Jan. 7, 1936. R. L. HEFNER 2,026,678

PAVEMENT MARKING MACHINE

Filed Oct. 2, 1933 3 Sheets-Sheet 1

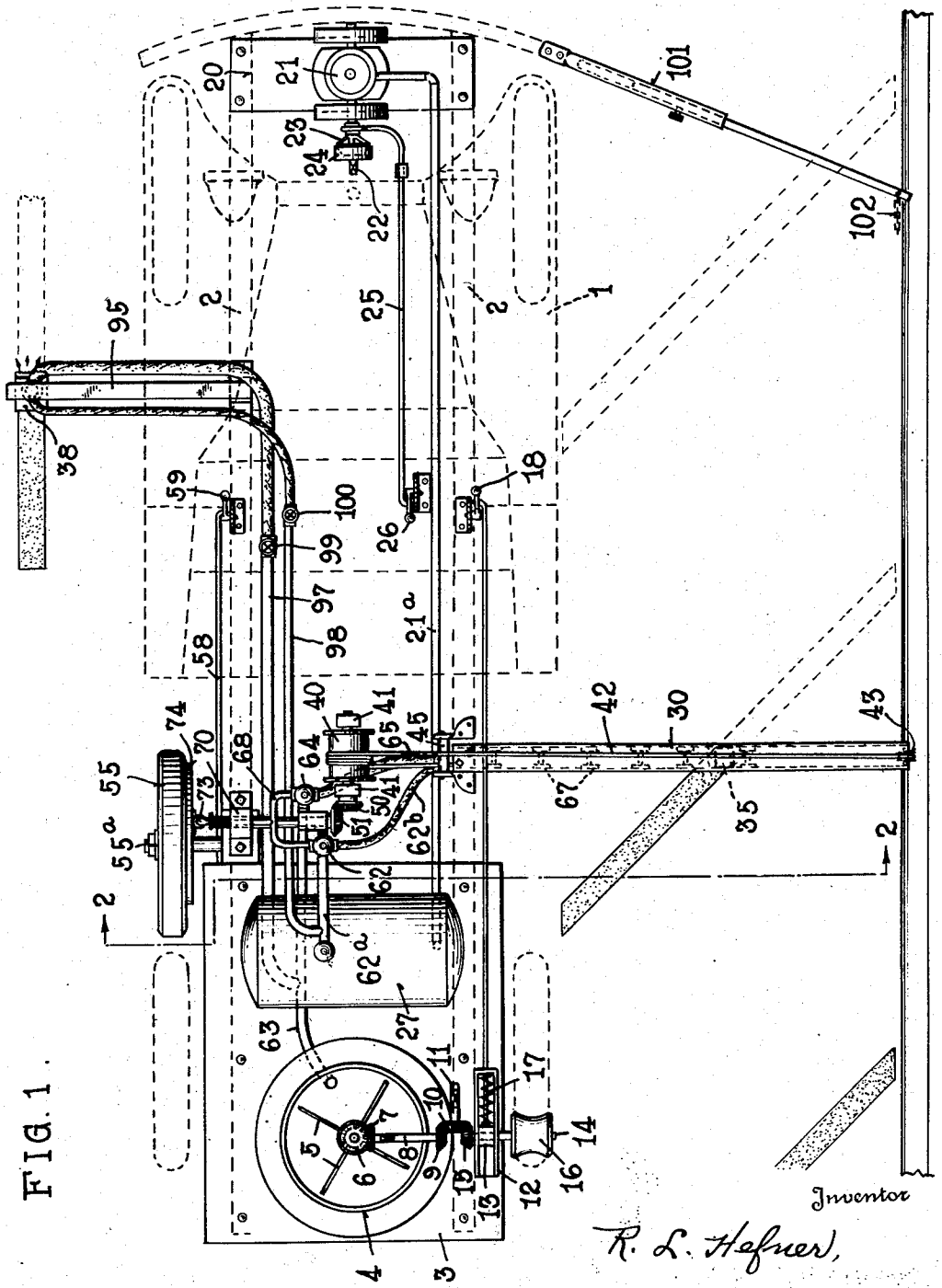


FIG. 1.

