R. W. FURNAS, DEC'D.
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PNEUMATIC STREET CLEANER.
APPLICATION FILED OCT. 22, 1915.

1,229,737.

Patented June 12, 1917.

3 SHEETS—SHEET 1.

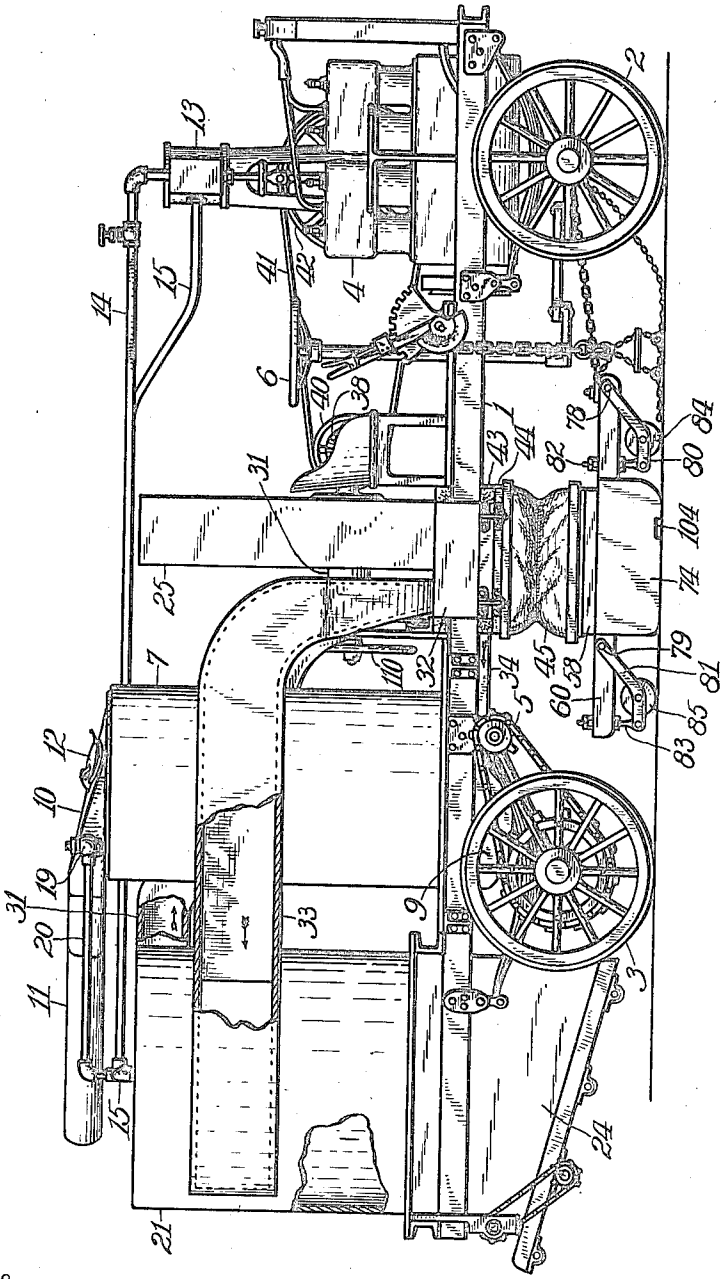


Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 2.

