

July 10, 1962

H. J. HUTTASH
SELF-PROPELLED CONCRETE JOINT TREATING
MACHINE AND METHOD

3,043,200

Filed June 20, 1958

2 Sheets-Sheet 1

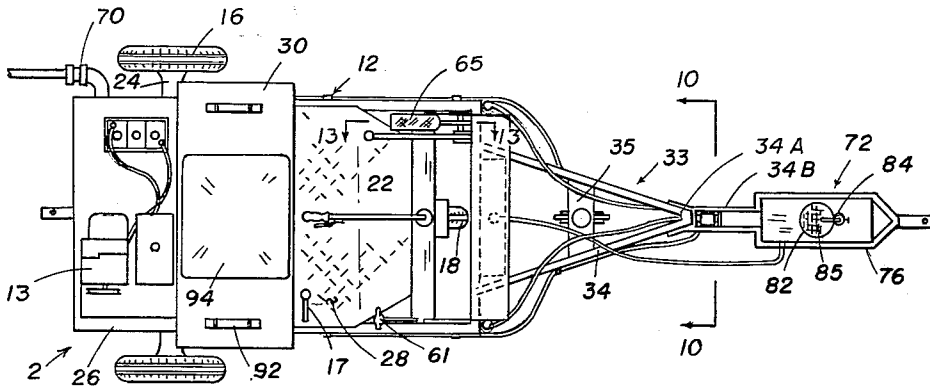


FIG. 1

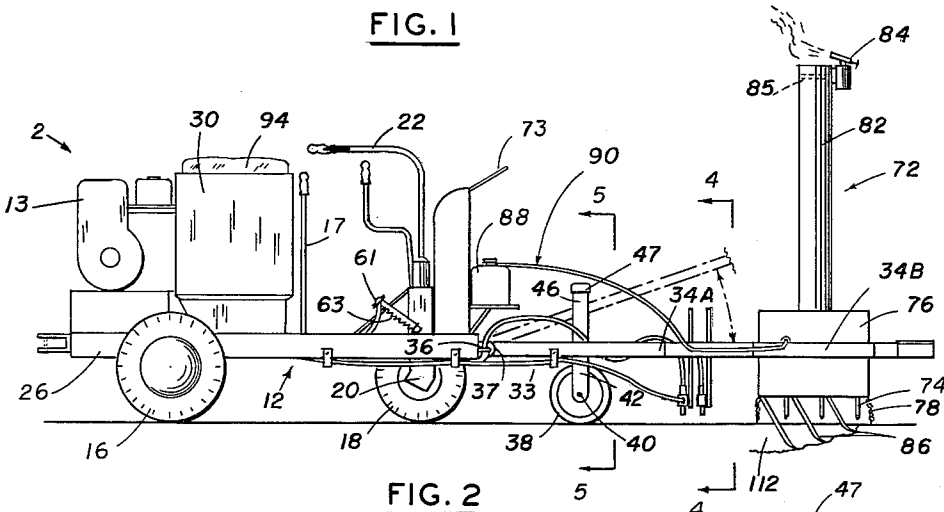


FIG. 2

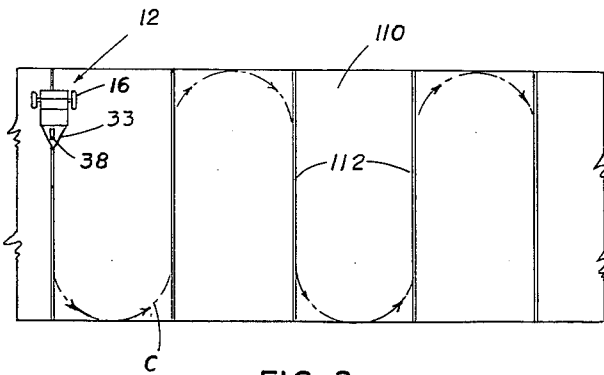


FIG. 3

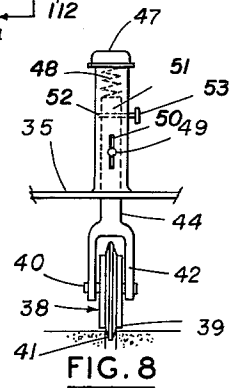


FIG. 8

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2 Sheets-Sheet 2

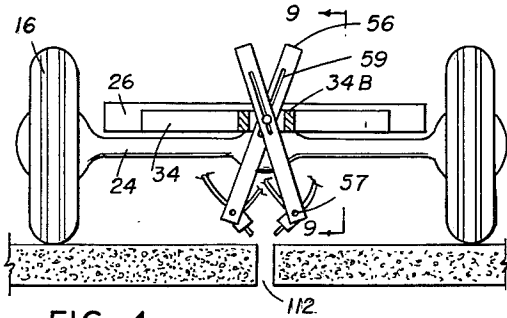


FIG. 4

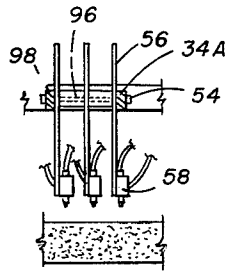


FIG. 9

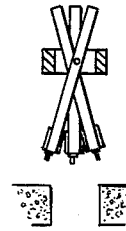


FIG. 10

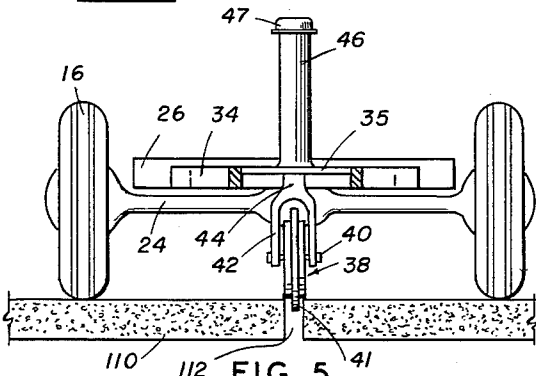


FIG. 5

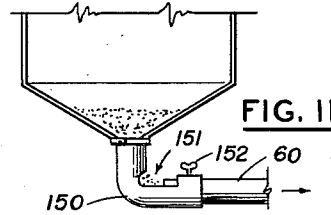


FIG. 11

