March 31, 1942. T. K. CUSHMAN ET AL 2,278,306

VACUUM CONTROL FOR POWER SWEEPER BROOMS

Filed Nov. 6, 1940 2 Sheets-Sheet 1

Fig. 1

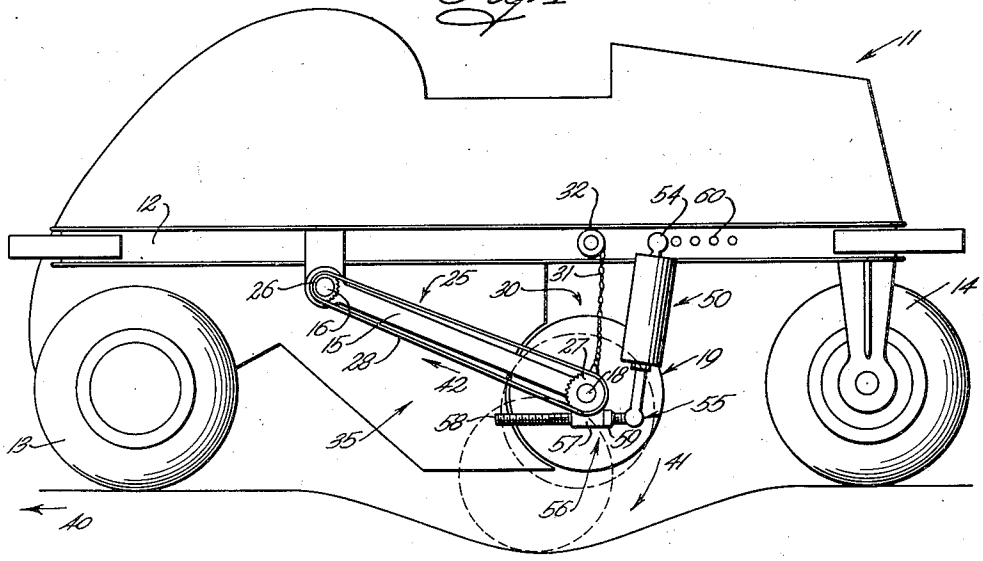
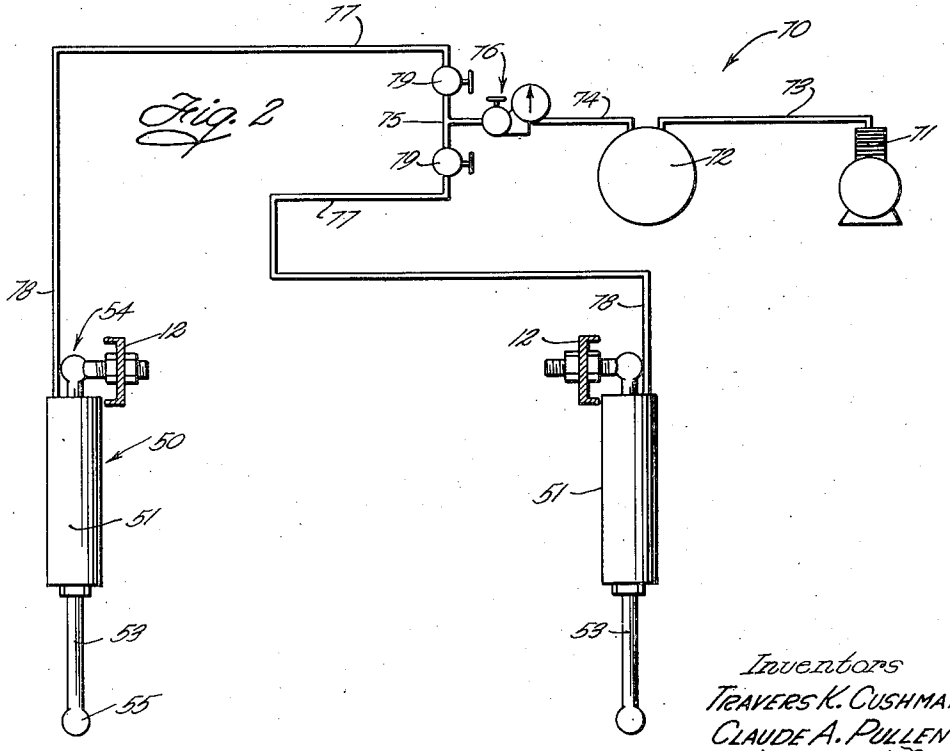