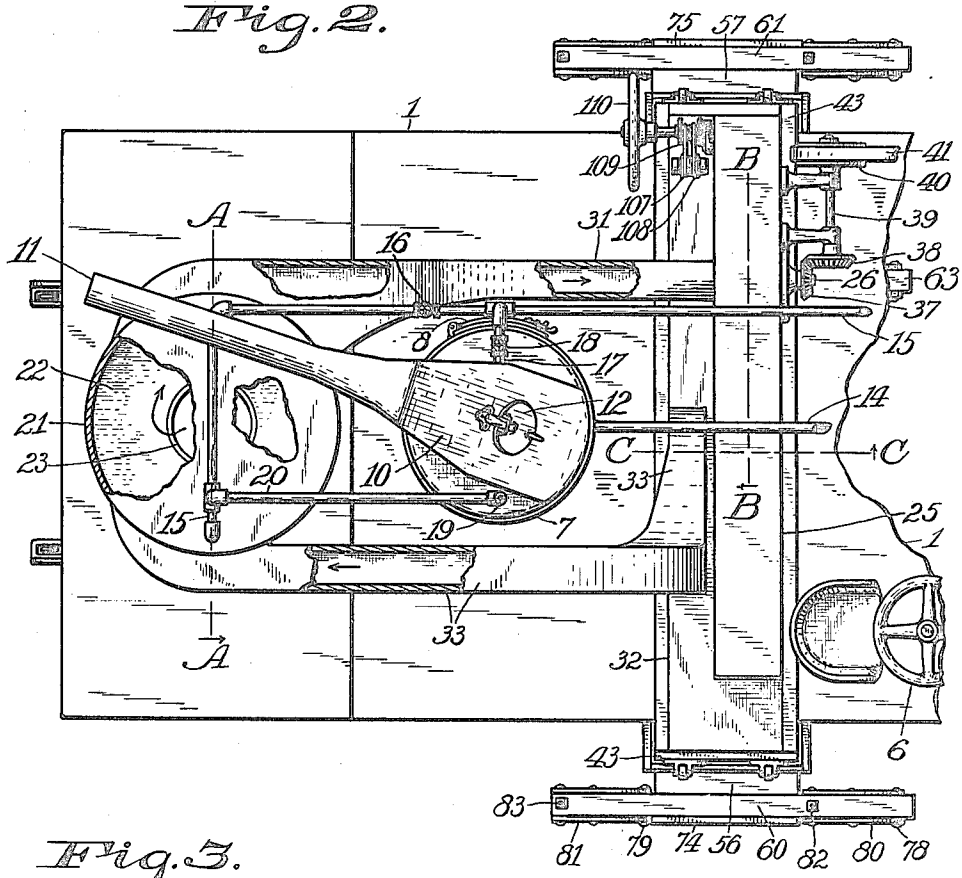


Fig. 3.

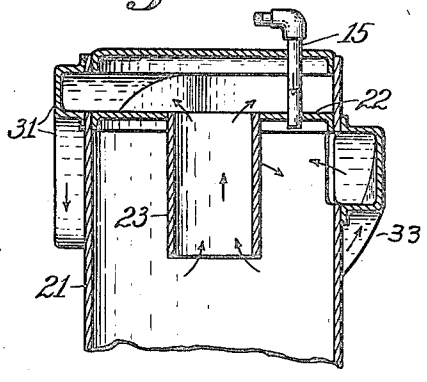
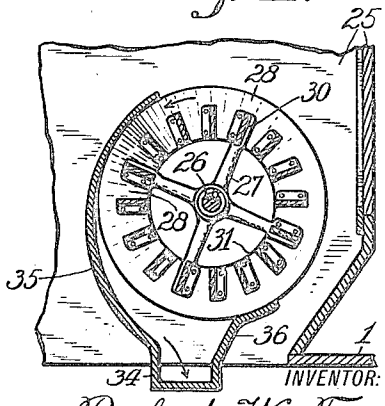


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

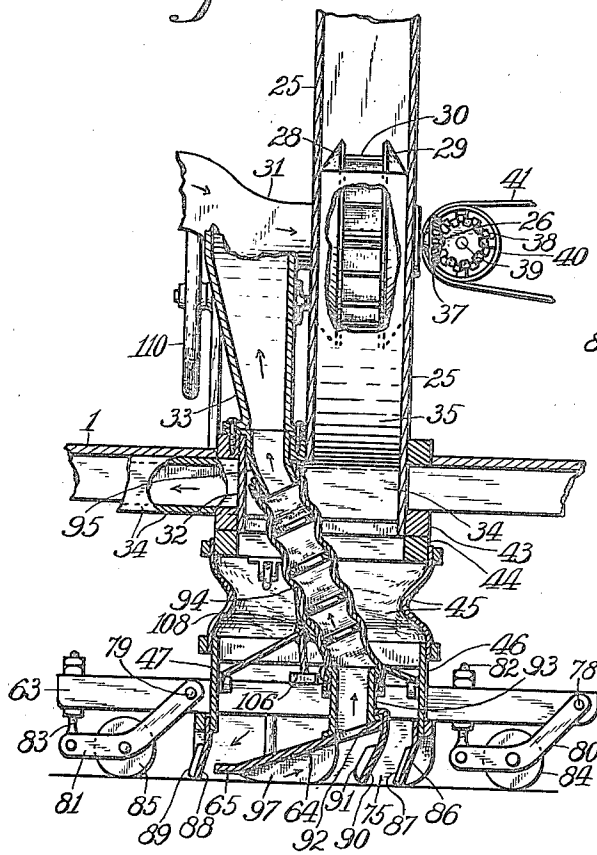


Fig. 6.

