inlet end of the duct 12 may be sufficient to cause wind blown litter to be drawn into the duct 12, but need not be sufficient to move heavier objects. Wind blown litter will accelerate along the duct, until it is moving sufficiently quickly, when it reaches the upward turn, to be carried up with the airflow into the machine, even if the suction at that point is insufficient to lift heavier objects.

To assist in the deflection of litter up into the vehicle, a baffle 30 is slung beneath the vehicle 10 to guide litter up into the vehicle. In order to avoid excess wear of the baffle 30, it is made slightly short so that it does not bear on the surface over which the vehicle is moving. This gives rise to a risk that litter travelling along the lower periphery of the duct 12 may leave the duct through the gap between the baffle 30 and the surface below, although windblown litter will tend to be pulled up by the airflow. Second ducts 20 may be used to help overcome any tendency to leave the duct 12. These ducts 20 are supplied with pressurised air in order to direct jets of air from the lower edge of the baffle 30 back along the lower periphery of the duct 12, towards the inlet 14. Consequently, litter travelling along the lower periphery of the path 18 will be deflected by the jets from the ducts 20 up towards the main stream of the path 18, so that the litter will again be caught up by the main flow of air along the duct 12, and so be carried into the vehicle.

Located on opposite sides of the inlet 14 are two disc members 32 whose function is described more easily with reference to Fig. 3. Each disc has a plurality of air outlets located around its circumference, and is mounted for complete or partial rotation about its centre by means not shown in the drawings, but which may be conventional in themselves. The outlets 34 of the discs 32 are supplied with pressurised air, so that in use, each outlet 34 creates a jet 36 of air directed down to the ground slightly in front of the vehicle. Each jet 36 sweeps an area of ground in the region of the inlet 14 as the discs 32 rotate, and by virtue of the locations of the discs 32, these regions are at the periphery of the air paths 18 into the duct 12. The discs 32 rotate in opposite directions so that the jets 36 sweep in towards the path 18. Consequently, as the apparatus approaches items of litter, and especially wind blown litter, these articles are deflected by the jets 36 and swept in towards the centre line of the apparatus, so that they will be drawn into the air entering the duct 12, and will therefore be carried into the vehicle for collection. The sweeping motion of the jets 36 reduces the possibility of wind blown litter being deflected away from the vehicle.

It may be possible to use fixed jets 26, but moving

jets are preferred. These may rotate continuously, or oscillate, in which case the jets will be turned off on the return sweep, to avoid deflecting litter away from the ducts.

The jets 36 also increase the width of the swath cleared by the machine, beyond the width of the machine. Some material may nevertheless be too far away to be collected, even by the action of the jets 36. Such material may nevertheless be blown by the jets, away from the machine. The machine will leave a swath from which material has been collected, and which is bordered by strips from which material has blown away. Thus, to achieve substantially complete clearance of a large area it is not necessary for neighbouring swaths cleared by the machine to be contiguous, but only that the border strips of neighbouring swaths are contiguous or overlap. This reduces the required number of passes of the machine.

Within the vehicle 10, the air being drawn along the duct 12 is conveyed, along with any litter transported with it, to the fan 16 which is creating the air movement. The shredded waste passes from the fan 16 to a filter 38 for extracting the litter from the air flow. Possible designs of filter 38 are shown in more detail in Figs. 4 and 5. The fan 16, if upstream of the filter 38, shreds any waste brought in by the air flow.

In Fig. 4, a duct 40 conveys air from the fan 16 towards a vertical and hollow cylinder 42 of filter material such as a wire gauze. The duct 40 directs the air flow through the cylindrical wall of the cylinder 42, so that the air passes across the hollow interior of the cylinder 42, and out of the cylinder through the cylindrical wall on the far side, where it is collected by a further duct 44. The cylinder 42 is mounted for rotation about its vertical cylindrical axis and is constantly rotated during use. Accordingly, air carrying shredded waste from the fan 16 leaves the duct 40 and is filtered to leave the waste material on the outer cylindrical surface of the cylinder 42. The material may fall off the cylinder 42 of its own accord, or be scraped off the cylinder as the cylinder rotates past a fixed scraper 46, or be blown off by air jets (not shown). The scraper 46 is located at an intermediate position between the position at which air leaves the duct 40 to pass through the cylinder 42, and the position at which air passes through the cylinder 42 to enter the duct 44.

Air reaching the centre of the cylinder 42 will consequently be substantially clean. Furthermore, the cylinder 42 will also be substantially clean in the region through which the air passes to enter the duct 44. However, any small amounts of waste which may remain attached to the outer surface of the cylinder 42 will tend to be blown off by the air entering the duct 44, thus leaving the surface of the cylinder 42 substantially clean. Any small amounts of waste which are carried along the duct 44 can be filtered out in a subsequent filtering stage, by conventional means.

