Oct. 25, 1932. J. C. WOODCOCK 1,884,475

LIQUID SPREADING APPARATUS

Filed Oct. 24, 1929 2 Sheets-Sheet 1

Fig. 1.

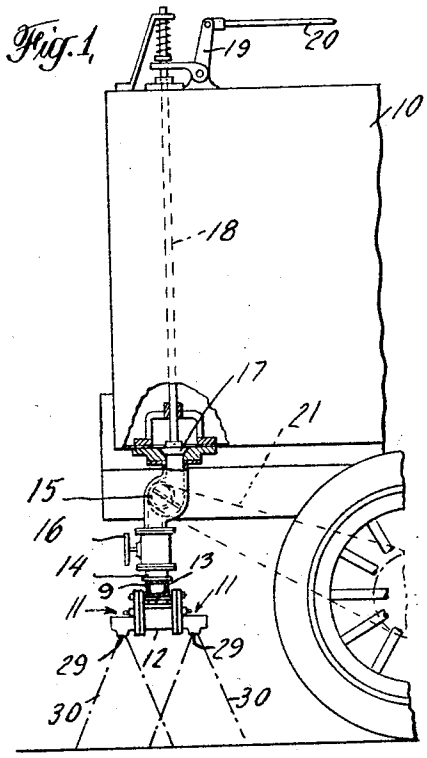


Fig. 2.

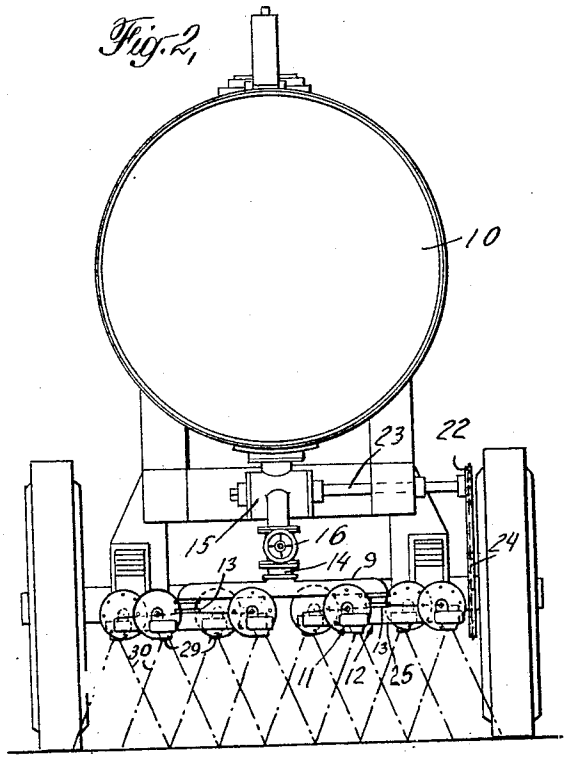


Fig. 3.

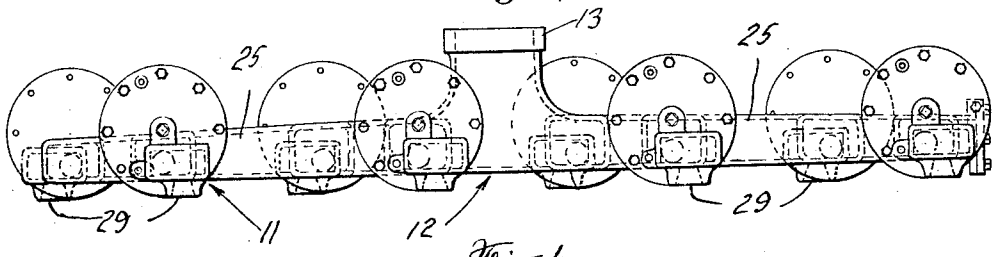
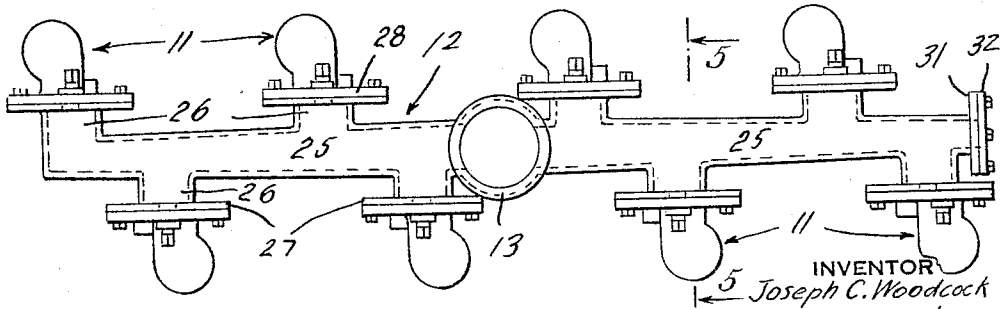