Fig. 2



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Fig. 4

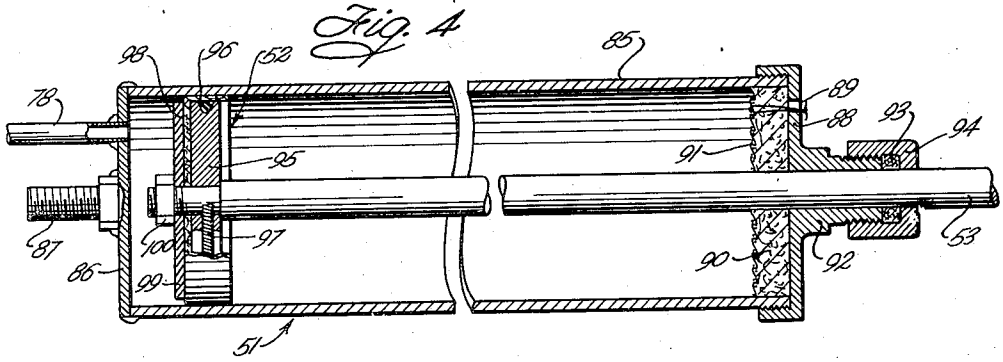
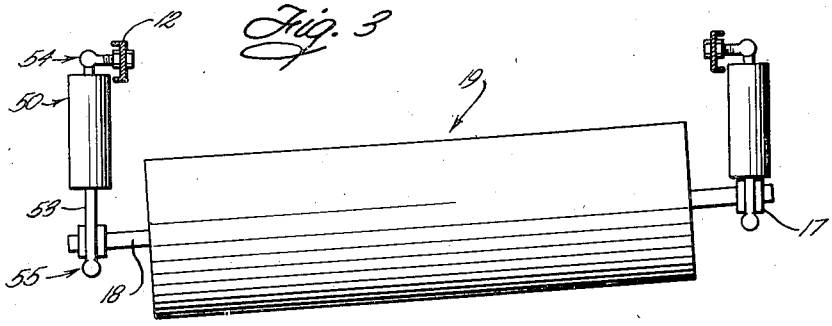


Fig. 3



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UNITED STATES PATENT OFFICE

2,278,306

VACUUM CONTROL FOR POWER SWEEPER BROOMS

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Application November 6, 1940, Serial No. 364,546

10 Claims. (Cl. 15—82)

Our invention relates to a vacuum type of control for the brooms of power sweepers, these being usually of a type in which the broom is rotated with the bristles in contact with the ground, the broom being mounted for raising and lowering. In this type of sweeper the brooms are usually quite heavy and are to a certain extent balanced by a spring and have chains or other devices to raise the broom to an inactive position or to lower the broom for operating in sweeping, the weight applied on the bristles being governed by the spring mounting or the tension given to the springs. Usually in this type of equipment the broom is mounted on a transverse shaft relative to the chassis or frame of the machine and the opposite ends of the shaft are supported by radius arms pivoted to the frame and having the journals mounted in their lower and rear ends.

