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2,913,744

SWEEPING MACHINES

Filed April 26, 1955

2 Sheets-Sheet 1

Fig. 1

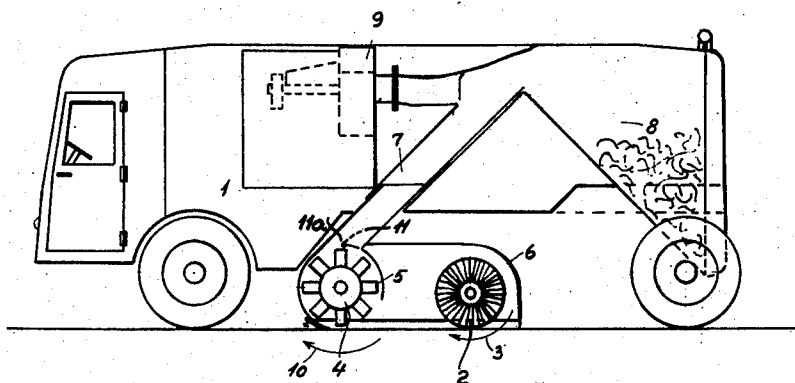
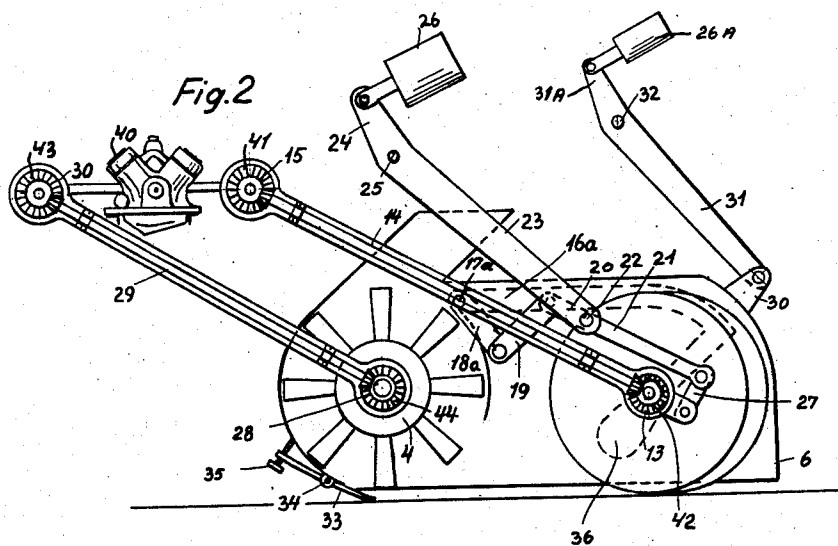


Fig. 2



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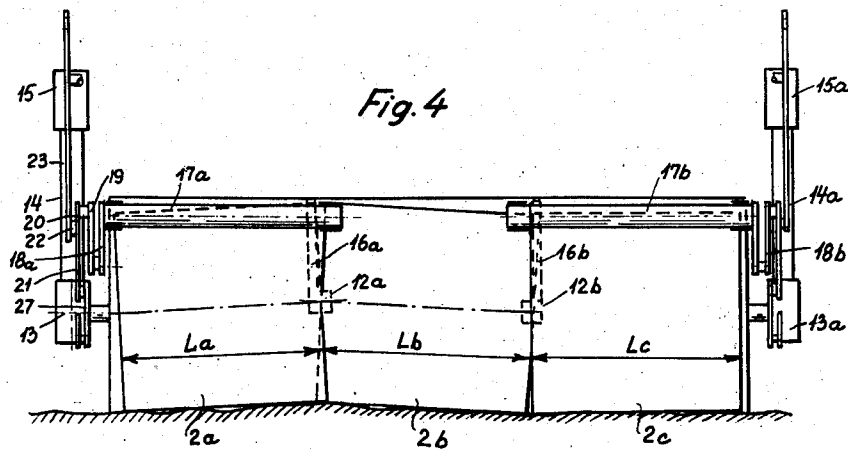
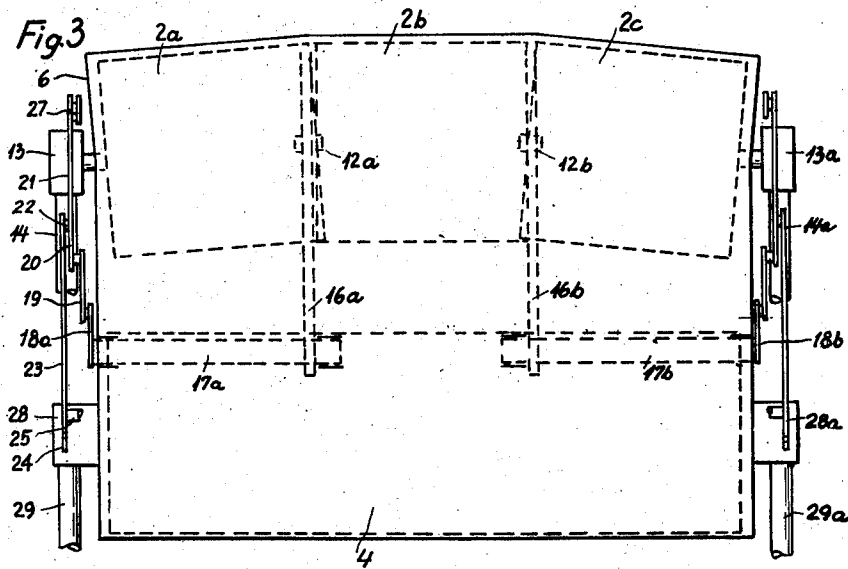
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SWEEPING MACHINES