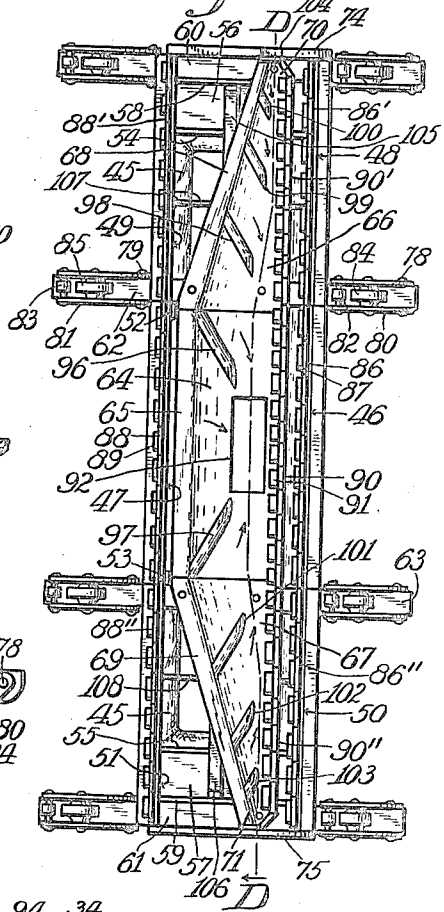
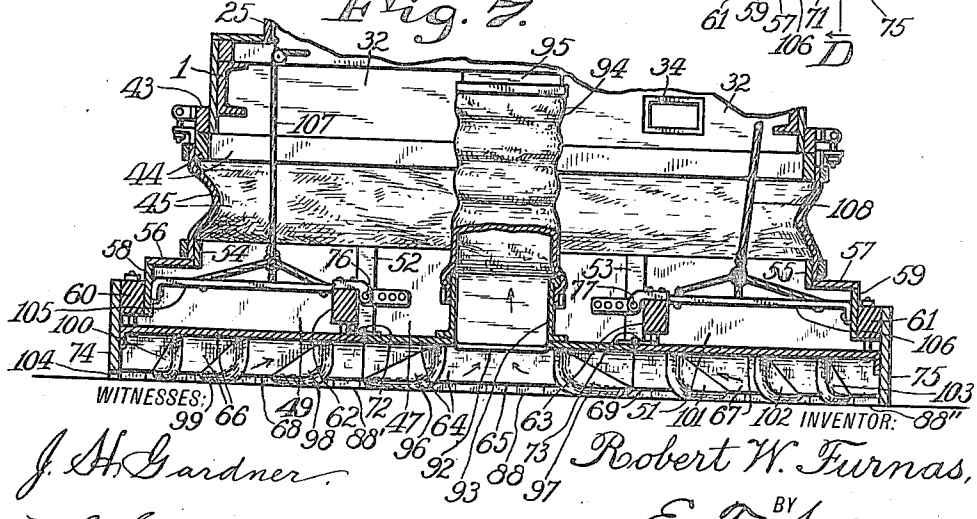


Fig. 7.



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PNEUMATIC STREET-CLEANER.

1,229,737. Specification of Letters Patent. Patented June 12, 1917.

Application filed October 22, 1915. Serial No. 57,366.

To all whom it may concern:

Be it known that I, ROBERT W. FURNAS, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Pneumatic Street-Cleaner, of which the following is a specification, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon.

This invention relates to the type of machine that is designed to clean streets, more especially paved streets, by lifting and removing the dust and dirt from the surface of the street or roadway, the invention having reference more particularly to engine-power pneumatic street-cleaning machines that are designed to haul away the dirt and debris to convenient places for discharging the load.

An object of the invention is to provide improvements in construction generally of pneumatic street-cleaning machines, more particularly with reference to the cleaning operations without causing annoyance to the communities where the operations are carried out.

Another object is to provide improved means whereby to gather and lift the dust and dirt from the surface of the street without raising the dust or causing or permitting it to fly away or be blown into the atmosphere.

A further object is to provide an improved gathering-chamber that shall be so constructed as to be capable of operation in a superior manner, not only in lifting the dust and dirt from the street but in lifting pebbles, small stones, tree twigs, sticks, and other debris effectively.

A still further object is to provide an improved gathering-chamber for pneumatic street-cleaners that shall be capable of cleaning a very broad strip of surface relatively to the width of the cleaning machine structure, which gathering-chamber shall be so constructed as to insure practically uniform suction power throughout the width of the strip for lifting the dust or debris.

With the above-mentioned and other objects in view, the invention consists in a pneumatic street-cleaning machine having various novel features of construction with respect to the lifting and controlling of the dust and dirt; the invention consisting more particularly in an improved gathering-chamber, and in the parts and combinations and arrangements of parts, as hereinafter particularly described and further defined in the appended claims.

