United States Patent

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[54] **TRACTOR MOUNTED PAVEMENT WASHER**

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[52] **U.S. Cl.** **239/163,** 15/405, 134/172, 180/82, 239/287, 239/550

[51] **Int. Cl.** **B05b 1/20**

[58] **Field of Search**.....239/11, 159, 163, 166, 167, 239/172, 287, 550, 587, 588; 180/82; 134/115, 172; 15/50 R, 82, 405

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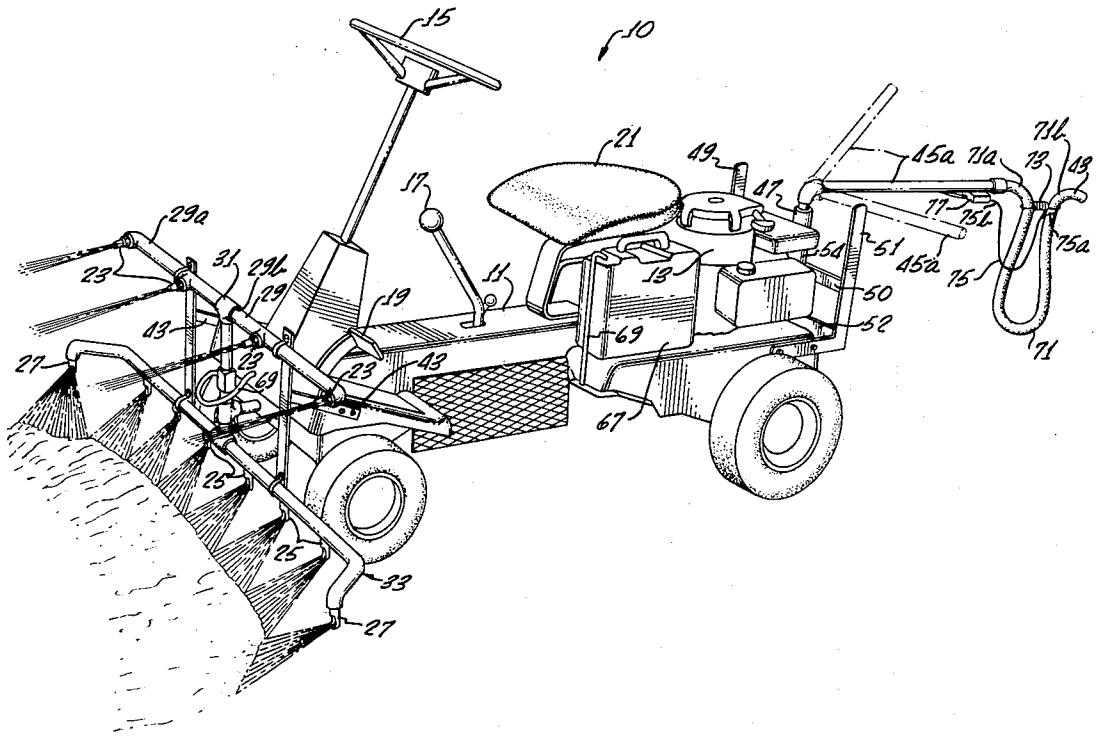
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[57] **ABSTRACT**

Disclosed is a pavement washer having two sets of spray nozzles mounted on the front of a small tractor. Nozzles of the first set are aimed ahead substantially horizontally to throw a pattern of cleaning solution well ahead of the tractor, while the second set of nozzles are aimed sharply downward as well as forward to spray a pattern of water ahead of the tractor but behind the cleaning solution. Also disclosed is an arrangement for connecting the tractor to a stationary source of water through a hose wherein provision is made to shut off the ignition of the tractor before the hose is pulled taut.

15 Claims, 5 Drawing Figures



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SHEET 1 OF 2

FIG. 1.