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Filed Oct. 2, 1933 3 Sheets-Sheet 2

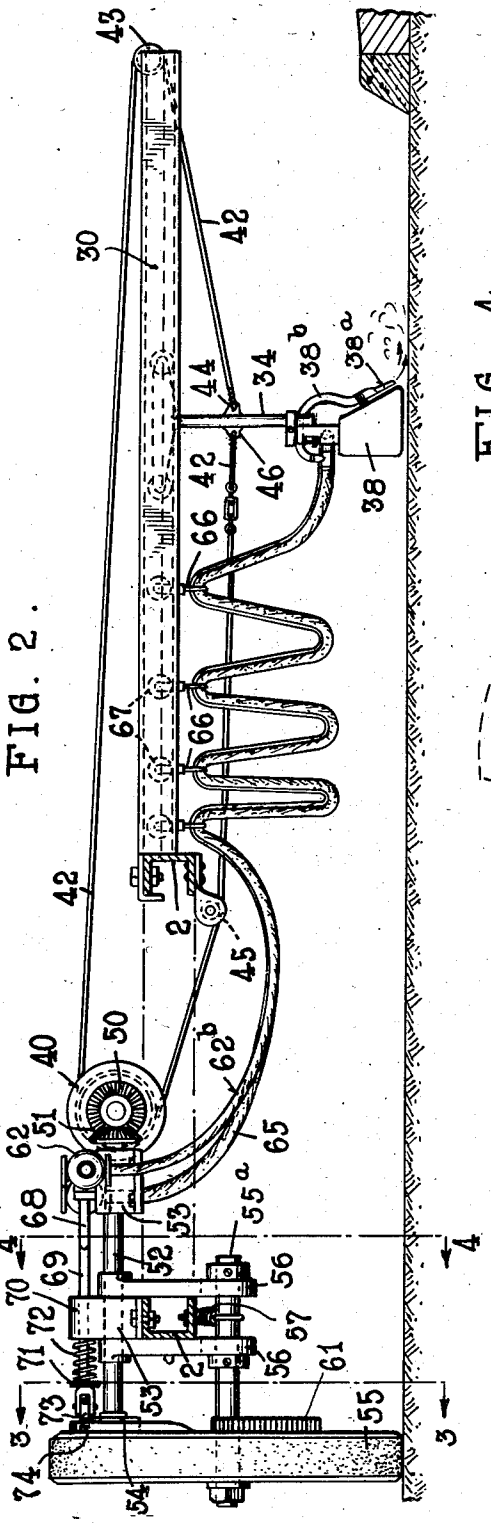


FIG. 2.

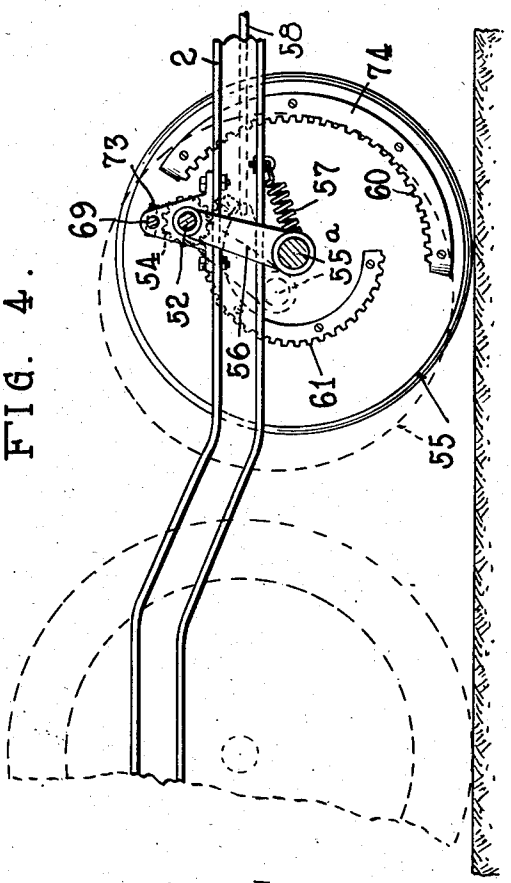


FIG. 4.

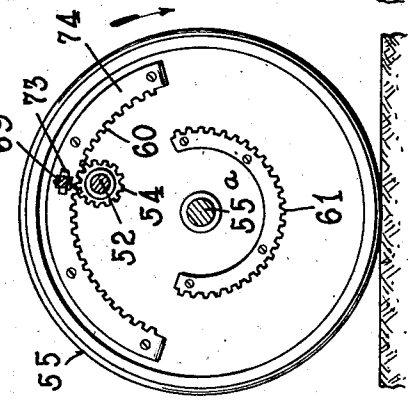


FIG. 3.