Referring to the drawings,—Figure 1 is a right-hand side elevation of a pneumatic street-cleaning machine constructed substantially in accordance with the invention; Fig. 2 is a top plan of the machine omitting the forward portion thereof; Fig. 3 is a fragmentary section of the separator of the machine on the line A A on Fig. 2; Fig. 4 is a fragmentary vertical section of the rotary pump portion of the gathering-hood on the line B B on Fig. 2; Fig. 5 is a fragmentary section of the rotary pump portion of the gathering-chamber on the line C C on Fig. 2; Fig. 6 is an inverted plan of the gathering-chamber; and, Fig. 7 is a section of the lower portion of the gathering-chamber in normal position taken approximately on the line D D on Fig. 6.

Similar reference characters on the different figures of the drawings indicate corresponding elements or features of construction herein referred to.

The improved street-cleaning machine comprises a suitable platform 1 constructed substantially as shown and suitably mounted on forward guiding wheels 2 and rearward driving wheels 3, an explosion engine 4 being mounted on the forward portion of the platform and connected with suitable gearing 5 having connection with the driving wheels for propelling the machine. A steering-wheel 6 is mounted on the platform for controlling the guiding wheels, so that the machine is designed to be advantageously propelled by a power-engine carried by the machine.

In order that practically constant and uniform power may be available for carrying on the cleaning operations without interfering with the propulsion of the machine, and in order that the dust may be economically moistened so as to facilitate separation of the dust from the air currents, a steam-boiler 7 is mounted upon the platform 1 at a suitable distance forward of the rear end thereof, the boiler being upright and having a fire-box door 8 and also an ash-pan or box 9 beneath the fire-box of the boiler The boiler is provided on its top with a smoke-box 10 to which a horizontally arranged

draft-pipe 11 is connected. The top of the smoke-box is provided with a door 12 which may be opened to provide proper draft in case the atmospheric currents blow into the end of the draft-pipe. A steam-engine 13 is mounted on the forward portion of the platform 1 at one side of the explosion engine and is supplied with steam through a pipe 14 connected therewith and also with the steam-boiler 7. An exhaust-pipe 15 is connected with the steam-engine and extends beyond the steam-boiler and is provided beyond the latter with a stop-valve 16; and a branch 17 is connected with the exhaust-pipe between the steam-engine and the stop-valve and extends into the smoke-box 10, and is provided with a stop-valve 18, so that the exhaust steam may be utilized when desired for creating a draft through the fire-box. The steam-boiler is provided with a safety valve 19 with which an escape-pipe 20 is connected, the latter being connected with the exhaust-pipe 15 above a suitable separator 21 which is mounted on the rearward portion of the platform 1 rearward of the steam-boiler. The separator has a horizontal partition 22 in the upper portion thereof so as to provide an upper chamber that has communication with the remaining or lower chamber of the separator by means of a tube 23 that is connected at its upper end to the partition and extends downward a suitable distance. The exhaust-pipe 15 is extended into the lower chamber of the separator so as to conduct the exhaust steam, when desired, and the waste steam from the safety valve, into the dust-arresting chamber of the separator for moistening the dust to facilitate or hasten its settling into a dirt-box 24 which is carried by the platform beneath the separator.

The upper part of the improved gathering-chamber is mounted on the platform 1 in transverse arrangement between the engines and the steam-boiler and comprises a case 25 that extends nearly across the platform, a shaft 26 being rotatably mounted in the case relatively near one end thereof and having arms 27 fixed thereon that carry two annular side members 28 and 29 to which fan blades 30 are secured for forcing air from the case, the air being received into the case around the shaft through a pipe or conduit 31 that is connected to the rear side of the case and with the upper chamber of the separator 21.

The case has a rearward extension 32 to which a pipe or conduit 33 is connected, the pipe being connected also with the separator 21 below the partition 22 for conducting the dust and debris and air into the separating chamber of the separator.

In order to dispose of fine dust that in some cases may escape from the separator into the upper portion of the gathering-chamber, or dust which in some cases may not be drawn into the separator from the case, a conduit 34 is connected with the lower portion of the case and also with the ash-pan 9, so that the fire may be supplied with forced draft and consume fine dust which may rise in the gathering-chamber and pass into the case portion thereof. The fan being arranged near one end of the case, a dividing plate 35 is placed between the fan and the opposite end of the case 25, being relatively close to the fan and connected with one side of the conduit 34 to direct the air currents into the conduit, the plate extending upward and over approximately to the side plates 28 and 29 of the fan which extend outward beyond the fan blades 30. Another dividing-plate 36 is placed in the case and connected with the opposite side of the conduit 34, the plate extending upward approximately to the side plates of the fan. When the fan is operated in the direction of the arrow thereon some of the air in the case 25 and also dry dust are forced together through the conduit 34.