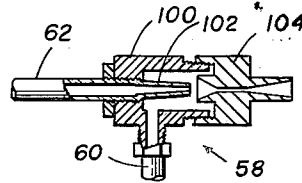


FIG. 7

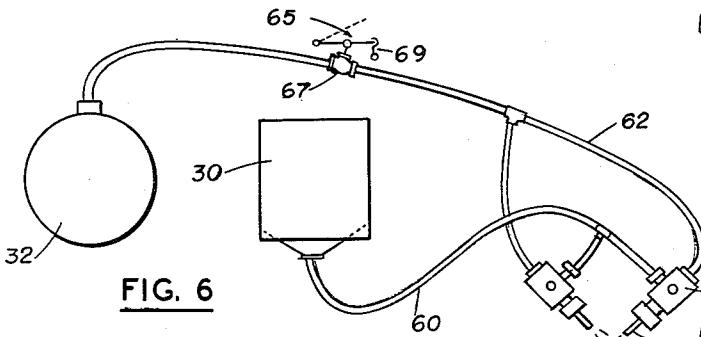


FIG. 6

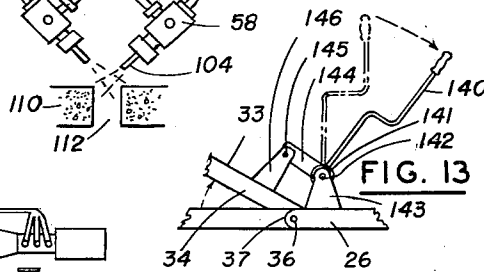


FIG. 13

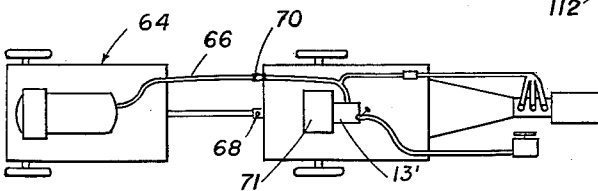


FIG. 12

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3,043,200 SELF-PROPELLED CONCRETE JOINT TREATING MACHINE AND METHOD

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4 Claims. (Cl. 94-22)

This invention relates to a self-propelled mechanism for the treatment of concrete and other paving material and more particularly to a mechanism of this type for applying a treatment by means of a mixture of air and finely divided abrasive material moving at a high velocity.