It can be seen from the above that the filter apparatus has a form of self-cleaning action, because the air being filtered passes through the cylinder 42 in a first direction to be filtered, and then back through the cylinder 42 in the opposite direction relative to the cylinder surface, to perform a cleaning action.

A second alternative is shown in Fig. 5. This arrangement uses a disc 48 of filter material which is mounted to rotate about its centre. Associated ducts 50, 52 and 54 provide a path for air which enters the duct 50 from the fan 16, passes through the filter disc 48 into one end of the duct 52, and then is re-directed to pass back in the opposite direction through the disc 48 into the duct 54 which conveys the substantially clean air away from the filter. The rotation of the disc 48 causes the filter material of the disc to describe a circular path from the region between the ducts 50, 52, in which the bulk of the shredded waste is filtered out from the air, to a second position between the adjacent ends of the duct 52 and the duct 54. Before reaching the second position, the filter material is scraped by a scraper 56 (or cleaned by air jets) to remove the majority of material collected by the filter disc 48. Any remaining material which is carried by the disc 48 as it reaches the second position will tend to be blown off by the air passing back to the duct 54, so that the disc 48 is left clean. The air leaving the duct 54 may contain small amounts of waste material which can be filtered out in a subsequent operation by conventional apparatus. It may not be necessary to redirect all of the air through the filter, but to use only part of the filtered air to clean the filter.

The waste material recovered from the filter disc 48 or the filter cylinder 42 falls into a collecting mouth 58A, 58B located beneath the filter. Whether the filtration is effected by the apparatus described above, or by conventional apparatus, the material recovered by the filters is supplied to a compacter apparatus 60 shown in Fig. 6. The compacter 60 comprises a screw conveyor 62 which receives at one end the debris falling from the filter, through the mouth 58. This waste is conveyed by the rotation of the conveyor 62 towards an outlet at 64. Spring mounted doors 66 are located at the outlet 64 and are sprung to their closed position. Consequently, as the conveyor 62 continues to move debris towards the outlet 64, the debris will become compacted until the degree of compaction forces the doors 66 to open against their spring bias, to allow a compacted parcel of litter to leave the outlet 64. The compacted packet may have been sufficiently compacted to retain its shape without assistance, or may then if required or desired be placed in a bag or sack, or bound or tied to form a bail. Each packet can then be released from the vehicle for subsequent collection. This contrasts with previous proposals in which collected litter is stored on board the collecting vehicle, causing the size and weight of the vehicle to increase and the range of the vehicle to reduce. By jet-

tisoning each packet of litter, the vehicle is kept as light as possible so that it can be used on a wider range of surfaces, such as grass and steep slopes. It is believed that it will be relatively easy in practice to arrange for transport of the packets either manually or by an appropriate form of transport to a road vehicle at a nearby location, which can then transport the packets to a waste disposal location. In some applications, it may be convenient to tow a trailer on which the packets can be stored.

In an alternative, a piston ram compressor could be used instead of the screw conveyor, or to further compress the material previously compressed by the screw conveyor.

In order to extend the range over which the vehicle can collect litter, it is provided with a hose 70 mounted on a boom 72 which can be raised, lowered and swung in conventional manner to move the hose 70. The hose and boom together provide a path 74 for air through which waste may be drawn from the end of the hose 70 into the vehicle 10, by suction. Suction may be created by the fan 16 or by a separate fan, or the fan may be selectively connectable to the hose 70 or for collecting through the duct 12. Any waste collected by the hose 70 is dealt with in the same way as waste collected by the duct 12.

The hose 70 is made of flexible material. The wall of the hose 70 is multi-skinned to leave one or more narrow annular passages 76 between the inner and outer skins. Only one annular passage is illustrated in Fig. 7, which shows the end of the hose 70. It is apparent from that drawing that the passage 76 is open at the end of the hose 70, around the mouth of the path 74. Alternatively the passage 76 may be closed.

Air is supplied under pressure to the passage 76 at the end of the boom 72 and flows along the passage. The air will leave at the end of the hose 70 if the end is open. The operator is provided with controls which allow the pressure of air supplied to the passage 76 to be varied, so that the passage 76 can be inflated to a variable degree, and this in turn allows the flexibility of the hose to be varied. In general, the higher the pressure supplied to the passage 76, the more rigid will be the hose. This provides a further freedom to the operator for controlling the position of the end of the hose 70, because he can move the boom 72 and also vary the flexibility of the hose 70, so that it reaches out to varying degrees from the vehicle 10. This is illustrated in Figs. 8A and 8B. Fig. 8A shows the position when a relatively low pressure is supplied to the passage 76. The hose 70 hangs limply from the boom 72. If the pressure to the passage 76 is increased, the hose 70 becomes less flexible and reaches out further from the vehicle. It is envisaged that the air pressure required to control the flexibility of the hose may be many times greater than the air pressures required to provide adequate suction into the path 74. Thus, the pressure in the passage 76 will

dominate the control of the hose flexibility.