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5 Claims. (Cl. 15—83)

This invention relates to a sweeping machine of the type used for the mechanical sweeping of roads, runways and other surfaces. Machines of this type generally comprise rotary brushes extending across the width of the machine and means for conveying the sweepings to a receiving receptacle forming part of the machine.

It is the general object of the invention to provide a sweeping machine of high capacity that will exert a uniformly distributed sweeping pressure irrespective of irregularities of the surface being swept. More particularly, it is an object of the invention to provide means, whereby the pressure of the brushes can be controlled by the operator of the machine while at all times being kept substantially uniformly distributed over the whole width of the sweeping track of the machine.

It is a further object of the invention to provide a machine of the kind in question in which wear will not only be uniformly distributed over the brushes, but will also be kept at a minimum.

It is a still further object of the invention to provide a sweeping machine of the type mounted in an automotive vehicle, in which a clean sweeping of the surface can be obtained no matter whether the automotive vehicle is travelling at a relatively high or a relatively low speed.

More particularly, it is an object of the invention to provide a machine as set forth that will collect the road sweeping, will work equally well when the road surface is either wet or dry and will in the latter case perform the operation without raising dust and causing a nuisance.

With these and other objects in view, according to one feature of the invention, a sweeping machine of the type set forth comprises a composite brush composed of a plurality of rotary brushes arranged in end to end relationship and connected with each other by means of universal joints and supported in bearings at the ends of the composite brush, said universal joints and said bearings being interconnected by means of balancing means of a character to ensure a substantially uniform ground pressure of the composite brush along the whole length thereof.

According to a more specific feature of the invention a sweeping machine comprises a machine frame in the form of an automotive vehicle having front and rear wheels, a sweeping box mounted in said machine frame between the front and rear wheels thereof in a position to have its open bottom located a short distance above the ground, a plurality of component rotary brushes arranged in end to end relationship to form a flexible composite brush, said composite brush being floatingly mounted in said machine frame independently of said sweeping box in a position to extend substantially transversely through the latter adjacent the rear end thereof, adjustable power means for transferring to the ends of said component brushes individual supporting forces balanced against each other in such a manner as to create a substantially uniform ground pressure of said compos-

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ite brush along the whole length thereof, a dust collecting reservoir mounted in said vehicle in a position above the level of said sweeping box, a duct extending at a rearward inclination from the top of the front end of said sweeping box to said reservoir, means for creating a vacuum in said reservoir and said duct, a paddle wheel extending transversely of said sweeping box adjacent the front end thereof in a position to receive dust and mud loosened from the ground by said composite brush and to propel the dust and mud thus received through said duct into said reservoir, and means for rotating said composite brush and said paddle wheel.

The invention will now be described in further detail with reference to the accompanying drawings, in which

Fig. 1 shows one form of a self-collecting sweeping machine according to the invention, in a diagrammatic side view, parts being shown in section and other parts being removed to expose essential components of the mechanism,

Fig. 2 shows on an enlarged scale the means for suspending the brushes, the paddle-wheel and the sweeping box, likewise in side view,

Fig. 3 likewise shows on an enlarged scale a plan view of the brush system, the paddle-wheel and the sweeping box, and

Fig. 4 shows a rear view of the brush system including the means for suspending same and the sweeping box.

In the drawings, 1 is the frame of the sweeping machine. In the example shown, this frame is in the form of a motor driven vehicle carrying the sweeping mechanism between the front and rear wheels thereof. The sweeping mechanism comprises a brush system or composite brush 2 composed of three individual brushes 2a, 2b and 2c. The brush system is arranged to rotate in the direction of the arrow 3, Fig. 1, and in front of the brush system, as viewed in the direction of travel of the vehicle, there is mounted a rotor 4 provided with flexible paddles 5 to form a paddle-wheel. The rotor 4 and the brush system are enclosed in a sweeping box 6, which by means of a passage 7 communicates with a storage compartment 8 to receive the dust and mud removed from the ground by means of the brush system. An exhaustor 9 is mounted in a passage branched from the passage 7 and serves to keep the latter and the storage compartment 8 under a vacuum so as to support the transportation of the dirt through the passage 7.