The shaft 26 has a bevel gear wheel 37 secured thereto that is in mesh with a bevel gear wheel 38 secured to a shaft 39 which is rotatably mounted on the forward side of the case 25 and has a pulley 40 secured thereto. A belt 41 extends about the pulley and also about a driving pulley 42 with which the steam-engine 13 is provided.

An open frame 43 comprising a part of the gathering-chamber is connected to the lower portion of the case 25 and its extension, the frame being beneath the platform 1. A similar companion frame 44 is suitably connected to and carried by the frame 43 on the under side thereof. The frames are approximately as long or slightly longer than the transverse dimension of the platform or main frame and are relatively narrow, an air-box 45 composed of flexible material being connected to the frame 44 and constructed so as to be extensible or contractible vertically and constitute a portion of the outer chamber of the gathering-chamber.

The lower portion of the improved gathering-chamber is sectional and structurally comprises practically the lower elements of an outer chamber and also an inner chamber within the outer chamber. The outer chamber portion comprises a front plate 46 and a rear plate 47 connected to the lower portion of the air-box, the plates being shorter than the air-box and connected to the latter midway between the ends thereof. The plates extend downward a suitable distance so as to terminate above the surface of the street or roadway. One side section comprises similar plates 48 and 49 connected to the air-box, the remaining side section comprising corresponding plates 50 and 51 similarly connected to the air-box. The side sections are on opposite sides respectively of

the middle section and connected to the ends thereof with joint plates 52 and 53 that permit relatively angular movement of the sections when working over uneven surfaces. Two upright plates 54 and 55 are connected to the opposite shorter portions of the air-box 45 and to the plates of the respective side sections, a top plate 56 is connected to and extends outward from the lower portion of the plate 54, a top plate 57 being connected to and extending outward from the plate 55, and end plates 58 and 59 are connected to and extend downward from the respective top plates, so that the lower portion of the outer chamber extends outward beyond the air-box and is conveniently further lengthened by means of frame beams 60 and 61 connected to the outer sides of the plates 58 and 59 respectively, the beams being connected to the forward and rearward plates of adjacent side sections. Two other frame beams 62 and 63 extend through and are connected to the inner end portions of the forward and rearward plates of said side sections of the chamber respectively. The inner chamber of the middle section comprises a top plate 64 that extends from the plane of the frame beams downwardly and rearwardly and has a rearwardly extending horizontal lip 65 on its lower rearward end, the upper portion of the plate 64 being in proximity to but not in contact with the forward plate 46, leaving an air-passage between the plates. One side section comprises an approximately triangular top plate 66, the other side section comprising an approximately triangular top plate 67, the forward upper edge portions of the plates being in alinement with the forward edge of the plate 64. One of the triangular plates is suitably connected with and carried by the beams 60 and 62, the other being connected with and carried by the beams 61 and 63. The plate 66 extends downwardly and rearwardly and has a lip 68 extending from the lip 65 and obliquely in forward direction therefrom so as to leave considerable air space behind the lip, the plate 67 being also inclined to correspond with the plate 64 and having a lip 69 on its lower rear end that extends forward obliquely so as to leave considerable air space in proximity to the beam 61, the top plate 66, as will be seen, having a relatively narrow end portion 70 adjacent to the beam 60, the other plate 67 having a narrow end portion 71 adjacent to the beam 61. The top plate 66 is connected to the plate 64 by means of a hinge 72, a hinge 73 connecting the plate 67 with the plate 64. An upright plate 74 which is secured to the beam 60, to the plates 50 and 51 and also to the plate 66, forms the end wall of one of the side sections of the outer and inner chambers, an upright plate 75 being secured to the outer side of the beam 61 and to the adjacent plates of the remaining side section to form the outer ends of the outer and inner chambers. One side section is further connected to the middle section by means of hinges 76, the opposite side section being connected to the middle section by means of hinges 77, the hinges being connected to the intermediate frame beams 62 and 63 respectively and to the adjacent portions of the middle section of the chamber. The frame beams extend forward and rearward beyond the gathering-chamber and the forward portion of each beam is provided with a horizontal pivot 78, the beam being provided also with a like pivot 79 adjacent to the rearward side of the chamber, wheel frames 80 and 81 being provided and connected at their forward ends to the pivots respectively, the rearward ends of the wheel frames being provided with adjusting bolts 82 and 83 respectively that are adjustably connected to the beam so as to enable the wheel frames, which are provided respectively with wheels 84 and 85, to carry the beam at various distances from the ground surface. The outer chamber has a flexible depending front portion that extends from the end plate 74 to the end plate 75 and preferably is composed of sections 86 provided with weights 87 on their rear sides respectively, the sections being connected to the plate 46 and extending downwardly and rearwardly to the ground surface, similar sections 86′ being connected to the member 48, similar sections 86″ being connected to the member 50. The outer chamber comprises also a rear flexible portion that extends from the end plate 74 to the end plate 75 and preferably comprises flexible sections 88 connected to the plate 47 and extending downward and rearward in proximity to the rear edge of the lip 65, each section having a weight 89 on its rear side, similar sections 88′ being connected to the plate 49, similar sections 88″ being connected to the plate 51. The inner chamber has also a flexible front portion that is arranged at a suitable distance back of the flexible front portion of the outer chamber and extends approximately from the end plate 74 approximately to the end plate 75, and it preferably comprises flexible sections 90 connected to the forward edge of the top plate 64 and having each a weight 91 on its rearward side, each section extending downwardly and rearwardly to the plane of the ground surface, similar sections 90′ being connected to the top plate 66, similar sections 90″ being connected to the top plate 67.