In addition controlling the flexibility of the hose, air leaving the passage 76 may act in a similar manner to the air jets 36 of Fig. 3, to deflect litter into the path 74.

It will be apparent from the above description that the vehicle operates mainly by air flow, rather than by brushing, so that problems of dust are less serious.

As has been described, the range of terrains over which the vehicle may be operated is extended by not storing the collected litter in the vehicle. The range of operating conditions may be further extended by designing the vehicle to be as low as possible so that it can be operated under obstruction such as shop canopies and in multi-storey car parks. The stability of the vehicle can be improved by mounting all heavy machinery such as the fan as low as possible on the chassis.

The versatility of the machine before collecting begins can be improved by providing an arrangement which allows the ground clearance at the front of the vehicle to be increased. This may be achieved by raising the duct-defining surfaces, or by raising the complete vehicle in relation to the wheels, e.g. by adjusting the vehicle suspension.

Couplings may be provided to allow the fan 16 or other elements of the machine (such as a compressor) to be used for other purposes, when the machine is not collecting, such as providing power for other equipment.

The apparatus has been described above in relation to air flows etc., and for use on land. A waterborne vessel is also envisaged, in which the fan 16 is replaced by a pump, and water is drawn through the duct 12 or hose 70. In the land version, the fan 16 can be replaced by other means for creating the necessary air flow, such as an air jet in place of the fan and directed across the duct to create an air flow.

It will be apparent from the above description that many variations and modifications to the apparatus described can be made without departing from the spirit and scope of the present invention.

Whilst endeavouring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

Claims

1. Waste collection apparatus (10) characterised by comprising a first fluid duct (12) having an inlet (14) and means (16) operable to create a fluid flow along the first duct from the inlet, whereby waste material may be drawn into the inlet by the

fluid flow and thereafter collected, the first duct being partly defined, in use, by the surface over which the apparatus is moving, and partly by a duct-defining surface or surfaces (28) of the apparatus, and wherein the duct extends generally horizontally from the inlet in a direction generally opposite to the forward direction of the apparatus, the fluid flow means, in use, causing wind blown litter to be drawn across the surface over which the apparatus is moving and along the duct to a location at which the duct turns upwardly into the body of the apparatus and is thereafter defined entirely by duct-defining surfaces of the apparatus.

2. Apparatus according to claim 1, characterised in that the cross-section of the duct (12) reduces between the inlet (14) and the said location, to cause fluid flowing along the duct to accelerate.

3. Apparatus according to any preceding claim, characterised by further comprising at least one second fluid duct means (20,32) having an outlet so located and arranged as to create a second fluid flow path (22,36) which is at the periphery of the first path (18) and is generally oppositely directed to cause waste material which, in use, is being drawn along the periphery of the first path to be deflected into the main stream of fluid flowing along the first path.

4. Apparatus according to claim 3, characterised in that the or one of the second fluid duct means (20,32) comprises at least one outlet (34) located in the region of the duct inlet (14).

5. Apparatus according to claim 4, characterised by comprising at least two outlets (34) located opposite one another in the region of the duct inlet (14).

6. Apparatus according to claim 4 or 5, characterised by comprising means for re-orienting the or each outlet (34) at the duct inlet (14), in relation to the duct (12), whereby the second flow path (36) can be re-oriented in relation to the first flow path (18).

7. Apparatus according to claim 6, characterised in that each outlet (34) is pivotally or rotatably mounted, whereby the second flow path (36) may sweep through a region at the periphery of the first flow path (18).

8. Apparatus according to claim 7, characterised in that a plurality of pivotally or rotatably mounted outlets (34) are operable to create respective second flow paths (36) which sweep in succession as aforesaid.