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PAVEMENT MARKING MACHINE

Filed Oct. 2, 1933 3 Sheets-Sheet 3

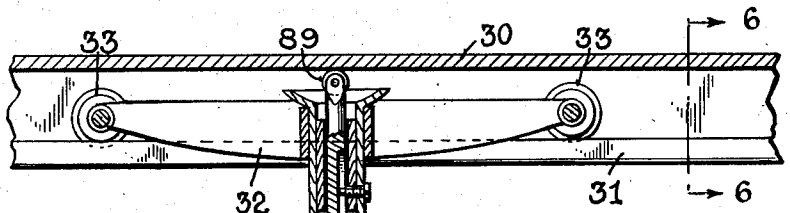


FIG. 6.

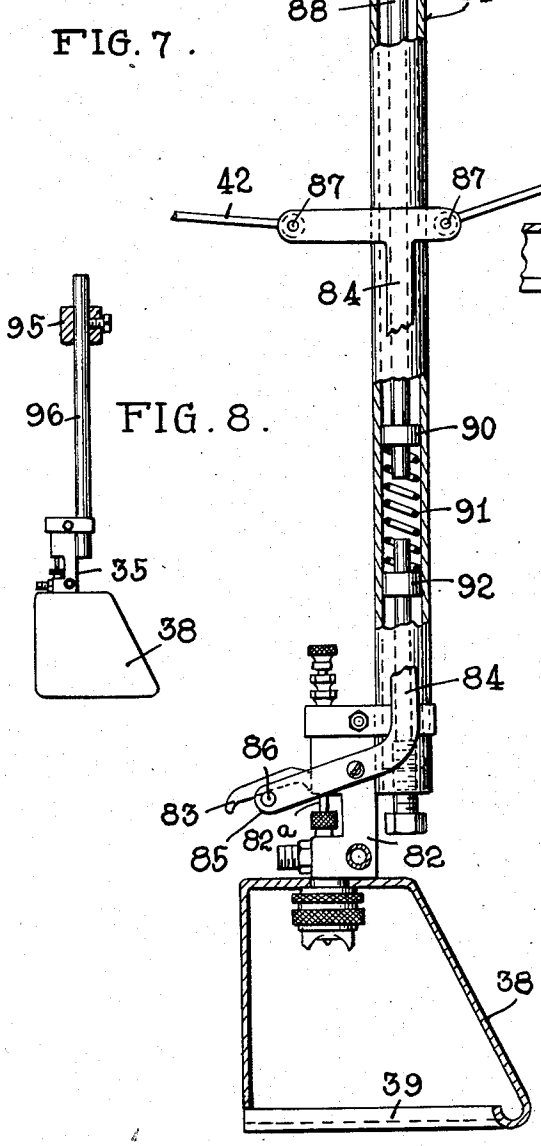


FIG. 7.

FIG. 8.

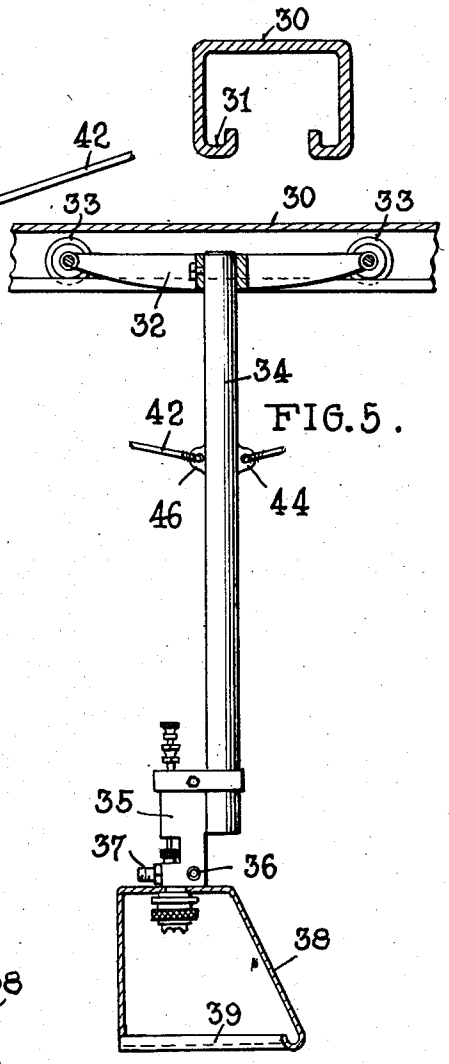


FIG. 5.

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UNITED STATES PATENT OFFICE

2,026,678

PAVEMENT MARKING MACHINE

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Application October 2, 1933, Serial No. 691,837

7 Claims. (Cl. 91—45)

This invention relates to pavement marking machines. More particularly it relates to marking machines which are adapted to move over the surface to be marked.