An object of the invention is to provide a self-propelled mechanism for the treatment of concrete which is suitable for one-man operation; this treatment being accomplished by a mixture of air and abrasive striking the material at an extremely high velocity at a constant distance from the concrete.

Another object of the invention is to provide a self-propelled mechanism for the treatment of paving material by means of a mixture of air and abrasive material striking the pavement at a high velocity which mechanism is both operated and propelled by a single operator, and in which the jet of air and abrasive is mechanically guided and directed with an extremely high degree of precision.

Another object of this invention is to provide a self-propelled mechanism for the treatment of concrete or other paving material by means of a mixture of air and finely divided abrasive material striking the concrete at extremely high velocity which is capable of one-man operation and maneuvering with a minimum of fatigue.

Another object of this invention is to provide a self-propelled mechanism for the treatment of expansion joints and the slab surface on either side of the joint and immediately adjacent thereto after the joint has been sawed in the concrete preparatory to filling the joint with an expansive material.

A still further object is to provide a self-propelled mechanism which will permit a single operator to maneuver and operate a joint cleaning device down an expansion joint in concrete at a controlled height from the joint and in perfect alignment therewith.

And yet another object is to provide a self-propelled mechanism for the removal of painted markings from curbs and paved surfaces by means of a mixture of air and abrasive striking the surface at high velocity with the result that the surface is etched as well as cleaned, facilitating the adhesion of any new markings which may be applied.

An additional object is to provide a self-propelled mechanism for the removal of old expansive material from expansion joints in concrete or other paving material and for the treatment of the joints to prepare them to receive new expansive material by freezing the old expansive material to render it brittle and crystalline, plowing and removing the old and now frozen expansive material, and directing a mixture of air and finely divided abrasive material at high velocity into such groove to remove any remnants of the old expansive material therein.

Further objects and a fuller understanding of the invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings, in which:

FIG. 1 represents a plan view of the invention.

FIG. 2 is a side elevation of the device shown in FIG. 1.

FIG. 3 shows a strip of pavement with concrete joints to be treated and the path followed by the invention in accomplishing this treatment.

FIG. 4 shows a fragmentary cross-sectional view taken along the lines 4-4 of FIG. 2.

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FIG. 5 shows a fragmentary cross-sectional view taken along the lines 5-5 of FIG. 2.

FIG. 6 is a schematic illustration of the arrangement by which air and finely divided abrasive material are mixed and given a high velocity.

FIG. 7 is a cross-sectional view taken through one of the blast nozzles of FIG. 6, showing how the air and abrasive material are mixed and ejected at high velocity.

FIG. 8 is a detail front elevation view of the guide wheel and its support structure.

FIG. 9 is a side elevational view of the fragmentary device shown in FIG. 10.

FIG. 10 is a fragmentary cross-sectional view of a modified nozzle arrangement of this invention taken along the lines 10-10 of FIG. 1.

FIG. 11 is a cross-sectional view through the sand hopper shown in FIG. 2 and schematically in FIG. 6.

FIG. 12 is an outline plan view of the complete assembly of another embodiment of this invention.

FIG. 13 is a fragmentary detail view taken in cross-section at 13-13 in FIG. 1.

Referring now more particularly to the characters of reference as shown in the drawings, the invention identified generally at 2, includes a vehicle cart assembly shown at 12, an outrigger assembly shown at 33, and a freezing assembly shown at 72. The cart 12 includes a motor 13 which provides motivation power to the wheels 16, which are equipped with pneumatic tires and which are situated near the rear and on either side of cart 12 through a conventional system of gear reduction, clutch and differential (not shown—being conventional and well-known); this clutch being dis-engaged by lateral movement of clutch lever 17.