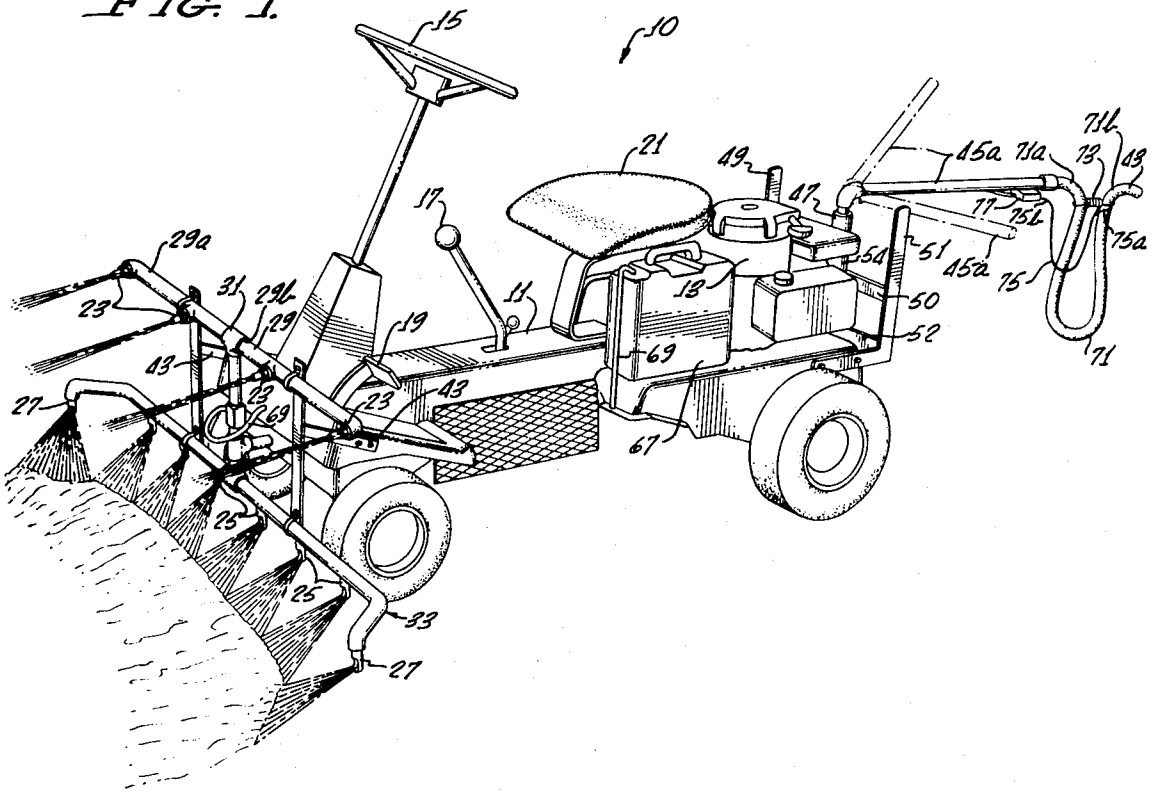
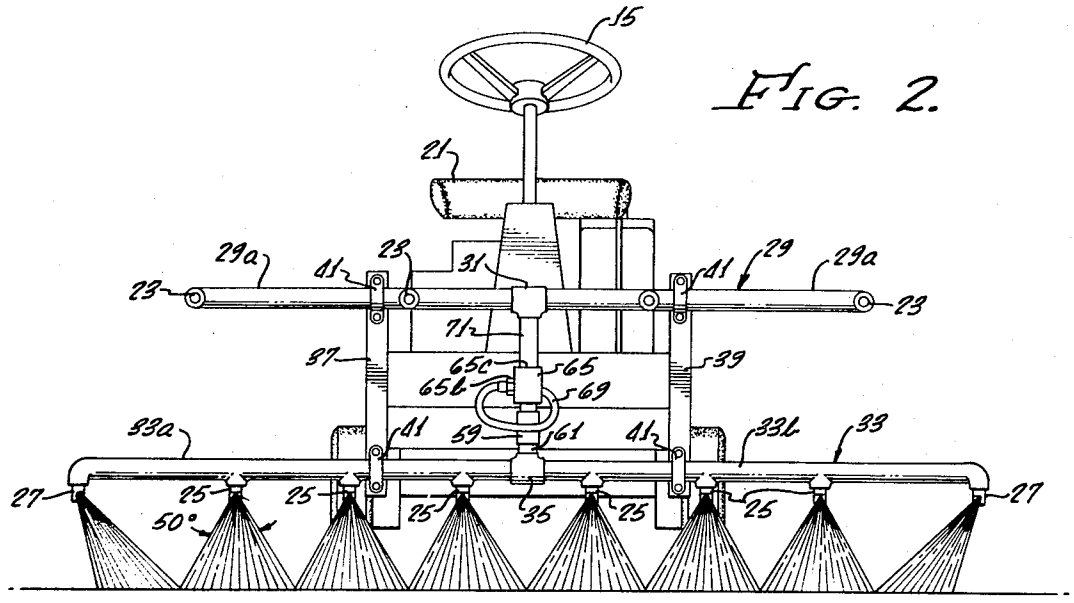