9. Apparatus according to any of claims 3 to 8, characterised by comprising means for supplying fluid to the second outlets in pulses.
10. Waste collection apparatus (10) characterised by comprising a first fluid duct (12) having an inlet (14), means (16) operable to create a first fluid flow path (18) towards and into the duct inlet (14) whereby waste material may be drawn into the inlet by the fluid flow and thereafter collected, and further comprising at least one second fluid duct means (20,32) having an outlet so located and arranged as to create a second fluid flow path (22,36) which is at the periphery of the first path and is generally oppositely directed to cause waste material which, in use, is being drawn along the periphery of the first path to be deflected into the main stream of fluid flowing along the first path.
11. Apparatus according to claim 10, and adapted to move over a surface, characterised in that the duct (12) is partly defined by the surface and partly by a duct-defining surface (28,30) of the apparatus, the or one of the second fluid duct means (20) having an outlet in the region of an edge of the duct-defining surface (30) adjacent to the surface over which the apparatus is moving, and the second path (22) being so directed to deflect waste material from leaving the duct between the edge and the surface over which the apparatus is moving.
12. Apparatus according to claim 10 or 11, characterised in that the portion of the duct (12) which is defined in part by the surface over which the apparatus is moving is generally horizontal and turns upwardly in the region of the said edge, to draw waste material up from the surface.
13. Apparatus according to any of claims 10 to 12, characterised in that the duct inlet (14) is the widest part of the duct (12), whereby fluid accelerates as it travels along the first path (18).
14. Apparatus according to any of claims 10 to 13, characterised in that the second fluid duct means (32) comprise at least one outlet (34) located in the region of the duct inlet (14).
15. Apparatus according to any of claims 10 to 14, characterised in that the second fluid duct means (32) comprise at least two outlets (34) located opposite one another in the region of the duct inlet (14).
16. Apparatus according to claim 14 or 15, characterised by comprising means for re-orienting the or each outlet (34) at the duct inlet (14), in relation to the duct (12), whereby the second flow path (36) can be re-oriented in relation to the first flow path (18).
17. Apparatus according to claim 16, characterised in that the or each outlet (34) is rotatably or pivotally mounted, whereby the second flow path (36) may sweep through a region at the periphery of the first flow path (18).
18. Apparatus according to claim 17, characterised in that a plurality of rotatably or pivotally mounted outlets (34) are operable to create respective second flow paths (36) which sweep in succession as aforesaid.
19. Apparatus according to any of claims 15 to 18, characterised by comprising means for supplying fluid to the outlet in pulses.
20. Fluid filter apparatus (38) characterised by comprising a filter element (42,48), means operable to move the filter element to describe a closed path including first and second positions at which fluid to be filtered passes through the filter element, and fluid guide means (40,44,50,52,54) operable to define a path for fluid to be filtered, the path passing through the filter element in a first direction at the first position and the fluid guide means guiding at least some of the filtered fluid to the second position at which the fluid may pass through the filter element in the opposite direction, and the apparatus further providing an intermediate cleaning position (46,56) on the closed path between the first and second positions, the filter element being cleaned as it passes the intermediate position.
21. Apparatus according to claim 20, characterised in that the closed path is substantially circular.
22. Apparatus according to claim 20 or 21, characterised in that the filter element (42) is cylindrically shaped and the drive means is operable to rotate the filter element around the cylindrical axis.
23. Apparatus according to claim 20 or 21, characterised in that the filter element (48) is flat and the drive means is operable to rotate the filter element around an axis perpendicular to the plane of the filter element.
24. Apparatus according to any of claims 20 to 23, wherein the filter element (42,48) extends continuously around the whole of the closed path.
25. Any novel subject matter or combination includ-

ing novel subject matter disclosed, whether or not within the scope of or relating to the same invention as any of the preceding claims.

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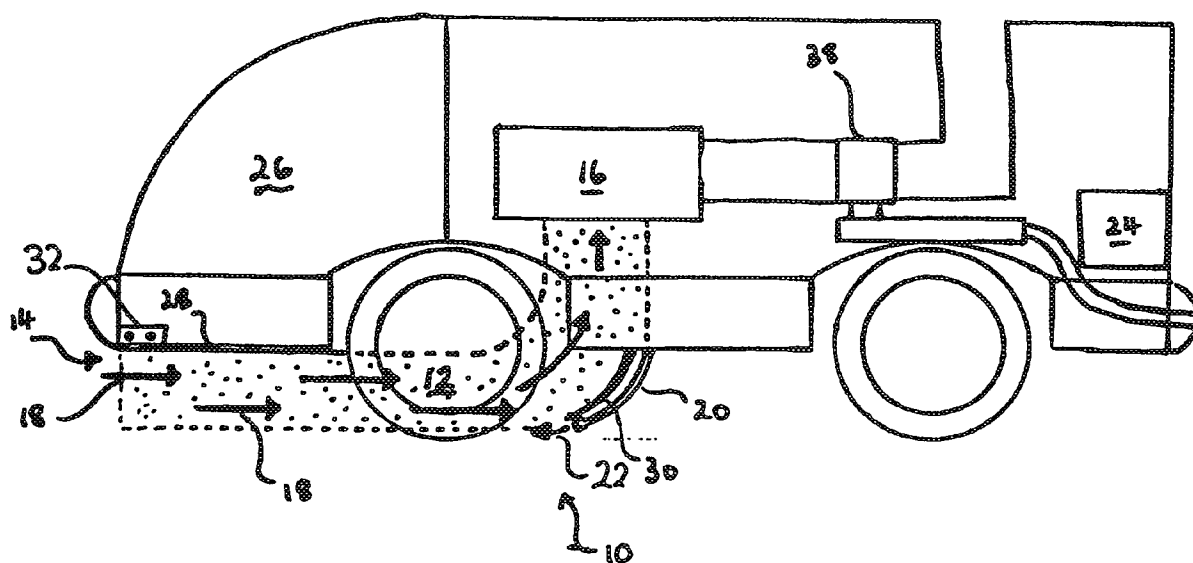


Fig 1.

