United States Patent [19]

Goethe et al.

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[54] MACHINE FOR CLEANING PAVING CRACKS

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[73] Assignee: **Crestmark Products Company Incorporated**, Kansas City, Kans.

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[21] Appl. No.: **224,560**

[52] **U.S. Cl.** **15/334**, 15/359, 15/363, 15/401, 15/405

[51] **Int. Cl.** **A47l 5/00**, A47l 9/00

[58] **Field of Search** 15/340, 354, 363, 15/393, 402, 405, 406, 334, 401

[56] **References Cited**

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Assistant Examiner—C. K. Moore
Attorney—Bradley and Wharton

[57] **ABSTRACT**

Apparatus for cleaning material from cracks in a surface, such as a highway pavement. A mobile vehicle is moved along the surface and has a depending, pivotally mounted arm that has a projection extending into the crack. The arm is mounted for pivotal movement about both horizontal and vertical axes to allow the projection to follow an irregular crack and avoid being damaged by an unyielding object in the crack. Yieldable biasing means normally holds the arm in relationship to the surface and will yield under force to accommodate pivotal movement of the arm. A source of pressurized air is also carried by the vehicle and is coupled with an appropriate delivery conduit to provide an airstream which is directed down into the crack, in perpendicular relationship to the latter, immediately behind the aforementioned projection. The airstream thus blows material from the crack to complete the cleaning operation. Also coupled to the air source is an elongated flexible conduit terminating in a hand lance which can be used by an operator to provide an airstream at a remote location from the vehicle for cleaning the surface or to operate other devices requiring pressurized air.

11 Claims, 5 Drawing Figures

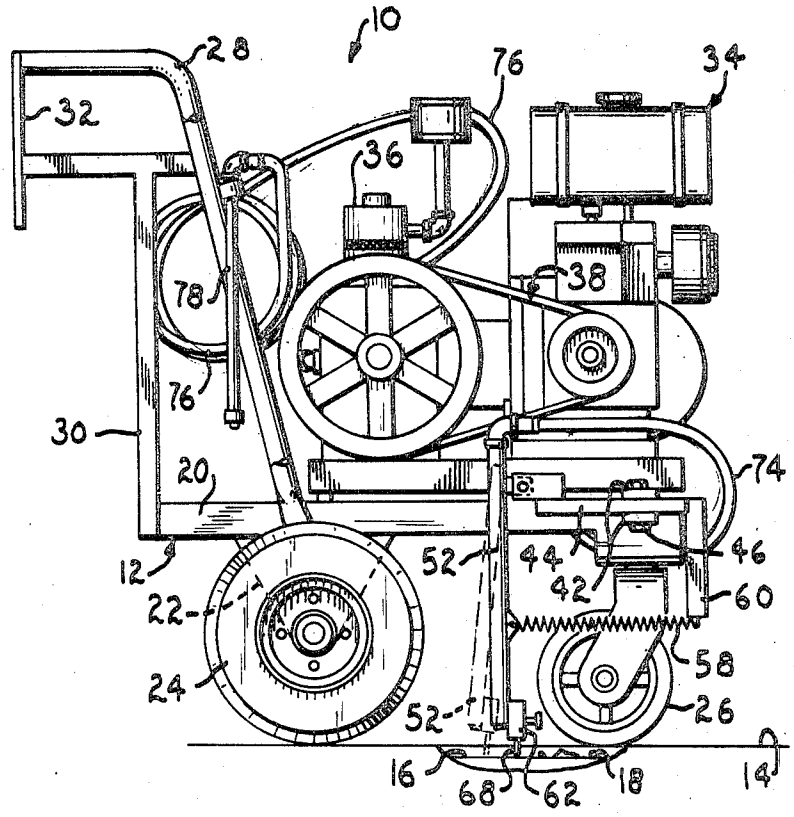


Fig. 1.

