ABSTRACT

A mobile frame mounting an extensible and retractable boom for generally upward and downward swinging movements and having a rotary saw or cutter element at its outer end for cutting grooves in concrete highway median strips or curbs transversely of the longitudinal dimension of the median strips or curbs. The boom is further movable between its operative position transversely of the direction of travel of the mobile frame and a storage position generally longitudinally of the direction of frame travel.

10 Claims, 6 Drawing Figures
CONCRETE MEDIAN AND CURB SAWING MACHINE

BACKGROUND OF THE INVENTION

This invention is in the nature of a modification of the pavement cutting apparatus disclosed and claimed in U. S. Pat. No. 3,547,492, issued to Wynn S. Binger, and is devised for the purpose of controlling the cracking of concrete highway median walls or strips, or concrete curbs. These median strips, as well as curbs are, to a great extent at the present time, formed in long continuous strips by slip molding, so that no expansion joints are formed. In areas having wide seasonal temperature variation, the strips and curbs crack due to expansion and contraction. The cracking or fracture of the concrete normally occurs at random spacing and along crooked lines, leading to an unsightly appearance and often resulting in weakened portions.

SUMMARY OF THE INVENTION

An important object of this invention is the provision of a machine which can quickly and easily produce grooves in concrete highway median strips and concrete curbs, so as to promote cracking or fracture of the median strips or curbs within the grooves, where the cracks are controlled as to direction and hidden from view.

Another object of this invention is the provision of a machine as set forth which is easily moved from place to place.

Another object of this invention is the provision of a sawing machine having portions movable between operative and storage positions, and wherein the same occupies only a small space when in storage.

To the above ends we provide a frame having driving wheels and steerable wheels, fluid operated motors for imparting rotation to the driving wheels, an extendable and retractable boom mounted on the frame for generally upward and downward swinging movements on a generally horizontal axis and for rotation about a generally vertical axis between an operative position generally transversely of the direction of movement of the frame and a storage position generally longitudinally of the direction of movement of the frame. A disk-like rotary cutting element or saw is mounted on the outer end of the boom, and is driven by a fluid pressure operated motor also mounted on the outer end of the boom. An engine on the frame drives a pumping mechanism for supplying fluid under pressure to the saw operating motor as well as to the wheel driving motor. Flexible conduits extend from the pumping mechanism on the frame to the saw operating motor on the outer end of the boom, and mechanism is provided for supporting the flexible conduits in all positions of extending and contracting movements as well as swinging and rotary movements of the boom.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in top plan of a machine produced in accordance with this invention, some parts being broken away;

FIG. 2 is a transverse section taken substantially on the line 2—2 of FIG. 1;

FIG. 3 is an enlarged fragmentary section taken substantially on the line 3—3 of FIG. 1 and showing a different position of some of the parts;

FIG. 4 is a fragmentary view, partly in side elevation and partly in section, taken generally on the line 4—4 of FIG. 1;

FIG. 5 is an enlarged fragmentary view in elevation of conduit supporting means of this invention, some parts being broken away and some parts being shown in section; and

FIG. 6 is an enlarged fragmentary section taken on the line 6—6 of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawings, a vehicle is shown as including an elongated generally rectangular frame indicated generally at 1, supported adjacent its rear end by a pair of laterally spaced pneumatic tire-equipped drive wheels 2 and adjacent its front end by a pair of pneumatic tire-equipped steerable wheels 3. The frame 1 comprises a pair of laterally spaced longitudinal side frame members 4 and 5 connected at their opposite ends by front and rear cross-frame members 6 and 7 respectively. Adjacent the front end of the frame 1, a conventional internal combustion engine 8 is supported on cross-frame members 9 and 10, the side frame members 4 and 5 being further connected by a plate-like member 11 rearwardly of the member 10, a control board 12 including laterally spaced legs 13 each welded at their lower ends to a different one of the side frame members 4 and 5, and a rear deck 14 disposed rearwardly of the legs 13. An oil tank or reservoir 15 is mounted between the side frame members 4 and 5 rearwardly of the cross-frame member 10, and a fuel tank 16 is mounted in the frame 1 below the deck 14, the reservoir 15 and fuel tank 16 having filler openings that are closed by respective caps 17 and 18.

The drive wheels 2 are mounted on and drivingly connected with conventional hydraulic motors 19 that are bolted to angle brackets 20 rigidly secured to the frame members 4 and 5 by tubular spacers 21 and other suitable means such as nut-equipped bolts 22. As shown particularly in FIGS. 1, 4 and 5, the control board legs 13 and motor brackets 20 are braced by a tubular cross member 23 that is welded or otherwise rigidly secured at its opposite ends to the legs 13 and motor brackets 20.