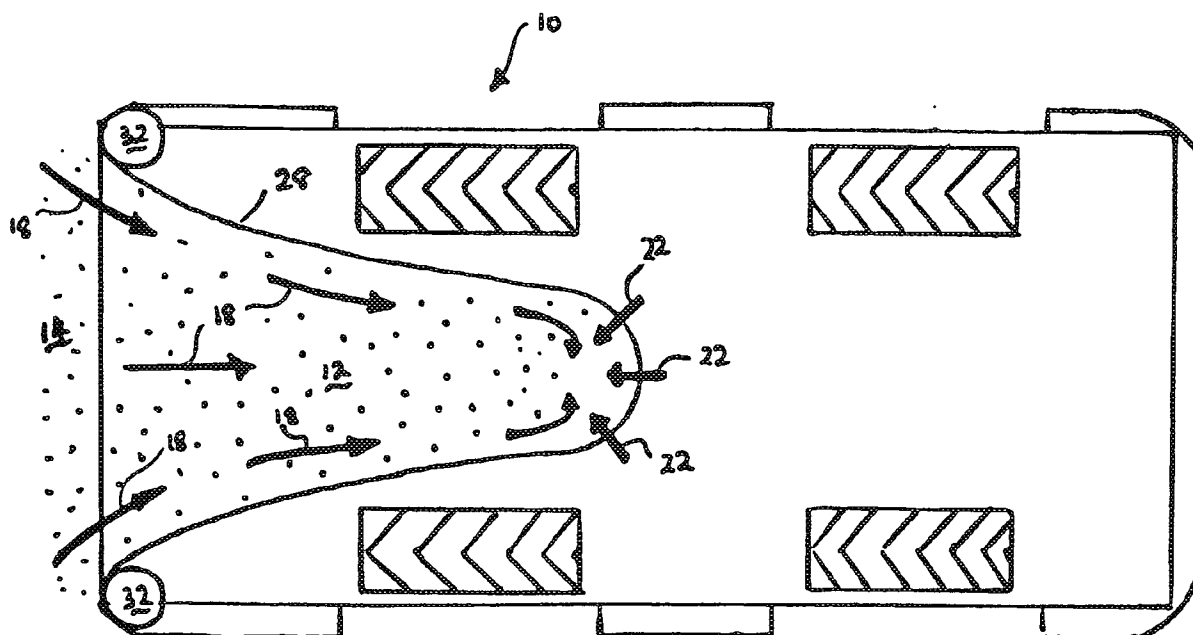


Fig 2.