In considering our invention it is desirable to make a distinction between the equipment which holds the broom raised in an inactive position when the sweeping machine is moved over the highway in a mere operation of transportation from one place to another from the mechanism employed in maintaining the broom with the desired road pressure when actively sweeping a road. In certain types of power sweepers as now employed, and prior to our invention, chains or the like operated by winches or the equivalent have been used to raise and lower the broom and to retain this in its inactive position. In conjunction with these chains, springs connected between the broom or its support and the frame of the machine have been used in an attempt to have the desired pressure of the broom on the road surface, the springs carrying or supporting part of the weight of the broom. The pressure on the road surface is derived from the unsupported weight of the broom and in the sweeping action it is desirable to maintain this as constant as possible so that the sweeping will be uniform and at higher elevated spots there will not be too great a pressure on the road surface or in depressions there would be too little road pressure of the broom. When springs are used to maintain the road pressure and presuming these are adjusted for operation on a level road, then when the broom passes over a depression the springs are tensioned to a greater extent, this being a type of energizing of the spring which causes a greater lift, the springs thus when stretched giving a greater lift than normal and thus the broom even as it bears on the road surface in a depression does not give the constant road pressure. In a contrary manner when the broom passes over a raised portion of the road, the broom is forced upwardly by the road contact, this lessening the stretch or de-energizing the spring causing such spring to have a lessened lifting power than normal and hence not supporting the desired or calculated weight of the broom. This causes a greater wear on the broom than under normal operating conditions. Moreover where springs are used to counterbalance the broom as to at least part of its weight, the springs develop a vibratory action giving the broom an up and down movement which is designated by the operators as a broom bump. Manifestly the broom striking the road surface for a short period of time increases the pressure and hence the wear on the broom causing the brom to wear out of its cylindrical or normal shape. In order to follow the road surface in normal operation and maintain a desired pressure, the wheels of the sweeper in passing into depressions or over elevations in the road surface develop the equivalent action of the broom of its passing over elevated parts or depressed parts in reference to the longitudinal vertical contour of the road.

Where the broom is counterbalanced or in part supported by hydraulic equipment such as hydraulic cylinders to maintain the desired operating pressure, it is usual to employ hydraulic cylinders and pistons in which a hydraulic fluid; usually oil, exerts a lift on the pistons. If the hydraulic pressure is stabilized to maintain the desired road pressure of the broom on a level road, manifestly as the hydraulic fluid is incompressible, the broom is prevented from following the road surface into depressions and hence these are either entirely missed or have inadequate sweeping. Again where the broom passes over elevations, the pressure in the hydraulic cylinders cannot be increased sufficiently rapidly to lift the broom and hence there is too much road pressure on the broom, more than the normal. In fact, in some constructions in cases of the forced elevation of the broom, the pistons move upwardly reducing the hydraulic pressure underneath such pistons and tending to suck more fluid into the cylinders.

Where compressed air is used to in part counterbalance the weight of the broom by using cylinders and pistons, the action is somewhat the same as the hydraulic equipment. In the compressed air operation the air is maintained compressed in these cylinders giving a lift on the pistons. This air pressure may be adjusted

to develop a normal and desired pressure of the broom on the road surface for sweeping on a flat or uniform surfaced road. This air pressure must be usually much above the normal atmospheric pressure and hence although compressible, does not readily permit the broom to descend into road depressions in its advance and still maintain the desired road pressure. The action is somewhat the same as the spring when its tension is increased that is, the compressed air gives a greater lift on the broom and hence tends to decrease the road pressure. In a contrary manner when the broom is forced upwardly by riding over an elevation in the road surface, the air pressure does not increase to develop an increased lift on the broom and thus support the desired proportion of its weight and hence there is a greater road pressure on the broom than normally desired causing increased wear.

Another disadvantage of all the prior art constructions using either counterbalancing springs, hydraulic or air counterbalancing equipment is that the operator of the machine cannot control the counterbalance to lower the broom quickly to sweep unusual depressions such as gutters or to ride over unusual elevations which is sometimes found in cross-walks or developed by the wheels dipping into depressions. The operators cannot manipulate the springs, the hydraulic or compressed air equipment with sufficient rapidity of action to maintain substantially the normal road pressure of the broom in these many circumstances of sweeping into considerable depressions or over considerable elevations in the road surface and such conditions are frequently met in practice.

Some of the defects of the present equipment whether the brooms are raised and lowered by power mechanical construction such as the chain lifts, by hydraulic equipment or air operated cylinders resides in the inability to give a quick control of the elevation of the broom in regard to the frame by the action of the operator of the sweeping machine. Another defect is the inability of the operator to maintain a desired pressure of the bristles of the broom on the road surface at a desired degree so that this pressure is not so great as to unduly wear the bristles or too light and thus prevent a proper sweeping action. With the present construction it is difficult when the sweeper is operated along the road and encounters for instance a cross gutter of only comparatively short transverse measurement is to have the broom quickly and properly dip into the gutter to sweep this clean. It is by the present practice usually necessary either to omit such transverse gutter sweeping by the machine and have this done afterwards by hand or in some cases the operator of the machine must stop the machine and do this himself by hand, moving the sweepings into a place where they can be picked up by the broom. Another limiting characteristic of the present machines is that one end of the broom cannot be readily raised or lowered in reference to the other end where it is necessary to have the broom at one end dip into a sloping hollow place in the road of a type separate and distinct from the usual camber of paved roads. This can be accomplished by our invention due to the separate control of each of the vacuum cylinders.