Fig. 4.



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Filed Oct. 24, 1929 2 Sheets-Sheet 2

Fig. 5,

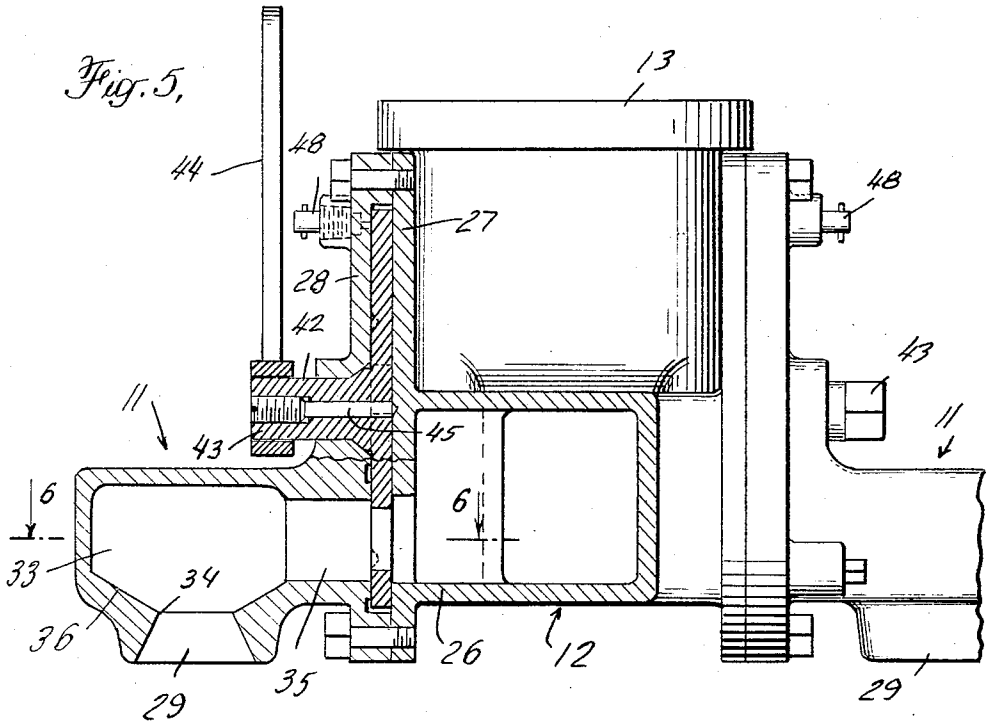


Fig. 6,

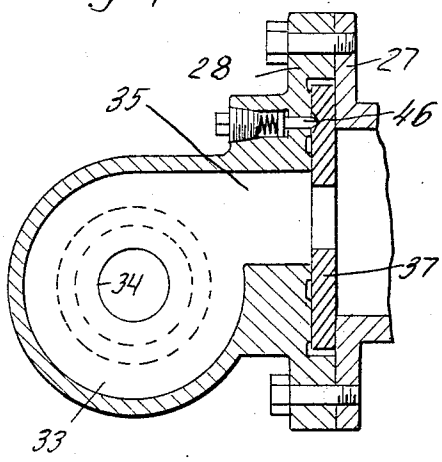
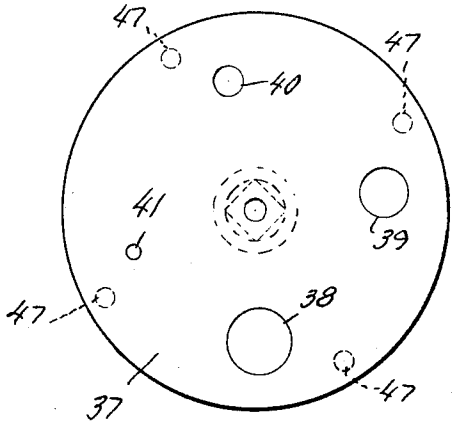


Fig. 7.