It is customary practice in cities today to paint a great many lines on the surface of the pavement for the purpose of controlling traffic and defining various areas for regulating parking.

The lines customarily used are of many and various types. Lines running parallel to the roadway for the purpose of defining traffic lanes are very common and are regarded as practically essential to modern traffic control. Transverse lines across the roadway at intersections are widely used to define crosswalks. In numerous instances areas are cross-hatched adjacent the curb with relatively closely spaced diagonal lines, to define parking or no parking areas and to indicate stalls for 45° angle parking.

It is an object of this invention to provide a machine which will in a large degree eliminate the manual labor now universally used to paint these lines.

A still further object of the invention is to provide a machine which will, while travelling in a direction parallel to the roadway, apply paint or the like to produce a series of diagonal lines inclined to the direction of travel of the machine.

Yet another object of the invention is to provide automatic means for starting and cutting of the flow of paint to the pavement at the beginning and end respectively of a diagonal line.

Another object of the invention is to provide a hood for the paint spraying apparatus proper which not only serves to define the width of the area painted but prevents dripping of paint onto the pavement after the flow is cut off.

Still another object of the invention is to provide an ambulent pavement marking machine which has adjustable guide means by which the line being made may be maintained a predetermined distance from the edge of the roadway.

Other and further objects of the invention will become apparent from the following specification when considered in connection with the accompanying drawings.

Referring to the drawings in detail:

Figure 1 is a plan view of the apparatus, the chassis being shown in dotted lines;

Figure 2 is a sectional view of the apparatus, taken on the line 2—2 of Figure 1, looking in the direction of the arrows:

Figure 3 is a sectional view taken on the line 3—3 of Figure 2. showing the gear for causing reciprocation of the spray nozzle;

Figure 4 is a sectional view taken on the line 4—4 of Figure 2, showing the manner in which the actuating wheel is engaged with and disengaged from the pavement surface;

Figure 5 is a detailed view of the nozzle, nozzle supporting hanger and carriage, showing the carriage mounted in the trackway;

Figure 6 is a sectional view of the trackway in which the nozzle supporting carriage reciprocates;

Figure 7 is a detailed view of a modified form of supporting hanger for the movable spray nozzle showing a different means for actuating the fluid cut off mechanism; and

Figure 8 is a detailed view of the stationary spray nozzle.

With more particular reference to the drawings, the apparatus comprises a chassis 1 shown in dotted lines in Figure 1, which may consist of an ordinary automobile or truck with portions of the body removed to permit the installation of the pavement marking apparatus.

As is conventional in automobile chasses, the frame comprises a pair of longitudinal members 2 extending substantially the length of the vehicle and adapted to support the body and motor thereof. Mounted on the frame members 2 at the rear end of the vehicle is a flat platform 3 lying between the rear wheels, extending forwardly thereof and adapted to support a fluid reservoir or tank 4.

The fluid tank 4 is preferably substantially cylindrical in shape and has, mounted on a vertical axis therein, a rotary agitator 5, having a bevel gear 6 secured thereto by which it is driven. The bevel gear 6 is driven by means of a second bevel gear 7, meshing therewith, which is mounted upon a horizontal shaft 8 which extends outwardly over the wall of the reservoir and is provided at its outer end with another bevel gear 9, which is in meshing engagement with a bevelled idler gear 10, rotatably mounted upon a horizontal stub shaft 11, secured to a suitable support on the platform 3.

A pair of longitudinal guides 12 are mounted on the platform 3 to one side of the idler gear 10 and carry slidably between them a movable bearing block 13, through which passes a shaft 14 which has secured at its inner end a bevel gear 15 adapted when the bearing block 13 is in a given position to permit the meshing of the gear 15 with the idler gear 10.

The outer end of the shaft 14 carries a roller 16 having a surface contour adapted for frictional engagement with the surface of the tire of the rear wheel of the chassis whereby the

roller 16 and the shaft 14 may be driven by the rotation thereof. The relation of the various elements just described is such that when the bearing block 13 is moved to a position where the friction roller 16 will engage the surface of the vehicle tire, the bevel gear 15 will be brought into mesh with the idler gear 10.

The forward ends of the guides 12 are connected together to form an abutment against which rests one end of a compression spring 17, which has its other end abutting against the bearing block 13 so that the roller 16 is normally urged out of engagement with the surface of the tire. An operating rod connects the bearing block with a suitable control lever 18 located convenient to the driver's seat of the vehicle.