Cart 12 is mounted on a tricycle type suspension consisting of wheels 16 and 18, with wheel 18 being mounted centrally under the cart frame 26 near its forward end and in the direction of travel. Wheel 18 is rotatably mounted in yoke 20, which in turn is supported on the chassis 26 and steerably connected to steering arm 22, enabling the operator to steer the cart 12 by lateral movement of steering arm 22. Wheels 16 are mounted on axle 24 which is rotatably attached to chassis 26. Support for the operator's feet, whether he be standing or sitting, is provided by floor plate 28, which is fastened to the top of chassis 26. A hopper 30 which carries and dispenses a supply of finely divided abrasive material is mounted on chassis 26 immediately behind floor plate 28. Hopper 30 is provided with a cover and seat 94 which opens to permit re-filling and closes to prevent contamination of the finely divided abrasive material. Conventional controls are provided to enable the operator to control the speed of cart 12.

The outrigger assembly, shown generally at 33, extends from cart 12 forward in the direction of travel. The outrigger depicted is in the form of an A frame but the outrigger assembly 33 may take various forms depending upon the job to be done. In the form depicted, the outrigger assembly 33 includes side members 34 which converge and are joined where they meet at a point ahead of cart 12 in the direction of travel. A lateral member 35 connects side members 34. Outrigger assembly 33 is pivotally connected to chassis 26 of cart 12 by means of hinge pins 36 which pass through holes in the ends of side members 34 and through holes in hinge brackets 37, which are rigidly attached to chassis 26.

This method of attaching outrigger assembly 33 to cart 12 permits the end of outrigger assembly 33 and its associated elements to be raised or lowered without any movement of cart 12. A guide wheel 38 is mounted beneath cross member 35, the guide wheel 38 has a cylindrical surface 39 on which it rolls, encircled by a flange 41 of great-

er diameter in the middle of the surface 39. The guide wheel 38 is rotatably mounted by means of shaft 40 in yoke 42. Yoke 42 is rigidly attached to a post 44 which is free to rotate inside shaft housing 46. The space between the top of post 44 and the cap 47 of housing 46 contains a compression spring 48 which seats at its upper end against cap 47 and at its lower end against the top of post 44 which is integral and rigidly connected to the yoke 42. Compression spring 48 exerts a force which tends to expel post 44 from housing 46 but the axial movement of post 44 is limited by pin 49 coming in contact with the end of slot 50. Housing 46 is rigidly connected to cross member 35 and post 44 passes through a hole in cross member 35 in sliding relation thereto. On occasions it is desirable that the yoke 42 be rigid with the cross member 35, and for this purpose, post 44 includes a drilled hole 51 which aligns with two holes 52 in the housing 46, so that a lock pin 53 may be inserted to prevent relative movement between the two parts. The guide wheel described and depicted is intended for use when the invention is being used to treat joints in pavement. An alternate form of guide wheel for use in connection with joint treating operations would consist of a modification of the guide wheel depicted and described above. The modification would include, instead of a flange of greater diameter than the guide wheel, the width of which flange is uniform at all points, a tapered flange 41 which decreases in width as the radial distance from the axis of rotation increases from a width greater than the width of the widest groove expected to be encountered to a width narrower than the narrowest groove expected to be encountered. The weight of outrigger assembly 33 causes the tapered flange on guide wheel 38 to be forced into the groove being treated by the invention so that said tapered flange 41 is always in contact with both shoulders of said groove simultaneously, thus preventing any lateral movement of guide wheel 38 relative to the groove being treated and resulting in more precise guidance. A guide wheel of any form suitable for the job being done may be substituted for the guide wheel described and depicted. The action of compression spring 48 maintains the flange of guide wheel 38 in the groove being treated despite any slight bouncing up and down of the outer end of outrigger assembly 33 which may be encountered in normal operation. Also, shaft 40 about which guide wheel 38 revolves is displaced a suitable distance from the axis of post 44 with the result that guide wheel 38 acts as a caster, automatically aligning itself with the direction of movement of housing 46.