When the brush system 2 rotates, the dirt on the ground, such as the surface of a road or a runway, is swept loose and is thrown onto the rotor 4, which rotates at a great speed in the direction of the arrow 10. The rotor 4, by virtue of its high speed of rotation, in turn throws the dirt up through the passage 7 to the compartment 8. In the passage 7 there is mounted a cylindrical flap 11, which is adjustable about an axis 11a between the positions shown in full lines and in dotted lines respectively, e.g. by means of a handle mounted outside the passage 7 on a shaft extending through the passage along the axis 11a and having the flap 11 mounted thereon. The purpose of the flap 11 is to prevent dirt from depositing on the lower part of the wall of the passage 7. This might occur in the case of wet dirt, since this will have a tendency to adhere to the paddle-wheel and will therefore not be thrown out parallel to the passage 7 but in a direction inclined relative thereto so as to strike the lower part of the wall of the passage 7. To prevent this, the flap 11 is set in the position indicated in full lines, so that dirt which is ejected from the paddle-wheel at a too late point of the rotation thereof is prevented from entering the passage 7. In the case of dry dirt, the flap 11 is set as indicated in dotted line to give a maximum cross-sectional area of the passage 7.

The stems of shafts of the individual brushes 2a, 2b

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and 2c are connected with each other at their adjacent ends by means of flexible joints such as universal joints 12a, 12b. The outer ends of the flexible stem or shaft of the composite brush thus formed are supported in bearings 13 and 13a. These bearings are supported by arms 14, 14a pivoted at their opposite ends in bearings 15, which are in turn supported in the frame 1 of the sweeping machine. The arms 14 and 14a are provided with power transmission means constructed to transmit power from a motor 40 to the stem or shaft of the composite brush. Such power transmission means need only be arranged at one side of the machine and may comprise a chain drive having the chain wheels thereof mounted coaxially with the bearings 15 and 13, or alternatively, as shown, bevel gears 41, 42 likewise mounted with one axis thereof coaxial with the bearings 13 and 15 respectively.

By virtue of the suspension system above described, the bearings 13, 13a are free to move along circular arcs having the bearings 15 and 15a as centers and the oscillating arms 14, 14a as radii, and the power transmission means will not interfere with this freedom of movement. Since a separate motor 40 is used for driving the brushes, the speed of rotation of the latter may be kept at an optimum value notwithstanding any variations of the speed of travel of the supporting vehicle.

The universal joints 12a, 12b are supported by curved arms 16a, 16b which are attached to shafts 17a, 17b respectively extending through the wall of the sweeping box and carrying an arm 18a, 18b respectively outside the latter. The free end of the arm 18a is hingedly connected with one end of link 19, the other end of link 19 is in turn hingedly connected with one end of a balancing lever 20, 21, the fulcrum of which is formed by a pivot 22 at one end of another balancing lever 23, 24 having its fulcrum 25 in the machine frame 1. The end of the balancing lever 24 remote from the pivot 22 is connected to a hydraulic or pneumatic cylinder 26 arranged to transfer to the balancing lever 23 an adjustable force tending to move the fulcrum 22 of the balancing lever 20, 21 in an upward direction for the purpose of partly balancing the weight of the brushes, whereby the ground pressure of the latter can be controlled to obtain optimum sweeping properties with minimum wear, it being observed that the brushes in themselves are usually too heavy to rest on the ground without counter-balancing. The end of the balancing lever 20, 21 remote from the point of attachment of the link 19 is coupled to the bearing 13 by means of a link 27. The parts 19, 20, 21, 22, 23, 24, 25, 26, 27 are duplicated on the other side of the machine, the arm 18b being pivotably connected to the link 19 at the other side of the machine.

In order that the brushes 2a, 2b and 2c shall bear on the ground at a uniformly distributed pressure, the reaction in the bearing 13 should amount to a certain proportion of the weight of one half of the brush 2a which is in turn proportional to one half of the length of the brush 2a, referred to in the following as $La/2$, and the force transferred by the curved arm 16a to the universal joint 12a should amount to the same proportion of one half of the combined weights of the brushes 2a and 2b which is in turn proportional to one half of the combined length of the brushes 2a and 2b, in the following referred to as

$$\frac{La+Lb}{2}$$

From Fig. 2 it will be seen that the reaction force in the bearing 13 thus required will produce a longitudinal force in the link 19 equal to $La/2$ multiplied by the length of the lever arm 21 divided by the length of the lever arm 20. Moreover, it will be seen that the bearing reaction in the universal joint 12a will produce a longitudinal force in the link 19 equal to $La/2+Lb/2$ multiplied by

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the length of the arm 16a divided by the length of the arm 18a. For the purpose of simplification, the length of the arm 20 will be referred to as a , the length of the arm 21 as b , the length of the arm 18a as c , and the length of the arm 16a as d . From the foregoing it will now be seen that the condition to be fulfilled can be expressed as follows:

$$\frac{La}{2} \times \frac{b}{a} = \frac{La+Lb}{2} \times \frac{d}{c}$$

or

$$\frac{La}{La+Lb} = \frac{d}{c} \times \frac{a}{b}$$

If the component parts of the leverage and the brushes are dimensioned so as to fulfil this condition, the brushes will exert a uniform pressure on the ground.