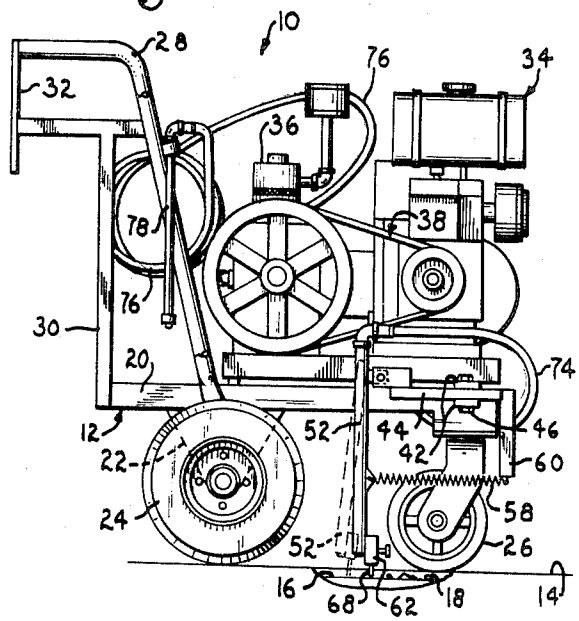


Fig. 3.

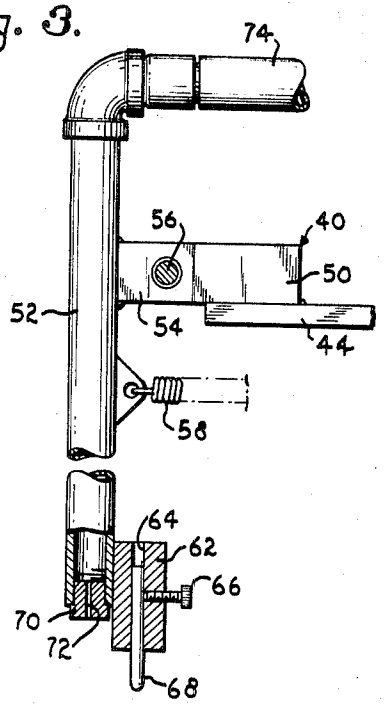


Fig. 4.

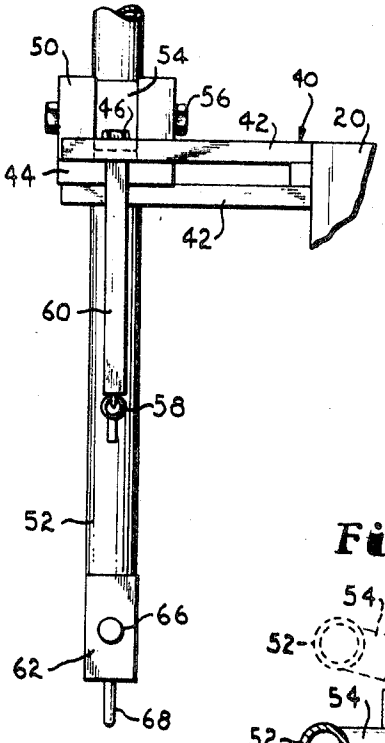


Fig. 2.

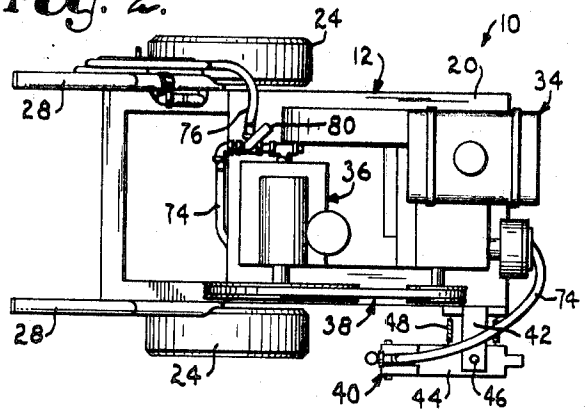
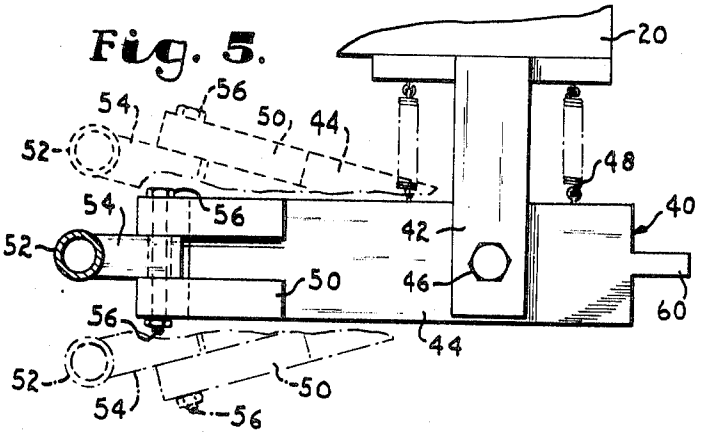


Fig. 5.