Outrigger assembly 33 extends beyond the forward point where side members 34 meet and join (at 34A) in the form of a rod 54 which is rigidly attached to side members 34. Rod 54 supports one or more adjustable arms 56 which each in turn support a blast nozzle 58. Adjustable arms 56 engage rod 54 by means of a longitudinal slot 59 in the upper end of each of said arms. Each adjustable arm 56 is separated from the adjacent said adjustable arm by means of a cylindrical spacer 96 which is hollow permitting spacer 96 to slide over rod 54. The forward end of rod 54 is threaded to accept nut 98 which may be loosened to permit adjustment of adjustable arms 56 through rotation of said arms about rod 54 and by changing the point in the longitudinal slot in said adjustable arms through which rod 54 passes. When the desired adjustment is attained nut 98 may be tightened to clamp adjustable arms 56 and maintain their position and spacers 96 against the apex 34A of the arms 34. Blast nozzles 58 can be rotated about the bolt 57 fastening each to its adjustable arm 56 to the desired angle and clamped in place. An abrasive hose 60 connects each blast nozzle to abrasive hopper 30. Compressed air flows through air hose 62 which divides into separate branches for each nozzle 58. Foot pedal 65 controls air valve 67 in air line 62, and this foot pedal is held in the down position

by latch 69, which can be released by a touch of the operator's toe. When foot pedal 65 is depressed, compressed air flows through air hose 62 and when the foot pedal is released, air valve 67 closes, stopping the flow of compressed air. Wheels 16 are equipped with brakes which the operator engages by depressing foot pedal 61. A ratchet 63 is rigidly connected to foot pedal 61 in such a way that the teeth of ratchet 63 can engage the edge of floor plate 28. When foot pedal 61 is depressed, ratchet 63 engages the edge of floor plate 28 to prevent the return of foot pedal 61 enabling the brakes on wheels 16 to be locked until the operator tilts foot pedal 61 with his foot causing ratchet 63 to be disengaged, allowing foot pedal 61 to return to its normal position.

Due to the large quantity of compressed air required to operate blast nozzle 58, it is contemplated that the most practical source of compressed air would be a mobile air compressor-internal combustion engine unit 64 towed behind the invention by means of trailer hitch 68 and operating with the invention as a unit. This towed air compressor-internal combustion engine unit supplies compressed air to the invention by means of air coupling 70 through which the compressed air flows from supply hose 66 to air hose 62. In the alternative, an air compressor 71 could be mounted on cart 12, making the invention an entirely self-contained unit. Likewise, engine 13 may be an internal combustion engine, an electric motor, or an air engine driven by compressed air received from the towed air compressor-internal combustion engine unit 64.

When the invention is used for the purpose of removing old expansive material from expansion joints 112 and for treating said joints to receive new expansive material, the invention includes freezing assembly 72. This freezing assembly 72 includes one or more spray nozzles 74 enclosed in housing 76 with the space between housing 76 and the surface of the pavement being enclosed by canvas skirts 78. Freezing assembly 72 is supported by structural member 80 which surrounds housing 76 and is rigidly connected to side members 34. Flue 82 is mounted atop housing 76 connecting the space enclosed by housing 76 with the outside atmosphere. A small hand blow-torch or other ignition unit 84 is mounted at the top of flue 82 in such a manner that its flame is directed across the top of the flue. Rigidly connected to structural member 80 are one or more plow points 86 whose function is to plow enough of the old expansion material out of the joint being treated to permit the blast of finely divided abrasive material to reach the bottom of said expansion joint, thus cleaning it completely. A cylinder 88 of liquified gas having a boiling point which is sufficiently low at standard atmospheric conditions is mounted on the front end of cart 12 and liquified gas flows from cylinder 88 through tubing 90 to spray nozzles 74 where it is sprayed on the old expansion material in liquid form. Two gases which have been found particularly suitable for this purpose are butane and propane, since these gases will freeze when expanded through a nozzle in their liquid state.

In its ordinary condition the expansive material used in expansion joints of pavement is resilient and has a gummy consistency similar to chewing gum. The resilience of the material gives it high resistance to erosion and its gummy consistency makes it extremely difficult to remove by scraping or plowing. As the liquified gas from spray nozzles 74 comes in contact with the old expansive material, the liquified gas is partially absorbed and because of its low boiling point, the liquified gas evaporates almost instantly with the result the the old expansive material is frozen by the heat transfer which accompanies the evaporation of the liquified gas. In a frozen state, the old expansive material is crystalline and extremely brittle. Plow points 86 are so located that they contact the old expansive material immediately after it has been frozen by the evaporation of the liquified gas with the result that plow points 86 are able to remove

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the old expansive material in the form of chips and crystals instead of in the form of a gummy mass. Plow points 86 are followed immediately by blast nozzles 58 which direct a mixture of air and finely divided abrasive material at extremely high velocity into the groove in the old expansive material plowed by plow points 86. In its frozen state the old expansive material has lost its resilience with the result that the erosive effect of the blast of air and finely divided abrasive material on the old expansive material is multiplied many times. This facilitates complete cleaning of the joints by the combination of plowing and blasting.