It will be seen from the foregoing that when the operator of the vehicle pushes the lever 18 forward, the bearing block 13 will be moved forward in its guides causing an engagement of the friction roller 16 with the surface of the tire of the vehicle and brings gears 15 and 10 into mesh to cause a rotation thereof. This rotation will cause a rotation of gears 9, 7 and 6, causing a rotation of the agitating means 5, located within the fluid reservoir 4, and it will be seen that in this manner, the fluid agitating means will be driven as long as the vehicle is in motion.

It is also obvious that a rearward movement of the operating handle 18 will cause a disengagement of the friction roller 16 from the tire, and discontinue the operation of the agitating means when desired.

Mounted on the forward end of the chassis on the frame members 2 is a platform 20 adapted to support a suitable rotary air compressor 21 which is driven by a shaft 22 lying substantially coaxially with the crank shaft of the motor used for driving the chassis.

The rear end of the shaft 22 is provided with an axially movable clutch member 23 adapted to engage a complementary clutch member 24, which may be secured to the forward end of the motor crank shaft. A suitable operating rod 25 and lever 26 serve to provide means whereby the driver of the vehicle may engage and disengage the clutch. The air compressor 21 is connected by means of a suitable conduit 21a with a compressed air storage tank 27 on the rear platform 3 preferably located just forward of the reservoir 4.

It will be seen that the compressor 21 serves to maintain an ample supply of compressed air in the tank 27 and that as the pressure in the tank is increased beyond the point desired, the compressor may be disconnected from the motor by means of the clutch 23, 24.

In order to paint lines which are oblique to the direction of travel of the vehicle such as the lines used to define 45° angle parking or similar zones, a laterally extending arm 30 is provided rigidly mounted on the frame of the vehicle chassis, and extending out from the side thereof a substantial distance sufficient to cover the width of the area to which the diagonal lines are to be applied. This arm 30 is shown in enlarged cross section in Figure 6, where it is seen that the arm is of inverted U-shape and is provided internally with a pair of trackways 31 extending throughout the length thereof and having an open space therebetween.

A nozzle supporting carriage, shown in detail in Figure 5, is provided with a pair of wheels at either end thereof adapted to run in the trackways 31 of the arm 30. Substantially centrally of the carriage is rigidly hung a nozzle supporting hanger 34 extending downwardly from the carriage and carrying at its lower end a suitable fluid spray nozzle 35.

The spray nozzle 35 may be of any type desired in which compressed air and a liquid material are mixed to project an atomized spray. Nozzles of this general type are well known and used commercially for applying paint to surfaces. As is conventional in such nozzles, the nozzle 35 is provided with a connection 36 adapted to receive a flexible conduit for conducting compressed air to the nozzle and a fitting 37 adapted to receive a similar conduit for supplying paint or the like.

The nozzle supporting hanger 34 is of sufficient length so that as the carriage 32 slides along the trackways 31 in the arm 30, the nozzle will be moved over the pavement just slightly above the surface thereof.

A hood 38 surrounds the lower end of the nozzle 35. This hood has the lower edges of three sides thereof turned inwardly and upwardly to form a continuous trough around three sides thereof, the purpose and function of which will be seen hereafter.

Mounted on the forward side of the hood 38 is a fan shaped air jet 38a connected to the air connection 36 of the nozzle by means of a conduit 38b. This air jet is directed down on the surface of the pavement directly in front of the hood and serves to clean and blow away foreign matter from the portion of the pavement surface over which the hood is about to pass.

It is apparent that the shape of the hood and its position with respect to the spray nozzle will serve accurately to define the surface of the pavement to which the spray from the nozzle is exposed and will definitely limit the application of the spray to the pavement surface immediately beneath the nozzle, and hence provide clean cut edges for the line being painted.

In order to reciprocate the carriage 32 back and forth along the trackways 31 of the arm 30, a drum 40 is mounted on an axis longitudinal of the vehicle in suitable bearings 41. An operating cable 42 is wrapped several times around the drum and extends therefrom outwardly above the arm 30 to the outer end thereof and passes around an idle pulley 43 back inwardly on the under side of the arm and is secured to a suitable lug 44 on the side of the nozzle supporting hanger 34.

The other end of the cable passes from the drum downwardly over an idle pulley 45 and connects to a lug 46 located adjacent to the lug 44 but on the opposite side of the nozzle supporting hanger. It will therefore be seen that rotation of the drum 40 in one direction will cause the nozzle and carriage to move outwardly away from the vehicle and rotation of the drum in the other direction will cause an inward movement of the nozzle over the surface of the pavement.

