May 16, 1961 J. E. JACKSON 2,984,471

PORTABLE CRACK ROUTER

Filed Sept. 23, 1957 3 Sheets-Sheet 1

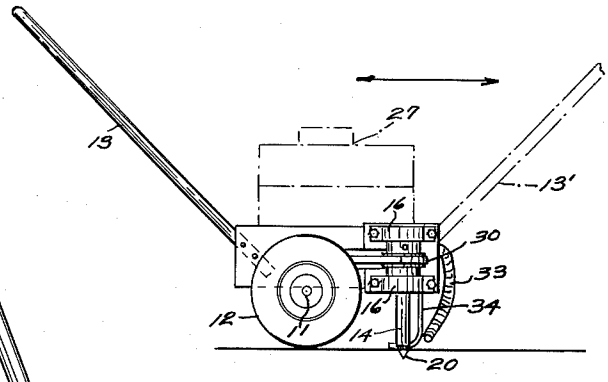


Fig. 1A

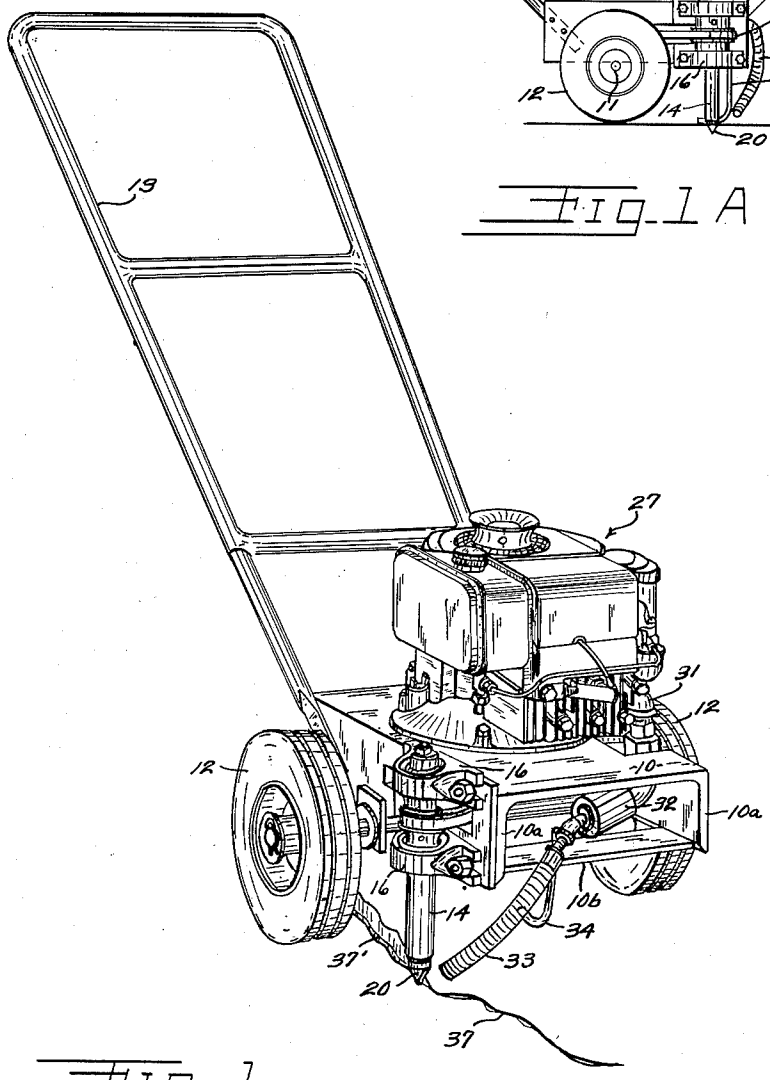


Fig. 1

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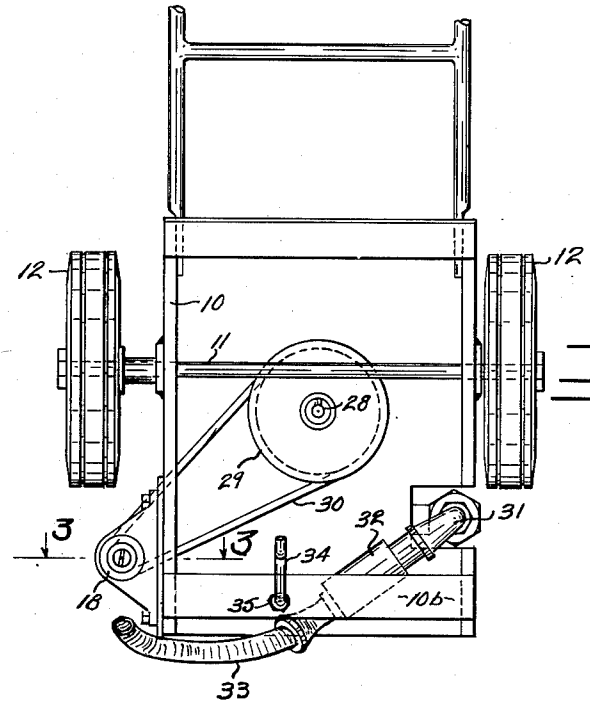


Fig. 2

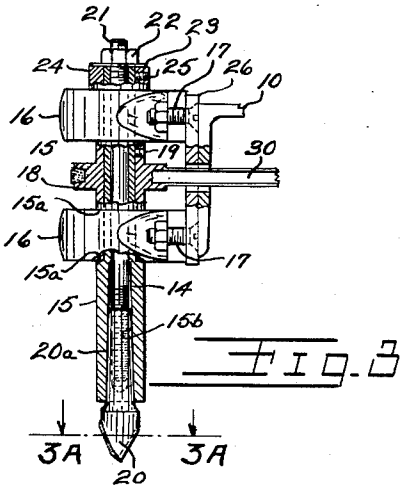


Fig. 3