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UNITED STATES PATENT OFFICE

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LIQUID SPREADING APPARATUS

Application filed October 24, 1929. Serial No. 402,217.

This invention relates to apparatus of the kind used to coat highways with tar products, liquid asphalt and like materials which are usually applied to road surfaces to serve as binders for the particles of the road material.

Liquid spreading apparatus of this kind comprises a tank for the liquid mounted upon a motor vehicle or other suitable means for moving it over the road to be coated, and at the rear of the vehicle a liquid distributing mechanism is provided to which the liquid flows, or is pumped, or is forced by air pressure from the tank, and by which it is applied to the road in a track or swath which may be about the same width as the vehicle but is ordinarily somewhat wider.

The coating materials are usually viscous to a high degree and accordingly the liquid distributing apparatus or mechanism must be arranged to handle such liquid and to apply it evenly over the entire width of the track or swath, and it is with such liquid distributing mechanism that the present invention is especially concerned.

Uniform covering or distributing of the liquid throughout the width of the track is of considerable importance since it is desirable that the liquid be applied to the road in such manner that no relatively bare streaks be left, nor streaks produced to which an excessive amount of liquid has been applied. In the apparatus heretofore used for this work, the liquid has been applied to the road surfaces by means of a plurality of nozzles arranged crosswise of the vehicle in properly spaced relation to deliver to the road a plurality of overlapping streams or sprays which together make up the track or swath of liquid which the sprinkling apparatus applies to the road during an excursion thereover.

It is necessary to be able to vary the amount of liquid applied to the road in accordance with the widely different kinds and conditions of road surfaces to be treated. Merely changing the extent of the valve opening controlling the flow to the main provided with discharge nozzles in the equipment which has previously been proposed, usually results either in coating the road too heavily in streaks where the streams or sprays overlap, or in reducing the width of the streams so that they do not overlap and thus leave dry streaks.

Moreover in the liquid spreading equipment now in general use with which I am familiar, the control of the density of the application by merely changing the valve settings is impracticable because of the extreme viscosity of the tar products which it is desired to apply to the road surfaces, and when it is desired to change the quantity of material applied to the road, it is necessary to remove one set of nozzles from the equipment and install another set of the desired size. This makes it necessary to provide several sets of nozzles which in the first place are rather expensive, and in the second place are very inconvenient to use.

My invention aims to provide a liquid distributing or spreading mechanism which will give a substantially uniform covering of the liquid over the entire width of the track or swath.

One object of my invention is to provide an apparatus in which the amount of liquid applied can be positively and readily controlled, and at the same time a uniform distribution throughout the width of the track preserved, or in other words, permit of a lighter or heavier application without leaving either bare streaks or streaks containing an excessive amount of liquid.

A further object of the invention is to provide an apparatus by means of which a known or predetermined amount of liquid can be applied to the road which can be varied in accordance with existing conditions of the road or other surface to be coated without having to use sets of interchangeable nozzles. Thus the covering or application, that is, the amount of liquid applied per square foot, necessary for various kinds and conditions of road surfaces can be determined in advance by test or otherwise, and the apparatus of the present invention provides means by which this desired predetermined amount of liquid can be applied.

Another object of my invention is to improve the construction of liquid-distributing apparatus so that it will more effectively dis-

tribute the liquid and be more convenient to operate than the apparatuses now in use.