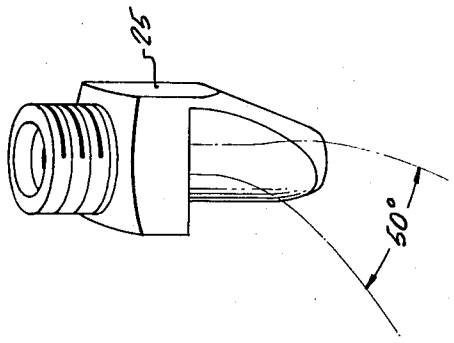
FIG. 2.



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FIG. 4.



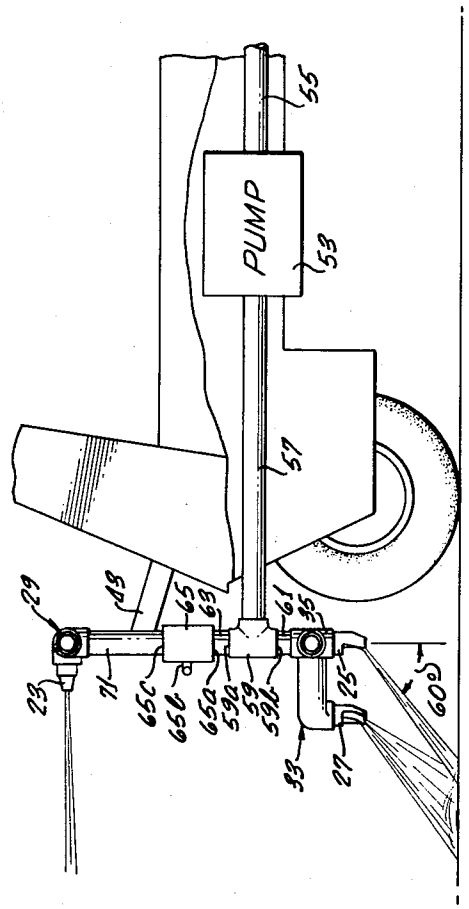


FIG. 3.

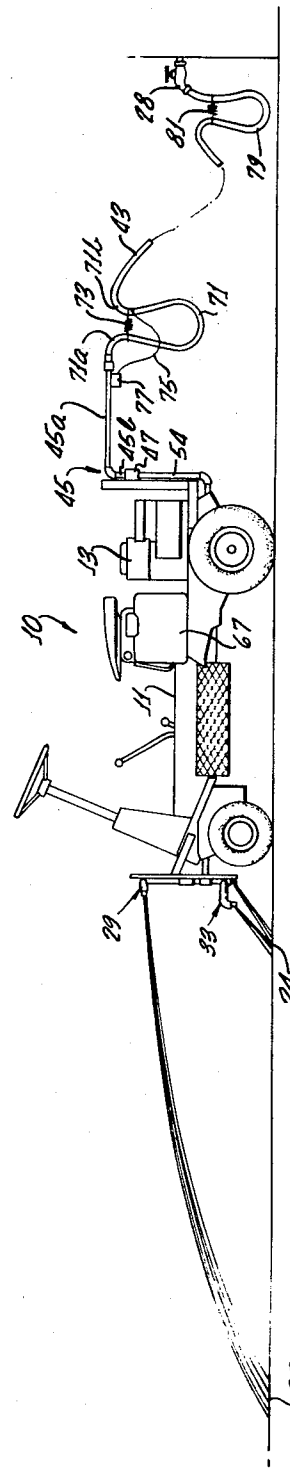


FIG. 5.