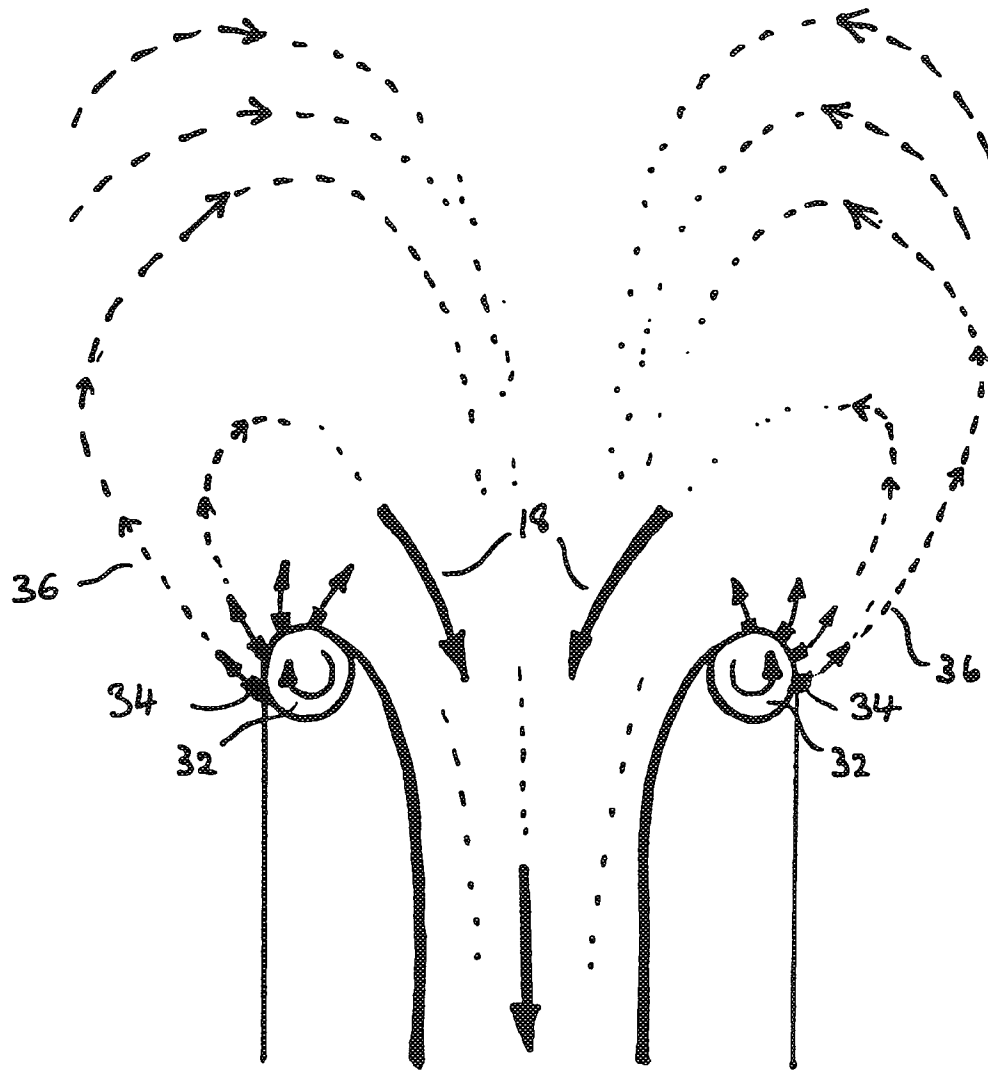
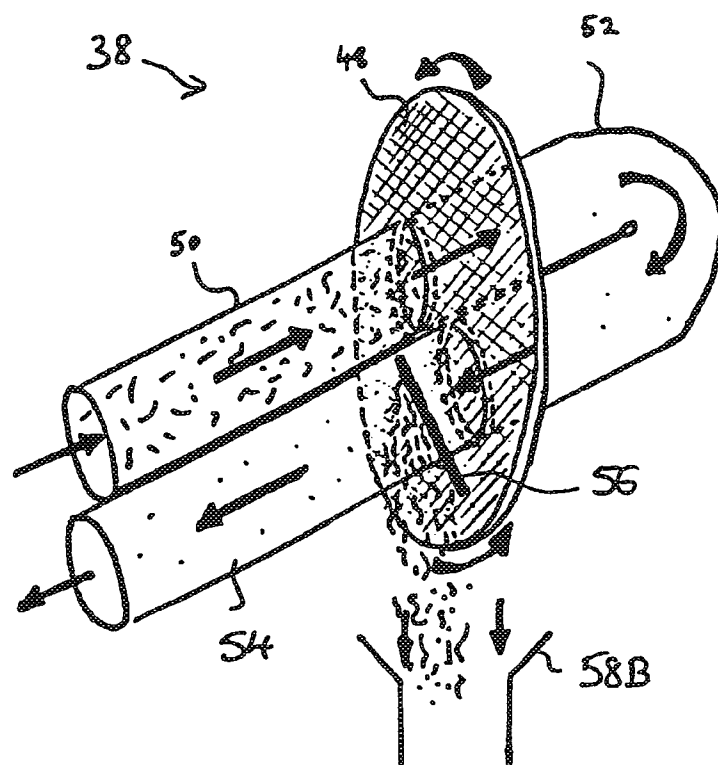
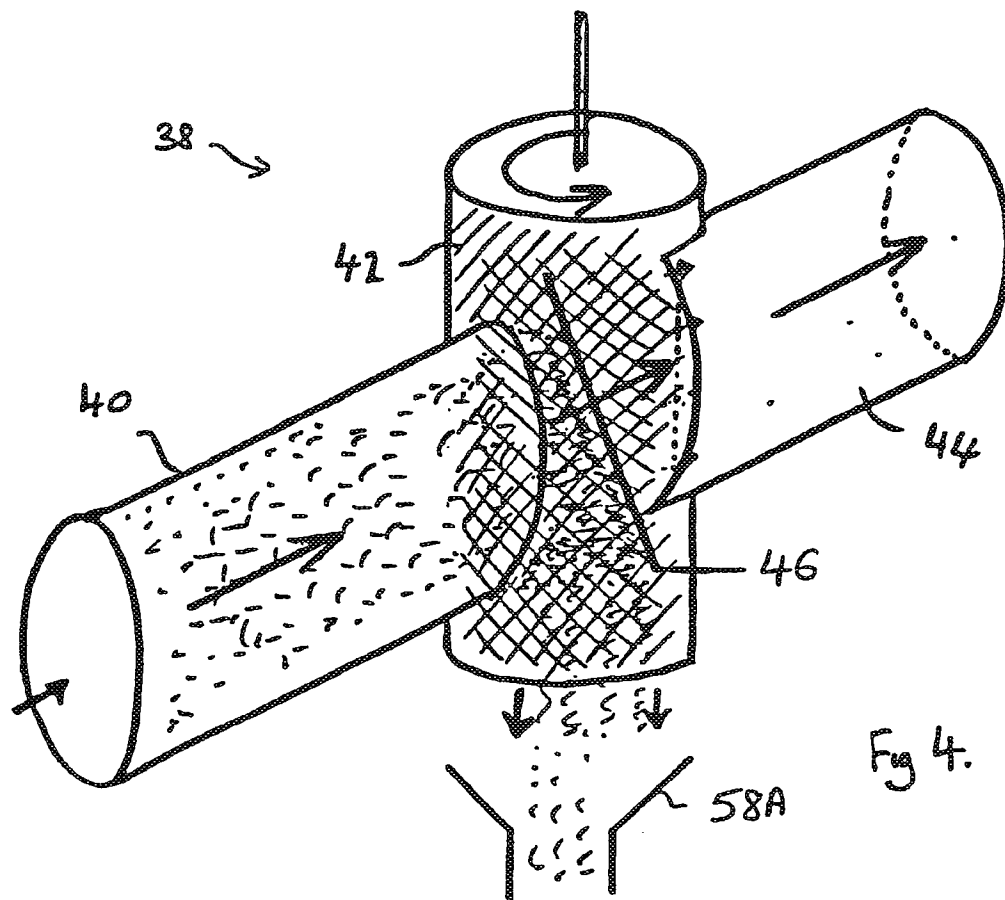