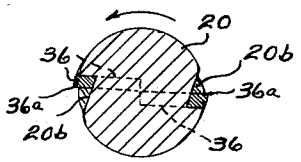


Fig. 3A

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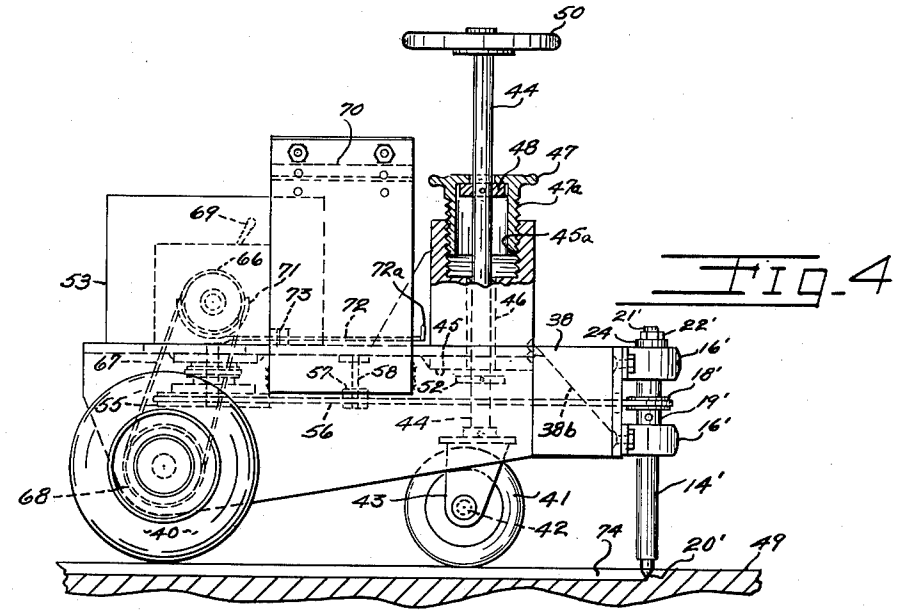


Fig. 4

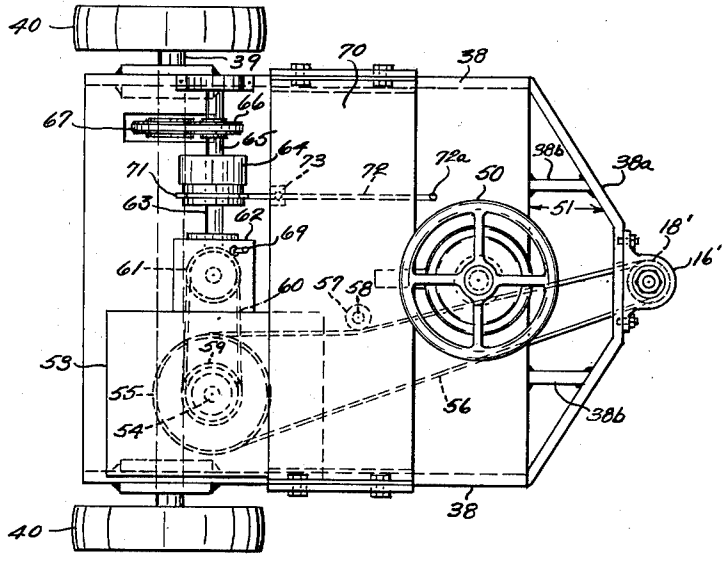


Fig. 5

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2,984,471

PORTABLE CRACK ROUTER

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4 Claims. (Cl. 262—27)