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TRACTOR MOUNTED PAVEMENT WASHER

The present invention is directed to a mobile pavement washing machine and more particularly to a tractor mounted spray head assembly by which a cleaning solution and water are sprayed on the pavement, with the water being sprayed far enough from the cleaning solution to allow the latter to take effect before being washed away.

With the growing public acceptance of drive-in places of commerce, the importance of the parking lot and of its maintenance has also increased. This is particularly true of drive-in restaurants where cleanliness of the parking lot is desirable since people eat either in their cars parked in the lot or at tables which are outside and immediately adjacent the parking lot. Heretofore parking lots have usually been cleaned manually, which is a time consuming, expensive, and unpleasant task. The present invention is directed to a small, modestly priced machine capable of cleaning a pavement such as a parking lot rapidly and thoroughly. In accordance with a principal feature of the invention, the pavement cleaning apparatus includes a spraying assembly mounted upon a small tractor, usually in front. The spraying assembly preferably includes at least two sets of nozzles. Through the first set of nozzles a cleaning solution, such as a mixture of a detergent and water is sprayed in a pattern well ahead of the tractor. Through the second set of nozzles water is sprayed, also ahead of the tractor but sufficiently spaced from the cleaning solution to allow the solution to have its desired cleaning effect upon the pavement before being rinsed away.

It is desirable that, as the tractor moves ahead, all of the cleaning solution be rinsed away. Toward this end the spray pattern in which the water is discharged at the pavement is made wider than the spray pattern of the cleaning solution, with the spray pattern of water being preferably made arcuate so as to tend to sweep inward and confine the strip of cleaning solution preceding it.

The water requirements of the pavement cleaning machine are considerable and it is most expedient to satisfy them by connecting the machine to a remote source of water through a hose rather than by carrying the necessary water supply on, or with, the tractor. Accordingly, in accordance with another feature of the invention, water is fed to the tractor from a stationary water source through a hose which is so designed that if through inadvertence the tractor should be driven too far away from the stationary water source, thereby tending to stretch the hose, this condition will be sensed and will preferably stop the tractor automatically. In keeping with this feature of the invention, at least one loop is formed in the hose and a yieldable means, such as a tension spring, is connected across the neck of that loop. Thus, as the vehicle is driven in a direction away from the stationary water source, tending to stretch the hose, the loop will be opened against the restraining force of the tension spring so that the pulling force exerted on the hose is determined initially by the strength of the spring. Sensing means, such as a limit switch, are connected across the neck of the loop in such a way that when the tension spring has been stretched to a predetermined limit, which is designed to occur before the loop has been completely straightened, the sensing means will be actuated. Advantageously, the sensing means may be a limit switch which is connected in series with the ignition of the tractor engine so that the engine is disabled before the loop is completely straightened, thereby preventing the hose from being damaged.

To prevent the water hose from interfering with the operation of the tractor, the hose is connected thereto by means of a horizontally swiveling pipe carried at the rear of the tractor. The range of travel of the swiveling pipe is limited by a pair of stops so as to insure that the pipe points either to the rear or to the side of the tractor, thereby keeping the hose out of its way. Preferably, the loop which is provided for stress relief is formed immediately at the point where the hose joins the swiveling pipe and the pipe extends horizontally at a sufficient height above the pavement to prevent the loop from dragging along the ground.

The invention may be more clearly understood from the following detailed description when taken in conjunction with the appended claims and the accompanying drawings wherein:

FIG. **1** is a perspective view of a tractor mounted pavement washer incorporating features of the present invention;

FIG. **2** is a front view of the tractor mounted pavement washer illustrated in FIG. **1**;

FIG. **3** is a side view, partially cut away, of the front portion of the pavement washer illustrated in FIG. **1** showing in particular the location of the water pump and detergent injector carried by the tractor;

FIG. **4** is a perspective view of a spray head of the type used to direct a water rinse at the pavement; and

FIG. **5** is a side view of the tractor mounted pavement washer illustrating the spacing between the spray patterns of cleaning solution and rinsing water and also showing the hose arrangement for supplying water to the tractor.