Both butane and propane are highly inflammable. However, the danger of fire is eliminated by restricting the inflammable gas to housing 76 by means of canvas skirt 78, thus allowing it to escape only through flue 82. When the gas reaches the top of flue 82 it mixes with the air and is ignited by the pilot light supplied by blow torch 84 and burned away.

Due to the lack of oxygen in housing 76 there is very little possibility that the flame from the burning gas at the top of flue 82 could move down through flue 82 into housing 76. However, as an added precaution flame barriers or arrestors 85 have been installed in flue 82. These flame barriers consist of screen wire mesh covering the entire cross section of flue 82 and acting to permit the passage of gas but to block the passage of flame.

For the operator's safety and comfort, the lid on hopper 30 which serves as a seat for the operator is equipped with hand grips 92 and a cushion 94.

In the schematic illustration shown in FIG. 6 tank 32 represents the source of compressed air. Hopper 30 represents a source of finely divided abrasive material. Blast nozzles 58 receive compressed air from tank 32 and finely divided abrasive material from hopper 30, mix the air and finely divided abrasive material together, and eject the mixer at extremely high velocity through venturi nozzles 104 into expansion joint 112 in pavement 110 or on any other surface which is being treated. Compressed air flows from tank 32 to blast nozzles 58 through hose 62, while sand or other abrasive material from hopper 30 flows to blast nozzles 58 through hose 60. Blast nozzles 58 are composed of a hollow cylindrical body 110 surrounding air nozzle 102 which is threadedly connected to housing 100 and to air hose 60. A venturi nozzle 104 is threadedly connected to housing 100 so that the axis of the venturi nozzle 104 coincides with the axis of air nozzle 102 and so that venturi nozzle 104 and air nozzle 102 are separated by a slight space. In operation air under pressure passes successively through air nozzle 102 and venturi nozzle 104 at extremely high velocity. The passage of the air through venturi nozzle 104 results in a decrease in pressure with the result that atmospheric pressure forces air and finely divided abrasive material through hose 60 into the annular space separating air nozzle 102 and housing 100. The abrasive material then passes through the space separating air nozzle 102 and venturi nozzle 104 into the stream of air moving at extremely high velocity and is itself accelerated to an extremely high velocity by the time it emerges from venturi nozzle 104. A shield 73 is provided on the forward end of cart 12 for the protection of the operator.

FIG. 3 illustrates how the invention is used to treat the joints 112 of a new strip of pavement 110. The cart 12 with outrigger 33 lowered to the point that the flange 41 of its guide wheel 38 engages the joint 112 begins to travel in straddling relation to the joint until the nozzle 58 has gone beyond the edge of the pavement 110, but the wheels 16 and 18 are still thereon. The outrigger 33 is then raised until guide wheel 38 is clear of the joint 112 and the front cart wheel 18 is steered by means of arm 22 in a tight circle (C) until guide wheel 38 can engage the next adjacent groove 112 and repeat the operation. It is apparent that a short space at one end of each groove 112 will remain untreated until the first pass

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is completed, but it will be picked up on the second pass. It is necessary that the ground wheels 16 and 18 remain on the pavement in many instances, since the earth adjacent the pavement 110 may be at a lower level or may be wet or rough. If the adjacent earth is smooth, dry, and at the same level, a similar method might be used to complete the joint cleaning operation by a single pass down the pavement 110.

When used for tasks which do not involve the removal of old expansion material freezer assembly 72 and the cylinder of liquified gas 88 are removed. Such other operations include the treatment of expansion joints in new pavement, removal of painted markings from pavement and curbs and the treatment of the pavement and curbs to provide better adhesion of new painted markings.

When the invention is used to remove painted markings or to treat pavement or curbs for the application of painted markings, guide wheel 38 can be replaced by a guide wheel having no flange about its middle if desired. When the invention is being used to perform these operations, manual guidance is required because there is no groove for guide wheel 38 to follow.