From the foregoing, it will be seen that due to the fact that the lugs 44 and 46 are located well down the shank of the nozzle supporting hanger 34, the hanger will tend to tilt slightly from the vertical swinging about one pair of rollers 33 as a pivot as it is towed either outwardly or inwardly along the trackway 31. As the nozzle supporting hanger is tilted, it will cause a tilting of the hood 38 which is rigidly secured thereto. Thus, as the nozzle supporting hanger

is towed inwardly, the hood will be tilted in such a manner that paint which has been sprayed thereon during the outward movement of the hanger will run down the sides and accumulate in the forward portion of the trough, and due to the inclination of the hood will be prevented from dripping onto the pavement surface. While on the outward movement, the hood and hanger will be tilted in the opposite direction and the paint which has accumulated will flow out the rear ends of the trough onto the pavement. However, as will be seen later, the drip of paint out of the ends of the trough will only be permitted when the nozzle is open and paint is being sprayed on the pavement.

The drum 40 is driven by means of a bevel gear 50 secured to the shaft thereof which meshes with a second bevel gear 51 secured to a shaft 52 extending transversely of the vehicle and mounted for rotation in suitable bearings 53. The outer end of the shaft 52 is provided with a pinion 54, the purpose and function of which will be seen hereafter.

In order to cause reciprocating movement of the paint nozzle 35 in and out along the trackway 31 commensurate with the forward movement of the vehicle, a friction wheel 55 is provided secured to a shaft 55a journalled in a bracket 56. The bracket 56 is pivotally swung from the shaft 52. As is seen in Figure 2, the bracket 56 may consist of a pair of arms mounted on either side of one of the frame members 2 of the chassis having their upper ends journalled on the shaft 52 on either side of the outer of the two bearings 53.

A tension coiled spring 57, seen in Figure 4, connects the bracket 56 with the adjacent longitudinal frame member 2 of the vehicle chassis and tends constantly to swing the friction wheel into engagement with the pavement surface. An operating rod 58 connected with the bracket and having its forward end secured to a suitable operating handle 59 adjacent the driver's seat of the vehicle serves to provide manual means by which the friction wheel supporting bracket 56 may be swung about the shaft 52 as a pivot, and thus cause engagement or disengagement of the friction wheel 55 with the surface of the pavement over which the vehicle chassis is passing.

A pair of arcuate racks 60 and 61 are rigidly secured internally of the friction wheel 55, each of these racks having the same number of teeth and adapted to engage the teeth of the pinion 54, which, as described above, is connected to the outer end of the shaft 52, which serves to drive the drum 40. It will be noted that the outer rack 60 is so positioned that it will engage the pinion 54 from the outside through a portion of the revolution of the wheel 55, while the rack 61 will engage the pinion 54 from the inner or opposite side through the remainder of the revolution of the wheel 55. Therefore, as the friction wheel 55 is rotated in one direction through one complete revolution, it will be seen that the pinion 54 will be rotated a given number of turns in one direction by the rack 60 and then driven the same number of turns in the opposite direction by the rack 61. Since, as described above, the racks 60 and 61 have identically the same number of teeth, the number of turns that the pinion 54 will be driven in one direction will exactly equal the number of turns which it is driven in the opposite direction. Inasmuch as the pinion 54 is in direct driving connection with the drum 40, it will be seen that as the vehicle chassis passes over the pavement with the friction wheel 55 in contact therewith, the friction wheel will be continuously rotated in one direction, but due to the functioning of the arcuate racks 60 and 61, and the pinion 54 as has just been described, the drum 40 will be turned through a definite angular distance and then reversed and turned through an equal angular distance in the opposite direction. This driving and reversal of the drum 40 will cause a reciprocation of the nozzle supporting carriage back and forth along the trackways 31 of the laterally extending arm 30.

The side of the drum is proportioned so that the angular distance through which it rotates before being reversed will be sufficient to drive the nozzle supporting carriage throughout the length of the trackway 31. Thus it is clear that as the vehicle moves forward with the friction wheel in contact with the ground, the paint spraying nozzle will be reciprocated laterally back and forth in a zig zag path formed of straight lines oblique to the direction of travel of the vehicle.

Inasmuch as in most street marking operations it is desirable to paint a series of parallel lines diagonal to the direction of travel, it is necessary that the paint spray from the nozzle should be permitted to flow only during the movement of the nozzle in one direction, thus creating a series of parallel lines oblique to the direction of travel of the vehicle.