In order to remove the dust and debris from the gathering-chamber, the upper forward portion of the top plate 64 of the inner chamber has an aperture 92 therein, a nipple 93 being secured to the top of the plate 64 to which a flexible and longitudinally

extensible or contractible pipe 94 is connected, the pipe extending upward through the air-box 45 of the gathering-chamber and being connected to a nipple 95 which is connected with the pipe or conduit 33.

A particular feature of the inner chamber contemplates the division of the large body of air, that descends from the fan in the large upper portion of the outer chamber, or case 25, to the lower portion of the outer chamber, into air currents and controlling the formation and action of air currents under the inner chamber, so as to produce practically uniform action of the air throughout the wide range of operation and enable the rotary pump to lift the dust and debris with substantially equal force over the whole width of the strip of street surface operated upon, in order that the heavier particles of dirt or debris shall be drawn into the central aperture 92 from the remote side portions of the gathering-chamber. Means for attaining this object preferably comprise a plurality of dividers that are spaced suitable distances apart under the inclined top of the inner chamber and extend forwardly from the lower rearward portion of the top and obliquely toward the medial line of action of the gathering-chamber, two of the dividers 96 and 97 being secured to the opposite end portions respectively of the top plate 64 and extending from the lip 65 toward the rear portion of the aperture 92, the dividers being suitably composed of wood and extending approximately to the ground surface or to the plane of the bottom of the plates 74 and 75, so that the dividers extend downward beyond the plane of the lip. Other dividers 98, 99, 100, are secured to the under side of the top plate 66 and extend forwardly and inwardly, the dividers that are the nearer to the narrower end 70 of the top plate being the shorter ones but extend slightly nearer to the flexible sections 90′ than the others. Other dividers 101, 102, 103, are secured to the under side of the top plate 67 and extend forwardly and inwardly from the lip 69. The plate 74 that is drawn along the curbing in operation has a recess or opening 104 in its bottom through which the dust and dirt adjacent to the curbing is drawn into the gathering-chamber.

In order to lift the lower adjustable portion of the gathering-chamber from the road surface when not in operation, suitable means are provided which preferably comprise a bar 105 securely connected to the beams 60 and 62 and a bar 106 connected to the beams 61 and 63, a cable 107 being suitably connected to the bar 105 and to portions of one of the side sections of the gathering-chamber, another cable 108 being connected to the bar 106 and adjacent portions of the other side section of the gathering chamber. The cables extend upward through the contractible air-box 45 and through the rearward extension 32 of the case 25, being suitably guided, and being connected with a winding-drum 109 provided with a hand-wheel 110, may be wound up to lift the gathering-chamber.

Various mechanical expedients may be resorted to in the construction of the various minor features and details of the machine, as will readily be apparent to the constructor, and are contemplated within the scope of the appended claims.