An exemplary embodiment of a tractor mounted pavement washer incorporating features of the present invention is illustrated in FIG. **1**. The tractor **10** may be a commercially available type in which a four wheeled chassis **11** is powered by a gasoline engine **13** and controlled by means of a steering wheel **15**, a gearshift lever **17**, a brake pedal **19**, and other controls not shown, by an operator positioned on a seat **21**. Mounted on the front of the tractor is a spray head assembly comprised principally of a first set of spray nozzles **23** and a second set of spray nozzles **25** and **27**. Serving to discharge a cleaning solution, the first set of spray nozzles are anchored in and supplied through a manifold **29** which, for sake of easy replacement, is comprised of two symmetrical halves **29***a* and **29***b*. Each of the manifold halves **29***a* and **29***b* are threaded at one end and are screwed into a common coupling as best seen in FIG. **2**. A second manifold **33**, also comprised of two halves **33***a* and **33***b*, extends under the first manifold **29** and serves to support, and supply water to, the second set of spray nozzles **25** and **27**. Again, for sake of easy replaceability, the second manifold **33** is made of two symmetrical sections, with one end of each section being threaded into a common coupling **35**. The couplings **31** and **35** permit replacement of the manifold sections **29***a* and **29***b*, and **33***a* and **33***b* not only with identical components, as would be the case in the event that the replaced part is damaged, but also with longer or shorter sections in the event that a different width of spray pattern is desired.

The manifolds **29** and **33** are rigidly connected to form a single assembly by means of a pair of horizontally spaced, vertically extending brackets **37** and **39** upon which they are mounted by a set of U-clamps **41**. The entire spray head assembly, comprised of the manifolds **29** and **33**, the spray heads **23**, **25** and **27** mounted thereon and the brackets **37** and **39**, is attached to the front of the tractor by suitable means which include a pair of side braces **43** bolted to the front fenders of the tractor **10**.

Water is supplied to the spray nozzles **25** and **27** from a remote, stationary source of water shown as the tap **28** through a flexible hose **43** attached to the back of the tractor **10**. In order to prevent interference with the operation of the tractor, the end of the hose **43** is connected to pipe assembly **45** having a horizontally extending portion **45***a* and a short vertical end portion **45***b* rotatably received in a coupling **47** in such a manner as to permit the horizontal pipe portion **45***a* to swivel from one side of the tractor **10** to the other in a horizontal plane. A pair of stops **49** and **51** bolted on opposite sides of the tractor **10** at its rear extend upwardly to limit the motion of the pipe portion **45***a* to approximately 180° of arc, thereby preventing the pipe portion **45***a* and the hose **43** attached to it from swinging past the rear wheels of the tractor. Cross braces **50** and **52** which extend horizontally between the stops **49** and **51** serve to help maintain them rigidly upright and also serve as a mounting platform for a vertically extending pipe **54** upon which the coupling **47** is secured.

To supply the necessary water pressure at the nozzles **25** and **27** the water received through the hose **43** and the pipe assembly **45** is first fed to a water pump **53** (see FIG. **3**) through a short length of heavy water hose **55** which is connected between the pump **53** and the pipe **54** under the coupling **47**. From the pump **53** water at the desired pressure is fed through a pipe **57** to the inlet of a coupling **59** having an upper and a lower outlet port **59***a* and **59***b*. The lower outlet port **59***b* of the coupling **59** is connected by a short length of pipe **61** to the coupling **35** which connects the two halves of the water discharge manifold **33**. The upper outlet port **59***a* of the coupling **59** is similarly connected through a short piece of pipe **63** to the water inlet port **65***a* of an injector whose function is to supply the upper set of spray nozzles **23** with a cleaning solution, e.g. comprised of a detergent and water. The water is supplied to the injector **65** from the pump **53** and through the coupling **59** as just described. The detergent of other pavement cleaning chemical is carried on the tractor **10** in a non-pressurized tank **67** which is vented to the atmosphere and connected through a suitable line **69** to a second inlet port **65***b* of the injector **65**. The injector **65** has an outlet port, indicated at **65***c*, where a mixture of the detergent received through the line **69** and water received through the coupling **59** is discharged under pressure. The injector outlet **65***c* is connected through a pipe section **71** to an inlet of the coupling **31** through which the solution is distributed to the two halves of the upper manifold **29**.