MACHINE FOR CLEANING PAVING CRACKS

This invention relates to maintenance equipment and more particularly to apparatus for cleaning foreign material from a crack in a surface. With poured concrete and other equivalent materials which are used to present a surface, aging of the surface invariably results in cracks being presented in the surface. In addition, in many instances it is necessary to leave expansion joints in the surface which joints are filled with a yieldable material. Particularly with paved surfaces such as highways, preventive maintenance requires that cracks in the surface be periodically cleaned of any material that has accumulated in the crack and the crack then filled with an asphaltic type of material to prevent further deterioration.

It has heretofore been the practice to utilize hand tools and manual labor to clean cracks in highway pavement before these cracks are filled. The existing and universally accepted technique has heretofore been to use a motor truck with driver towing a portable air compressor weighing up to 8,000 lbs. and with two or more manual laborers using steel pipe lances connected to hoses from the air compressor and using metallic points on hand tools to loosen foreign material from the paving joint. This cleaning process is necessary to the achievement of a satisfactory filling operation although the cleaning is tedious and time-consuming.

It is, therefore, an object of the present invention to provide apparatus which combines in a single mobile vehicle, a scratching tool, a source of pressurized air, and delivery means coupled with the air source for directing an airstream into the crack whereby a single operator of a small mobile vehicle can clean a crack in less time and with superior results than as heretofore been possible with the above-described technique.

Another object of this invention is to provide apparatus for cleaning material from a crack in a surface wherein a scratching rod to loosen the material and an air source for blowing the material from the crack are provided to follow along the crack, and an auxiliary tool and air system is available for cleaning the surface at a distant location from the vehicle.

Another one of the aims of this invention is to provide apparatus for cleaning material from a crack in the surface wherein the apparatus is mounted on a mobile vehicle and steering of the vehicle is facilitated by a lead wheel which is freely rotatable about a vertical axis.

Still another one of the objects of our invention is to provide apparatus for cleaning material from a crack in a surface wherein apparatus is mounted on a mobile vehicle and the vehicle is easily transportable because of a handlebar arrangement which presents a bracket for securing the vehicle on the endgate of a truck or the like without requiring that the vehicle be completely lifted into the truck.

It is also an aim of this invention to provide apparatus for removing material from a crack in a surface wherein the results obtained are superior to those achieved with manual labor because of the strategic positioning of the scratcher rod and airstream relative to the crack, which positioning is always maintained by the apparatus and is not dependent upon the skill of an operator as are prior manual techniques.

In the drawing:

FIG. 1 is a side elevational view of the crack cleaning apparatus of the present invention;

said structure being mounted for pivotal movement about both horizontal and vertical axes;

means for biasing said structure against movement while yielding under force to allow movement of the structure about said axes;

FIG. 3 is a greatly enlarged side elevational view of the scratching rod and the adjacent air delivery tube which delivers an airstream to the crack;

FIG. 4 is a front elevational view of that portion of the apparatus shown in FIG. 3; and

FIG. 5 is a greatly enlarged, top plan view of the pivotal arm structure which mounts the air delivery tube and the scratcher rod for pivotal movement about both horizontal and vertical axes.

Referring initially to FIGS. 1 and 2 wherein the apparatus of the invention is designated generally by the numeral 10, it is seen that the apparatus comprises a vehicle designated generally by the numeral 12, the vehicle being disposed for movement over a surface 14. Surface 14 has a longitudinally extending crack 16 with a material 18 occupying at least a portion of the crack. Apparatus 10 is moved over the surface along crack 16 to remove material 18 therefrom.