Another of the difficulties encountered in the present type of machines is the wearing of the broom to somewhat of a conical shape, that is, tapered from one end to the other. This generally occurs in brooms having the usual type of rotational drive, that is, a sprocket chain drive to one end of the broom. If the brooms are driven to rotate the bristles in contact with the ground in a forward direction relative to the movement of the machine over such roadway, this requires the sprocket chains to give a tension pull on the underside of the sprocket wheel connected to the axle of the spool, the chain usually leading in runs parallel to the axis of the radius arm with the driving sprocket in alignment with the fixed pivot of the arm. This action of the chain together with the downpull on the back of the sprocket produces a decided downward stress on one end of the axle of the broom compared with that at the other end. In addition, this end of the broom having the drive is usually heavier than the opposite end, therefore the broom tends to become tapered towards the driven end due to the wearing action on the rod and the increased pressure on the bristles. Another feature of our invention is compensating for this increased downward pressure of one end of the broom by having an adjustable mounting for the vacuum cylinder and piston connection between the broom axle and the chassis of the machine. Hence although the same degree of vacuum may be admitted to both cylinders, we can obtain a slightly greater lift on the driven end of the sweeper brush compared with the opposite side and yet control the simultaneous lift and drop of the broom or its tilting transverse direction.

A characteristic of our invention in using a vacuum lift for the power driven broom of a sweeper is that when operating on a road with the usual minor uneven surfaces, a substantially constant road pressure may be maitnained by the broom. The vacuum cylinder or cylinders are connected to a source of vacuum which is preferably always creating a partial vacuum in the system and with a control valve or valves together with suitable gauge assemblies between the vacuum source and the lifting cylinders. The vacuum lift of course is operative by the atmospheric air pressure acting on the piston giving a positive lift, the partial vacuum being on the suction side of the piston. There is always a leak past the pistons but the desired degree of vacuum is maintained by the valve control and indicator on the vacuum side of such lifting pistons. As the effective lifting pressure is the differential between atmospheric air pressure and the partial vacuum on the suction side of the piston, the movement of the piston lengthwise in the cylinder has very little effect on the change of this effective pressure, therefore when the control valves are set to counterbalance a desired proportion of the weight of the broom and leave an unsupported balance to develop the pressure of the broom on the road surface, this is substantially maintained on a smooth road and on a road with moderate changes as even where the broom drops into minor depressions or rises over minor elevations the same degree of vacuum counterbalances the same partial weight and thus maintains the same desired road pressure. However another advantage of our invention is that due to the sensitiveness of the vacuum lift, the broom may be quickly lowered to work into a deep gutter or to rise over a considerable elevation or a bump in a road while still maintaining substantially the desired road pressure. For instance to drop the broom the effective degree of vacuum may be momentarily decreased which decreases the counterbalanced weight lifted and allows the

broom to descend. Likewise by increasing the effective vacuum a greater proportion of weight may be lifted and the broom carried upward on elevations or obstructions and still maintain approximately the desired road pressure. The operators of the machine by having suitable vacuum gauges soon become skilled in the manipulation of the controls for the above noted purpose. In addition advantages of having a vacuum lift assembly between each end of the broom and the frame of the vehicle is that in normal operation without manipulation of the valve control, the broom may tilt on a lateral inclination to accommodate itself to the particular road surface or when desired by controlling the valves a positive tilt of one end of the broom downwardly and the other end upwardly may be accomplished.

Our invention also includes certain details as to the construction of the vacuum cylinder and piston with a ball and socket mounting for the cylinder and the piston rod. Details of the valve control and their relationship to the vacuum system also are included as features of our invention.

Our invention is illustrated in connection with the accompanying drawings, in which:

Fig. 1 is an elevation showing the outline of a typical municipal road sweeper with the vacuum lift equipment operatively connected to the rotatable sweeper broom.