This invention relates to improvements in a crack router, or more specifically to a portable device for routing out, cleaning out or widening either a straight or random crack in a pavement prior to filling said crack with a sealing substance such as tar, asphalt or other bituminous or rubber base material.

One of the objects of the present invention is to provide a crack router having a frame, rolling support means operatively connected with the frame for supporting the same for movement over a surface, a tool mounted on the frame for rotation about a generally vertical axis and having a cutting head on the lower end thereof, together with means on the frame operatively connected with the tool for rotating the latter about its own axis and means for holding the cutting head either below or above the level of the surface being worked upon.

Another object of the present invention is to provide a router as defined in the preceding paragraph together with an internal combustion engine for rotating the tool, together with conduit means leading the gaseous exhaust from said engine to a zone closely adjacent to where the cutting head of the tool is performing its cutting operation in a pavement or the like so as to clean out the crack being operated upon either before or after the cutting operation, or both.

Another object of the present invention is to provide a novel method of cleaning out a crack in a pavement or the like which comprises the steps of rigidly supporting a tool for rotation about a generally vertical axis and having a cutting head at the lower end thereof, rotating the tool at high speed about its own axis, moving the cutting head into the crack and below the surface of the pavement and then moving the tool along the crack while maintaining the cutting head at approximately a constant level.

Another object of the present invention is to provide a portable vehicle having two or more wheels and so arranged that the operator may readily feed the cutting head of the tool into or out of a crack in a pavement while easily following the crack for the routing operation. The specification will describe two different embodiments of such a vehicle, one of which is self-propelled and ridden by the operator and the other of which is propelled by the operator walking along the pavement.

Other objects and advantages of the present invention will be apparent from the accompanying drawings and specification and the essential features thereof will be set forth in the appended claims.

In the drawings—

Fig. 1 is a perspective view of an embodiment of my invention associated with a two-wheel vehicle adapted to be propelled by the operator walking along the pavement;

Fig. 1A is a side elevational view of the device of Fig. 1 to a smaller scale and illustrating in full and dot-dash lines how the device may either be pushed or pulled by an operator;

Fig. 2 is a bottom plan view of the device of Fig. 1;

Fig. 3 is a sectional view, enlarged, taken along the line 3—3 of Fig. 2;

Fig. 3A is a sectional view, enlarged, taken along the line 3A—3A of Fig. 3;

Fig. 4 is a side elevational view of another embodiment of my invention partly broken away in central sectional view to show a detail of construction; while

Fig. 5 is a top plan view of the device of Fig. 4.

My device has a number of uses but particularly it is useful in connection with concrete or asphaltic concrete pavements such as are commonly found on highways, airports and the like. There are two chief problems related to cracks in pavements of this type. One problem relates to random cracks which are formed in the pavement due for the most part to freezing and thawing, settling of the ground etc. These are random cracks which change direction continuously and wander about in a very sinuous path. My invention is adapted to route out these cracks so that they may be filled with tar, pitch, asphalt, rubber base material or usually some such bituminous material to seal the same. Another problem is encountered in the expansion joints which generally run in straight lines across the highway or across an airport. These expansion joints are filled with a sealing compound when the pavement is first constructed, thereafter from time to time it is necessary to clean out the old sealing material and reseal these joints. My invention is also adapted for the cleaning out of such generally straight cracks for the purpose of resealing the same with a fresh sealing compound.