In the accompanying drawings I have illustrated by way of example the preferred embodiment of my invention. In these drawings:

Fig. 1 is a side elevation of the rear portion of a tank vehicle equipped with my improved liquid spreading apparatus, a portion being broken away and shown in central vertical section;

Fig. 2 is a rear elevation of the tank vehicle;

Fig. 3 is an enlarged rear elevation of a spray bar or manifold for distributing the liquid to the eight distributing nozzles thereon. This spray bar is double the size of the bar shown in Fig. 2;

Fig. 4 is a top view of the spray bar illustrated in Fig. 3;

Fig. 5 is an enlarged vertical transverse section taken on line 5—5 of Fig. 4 looking in the direction of the arrows and showing a section through one of the nozzles and nozzle control valves.

Fig. 6 is an enlarged horizontal section taken on line 6—6 of Fig. 5; and

Fig. 7 is an elevation of the orifice plate valve element.

Referring to the accompanying drawings, the liquid to be sprayed upon the road is contained in a tank 10 mounted upon a suitable vehicle, for travelling over the surface of the road which is to be treated. The liquid-spreading mechanism is located at the rear of the vehicle and comprises a plurality of nozzles 11 mounted upon a spray bar 12 and having their mouths directed toward the surface of the road, and preferably in a substantially vertical direction. In the form of the invention as shown in Fig. 2, two spray bars 12 are each attached by means of a screw connection 13 to the ends of a manifold pipe 9 which is suitably connected substantially midway of its ends with a centrally located vertical supply pipe 14 extending downwardly from the bottom of the tank 10. Each of the spray bars 12 in Fig. 2 are shown provided with four nozzles. According to a preferred form of this invention, spray bars such as shown in Fig. 3 having eight distributing nozzles may be connected to the ends of manifold 9, the ends of these spray bars extending beyond the wheels of the vehicle so that a swath twice as wide as that produced by the arrangement of the nozzles in Fig. 2 would be formed.

There is shown in the supply pipe 14 a rotary pump 15 by means of which the liquid from the tank 10 is delivered under suitable pressure to the spray bar and the liquid distributing nozzles. The pump is not essential, however, and the liquid may, if desired, be allowed to flow to the liquid spreading mechanism under the head in the tank 10 or be supplied under air pressure. There is also provided in supply pipe 14 a hand valve 16 by which the supply of liquid to the distributing mechanism can be cut off when the spraying apparatus is not in use.

During the operation of spreading the liquid upon the road, the valve 16 is opened and left open and the supply of liquid to the distributing nozzles is under the control of a lift valve 17 which is arranged to be readily operated from the vehicle driver's seat by means of the vertically movable valve stem 18, the crank lever 19 and the rod 20.

The rotary pump 15 may be driven in any appropriate manner but the drive is preferably effected by means of a chain 21 operatively connecting a sprocket 22 on the pump shaft 23 with a sprocket 24 mounted upon one of the rear wheels of the vehicle. In this way the pressure of the liquid to be supplied to the nozzles is directly proportional to the speed of the vehicle so that when the vehicle is being operated at a comparatively slow speed a comparatively small amount of liquid is forced through the nozzles, and as the speed of the vehicle is increased, a correspondingly larger amount of liquid is caused to pass through the nozzles and be applied to the road surface.

The spray bar 12 is of a particular construction, having arms 25 extending in opposite directions from the central connecting inlet 13. The arms are substantially rectangular in cross-section and the passageways through them are preferably of the same shape, the cross-sectional area of these passageways decreasing gradually toward the outer ends of the arms. There are distributing necks 26 arranged in staggered relation on the front and rear sides of arms 25, each of these necks having flanges 27 on which the nozzles 11 are mounted by means of their individual valve casings 28. The passageways in the distributing necks 26 are also rectangular in shape as is shown in dotted lines in Fig. 3. The cross-sectional area of these rectangular passageways both in the arms 25 and in the distributing necks 26 are made larger than the area of the maximum valve opening so that even with maximum flow of liquid through the spray bar the pressure at the entrance of all of the valves is equal.