Fig. 2 is a diagram considered on a transverse section of the machine showing the two vacuum cylinder assemblies, the piping, the valves and vacuum system.

Fig. 3 is another view of the diagram of Fig. 2 illustrating a cross tilt of the broom by an unequal action of the vacuum cylinders and pistons.

Fig. 4 is a longitudinal section through one of the vacuum cylinders and the piston assembly.

In the illustrations, Fig. 1 designates the typical type of municipal roadway sweeper 11. This is illustrated as having a chassis or a frame 12, the two front wheels 13, a single rear steering wheel 14, a pair of radius arms 15 pivoted at 16 by a bracket connection or the like to each side of the frame. In these radius rods there are journals 17 for the axle 18 of the broom 19. It is usual to drive the broom by a driving assembly 25 in which there is a driving sprocket 26 mounted concentric with the pivot 16 and having a driven sprocket gear 27 connected to the axle 18, this being operated by a drive sprocket chain 28. The usual equipment also includes a lifting and lowering assembly 30 including a chain 31 indicated as taking over an idler pulley 32 with some type of equipment for exerting a lift on the chain or releasing and lowering the chain. The conventional counter-balancing springs are not illustrated as with our construction these may be omitted, however it is desirable to have the lifting chains to hold the broom in an inactive position after it has been raised by the vacuum equipment. A sweepings receptacle 35 depends from the frame and has a scoop or the like adjacent the broom movable to a certain extent with the broom to collect the sweepings. The machine is intended to move and sweep when travelling in a forward direction indicated by the arrow 40 in which case the broom rotates in a forward direction as 41 and the drive chain operates with its lower run moving in the direction of the arrow 42. The single rear wheel allows the equipment to turn at a sharp angle. The drive is through the front wheels 13.

With our equipment we utilize two vacuum cylinder and piston assemblies 50 each of which has a cylinder 51 with a piston 52 therein with a projecting piston rod 53. The pistons have a ball and socket joint connection 54 to the side beams of the chassis 12 of the machine and the piston rods a ball and socket connection 55 with a bracket assembly 56 leading to the axle support. This bracket is illustrated as having a sleeve 57 connected to the journal structure 17 with a threaded rod 58 extending therethrough locked in place by a nut and lock nut assembly 59 allowing the variable spacing of the ball and socket 55 of the piston rods to the journal assembly. In addition the beam of the frame is provided with a series of bolt holes 60 so that the ball and socket connection 54 for the cylinder may also be located in different positions on the frame. This allows a variable spacing of the cylinder and piston connection on one side of the machine in reference to the other should this be desirable or necessary, it being our usual practice to space the cylinder and piston on the side having the chain drive further from the axle of the broom than on the opposite side. In these types of brooms it is the usual practice only to have a sprocket chain or equivalent drive to one end only.

The vacuum supply equipment and control designated by the assembly numeral 70 is illustrated as having a vacuum pump 71 which may be of any suitable type. This vacuum may be developed by the suction of an internal combustion engine but preferably by a separate pump driven by its own power or connected by a drive to the engine propelling the machine. We also employ a vacuum tank 72 usually designated as a vacuum reservoir or a booster tank with a first piping connection 73 so that the desired high degree of vacuum may be maintained in this tank. To this tank there is a pipe 74 with a combination control valve and gauge 76, these being standard equipment, the gauge being graduated to indicate the number of inches of vacuum and the valve making a thru connection or being used to break the vacuum by a connection to atmospheric air. There are individual feed pipes 77 from the manifold 75 beyond the valve assembly 76. Each of these has a flexible portion 78 with a connection to the head of the cylinder. In each of these pipes there is a cut-off valve 79 which is designed either to operate in the closed or open position. In the open position there is a connection through to the cylinders from the manifold and when closed this is shut off.

The type of valve and gauge assembly 76 is a standard construction of bleed valve now on the market known as a four-way valve in which as we have not changed the construction, this is not illustrated in detail. We have used this standard valve which may be purchased with our vacuum equipment.