The form of my invention shown in Figs. 1 through 3 is useful for any of the purposes described above but it is particularly useful in following a random crack which changes direction often and suddenly. A frame **10** is provided with an axle **11** on the opposite ends of which are mounted two wheels **12** which are rotatable about the axle **11** and support the frame for movement over a surface to be worked upon. A preferably rigid handle **13** is rigidly attached to the frame **10** and this may be attached to the rear of the frame as indicated in Fig. 1 and in full lines in Fig. 1A so that the operator may walk behind the vehicle as he pushes it ahead of him. Alternatively, the handle may be fixed to the front end of the frame as indicated in dot-dash lines at **13'** in Fig. 1A so that the operator can pull the vehicle behind him. The dot-dash construction as shown at **13'** would not be connected on the outside of the channel shape frame **10** as indicated in Fig. 1, but instead could be attached to the inner faces of the flanges **10***a* of the frame **10** as will be readily understood. The handle **13** may be made adjustable for height but this is not shown here as it is quite common.

Referring to Figs. 1 and 3, a tool **14** is mounted on the frame **10** for rotation about a generally vertical axis. Obviously, the details of this tool and its mounting may be widely varied and still give satisfactory results. The embodiment here shown comprises a hollow sleeve **15** which is firmly and rotatably held in two spaced friction reducing bearings, ball bearings being used, held in the brackets or bearing caps **16** which are bolted to frame **10** at **17**. The sleeve **15** has shoulders **15***a* above and below each of the bearings and snug against the bearing races so that the tool **14** cannot move in a vertical direction. A pulley **18** has a hub which fills the space between the upper and lower bearings **16** and the pulley is fixed on the hollow sleeve **15** as by means of a set screw **19**. A cutting head **20** is held in the lower end of sleeve **15**, preferably by means of a frusto-conical shank **20***a* which fits in a complementary frusto-conical portion **15***b* at the lower end of sleeve **15**. An elongated bolt **21** is threaded into the shank **20***a* and extends out the top of the sleeve **15**. All of the parts are held in place by

a nut 22 threaded to the top of bolt 21 and engaging against a washer 23 which in turn engages against a collar 24 which is firmly secured to sleeve 15 by a set screw 25 and which collar fills the space between nut 22 and its washer on the upper side and the race of the upper bearing 16 on the lower side. Preferably, the bearing caps 16 are secured not directly to the frame 10 but instead to an intermediate plate 26 which in turn is secured to the frame 10 either by bolts or by welding.

Power means is provided on the frame 10 operatively connected with the tool 14 to rotate the same about its own axis. In the present instance, I have shown an internal combustion engine 27 mounted on the upper surface of frame 10 and having a driven shaft 28 extending downwardly through the web of the channel form frame 10 to the lower side thereof and there equipped with a large pulley 29 which is secured as by a set screw to shaft 28. A flexible drive belt 30 passes around pulley 29 driven by the engine and around the smaller pulley 18 which drives the cutting tool as previously explained. The control devices for engine 27 need no description here since they are standard and well known.

I desire to rotate the tool at a high speed sufficient to enable it to cut easily as the machine follows a crack or joint (such as in concrete). Also, I prefer a speed where the cutting bit will clear itself of sticky material such as asphalt or bituminous rubber base material. One embodiment of my invention utilizes a ¾ inch diameter bit running between 5000 and 10,000 r.p.m., with the preference close to 10,000 r.p.m.. Obviously, a larger diameter bit might rotate at a slower speed so long as the peripheral cutting speed was maintained.

Preferably, means is provided of utilizing the exhaust gases from engine 27 to clean out the crack where the cutting operation is being performed. To this end, the exhaust gases from the internal combustion engine are led through the fittings 31 to a muffler 32 and are thence connected with a flexible conduit 33 which terminates at a point near the cutting head 2. The open end of conduit 33 is near enough the cutting head 20 to blow away loose material ahead of the cutting head and also to clear away particles loosened out of the crack after the cutting head has passed.

Preferably, means is provided to enable the operator to position the cutting head 20 a predetermined distance below the surface of the pavement being operated upon. For this purpose, a substantially rigid stop member 34 in the form of a bar is passed through a suitable opening in a cross member 10*b* of the frame and secured thereto by means of nuts 35 threaded on the bar 34 above and below the cross member 10*b*. For instance, when the generally horizontal lower end of the stop member 34 is resting upon the pavement, then the cutting head 20 would normally be approximately three-quarter inches to one inch below the surface of the pavement being operated upon when utilizing a cutting tool as illustrated in Figs. 3 and 3A. This is a tool utilized to widen out a random crack so as to receive sealing material. Under other circumstances, a cutting head having a length of two or three inches, and tapering over that distance from a diameter at the top of about ¾ inch to approximately a point at the bottom is used for cleaning out old expansion joints.