Injectors of the type suitable for use with the present invention are well known. One which was found to operate satisfactorily is manufactured by the Dema Engineering Company of St. Louis, Mo. under its model 200 series. In operation, water is supplied under pressure by the pump **53** directly to the spray nozzles **25** and **27** and to the water inlet port **65***a* of the injector **65**. In a manner which need not be understood for purposes of explaining the present invention, a vacuum is created in the injector **65** by the rapid flow of water through the water inlet port **65***a* and this vacuum has the effect of pulling detergent from the tank **67** through the inlet port **65***b* into the injector **65**, where it is mixed in a predetermined proportion with water. The water-detergent mixture is expelled through the injector outlet port **65***c* and is fed to the manifold **29**. Means, not shown, are provided on the injector **65** to adjust the richness of the water-detergent mixture.

In addition to serving as a source of cleaning solution for the spray nozzles **23**, the injector **65** may also be used to supply the cleaning solution to additional accessories, such as hand operated washing-brushes of the type having an opening through which a cleaning solution is dispensed during use. Where this feature is desired, a standard threaded tap would be provided on the pipe section **71** which is connected to the output port of the injector **65**. Shut-off valves would be interposed respectively between the tap and the coupling **31** and between the coupling **59** and the coupling **35** in order to permit use of the accessory when the tractor is not being used for pavement cleaning.

It is an important aspect of the invention that a cleaning solution and water are deposited on the pavement to be cleaned in two patterns **22** and **24** (see FIG. **5**) which are spaced apart sufficiently to permit the cleaning solution to take effect before it is rinsed away by the water. Toward this end the spray nozzles **23** are supported relatively high above the pavement to be cleaned and are aimed to spray substantially directly forward that is, within 15° of horizontal in order to project the cleaning solution a substantial distance ahead of the tractor **10**. In contrast, the spray nozzles **25** and **27**, which serve to direct rinsing water at the pavement, are mounted relatively close to the pavement and are directed at it at a fairly sharp angle, of the order of 60° from vertical. This has the effect of reducing the distance to which the water is projected forward from the tractor **10** and also serves to increase the force with which the water strikes the pavement. Accordingly, the water pattern produced by the apparatus of the present invention impinges sufficiently far behind the pattern of cleaning solution to allow the latter to take effect and at the same time the water pattern strikes the pavement with considerable force, thereby enhancing further the cleaning effectiveness of the unit.

The preferred distance between the cleaning solution spray pattern **22** and the rinsing water spray pattern **24** will vary with the length of time it is desired that the cleaning solution have to act upon the pavement and upon the speed with which it is expected that the tractor **10** will be driven. However, in order to insure that the cleaning solution will not be washed away prematurely, it is desirable that there be some separation between the two spray patterns, i.e. that they do not overlap. In some instances, either or both of the manifolds **29**, **33** may be arranged for vertical adjustment to adjust the separation between patterns.

A spray nozzle of the type found suitable for use on the lower manifold **33** for dispensing water is shown in FIG. **4** and is manufactured by Spraying Systems Co. of Delwood, Ill. as Model 1/4 P5010. At a pressure of 40

pounds per square inch the spray characteristics of the particular nozzle used were such as to project water at the pavement in a flat, fanshaped spray pattern at a 30° included angle with the pavement and with the spray angle being 50°, as shown in FIGS. **3** and **4**. The spray nozzles **23** preferably are spaced so as to produce a single substantially continuous pattern across the front of the tractor **10**.

It has been found advantageous to make the combined water spray pattern produced by the nozzles **25** and **27** wider than the cleaning solution pattern laid down by the spray nozzles **23** and to space the nozzles **25** and **27** to produce a single continuous spray pattern extending transversely across the tractor in order that all of the cleaning solution be rinsed away by the water. For this reason the lower manifold **33** is made longer than the upper manifold **29** and is provided with a larger number of spray nozzles **25** and **27**. In addition, it has been found particularly effective to distribute the rinsing water in a pattern such that the strip of cleaning solution will be confined by the edges of the rinsing water rather than being forced by it to flow out of the path of the rinsing water. For this purpose, the ends of the lower manifold **33** are angled forward, with a spray nozzle **27** being mounted at each such forwardly angled end. As a result, the spray pattern discharged by the end nozzles **27** is directed partially inward, toward the central part of the water spray pattern produced by the spray nozzles **25**, thus providing a water spray pattern as shown in FIG. **1**, which for convenience in terminology can be called arcuate or convex. It has been found satisfactory to use the same type spray nozzle as that which is used for the central water spray nozzles **25**, although one with a wider spray angle might be used to advantage where it is desired to extend the curved edges of the water spray pattern.