As to the details of the cylinders, these have a cylinder wall 85, an upper head 86 with the connection for the flexible end 78 of the vacuum pipes. A screw threaded stud 87 is secured to this head and on this may be attached the ball and socket joint 54 connecting to the frame of the machine. The lower head 88 is preferably threaded on the cylinder 85 and has a series of inlet air ports 89. An air screen packing 90 is located on the inside of this head being retained

by a wire mesh or similar retaining screen 91. A simple form of fastening is to lay this in position with wires passing through the air ports 89. A neck 92 extends from the head 88 and provides a guide for the rod 53, there being a packing 93 and a packing gland 94 to form a substantial dust tight connection with the movable piston rods. The pistons 52 are preferably constructed with a piston head disk 95 having an annular semi-circular groove 96 on its periphery. A helically coiled spring 97 is fitted in this groove and presses out on the skirt of a piston leather cup 98. This cup has the usual bottom or base extending over the head 95, the skirt extending towards the cylinder head 88 having the air ports. The spring 97 maintains an outward pressure on the skirt restricting the air leakage past the pistons but even with the best construction there is a certain amount of this air leakage. The leather cup may be held in place in any suitable manner as by a disk 99 retained by a nut 100 on the piston rod, this having a reduced section with a shoulder engaging the piston head 95.

The operation of our invention is substantially as follows: the combination adjusting valve and gauge 76 as well as the cut-off valve 79 are located in convenient position for the operator to handle same in controlling the drive and operation of the sweeper machine. By the gauge he may readily determine the number of inches of vacuum operative to actuate the piston in each of the vacuum cylinders. There is thus maintained above the pistons in each cylinder the desired degree of vacuum. The operator releases the chains 31 so that the broom may be lowered and such lowering may be effected by the control valve 76 causing a sufficient break in the vacuum to allow drop of the broom and then adjusting the valve 76 until the desired suction is obtained, that is, the gauge indicates the number of inches of vacuum causing an upward lift on the broom until the bristles bear on the roadway with the desired pressure. The operator of course either learns this by experience or by instructions. When the broom is in operation the sustaining chain 31 is slack to allow a further depression or lowering of the broom from the action on a level roadway. Presuming the machine is operating over a cross gutter such as shown by the road surface of Fig. 1, as the broom approaches the dip into the gutter, the operator quickly cracks the vacuum by the control valve 76 allowing the broom to drop and to follow down the descending slope into the gutter. Instead of allowing the pressure of the road to raise the broom the operator then actuates the valve 76 so that there is a graduated but yet quick lift of the broom as it passes out of the gutter. The rapidity of the broom control of course depends on the depth of the gutter, the transverse width of this in the direction of travel of the sweeper machine and the speed of the movement of the machine but with our invention the operator has a control which he has not had by the present machines and may by proper manipulation of the valve 76 give the desired gradual lowering of the broom and again the raising thereof to properly sweep these cross gutters no matter whether they involve abrupt dips or a gradual slope. Of course in approaching a gutter the front wheels 13 first dip into this, then if the gutter is not too great in transverse measurement, the gutter is bridged between the front and rear wheels 13 and 14 and after the broom has passed out of the gutter the rear wheel 14 dips therein. With our invention and by control of the valve 76 the operator may lower and raise the broom to always maintain road contact with the desired bristle pressure on the road surface.

Due to the fact that there is somewhat greater weight on the end of the broom having the sprocket chain drive than on the opposite end, there is a tendency for greater wear on the bristles at this drive end. In addition the sprocket chain passing over the drive sprocket on the spool axle develops quite a decided downward reaction tending to increase this pressure on the bristles on one end than the other, the tendency of both reactions being to develop a cone type of wear on the broom with the small end of the cone towards the drive end of the broom. With our invention we can compensate for this by shifting the vacuum cylinder assembly further away from the axle on the driving end of the broom than on the other end and thus obtain a greater leverage in the lift.