A preferred form of tool for widening cracks is shown in Figs. 3 and 3A. Here, the cutting head below the shank 20*a* starts at the top with a diameter between 1 and 1¼ inches and extends downwardly approximately 1¼ inches to a point. The lower end of this cutting head would approximate a cone and flutes 20*b*, diametrically opposite each other, are cut in the sides of this cone extending from approximately the upper end thereof to the point. Hardened cutting bits 36, such as tungsten carbide, are set into the cutting head as indicated and extending down the slant of the cone and meeting in approximately a point at the bottom of the cutting tool. This is in fact a flattened point as indicated in the drawings. The cutting bits provide the cutting edges 36*a* when the tool is rotated in the direction of the arrow of Fig. 3A.

The operation of this form of my invention should now be apparent. With the engine 27 operating and rotating the tool 14 about its own axis through the medium of the belt 30, the operator moves the device on its wheels 12 while depressing the outer end of the handle 13 so as to maintain the cutting head 20 raised above the pavement being worked upon. The operator places the cutting head 20 over a random crack such as that shown at 37 in Fig. 1 and then lifts up on the handle 13 so as to move the cutting tool down into the pavement. When the stop member 34 strikes the pavement, then the operator pushes the two-wheel cart device forward following the crack 37 and causing the same to be routed out to a wider dimension as indicated at 37'. As indicated previously, the parts are so arranged that the operator can watch the cutting head 20 as he moves the device over the pavement. The two-wheel cart arrangement makes it very easy for the operator to turn quickly toward the left or right as the crack 37 changes direction. The conduit 33 directs exhaust gases from engine 27 toward the crack so as to keep it clean and to permit the operator to see what he is doing.

The form of my invention shown in Figs. 4 and 5 is a preferred form of my device when there are long straight cracks to be dealt with. This would be the case where expansion joints are formed in highways or airports, which joints need to be cleaned out either to put original or replacement sealing material in the crack.

While such a device might take a number of forms, I have shown a small cart having a frame 38 which carries a shaft 39 extending transversely thereof and equipped with wheels 40 on opposide sides of the cart rotatable with shaft 39 when the latter is driven as will hereinafter appear. The front end of the cart is here shown as supported on a single caster wheel 41 rotatably mounted on a short axle 42 which is held in the bifurcated ends of the caster bracket 43. The bracket 43 is fixed to a vertically extending steering shaft 44 which extends upwardly through a central opening in a block 45 which is fixed to the frame 38. A sleeve bearing 46 surrounds shaft 44 where it passes through block 45. An enlarged bore 45*a* is provided in the upper end of the block 45 which carries a female thread which in turn mates with a male thread on the hub 47*a* of a hand wheel 47 which surrounds shaft 44. The wheel 47 and the hollow hub 47*a* form a downwardly opening cup-shape recess which embraces a collar 48 which is pinned to the shaft 44. Thus, the collar 48 engaging the member 47, 47*a* limits the height of the frame 38 above the ground. By threading the member 47*a* out of the block 45 the cutting head 20' of the tool 14' is caused to enter into the pavement 49. By threading the member 47*a* into the block 45, the tool and its cutting head is lifted out of the pavement 49. A steering wheel 50 is fixed to the top of shaft 44 and may be turned by the operator to turn the wheel 41 and thus steer the vehicle.

The mounting of the tool 14' on this form of my device is identical with the mounting structure already described in connection with the first form of my invention. The frame of the vehicle has a forwardly extending portion 38*a*, which is open at 51 so that the operator may see down through to watch the tool, save for the gusset plates 38*b* which are welded between the main portion of the frame and the part 38*a* to give additional strength. The mounting parts for the tool are given the same reference characters as in Figs. 1 and 3 with a prime suffix added. The pulley 18' is secured to the shaft of the tool by the set screw 19' as described in connection with the reference characters 18 and 19 of Fig. 3.

Power means is provided on the vehicle to rotate the tool 14' about its own axis. For this purpose, I have

indicated an engine 53 mounted on the frame 38 and having an output shaft 54 on which is fixed a large pulley 55 which is drivingly connected by a flexible belt 56 with the pulley 18' fixed to the tool shaft. Preferably, an idler pulley 57 is mounted on a suitable shaft 58 to hold the belt 56 taut.