An alternative spray pattern may be used with the pavement washer of the present invention where it is desired that the cleaning solution remain on the pavement for a particularly long time before being rinsed away. With this spray pattern the cleaning solution pattern is directed to one side of the water pattern. Thus with each pass of the tractor two strips will be sprayed side by side, one of cleaning solution and one of water. And as each strip of cleaning solution is being washed off the pavement by the adjacent spray pattern of water, during successive passes with the tractor another strip of cleaning solution is being laid down and will not be rinsed off until the following pass. For this purpose, the upper manifold **29** may be arranged to provide adjustment in the direction of spray from the detergent nozzles **23**.

In order to reduce the risk of tearing the pipe **43** due to inadvertently driving the tractor **10** beyond the reach of the hose **43**, means are provided to give an immediate warning when the reach of the hose **43** has been approached and before the hose breaks. Specifically, a loop **71** is formed in the hose **43** near the swiveling pipe portion **45** and the ends of the loop are yieldably connected through a tension spring **73** which is connected across the neck of the loop **71**. Also connected across the neck of the loop **71** is a cord **75** whose one end is connected to one end of the loop **71** at **71***a* and whose opposite end is connected to a switch **77** mounted on the pipe **45***a* near the other end **71***b* of the loop **71**. In a manner not shown, the switch **77** is connected in series with the ignition system of the tractor engine **13** so that when the cord **75** is pulled the switch **77** opens and the ignition system of the motor **13** is temporarily interrupted, thus stopping the motor. The length of the cord **75** is selected so that, as the tractor **10** is driven to the limit of the hose **23** and begins to open the loop **71** against the force of the spring **73**, the cord **75** is pulled tight before the loop **71** itself is completely straightened. Consequently, the switch **77** will be actuated and the tractor will be stopped while there is still some slack left in the loop **71** of the hose **23** and before the hose is damaged. If desired, an additional loop **79** may be provided in the hose **43** with a tension spring **81** connected across the second loop.

In some cases the pipe assembly **45** and the hose **43** with its associated accessories may be replaced by a water tank carried on or with the tractor **10**. Where the amount of water required is moderate, the tank may be carried on the tractor itself. A greater water requirement could be satisfied by providing a separate, towable water tank hitched to the back of the tractor.

What is claimed is:

1. A pavement cleaning machine comprising in combination:

a. a vehicle;

b. a first set of spray nozzles extending transversely across the front of said vehicle and connected to a source of pavement treating solution and mounted on said vehicle in an array shaped to direct said solution at said pavement in a first pattern ahead of said vehicle as said vehicle travels; and

c. a second set of spray nozzles extending transversely across said vehicle and connected to a source of water and mounted on said vehicle in an array shaped to direct said water at said pavement in a second pattern spaced in non-overlapping relationship behind said first pattern and being aimed forward and toward the ground to sweep the pavement with water for rinsing said solution from the pavement, said first and second sets of nozzles being operated at the same time.

2. A pavement cleaning machine in accordance with claim **1** and further characterized by the second pattern being wider than the first pattern and being inwardly aimed at its ends into an arcuate shape so as to confine said solution to the pavement covered by said second pattern during the travel of said vehicle.

3. A pavement cleaning machine in accordance with claim **1** wherein at least one of said first and second set of spray nozzles is carried on a manifold comprised of two pipes removably extending in opposite directions from a common threaded pipe coupling.

4. A pavement cleaning machine comprising in combination:

a. a self-powered vehicle;

b. a first set of spray nozzles connected to a source of pavement treating solution and mounted on said vehicle in an array shaped to direct said solution at said pavement in a first pattern;

c. a second set of spray nozzles connected to a source of water and mounted on said vehicle in an array shaped to direct said water at said pavement in a second pattern spaced in non-overlapping relationship with said first pattern for rinsing said solution from the pavement;

d. a hose for supplying water to said second set of nozzles from said source of water;
e. a tension spring connecting portions of said hose so as to form a loop therein; and
f. sensing means connected across the neck of said loop and electrically connected to disable said vehicle when said tension spring has been stretched to a predetermined length.