Fig 3



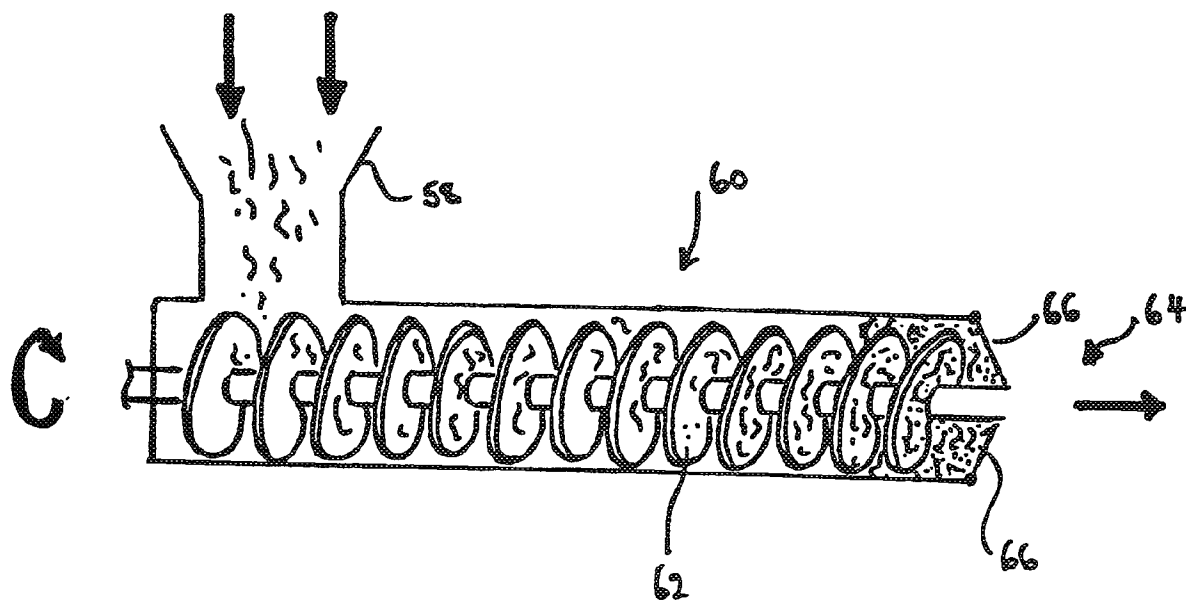


Fig 6 .