As above mentioned the main control valve 76 may be slightly opened, that is, to so-called crack the vacuum allowing an equal drop of the pistons in both of the cylinders and hence the even drop of the broom, however as the operator may only open the valve 76 for a short time period necessary to cause this drop and then close the valve, the air suction again comes into operation giving a lift on the broom and thus maintaining the desired pressure contact of the bristles on the road surface. As the broom rides up for instance out of a gutter, the degree or inches of vacuum may be increased to raise the broom in synchronism with the upward slope from a depression or rut to the normal level of the road surface, thus giving a complete sweeping action into and out of a cross rut or gutter. Most of the controls may be given thus by using only the vacuum cracking valve 76. The operator soon becomes conversant by a reading of his gauge as to the degree of vacuum necessary to give the desired drop or upward lift of the pistons in the vacuum cylinders. It of course is to be understood that the lift in reality is due to the atmospheric air pressure in the vacuum cylinders on the underside of the piston heads and that the degree of lifting pressure is due and regulated by the degree of the partial vacuum on the upper side of the piston heads however it is conventional in the art to refer to a vacuum lift and control. It is necessary to either maintain the vacuum pump 71 always operating or the booster tank 72 under considerable vacuum as there may be a leakage of air past the cylinder heads, this being greater of course as there is a greater differential pressure of atmosphere on the underside of the pistons than on the upper or vacuum side.

The valves 79 giving a control for the individual cylinders are designed to have two positions either open or closed but when open these provide the through vacuum connection from the manifold 75 through the pipes 77 to the vacuum cylinders but when they close this connection is shut off. Therefore if it is desired to lower or drop one end of the broom while maintaining the other in its normally raised position, one of these valves 79 may be closed for the desired time period, then due to the leakage of atmospheric air past the piston in the vacuum cylinder on the end of the spool to be lowered, such end drops to the desired degree. The bearings and the sprocket drive are of such a character that in the conventional sweeper broom such broom can tilt within limits considered transversely of the ma-

chine. It is of course obvious that one end of the broom can be raised while the other end is being lowered by the proper control of one or both of the shut-off valves 79 in conjunction with the operation of the vacuum cracking valve 76.

The differential operation of opposite ends of the broom, that is, raising one end and lowering the other end may be accomplished by having a definite vacuum controlled by the valve and gauge assembly 76 in the manifold 75. On the side in which it is desired to lower the broom, closing the shut off valve 79 cuts off the connection of one pipe 77 to the manifold and due to the air leak in the cylinder on that side the broom will drop. At the same time the operator of the machine may increase the vacuum by the control valve 76 and as the second valve 79 is open leading to the cylinder on the opposite side of the broom due to the vacuum being increased therein, such side of the broom will be raised.

Our invention in practice replaces the mechanical equipment for raising the broom completely above the road surface to an inoperative position. This is accomplished by the operation of the valve 76 to increase the degree of vacuum in the vacuum cylinders and hence elevate the broom completely above the road surface, the chain such as 31 is then wound in or taken up as to its slack, then the chains on each side hold the broom in the elevated position, hence when the broom is inactive during for instance the transport and storage of the sweeper machine, the vacuum pump may be stopped and the vacuum tank and piping system equalized with atmospheric air. When again starting the machine in a sweeping operation it is of course necessary to build up the desired degree of vacuum in the tank 72, the piping and the vacuum cylinders. In some installations the vacuum may be created and maintained by the suction of the internal combustion engine used to propel the vehicle and/or drive the sweeping broom, however we considered it advisable to have a separate vacuum pump driven in any suitable manner.

The conventional chain drive for the broom as shown in Fig. 1 with the conventional broom control develops a cone shape to the broom with the apex end being towards the single drive end of the broom. This is believed to be due to the down pull developed by the drive chain and also possibly by the increased weight on the drive end of the broom over the opposite end, however by our invention we compensate for this wear by adjusting the threaded rod 58 through the sleeve 57 to position the ball and socket connection 55 a greater distance from the center of the broom axle on the side having the chain drive than on the opposite side. At the same time we may also shift the upper ball and socket joint connection 54 rearwardly in the bolt holes 60. We can thus arrange to have a slightly more powerful lift on the side of the broom having the drive chain connection than on the opposite side and therefore cause an even and cylindrical wear of the broom instead of this wearing to a conical shape.

Various changes may be made in the details of the construction without departing from the spirit or scope of the invention as defined by the appended claims.

We claim:

1. In a power sweeper having a frame, a rotatably driven broom, the combination of a lifting and lowering control for the broom including means for creating a vacuum, vacuum cylinder and piston constructions interconnected between the frame and the broom with piping connection from the cylinders to the vacuum source, and valve means in said piping system to control the degree of vacuum in the cylinders and hence the lifting or lowering of the broom.