5. A pavement cleaning machine comprising in combination:
a. a self-powered vehicle;
b. a first set of spray nozzles connected to a source of pavement treating solution and mounted on said vehicle in an array shaped to direct said solution at said pavement in a first pattern;
c. a second set of spray nozzles connected to a source of water and mounted on said vehicle in an array shaped to direct said water at said pavement in a second pattern spaced in non-overlapping relationship with said first pattern for rinsing said solution from the pavement;
d. a pipe assembly rotatably mounted upon the rear of said vehicle in a pipe coupling member, said pipe assembly having a horizontally extending portion swiveling in a horizontal plane about a verticle axis defined by said pipe coupling member;
e. means for connecting said pipe coupling member to said second set of nozzles; and
f. a hose connected between said horizontally extending portion and said source of water.

6. A pavement cleaning machine comprising in combination:
a. a vehicle;
b. a tank mounted on said vehicle for holding a pavement cleaning chemical;
c. means on said vehicle for connecting to a source of water;
d. an injector having a first inlet connected to receive chemical from said tank, a second inlet connected to receive water from said source and an outlet for dispensing a solution of said chemical and said water;
e. a first set of spray nozzles connected to receive said solution from said injector outlet and mounted on the front of said vehicle in an array shaped to direct said solution at said pavement in a first pattern; and
f. a second set of spray nozzles connected to receive water from said source and mounted on the front of said vehicle in an array shaped to direct water at said pavement in non-overlapping relation with said first pattern for rinsing said solution from the pavement.

7. A pavement cleaning machine in accordance with claim **6** wherein said means for connecting to a source of water includes a pump on the vehicle for increasing the water pressure.

8. A pavement cleaning machine in accordance with claim **6** wherein said vehicle includes a seat and controls for operation by an operator positioned on the seat.

9. A pavement cleaning machine in accordance with claim **6** wherein said tank is non-pressurized and vented to the atmosphere.

10. A pavement cleaning machine in accordance with claim **6** and further characterized in that said first and second set of nozzles are respectively supported by upper and lower manifolds rigidly mounted transversely across the front of said vehicle, said first set of nozzles being aimed a substantial distance ahead of said machine, and said second set of nozzles being aimed toward the pavement closely in front of the machine.

11. A pavement cleaning machine in accordance with claim **10** wherein said second set of nozzles are spaced so as to produce a single continuous spray pattern extending across the front of the vehicle.

12. A pavement cleaning machine in accordance with claim **11**, wherein said second manifold has ends which extend past the ends of said first manifold and extend forwardly with the end nozzles on the second manifold directed toward the central part of the water spray pattern to confine said solution.

13. For spraying a cleaning solution and water onto a pavement from a self-powered vehicle, a spray head assembly comprising in combination:
a. first and second sets of spray nozzles mounted on a common framework;
b. means for attaching said framework to the front of said vehicle, said first and second sets of spray nozzles being respectively aimed to deposit said solution and water in a first and a second pattern in front of said vehicle when the framework is so attached, said first pattern being non-overlapping spaced from said second pattern;
c. said first and second sets of nozzles being respectively supported by first and second spray bars extending transversely across the front of said vehicle, the first spray bar being mounted above the second spray bar, with its nozzles aimed substantially horizontally forward so as to deposit a ribbon of said solution ahead of said vehicle as said vehicle travels and the nozzles of the second set being aimed forward and toward the ground to sweep said pavement with water.

14. A spray head assembly in accordance with claim **13** and characterized further in that said second spray bar is longer than said first spray bar, and has a nozzle at each of its ends which extend forward so as to produce an arcuate spray pattern which sweeps the edges of said ribbon of solution toward each other.

15. A spray head assembly in accordance with claim **13** and characterized further in that each of said spray bars is comprised of two symmetrical sections threaded at one end and removably fitted into opposite sides of a common coupling.

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