Means is also preferably provided for driving the vehicle over the pavement 49. For this purpose, a pulley 59 is fixed on shaft 54 and is connected by a belt or chain 60 with a pulley 61 which drives gears in a gear changing box 62 mounted on the frame. The output shaft 63 from the gear changer box is connected through clutch 64 with a shaft 65 having a pulley 66 which is connected by a chain or belt 67 with a pulley or sprocket 68 which rotates with shaft or axle 39. A gear shift lever 69 is provided on the gear changer box 62 within easy reach of an operator sitting on the seat 70. The clutch 64 is controlled by means of a yoke 71, fitting in a groove in the clutch shifting control, this yoke being oscillatable by means of a shaft 72, having a bearing at 73, and having a control member 72*a* at the forward end thereof adjacent the position of the operator. Thus, the operator may move the control member 72*a* either by hand or by foot so as to oscillate the yoke 71 and to throw the clutch 64 in or out.

Preferably, but not necessarily, the steering shaft 44 and the tool 14' are positioned in a plane extending in a fore-and-aft direction so that the operator may sit in the middle of the seat 70 straddling the steering shaft and block 45, in which position he can guide the tool very accurately along a straight line since he can line up the tool directly in front of him and along the length of the crack he is following.

The operation of the form of my device shown in Figs. 4 and 5 should now be apparent. With the engine 53 operating, the tool 14' will be rotated by means of belt 56. By controlling the gears in box 62 and manipulating clutch 64, the operator may move the vehicle until the cutting head 20' is over the crack which is to be routed. The operator will then unclutch the vehicle drive at 64 while he manipulates the wheel 47 to rotate the threaded portion 47*a* out of the block 45 and cause the cutting head 20' to enter the desired distance into the pavement 49. Upon completion of the routing of the crack 74 in the pavement, the wheel 47 is then screwed into the block 45 to lift the frame 38 and cause the tool 20' to clear the pavement for movement to another location. The collar 52 fixed to shaft 44 may be provided to limit the movement of the frame downwardly by collar 52 engaging block 45, if desired. It will be understood that the operator sitting on the seat 70 by the steering wheel 50 can look downwardly through the opening 51 and see the cutting head 20' where it engages the pavement. While not shown in the drawings, a conduit 33 may be connected to the exhaust from an internal combustion engine at 53, this conduit being conducted to a point adjacent the cutting head 20' for the same purpose as mentioned in connection with Fig. 1.

What is claimed is:

1. The method of cleaning out a crack in a pavement comprising moving in quickly changeable directions a generally vertical single pointed cutting tool comprising a bit approximately ¾ inch in diameter rapidly rotating between approximately 5,000 and 10,000 revolutions per minute about an axis substantially at right angles to the surface of the pavement into said crack, and then moving said tool along said crack while maintaining said cutting tool at the same level whereby the speed of said tool enables it to clear itself of bituminous material.

2. Apparatus for removing material from a surface such as a road, floor or airport comprising a frame, a total of two wheels operatively connected with said frame on a common axis for rotation and adapted to support said frame for rolling movement over a surface to be operated upon, a generally vertical pointed tool mounted on said frame laterally spaced from said axis and in position for engagement with said sufrace when said frame is tilted about said wheels, means on said frame operatively connected with said tool for rotating the latter about a substantially vertical axis, said means on said frame operatively connected with said tool for rotating the latter at a speed between approximately 5,000 and 10,000 revolutions per minute where said cutting tool is a bit approximately ¾ inch in diameter.

3. Apparatus for removing material from a surface such as a road, floor or airport comprising a frame, a total of two wheels operatively connected with said frame on a common axis for rotation and adapted to support said frame for rolling movement over a surface to be operated upon, a generally vertical pointed tool mounted on said frame laterally spaced from said axis and in position for engagement with said surface when said frame is tilted about said wheels, means on said frame operatively connected with said tool for rotating the latter about a substantially vertical axis, said means on said frame operatively connected with said tool for rotating the latter at a speed to provide a peripheral cutting speed approximately equal to that of a bit ¾ inch in diameter rotating between 5,000 and 10,000 revolutions per minute.

4. The method of cleaning out a crack in a pavement comprising moving into said crack and in quickly changeable directions a generally vertical and pointed cutting tool rapidly rotating about an axis substantially at right angles to the surface of the pavement at a speed to provide a peripheral cutting speed approximately equal to that of a bit ¾ inch in diameter rotating between 5,000 and 10,000 revolutions per minute, and then moving said tool along said crack while maintaining said cutting tool at approximately the same level whereby the speed of said tool enables it to clear itself of bituminous material.

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