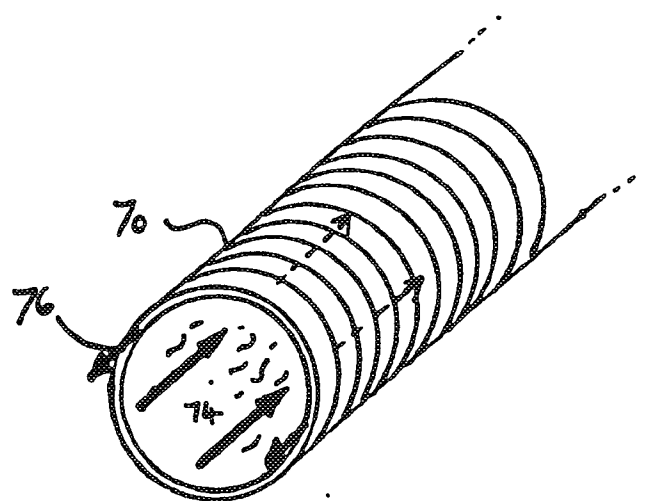


Fig 7

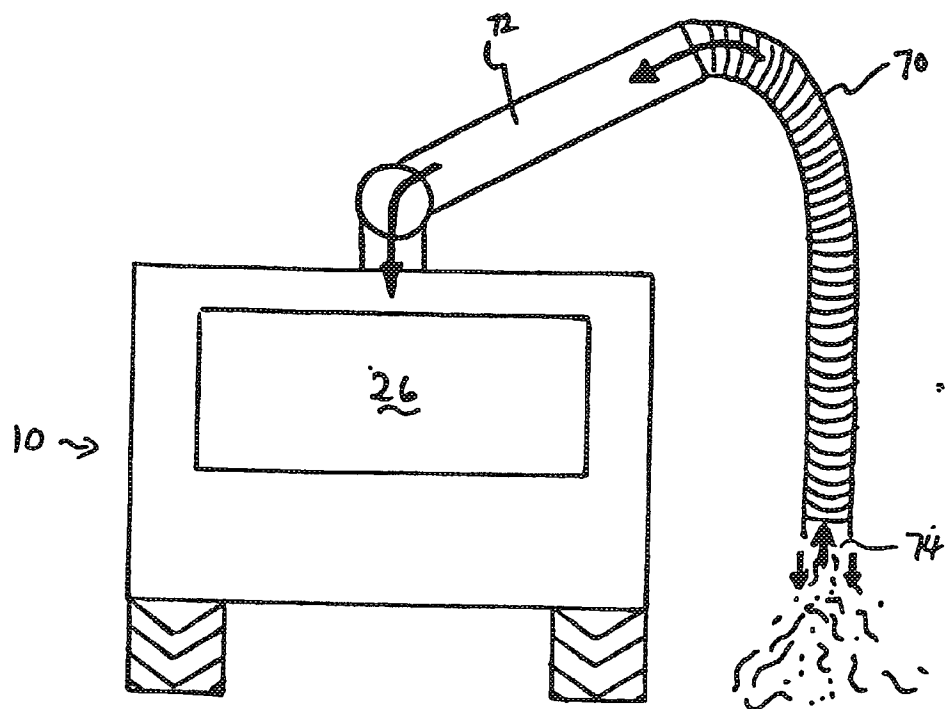


Fig 8A

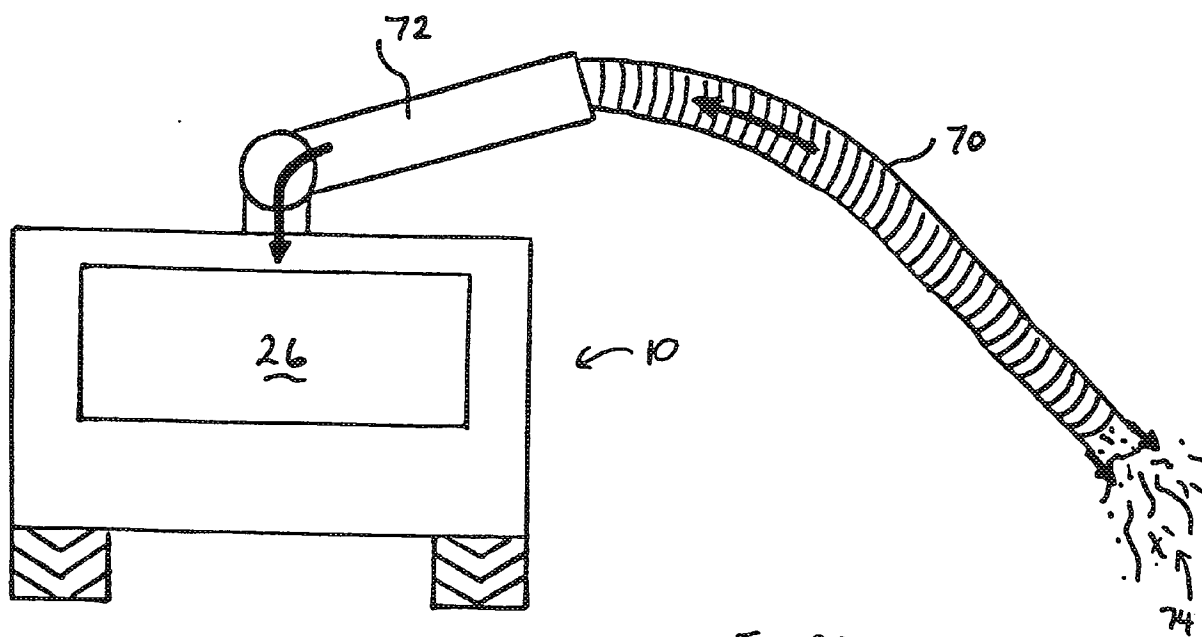


Fig 8B.