In operation the machine is propelled forward, steam pressure being maintained in the boiler 7, and the steam-engine 13 being operated the rotary pump or exhaust-fan is properly driven, with the result that air is set in motion and forcibly drawn from the lower portion of the gathering-chamber and through the pipe or conduit 31 into the case 25, the air being forced downward from the case and into the lower portion of the gathering-chamber but not with sufficient force to cause it to escape into the atmosphere, since the air is drawn into the inner chamber and thence through the conduit 94 and the conduit 33 into the separator 21 by reason of the suction produced in the conduit 31. The large body of air passing downward slowly as a body in the outer chamber is divided into relatively rapid currents by the structure of the inner chamber, so that a strong current flows under the lip 65 and between the dividers 96 and 97 to the aperture 92, other currents being formed by the remaining dividers of the air passing under the lips 68 and 69, the velocity of the currents being maintained under the relatively low rearward portions of the top of the inner chamber, so that the dust and debris is forced over under the middle section and is drawn forcibly upward through the aperture 92 and finally into the separator where the refuse is separated, through the action of centrifugal force and force of gravity, from the air received into the separator, and gravitates into the dirt-box or receptacle 24 to be carried to a suitable place and discharged. The suction produced in the inner chamber being slightly greater than the outward pressure in the surrounding portion of the outer chamber exerted by the fan, it will be apparent that some atmospheric air is drawn into the gathering-chamber, and particularly into the inner chamber through the opening 104, the augmentation of the volume of circulating air being disposed of by forcing the excess air, which may carry fine particles of dust, through the conduit 34 to supply the fire under the steam-boiler with the necessary air to attain the proper combustion of the fuel used in the furnace. The bottom portions of the gathering-chamber are carried on the surface of the street

by the carrying-wheels provided for the purpose, and when the bottom slightly wears away the wheels are adjusted relatively to their frame so as to slightly lower the gathering-chamber to meet the requirements of operation.

Having thus described the invention, what is claimed as new is,—

1. A pneumatic street-cleaner including an outer gathering-chamber, an inner chamber, a separate separator, a suction-conduit connected with the inner chamber and also directly connected with and discharging unobstructedly into the separator, a separate conducting-pipe connected with the separator and the outer gathering-chamber, and means in the outer gathering-chamber at the end of the conducting-pipe adapted for forcibly drawing air directly from the conducting-pipe into the outer gathering-chamber.

2. A pneumatic street-cleaner including an outer gathering-chamber, a separate separator, an exhaust-fan rotatably arranged in the higher portion of the gathering-chamber to discharge broadcast into the interior of the gathering-chamber, a separate conducting-pipe connected with the separator and the gathering-chamber adjacent to the exhaust-fan for the passage of air from the separator directly to the exhaust-fan, a suction-conduit connected with the separator and extending into the gathering-chamber, and an inner chamber in the gathering-chamber connected to the suction-conduit and provided therein with means adapted for dividing air into currents and directing the currents to the suction-conduit.

3. A pneumatic street-cleaner including an outer chamber and an inner chamber, a separator, a suction-conduit connected with the inner chamber and the separator, means carried under the inner chamber for dividing currents received from the outer chamber into different currents and directing these currents through the inner chamber to the suction conduit, an exhaust-fan in the outer chamber, and a conduit connected with the separator and the exhaust-fan.

4. A pneumatic street-cleaner including an inner gathering-chamber comprising an inclined top that has a straight higher front portion and relatively narrow end portions, the under side of the top having a plurality of dividers thereon that extend from the lower portion toward but not to the front of the higher portion of the top and also obliquely each toward a common median plane, the outer ones of the dividers being successively shorter and nearer than the others to the front portion of the top.

5. A pneumatic street-cleaner including a movably supported platform, a separator mounted upon the platform, an outer chamber comprising an upper portion carried upon the platform and a lower portion below the platform, the upper portion of the outer chamber having an exhaust-fan therein that operates partially in the space within the outer chamber, a conduit connected with the separator and the outer chamber adjacent to the exhaust-fan, an inner chamber, and a conduit connected with the inner chamber and the separator.

6. A pneumatic street-cleaner including a movably supported platform, a separator mounted upon the platform, a gathering-chamber comprising an outer chamber having an upper portion carried upon the platform and a lower portion extending below the platform, the upper portion of the chamber having an exhaust-fan within its confines, an inner chamber in the outer chamber below the exhaust-fan, a suction-conduit connected with the inner chamber and the separator, a conduit connected with the separator and the upper portion of the outer chamber adjacent to the exhaust-fan, and means in the inner chamber adapted for dividing air into currents and directing the currents to the suction-conduit.

7. In a pneumatic street-cleaner, the combination with an outer chamber, of an inner chamber comprising a middle section and two side sections hinged to the opposite ends respectively of the middle section, each section having an inclined top extending downwardly rearwardly, and a plurality of partition devices secured to the under side of said tops in spaced apart order and extending from said under side and forwardly and toward a common median plane, the devices on either side of such plane being shorter each with respect to the adjacent one in progression from such median plane.