A suitable conduit 62a connects the compressed air tank 27 with an air valve 62. The opposite side of the air valve 62 is connected by a long flexible conduit 62b, with the air fitting 36 on the movable paint nozzle. Likewise, the conduit 63 connects the paint reservoir 4 with a paint valve 64 located adjacent the air valve 62 and a flexible paint conduit 65 provides communication between the paint valve 64 and the spray nozzle.

In order to support the conduits 62b and 65 between the valves and the paint nozzle, they may be hung in festoons from a series of suitable hooks 66 which are mounted on rollers 67 running in the trackways 31 of the arm 30.

The air valve 62 and the paint valve 64 are of the plunger type and the plungers thereof are connected together by means of a U-shaped cross piece 68, in order that these two valves may be simultaneously operated.

A valve operating rod 69 is mounted in a guide 70, which may be located just above the outer of the two bearings 53. This valve operating rod is adapted for limited reciprocation and has its inner end operatively connected to the cross piece 68. The valve operating rod is provided at its outer end with a collar 71 which serves with the guide 70 to confine a compression spring 72 which normally urges the valve operating rod outwardly to close the valves. The extreme outer end of the valve operating rod is provided with a roller 73 which is adapted to roll against the side of the friction wheel 55.

The rack 60 has its ends tapered and lies in the path of the roller 73 forming a cam surface 74 which, as is seen in Figure 2, will urge the valve operating rod 69 to the right opening the paint and air valves 62 and 64, during the time the rack 60 and roller 73 are in contact with each other. Due to the fact that the roller 73 and pinion 54 lie in substantially the same radial plane of the friction wheel 55, it will be seen that the roller 73 will ride up on the cam surface 74

formed by the rack 60 at the same time as the teeth of the rack 60 engage the pinion 54. Thus the flow of paint and air to the spray nozzle will be opened simultaneously with the beginning of the outward movement thereof. Likewise the flow will be cut off as soon as the hanger and nozzle reach the outer end of their stroke. It will thus be seen that as the vehicle chassis is moved over the surface of the pavement, the paint nozzle starting from its extreme inward position will apply to the surface of the pavement a line oblique to the direction of travel of the vehicle from closely adjacent the vehicle chassis to substantially the end of the laterally extending arm 30. Upon reaching the end of the arm 30, the friction wheel 55 will have rotated sufficiently so that the roller 73 will drop off the raised portion of the cam surface 74 cutting off the supply of paint and air to the nozzle and the pinion 54 will have arrived at the end of the arcuate rack 60 and will engage the other arcuate rack 61 and commence movement of the paint nozzle inward toward the vehicle. The flow of paint and air to the nozzle remaining cut off throughout the entire inward movement of the paint nozzle, it will be seen that upon reaching the inner end of its reciprocatory movement, the cycle will then again be repeated.

It will be understood from the foregoing that the cam surface 74 and the cooperating roller and valve control rod 73 and 69 respectively are merely illustrative of one way in which the flow of paint from the nozzle may be automatically shut off at the time the nozzle reaches the end of the line being painted.

Another means by which substantially the same result may be accomplished is illustrated in the modified form of nozzle supporting hanger shown in Figure 7. The carriage 32 with rollers 33 at either end thereof is substantially the same as illustrated in Figure 5. A hollow nozzle supporting hanger 81 is provided hung from the carriage 32 and carries at its lower end a nozzle 82 of the same general type as the nozzle 35. The nozzle 82, however, is provided with a valve for controlling the emission of spray operated by a lever 83 which is adapted to reciprocate in a vertical plane.

A bell crank arm 84 is pivotally mounted on one side of the nozzle and has one arm 85 extending laterally beside the valve operating lever 83. The end of the arm 85 is provided with a pin 86 adapted to engage the under side of the valve operating lever so that movement of the bell crank arm about its pivot serves to open or close the nozzle valve. The other end of the bell crank arm extends upwardly alongside of the hanger 81 and is provided at its upper end with a cross piece having apertures in each end thereof adapted to receive the ends of the cable 42.