The spacing of the necks 26 and flanges 27 on the spray bar is such as to bring the discharge outlets 29 of the nozzles in equally spaced relation lengthwise of the bar, and as will be later explained, the discharge streams 30 from the respective outlets lengthwise of the spray bar produce layers or strips of liquid on the ground which meet as shown in Fig. 2. In practice, with the nozzles 12 inches above the level of the road, a cone or spray 12 inches wide, i. e., a cone the diameter of the base of which is 12 inches, is formed.

At the right hand end of the spray bar is shown an additional flange 31 covered by a cap 32. The cap may be removed and an additional nozzle mounted in its place so as to increase the width of the swath or track which is coated by the passage of the apparatus over the road.

The construction of the individual nozzles and valves is illustrated in Figs. 5 to 7 inclusive. The nozzle itself consists of a casting in which there is a suitable centrifugal chamber 33 circular in horizontal cross-section as shown in Fig. 6, and having the restricted circular opening 34 in its bottom. Preferably the discharge mouth 29 which causes discharge of the liquid material in a vertical direction widens out in the form of a cone below the restricted opening 34. The axis of the outlet 29 and the opening 34 is concentric with the axis of chamber 33. The nozzle inlet 35 which permits flow of material in a horizontal direction is at one side of the chamber 33 and the outer side of the inlet is tangent to the outer wall of the chamber.

Liquid entering the chamber through the horizontal inlet 35 therefore is subjected to a centrifugal action or in other words is given a rotary or whirling motion, the rapidity of rotation depending upon the velocity of entry. The floor 36 of chamber 33 slopes from the circular walls of the chamber toward the restricted opening 34 and as the rotating liquid is forced onward by the liquid behind it, it passes over this sloping floor increasing in velocity and finally being discharged through the restricted opening 34 and the outlet 29. The liquid retains its rotary motion as it is being discharged and descends to the surface of the road in the form of the cones 30 previously referred to.

The flow of liquid into the inlet 35 of each of the nozzles is controlled by the movable orifice plate 37 provided with orifices 38, 39, 40 and 41, differing in size. The orifice plate 37 is conveniently made circular in form and mounted on a shaft 42 which projects through the valve casing 28 and is squared at its outer end as indicated at 43 for the reception of a wrench 44 by which the plate may be moved to bring the various orifices successively opposite the inlet 35.

The orifice plate 37 rotates between the valve casing 28 and flange 27 in a circular recess in casing 28. It is important that the outer face of the orifice plate 37 be held in close engagement with the bottom of the recess in casing 28, and for this purpose a pin 45 extends through the center of shaft 42 and engages the flange 27. The outer end of pin 45 is enlarged and screw-threaded into a tapped hole in shaft 42 and can be adjusted by means of a screw driver.

In order that the orifices may be easily centered with respect to the inlet 35, a spring-pressed frictional locking pin 46 is mounted in an aperture in the valve casing 28 and engages depressions 47 in the orifice plate.

In order to lubricate the orifice plate and to effectively seal the valve against leakage from one orifice to another and around the orifice plate, a fitting 48 is provided by which a lubricant and sealing medium, such as a so-called high temperature grease, may be injected under pressure into the recess in which the orifice plate rotates.

By placing a valve such as the orifice plate 37 at the entrance to the centrifugal chamber of the nozzle, the amount of liquid admitted to and passed through each nozzle can be controlled or regulated without materially altering the size of the conical discharge stream 30. When only a comparatively small amount of liquid is being sent through the nozzle the discharge cone is hollow, and as the flow is increased the walls of the hollow cone increase in thickness but the diameter of the cone where it strikes the ground does not change substantially if the height of the cone above the ground is unchanged.