8. In a pneumatic street-cleaner, an inner chamber comprising an inclined top that has a straight higher front portion and relatively narrow side portions, the under side of the top having a plurality of dividers thereon that extend from the lower portion toward but not to the front of the higher portion of the top and also obliquely each toward a common median plane, the outer ones of the dividers being successively shorter and nearer than the others to the front portion of the top.

9. In a pneumatic street-cleaner, the combination of a gathering-chamber comprising a middle section and also two side sections hinged to the two opposite sides respectively of the middle section, each side section being provided with two frame beams, each beam having two supporting wheels; an exhaust-fan connected with all the sections of the gathering-chamber, a separator, a conduit connected with the separator and the exhaust-fan, and a conduit connected with the separator and the middle section of the gathering-chamber.

10. In a pneumatic street-cleaner, the com-

bination of a fan-case, a separator, an exhause-fan in the fan-case, a conduit connected with the separator and the fan-case and the exhaust-fan, an outer chamber portion and an inner chamber in the outer chamber portion, a suction-conduit connected with the inner chamber and the separator, an air-passageway that is relatively shorter and larger in cross-sectional capacity than the suction-conduit and connecting the outer chamber portion with the fan-case, and means carried under the inner chamber for dividing the air received into the outer chamber portion into different currents and directing the currents through the inner chamber to the suction-conduit.

11. In a pneumatic street-cleaner, the combination of a movably supported platform, a separator and a fan-case mounted upon the platform, the rearward portion of the fan-case having an extension thereon adjacent to the platform, an exhaust-fan mounted in the fan-case, a gathering-chamber structure having a flexible air-box portion that is connected with the lower portion of the fan-case and its extension, a conducting-pipe connected with the fan-case extension and the separator, a flexible conduit connected with the gathering-chamber structure and the fan-case extension to form communication with the conducting-pipe, the conduit extending through the air-box, and a conducting-pipe connected with the separator and the exhaust-fan.

12. In a pneumatic street-cleaner, the combination of a gathering-chamber comprising an outer chamber lower structure and an inner chamber, the lower structure having an open top and extending about the inner chamber, the gathering-chamber comprising also an outer upper structure having an open bottom connected with the open top of the lower structure to permit free and slow passage of air from the upper structure to the lower structure; a rotatable exhaust-fan occupying a relatively small portion of the interior of the upper structure; air-current controlling means carried in the inner chamber, a separator, a conduit connected with the inner chamber and extending through the outer chamber into the separator, and a conducting-pipe connecting the separator with the exhaust-fan.

13. In a pneumatic street-cleaner, a gathering-chamber comprising upright forward and rearward plates spaced apart, a plurality of frame beams each secured horizontally to the forward and rearward plates, wheels supporting the frame beams, two side plates each secured to the forward and rearward plates, forward flexible plates depending from the upright forward plate, rearward flexible plates depending from the upright rearward plate, a top plate extending under and supported by the frame beams, the top plate extending from one to the other of the side plates above the plane of the bottom thereof and at an inclination to such plane, the higher portion of said top plate being in proximity to but spaced apart from said upright forward plate, the lower portion of said top plate being spaced apart from said rearward flexible plates, inner flexible plates depending from the higher portion of said top plate, and dividing devices depending from the under side of said inclined top plate, in combination with a rotary pump, a flexible air-box connected with the pump and also with said upright plates and side plates, and a conduit connected with the higher portion of said inclined top plate and extending through and away from said air-box.

14. In a pneumatic street-cleaner, the combination of an outer chamber upper structure and an outer chamber lower structure below the upper structure, an air-passage connecting the lower structure with the upper structure, an exhaust-fan rotatably mounted in the upper structure, and a conduit having side portions extending into the upper structure below the exhaust-fan and upward divergently approximately to the exhaust-fan for receiving and conducting a portion of the air away from the outer chamber structures and the air-passage.

15. In a pneumatic street-cleaner, the combination with an outer chamber, of an inner chamber comprising a middle section and two side sections hinged to the opposite sides respectively of the middle section, each section having an inclined top extending downward rearwardly, the lower end of each section having a rearward-extending lip thereon and a plurality of partition devices secured to the under side of said tops in spaced apart order and extending from said lower ends and forwardly and toward a common median plane, the devices on either side of such plane being shorter each with respect to the adjacent one in progression from such median plane.

In testimony whereof, I affix my signature in presence of two witnesses.

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Witnesses:

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DUDLEY A. COX.