The rotor 4 is mounted at either end in bearings 28, 28a, which are suspended from the frame of the machine by means of arms 29, 29a pivoted at 30. The arms 29, 29a are provided with power transmission means, such as bevel gears 43, 44 similar to the bevel gears 41, 42, so that power can be transmitted to the rotor 4, e.g. from the motor 40, while the ends of the rotor are free to move along a circular arc having the pivots 30 as center and the arms 29 and 29a as radius.

The sweeping box 6 is suspended from the machine frame by means of an arm 31 pivoted at 32 and hingedly connected to a lug 30 of the dust box. If a strong pressure is exerted by the pressure cylinder 26, the dust box will be lifted by the upwardly directed force thereby exerted on the shafts 17a, 17b, the arm 31 rotating about its pivot 32. To facilitate the lifting of the dust box, the arm 31 may be provided with a small lever arm 31a, which is coupled to a hydraulic or pneumatic cylinder 26a, the latter being coupled to the hydraulic or pneumatic system in such a manner as to be set under pressure at the same time as the cylinder 26 exerts the high pressure for lifting the brushes. If the pressure in the cylinder 26 is adjusted at a lower value, the uniform pressure of the brushes 2a, 2b and 2c against the ground may be varied.

The lower portion of the front end of the sweeping box 6 is formed by one or more flaps 33, which are pivoted at 34 and are arranged to be adjusted by means of adjustment screws 35 forming stop members for the downward movement of the flap but not preventing this from moving upwards.

In each side wall of the sweeping box 6, there is provided an arcuate slot indicated in dotted lines at 36 to enable the brushes to move independently of the sweeping box.

I claim:

1. A sweeping machine comprising a composite brush composed of a plurality of rotary brushes arranged in end to end relationship and connected with each other by means of universal joints and supported in bearings at the ends of the composite brush, said universal joints and said bearings being interconnected by means of balancing means of a character to balance the vertical forces occurring at said universal joints and said bearings against each other in proportions such as to ensure a substantially uniform ground pressure of the composite brush along the whole length thereof.

2. A sweeping machine comprising a machine frame supported on wheels, a plurality of rotary brushes arranged in end to end relationship to form a composite brush extending transversely of said machine frame, universal joints connecting adjacent ends of said individual brushes, bearings mounted at the ends of said composite brush, and balancing leverage mounted in said machine frame and supporting said bearings and said universal joints with the vertical forces balanced against each other in proportions such as to ensure a substantially uniform ground pressure of the composite brush along the whole length thereof.

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3. A sweeping machine comprising a machine frame supported on wheels, a plurality of component rotary brushes arranged in end to end relationship to form a flexible composite brush, said composite brush being floatingly mounted in said machine frame substantially transversely thereof, and adjustable power means for transferring to the ends of said component brushes individual supporting forces balanced against each other in proportions such as to create a substantially uniform ground pressure of said composite brush along the whole length thereof.

4. A sweeping machine comprising a machine frame supported on wheels, three rotary brushes arranged in end to end relationship to form a composite brush which is floatingly mounted in said machine frame to extend substantially transversely thereof, universal joints interconnecting adjacent ends of said individual brushes, bearings mounted at the ends of said composite brush, a first balancing lever pivotably mounted in said machine frame adjacent each side thereof, adjustable power means connected to one end of said first balancing lever, a second balancing lever pivotably mounted at the other end of said first balancing lever, and leverage connecting the bearing at the respective side of the machine and the universal joint next following with one and the other end of said second balancing lever respectively.

5. A sweeping machine comprising a machine frame supported on wheels, a plurality of rotary brushes ar-

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5 ranged in end to end relationship to form a composite brush which is floatingly mounted in said machine frame to extend substantially transversely thereof, universal joints interconnecting adjacent ends of said individual brushes, bearings mounted at the ends of said composite brush, a first balancing lever pivotably mounted in said machine frame adjacent each side thereof, a second balancing lever pivotably mounted at the other end of said first balancing lever, and leverage connecting the bearing at the respective side of the machine and the universal joint next following with one and the other end of said second balancing lever respectively.

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