Because of the above the spacing of the nozzles 11 on the spray bar can be made such that the discharge cones lengthwise of the spray bar meet one another upon the ground and do not overlap, i. e. the bases of the cones formed by adjacent nozzles lengthwise of the spray bar are substantially tangent to each other notwithstanding variations in the amounts of liquid fed through the nozzles. Thus what might be considered a uniform strip or layer of coating material transversely of the path of movement of the spraying vehicle is imparted to the road or other surface. The cones formed by the row of rear nozzles, it will be noted from Figs. 1 and 2, overlap those formed by the row of front nozzles, the overlapping occurring in the direction of movement of the spraying vehicle. As the vehicle moves continuously at a substantially constant rate there results a uniform double layer of spraying material on the road. By positioning the orifice plate controlling the rate of flow into each nozzle so that flow occurs through either the row of rear or front nozzles, one-half the application of coating material may be imparted to a given surface than would result if both the front and rear rows of nozzles were used to apply the coating material to this surface. In practice it has been found that my invention results in the application of a layer of uniform thickness throughout the entire width of the swath without danger of leaving bare streaks or streaks produced by double application. Moreover with the apparatus of my invention it is not only possible but practicable at all times to know exactly how much material is being applied to the road per square yard because the speed of the vehicle and the pressure in the spray bar can be readily held substantially constant and at known and prede-

termined values, and the orifice valves provide means whereby the exact flow of material through the valves and nozzles can always be known when the pressure in the spray bar is known.

It will be obvious that by positioning the orifice plate in all the nozzles of one spray bar so that no flow therethrough occurs, a swath of one-half the width than would result from operation of the flow through both spray bars may be formed.

I claim:

1. In an apparatus for spreading liquid upon roads, a spray bar, two rows of centrifugal nozzles, one on each side of said bar, the nozzles of one row being staggered with respect to those of the other row and each nozzle being provided with an inlet opening eccentric to the axis of the nozzle and an outlet opening concentric to said axis to produce a conical discharge stream, a movable orifice plate, provided with a plurality of orifices differing in size for controlling the rate of flow of liquid admitted to each of said nozzles, mounted at the inlet of each of said nozzles and means to move said orifice plate to bring said orifices respectively opposite the inlet of said nozzles.

2. In an apparatus for spreading liquid upon roads, a vehicle for moving the apparatus over the road to which the liquid is to be applied, a tank for the liquid on said vehicle, a discharge outlet from said tank and a manifold connected to said discharge outlet, said manifold comprising a substantially straight spray bar having an inlet connection and arms extending in opposite directions from said connection, each of said arms having a channel therein for the passage of liquid and each of said arms having outlets disposed alternately upon the front and rear sides thereof, nozzles in communication with said outlets each having a centrifugal chamber provided with an outlet concentric with the axis thereof and an inlet eccentric to said axis, and a movable orifice plate mounted adjacent said inlet, said orifice plate being provided with a plurality of orifices differing in size and means to move said orifice plate to bring said orifices respectively opposite the inlet of said chamber.

3. In apparatus for distributing viscous road binding liquid, a spray bar having an inlet connection and arms extending in opposite directions from said connection, each of said arms having a channel therein of substantially rectangular cross-section for the passage of liquid therethrough, and each of said arms having outlets disposed alternately upon the opposite side walls thereof, nozzles in communication with said outlets, each of said nozzles being provided with an inlet eccentric to the axis of the nozzle and an outlet concentric to the said axis, casings on the sides of the spray bar each individual to a nozzle, an orifice plate rotatably mounted in each of said casings, each of said orifice plates being provided with a series of orifices of different sizes, the orifices of each plate being adapted to be positioned immediately adjacent the said inlet opening of the nozzle in which said plate is positioned to control the flow of liquid from said spray bar to said nozzle, and readily accessible means individual to each nozzle for adjusting said orifice plates.

4. In apparatus for distributing viscous road binding liquid, a spray bar having a channel therein of substantially rectangular cross-section for the passage of liquid therethrough, said channel having outlets disposed alternately upon the opposite side walls thereof, nozzles in communication with said outlets, each of said nozzles being provided with an inlet eccentric to the axis of the nozzle and an outlet concentric to the said axis, casings on the sides of the spray bar each individual to a nozzle, an orifice plate rotatably mounted in each of said casings, each of said orifice plates being provided with a series of orifices of different sizes, the orifices of each plate being adapted to be positioned immediately adjacent the said inlet opening of the nozzle in which said plate is positioned to control the flow of liquid from said spray bar to said nozzle, and readily accessible means individual to each nozzle for adjusting said orifice plates.

In witness whereof, I affix my signature.

JOSEPH C. WOODCOCK.