To facilitate manual raising and lowering the outrigger 33, a lever 140 including a boss 14 is pivoted by pin 142 to a bracket 143 on chassis 26 adjacent the mounting bracket 37. A bell crank 144 projects forward from the boss 141 and is connected by pin 145 to a bracket 146 projecting up from arm 34. Hence it will be seen that by pulling rearward on lever 140 the outrigger 33 will be caused to pivot about pin 36 as shown in detail in FIG. 13.

FIG. 11 shows the method of attaching the hose 60 to the hopper 30 by means of an elbow 150 having an adjustable air intake 151 and an adjustment nut 152 to grip the hose 60 after adjustment.

From a study of the drawings and the detailed description above, it will be apparent that there has been developed an invention which accomplishes the objects set forth. Although the invention has been described with a certain degree of particularity, it is understood that the embodiment described is used only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be made without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A self-propelled machine for the removal of old expansive material from expansion joints in pavement and for the treatment of the surfaces of the paving material in and immediately adjacent to said expansion joints comprising: a self-propelled cart, means for applying gas in a liquid state, which gas has an extremely low boiling point under standard atmospheric conditions, to the old expansive material to render said expansive material brittle and crystalline; plow means to partially remove said old expansion material that has been rendered brittle and crystalline; a dispenser for finely divided abrasive material moving with said cart; a source for compressed air moving with said cart; one or more nozzles behind said plow means in which the compressed air and the finely divided abrasive material are mixed and ejected at extremely high velocity; means for conducting compressed air from its source to said nozzles; means for controlling the flow of the compressed air to said nozzles; means for conducting finely divided abrasive material from the dispenser to said nozzles, means for regulating the amount of finely divided abrasive material conducted to said nozzles, said nozzles serving to direct said mixture of abrasive material and compressed air into said expansion joint to remove the remainder of said brittle old expansion material and to etch the paving material; a means for guiding said machine automatically along a groove in the pavement being treated; a mounting means supported by said guidance means, said mounting means supporting said means for applying a liquid gas, said plows,

and said nozzles, said mounting means being pivotally connected to said cart; and adjustable means interconnecting said cart and mounting means for raising and lowering said mounting means.

2. A method of cleaning old expansion material from grooves in paving and treating the paving groove for subsequent refilling, comprising the steps of: applying onto the old expansion material a liquified gas having a boiling point sufficiently below standard atmospheric conditions to cause freezing of said material when applied in liquid form and evaporated in the atmosphere for rendering the old expansion material brittle and crystalline, plowing the old expansion material out of the groove, directing a jet of compressed air and abrasive material against the sides of said groove and moving and guiding the jet longitudinally along said groove.

3. A machine for treatment of expansion grooves in pavement comprising; means carried by said machine for removing material from the grooves, a source of compressed air and a dispensing means for finely divided abrasive material mounted on said machine, a plurality of nozzle means for mixing the abrasive material and compressed air and ejecting the mixture at high velocity, means for controlling the flow of compressed air and abrasive material to said nozzles, means for mounting said nozzles on said machine including, a plurality of adjustable support arms, means to pivotally clamp said nozzles to said arms for directing the nozzles in a vertical plane, a longitudinally extending slot in each of said arms, means carried by said machine for engaging said arms through said slots and clamping said arms in selected positions whereby said arms are vertically and angularly adjust-

able about said engaging means, and means carried by said machine for engaging a groove to guide said machine along said groove.

4. A machine for treatment of expansion grooves in pavement comprising; a wheel supported frame, means for mixing and ejecting compressed air and finely divided abrasive material at a high velocity including a plurality of nozzles, means for mounting said nozzles on said frame whereby crossed streams of said mixture are directed angularly and transverse to the side walls of said grooves and including, a plurality of adjustable support arms having slotted portions, means to pivotally clamp said nozzles to said arms for directing the nozzles in a vertical plane, means carried by said machine for engaging the slotted portions of said arms and clamping said arms in preselected positions whereby said arms are vertically and angularly adjustable about said engaging means, and means carried by said machine for engaging said groove to guide said machine along said groove.

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