A stabilizing rod 88 is mounted within the hollow hanger 81. This rod carries at its upper end a roller 89 adapted to roll along the upper internal surface of the arm 30. The lower end of the rod 88 carries a collar 90, which abuts against one end of a compression coil spring 91 which has its other end supported by a fixed abutment 92. This coil spring 91 tends constantly to urge the roller 89 against the inner surface of the arm 30 and maintain the nozzle hanger resiliently in a vertical position. It will be seen that when the hanger is being drawn outwardly away from the chassis by means of the cable 42 on the right hand side of Figure 7 the bell crank arm will be swung about its pivot sufficiently to open the nozzle valve and will tilt the hanger 81 slightly from the vertical about one of the rollers 33 as a center, such tilting movement being resisted by the spring 91. Likewise when moved along the trackway in the other direction the tension will be exerted on the other end of the cable 42 and swing the bell crank arm in the opposite direction. Thus it will be seen that the spray of fluid from the nozzle 82 will be permitted to flow only so long as the nozzle hanger 81 is being moved in a direction outwardly and away from the chassis.

In this modification, the tilting of the hanger caused by the tug of the cable 42 will have substantially the same effect as in the preferred embodiment of the invention, except that in this form tilting is resisted by the spring 91. However, as in the form illustrated in Figure 5, the tilting of the hood serves to prevent dripping of paint onto the pavement except when the nozzle is open and paint is being sprayed on the pavement.

Obviously when this type of nozzle supporting hanger is used, the automatically controlled valves 61 and 64 may be maintained open all the time and the cam mechanism on the side of the friction wheel 55 may be dispensed with.

In order to paint lines parallel to the direction of movement of the chassis a stationary nozzle supporting arm 95 is provided extending laterally from the opposite side of the vehicle, and having at its outer end means for securing a vertically adjustable nozzle supporting hanger 96. This nozzle supporting hanger 96 may carry at its lower end a nozzle 35 and hood 38 similar in construction to that described in connection with Figure 5. Paint and air conduits 97 and 98 controlled by suitable manual valves 99 and 100 respectively serve to provide the stationary nozzle 35 with fluid. In order to aid the driver in maintaining the proper course for the vehicle with relation to the edge of the roadway, a laterally adjustable extensible arm 101 is provided secured to the forward end of the vehicle. The outer end of the arm 101 is provided with a depending guide chain 102, which may hang down therefrom to the surface of the pavement. This depending chain serves as a guide for the driver of the vehicle to help him maintain the course of the chassis at a fixed distance from the edge of the roadway. This is a particularly desirable feature for use during the operation of the stationary spray nozzle 35, as the arm 101 may be extended to a distance sufficient so that when the chain 102 hangs at the edge of the roadway, the stationary nozzle will follow a course down the center of the roadway.

It is obvious that many and further modifications of the invention will become apparent.

What I claim is:

1. An apparatus of the class described comprising a chassis adapted for movement over the surface to be marked, an arm extending laterally from said chassis, paint applying means suspended from said arm and movable therealong and means actuated by forward movement of said chassis for causing lateral movement of said paint applying means along said arm.

2. Apparatus of the class described comprising a chassis adapted for movement over the surface to be marked, a trackway laterally extending from said chassis, fluid diffusing means mounted for lateral movement along said trackway, means actuated by forward movement of said chassis for automatically moving said fluid

diffusing means back and forth along said trackway.

3. Apparatus of the class described comprising a chassis adapted for movement over the surface to be marked, an arm extending laterally from said chassis, paint applying means suspended from said arm and movable therealong, manually controlled means for causing automatic reciprocatory movement of said paint applying means along said arm.

4. Apparatus of the class described comprising a chassis adapted for movement over the surface to be marked, an arm extending laterally from said chassis, paint applying means suspended from said arm and adapted for movement therealong, means for controlling the flow of paint to said paint applying means and means actuated by movement of said chassis for causing reciprocating movement of said applying means along said arm and to operate said controlling means.

5. An apparatus of the class described comprising a laterally movable paint applying means, means for controlling the flow of paint to said paint applying means, means for causing reciprocatory movement of said paint applying means, said means also serving to control the flow of paint to said applying means, whereby paint is permitted to flow to said applying means when said applying means is moved in one direction but not permitted to flow when said paint applying means is moved in the other direction.

6. An apparatus of the class described comprising a chassis adapted for movement over a pavement surface to be marked, an arm extending laterally from said chassis, paint applying means depending from said arm and adapted for movement therealong, means for causing reciprocating movement of said paint applying means along said arm comprising a wheel adapted to engage the pavement surface and to be rotated by movement of said chassis.

7. An apparatus of the class described comprising a chassis adapted for movement over a pavement surface to be mark d, an arm extending laterally from said chassis, paint applying means depending from said arm and adapted for movement therealong, means for causing reciprocating movement of said paint applying means along said arm comprising a wheel adapted to engage the pavement surface and to be rotated by movement of said chassis, and manually operating means for disengaging said wheel from the pavement surface.

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