Vehicle 12 comprises a framework 20 having a pair of depending brackets 22 which mount a pair of aligned wheels 24. At the forward end of framework 20, spaced from and intermediate wheels 24, is a caster wheel 26 which is freely rotatable about a vertical axis to facilitate steering of vehicle 12 along crack 16. Extending upwardly from framework 20 are a pair of handlebars 28 which are partially supported by a pair of interconnected T-braces 30. Depending from the terminal end of each of the handlebars 28 and rigid with the latter as well as with a corresponding T-brace 30 is a structural element 32 which cooperates with the brace 30 to form a hanger bracket. The hanger brackets thus presented allow the entire apparatus 10 to be hung from the endgate of a truck, thus eliminating the need to lift the apparatus completely into the truck each time it is moved, particularly for short distances. Mounted atop framework 20 is a gasoline powered engine 34 which drives an air compressor 36 through a pulley assembly 38.

Disposed at one side of framework 20 is a pivotal arm structure which is designated generally by the numeral 40 and is shown in detail in FIGS. 3–5. Structure 40 is mounted on framework 20 by a pair of spaced-apart lateral projections 42 as best illustrated in FIG. 5. Projections 42 receive therebetween a horizontally disposed plate 44, and a bolt 46 which passes through projections 42 and plate 44 to allow the latter to pivot about a vertical axis as indicated by the phantom position of the plate shown in FIG. 5. To resist this lateral movement of plate 44, however, yieldable biasing means in the form of alignment springs 48 are provided extending between plate 44 and frame 20.

Extending from the rearward end of plate 44 in perpendicular relationship to projections 42 are a pair of spaced-apart mounting ears 50 that extend beyond the end of plate 44 and are rigid with the latter. An elongated, generally vertically disposed air delivery tube 52 has a mounting block 54 welded or otherwise rigidly secured to it which mounting block is received between ears 50. A bolt 56 extends through ears 50 and block 54 to provide a horizontal axis, in spaced relationship

to the axis presented by bolt 46, about which delivery tube 52 may pivot. To resist this pivotal movement, however, yieldable biasing means in the form of a coil spring 58 extends from air delivery tube 52 to a vertical bracket element 60 which depends from plate 44. At the foremost end of air delivery tube 52 a block housing 62 is welded or otherwise rigidly secured with a through-bore 64 in the housing 62 and a set-screw 66 providing a mount for a scratcher rod projection 68. Manifestly, setscrew 66 permits the exposed length of scratcher rod 68 to be varied to assure that the rod will project into crack 16. Rod 68 is preferably constructed from very hard material such as case-hardened tungsten carbide to preclude damage or breakage of the rod as it moves along crack 16 and contacts the material in the crack. It is to be noted that even when scratcher rod 68 is adjusted for minimal projection from housing 62 it will extend below the end of conduit 52 which is closed by a fitting 70 having a small outlet orifice 72 communicating with the interior of conduit 52. For maximum impingement of air into crack 16, outlet orifice 72 should be disposed between ½ inch and 1¼ inches above surface 14. Orifice 72 should have a diameter proportioned to the volume of air delivered by the compressor so that the pressure of the air impinging on the crack will be between 75–100 p.s.i.g. Because of the relative positions of scratcher rod 68 and outlet orifice 72, air delivered to delivery tube 52 through air hose 74 coupled with the tube and with compressor 36 will always be directed downwardly into crack 16 from a position spaced above the crack and behind rod 68. To this end, it is desirable to maintain the impinging airstream generally perpendicular to the surface of crack 16. Coil spring 58 assures that this position will normally be maintained and any major fluctuations as a result of striking a stationary object will be followed by a return to the normally perpendicular position.

Also coupled with air compressor 36 is a length of flexible conduit for delivering air under pressure to a hand lance 78 which is intended to be operated manually when it is desired to clean an area of surface 14 distant from the vehicle 12. A three-way valve 80 is operable to direct pressurized air from compressor 36 to either flexible conduit 74 or flexible conduit 76.

In operation, apparatus 10 is moved over surface 14 with scratcher rod 68 projecting into crack 16. As the vehicle 12 moves along the surface, if projection 68 should strike an unyielding object in the crack, delivery tube 52 will pivot about its horizontal axis into the phantom position illustrated in FIG. 1 to allow rod 68 to pass over the unyielding object without damage to the apparatus. Also, since the crack 16 will normally follow an irregular and varying path, it is desirable that tube 52 be pivotal about the vertical axis of bolt 46 to allow lateral movement of rod 68, thus assuring it will always remain in the crack even when vehicle 12 must be turned to follow the path of the crack. Springs 48 and 58 serve to return tube 52 to its normal, generally perpendicular position whenever such pivotal movement occurs. It is normally desirable that the horizontal and vertical axes of pivotal movement of arm structure 40 be disposed in spaced relationship to each other to avoid complete "universal" movement of the arm structure which would permit angular movement of the structure other than about the horizontal and vertical axes and would make it more difficult to keep rod 68 disposed in crack 16.