2. In a power sweeper having a frame, a rotatable broom mounted therein with a supporting connection between opposite ends of the broom and the frame, the combination of a vacuum lift and lowering equipment for the broom including a cylinder and a piston having a piston rod operatively connected between the frame and the broom, a manifold pipe with means creating a vacuum therein, a pipe therefrom to each cylinder, and valve means in the pipes so arranged that the degree of vacuum in the cylinders may be controlled for quickly raising or lowering the broom.

3. In a power sweeper having a frame, a rotatably driven broom, the combination of a vacuum lifting and lowering control including means for creating a vacuum, a vacuum cylinder assembly on each side of the frame each with a connection to the broom axle, piping connections between the vacuum means and the vacuum cylinder assembly with a vacuum cracking control valve.

4. In a power sweeper having a frame, a rotatably driven broom, the combination of a vacuum lift for the broom including means to create a vacuum, a vacuum cylinder and piston connection from each side of the frame to the supporting ends of the broom, a manifold connected to the vacuum creating means having a control valve and vacuum gauge, a pipe from the manifold to each vacuum cylinder and each latter pipe having a shut-off valve therein.

5. In a power sweeper having a frame, radius arms pivoted to the frame, a broom having an axle journalled in the radius arms, a drive to one end of the broom, the combination of a vacuum lift assembly including a vacuum source, a vacuum cylinder and piston with connecting means between the frame and the end of the broom at such side of the frame, the vacuum cylinder and piston device having a pivotal connection between the frame and the broom end, a piping system between the vacuum source and the cylinder with a control valve to actuate the vacuum cylinder and piston device.

6. In a power sweeper having a frame, radius arms pivoted to the frame, a broom having an axle journalled in the radius arms, a drive to one end of the broom, the combination of a vacuum lift assembly including a vacuum source, a vacuum cylinder and piston with connecting means between the frame and the end of the broom at such side of the frame, the vacuum cylinder and piston device having a pivotal connection between the frame and the broom end, a piping system between the vacuum source and the cylinder with a control valve to actuate the vacuum cylinder and piston device, means to adjust one of the vacuum cylinder and piston devices relative to the frame and the axle to vary the lift in relation to that of the other vacuum cylinder piston device.

7. In a power sweeper having a frame with radius arms from each side pivoted to the frame, a broom having its axle journalled in radius arms, a drive connection to one end of the broom, the combination of a vacuum lift and lowering assembly including a vacuum source on the frame, two vacuum cylinder and piston assemblies one on each side of the frame and each having a connection between the frame and the

broom axle on the same side, a manifold connected to the vacuum source with a vacuum release valve therein, pipes from the manifold to each cylinder and piston assembly and each of said latter pipes having a shut-off valve therein.

8. In a power sweeper having a frame, radius rods pivoted to the frame, a broom having an axle journalled in the trailing end of the radius arms, a sprocket chain drive to one end of the broom to drive the portion of the broom in contact with the ground in a forward direction relative to the advance of the sweeper, the combination of a vacuum lift assembly including a vacuum source, a vacuum cylinder and piston with connections between the frame and each end of the broom, the vacuum cylinder and piston assembly having a variable pivotal connection between the frame and the broom for adjusting the assembly at the drive end of the broom to have a greater lift than the connection at the opposite end, a piping connection between the source and the cylinder and piston assembly with valve means operative to control the lowering and lifting of the broom.

9. In a power sweeper having a frame, a broom connected to said frame to bear on the road surface, the combination of a vacuum operative assembly to maintain the desired pressure of the broom on the road surface including a vacuum cylinder and piston construction interconnected between the frame and the broom at each end of the broom, a vacuum source mounted on the frame, a connection from said source to each cylinder, and a control means in said connection for optionally connecting the cylinder to the vacuum source or admitting air to the vacuum cylinder whereby the position of the broom may be varied.

10. In a power sweeper having a frame, a power driven broom rotatably mounted and positioned transversely of the frame, the mounting for the broom permitting of the broom assuming various elevations, a vacuum cylinder and piston construction connected to each end of the broom and to the frame, a vacuum source, branch pipes connecting the vacuum source to each vacuum cylinder, a valve for optionally connecting both branch pipes to the vacuum source or admitting air thereto, and control valves in each branch pipe.

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