Air is preferably supplied to conduit 52 under a pressure of between 75 and 100 p.s.i.g. which has been found to give optimum cleaning results. To this end, the fact that tube 52 is disposed to direct the airstream downwardly in generally perpendicular relationship to the crack results in maximum cleaning effectiveness. It will be appreciated by those skilled in the art that rod 68, as it moves along crack 16, will actually serve to remove some of the larger particles from the crack while loosening all of the material which is subsequently blown from the crack by the airstream which follows the rod 68. Since the cleansing airstream is always directed into crack 16 from the optimum position spaced slightly above the crack, closely following rod 68, and generally perpendicular to surface 14, the cleaning effectiveness of apparatus 10 is far superior to that which is possible with manual labor.

If it is desired to clean an area of the surface removed from vehicle 12, the operator of the vehicle simply takes the length of conduit 76 which is coiled on vehicle 12 and utilizes lance 78 which is coupled with the conduit to loosen any material similar to the manner in which rod 68 functions. Lance 78 and its associated airstream are particularly useful in cleaning chuckholes in the highway pavement at the same time smaller cracks are being cleaned by the apparatus 10.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. Apparatus for removing material from a crack in a surface, said apparatus comprising:
   - a vehicle adapted to be moved over the surface along said crack;
   - pivotal arm structure mounted on the vehicle and including a projection extending into said crack to contact said material and dislodge the same as the vehicle moves along the crack, pivotal arm structure mounted on the vehicle and including a projection extending into said crack to contact said material and dislodge the same as the vehicle moves along the crack,
   - a source of air under pressure mounted on said vehicle; and
   - delivery means coupled with said air source for directing an airstream into said crack from behind said projection whereby said material is blown from the crack by the airstream.

2. The invention of claim 1, wherein said delivery means comprises an orifice presenting member disposed above and in spaced relationship to said crack.

3. The invention of claim 2, wherein said orifice is disposed in a horizontal plane adjacent said projection whereby to direct said airstream downwardly into said crack.

4. The invention of claim 3, wherein the size of said orifice is proportioned to the volume of air delivered by the compressor.

5. The invention of claim 4, wherein the air emanating from said source is under a pressure of between 75 to 100 p.s.i.g.

6. The invention of claim 1, wherein said horizontal and vertical axes are disposed in spaced apart relationship whereby to preclude movement of said structure other than about said axes.

7. The invention of claim 1, wherein is included a length of flexible conduit coupled with said air source, and valve means operable for directing air through said

conduit, whereby the conduit may be utilized to direct an airstream to a location distant from said vehicle whereby to remove material from said surface at said distant location.

8. The invention of claim 7, wherein is included a hand lance coupled with said conduit and adapted to be grasped by an operator for facilitating use of said airstream at said distant location.

9. The invention of claim 7, wherein said valve means is operable to direct said airstream through either said conduit or said delivery means.

10. The invention of claim 1, wherein said vehicle comprises a pair of aligned wheels disposed for engagement with said surface, and a third wheel spaced forwardly of the vehicle from said aligned wheels, said third wheel being freely rotatable about a vertical axis whereby to facilitate steering of the vehicle.

11. The invention of claim 1, wherein said vehicle includes a pair of handles extending upwardly away from said surface and adapted to be grasped by an operator to steer the vehicle, said handles comprising a bracket adapted to be placed over the endgate of a truck for supporting the vehicle when it is transported by a truck.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,755,841 Dated September 4, 1973

Inventor(s) Robert L. Goethe and Robert R. Green

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Claim 1, line 8, after "crack," the remainder of line 8 and lines 9 through 12 should be deleted and the following inserted :

-- said structure being mounted for pivotal movement about both horizontal and vertical axes;

means for biasing said structure against movement about both horizontal and vertical axes; --.

Signed and sealed this 19th day of February 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Parents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.