The steerable wheels 3 are journaled on supporting portions 24 having axially inner ends that are journaled on wheel mounting brackets 25 by means of king-pins or bolts 26, the brackets 25 being welded or otherwise rigidly secured to the side frame members 4 and 5 adjacent the front ends thereof. The steering movement is imparted to the wheels 3 by a fluid operated mechanism comprising a cylinder 27 and a cooperating piston-equipped piston rod 28, the cylinder 27 having a closed end connected to a bracket 29 suitably mounted on frame 1. With reference particularly to FIG. 2, it will be seen that the piston rod 28 extends outwardly from the opposite end of the cylinder 27 and is pivotally connected at its free end to the intermediate portion of an elongated steering link 30, as indicated at 31. The opposite ends of the link 30 are pivotally connected to rearwardly projecting knuckle portions 32. Fluid under pressure is supplied to the cylinder 27 from one of a pair of fluid pumps 33 and 34 through steering valve mechanism not shown but contained in the control board 12 and operated by a steering wheel 35. Likewise, the wheel driving motors 18 are supplied with
fluid under pressure from one of the pumps 33 or 34, the speed of operation of the wheel drive motors 18 being controlled through suitable valve means, not shown, but located in the control board 12 and operated by a control lever 36. It may also be assumed that the control lever 36 controls the direction of rotation of the drive wheels 2 as well as the speed thereof.

An extensible and retractable boom, indicated generally at 37, comprises a plurality of cross-sectionally rectangular hollow telescoping boom sections 38, 39, 40 and 41, the boom section 38 having secured thereto an inverted generally U-shaped bracket 42 through which extends a shaft 43 that is disposed on a horizontal axis extending transversely of the boom 37. The shaft 43 is journaled at its opposite end in bearings 44 that are rigidly mounted on a base member or turntable 45 that is mounted on the plate-like member 11 for rotary movements on a generally vertical axis, by means of a nut-equipped pivot screw 46. As shown particularly in FIG. 3, the inner end boom section 38 is of the largest cross-sectional dimension, the next smaller boom section 39 being longitudinally slidable mounted therein. The boom section 40 is longitudinally slidable in the boom section 39, and the outermost boom section 41 is slidable in the boom section 40. The boom sections 38-41 are provided at their outer ends with respective laterally outwardly projecting flanges 48, 49, 50 and 51. Each of the flanges 49, 50 and 51 is provided with a respective tie rod 52, 53 and 54 which extends longitudinally inwardly therefrom and through a suitable opening in a respective one of the flanges 48, 49 and 50, the inner ends of each rod 52, 53 and 54 being provided with a stop collar or nut 55 that engages a respective one of the flanges 48, 49 and 50 to limit outward movement of each boom section 39, 40 and 41 relative to each other and to the inner boom section 38.

Means for imparting extending and retracting movements to the boom sections 39, 40 and 41 relative to each other and to the inner boom section 38, comprises a fluid pressure operated series of telescoping pistons 56, 57, 58 and 59, the former of which is anchored at one end to the outer end of the boom section 41 by means of a transverse anchoring pin 60, the opposite end of the innermost cylinder 59 being connected to the inner boom section 38 by means of a transverse anchoring pin 61, see FIG. 3. The cylinders 56-59 of well-known construction, the inner cylinder 59 having connected thereto a pair of conduits 62 which may be assumed to be connected to one of the pumps 33 and 34 through suitable valve means, not shown, but which may be assumed to be mounted in or under the control board 12, and operated by control members 63 and 64.

Means for pivotally moving the boom 37 about the axis of the shaft 43 comprises a fluid pressure cylinder 65 and a cooperating piston 66 to which is connected a piston rod 67 that projects axially outwardly from the upper end of the cylinder 65. The lower end of the cylinder 65 is provided with a transverse shaft 68 pivotally mounted in a pair of bearings 69 on the turntable 45. The outer end of the piston rod 66 is connected to one end of an elevator bracket 70, by means of a pivot pin 71, the bracket 70 being rigidly secured to the innermost boom section 38 in spaced relation to the pivot shaft 43 longitudinally with respect to the boom 37. By means of the pivot connection afforded by the pivot shaft 43 and pins 68 and 71, the boom 37 may be swung upwardly or downwardly from its generally horizontal position shown by full lines in FIG. 2, and in FIG. 3. As shown in FIG. 2, the cylinder 65 is provided at its opposite ends with conduits 72 for connection to one of the pumps 33 or 34 through suitable control valve mechanism, not shown, but which may be assumed to be mounted in the control board 12 and operated by control members 73 and 74.

A cutting head 75 is bolted or otherwise rigidly secured on the outer end of the outermost boom section 41, and has rigidly mounted thereon a rotary fluid pressure operated motor 76 having an output shaft 77 the outer end of which is journaled in a bearing 78 on the head 75. A circular saw or cutting element 79 is mounted on the drive shaft 77 for common rotation therewith, and partially underlies a hood or shroud 80 that is pivotally connected to the cutting head 75. The shroud 80 is provided with a fitting 81 for delivery of coolant liquid to the cutting blade or saw 79, a flexible conduit 82 being connected to the fitting 81 and extending generally longitudinally of the boom wherein it is supported by the control board 12 by valve means contained within a housing 83. The extreme inner end of the conduit 82 is provided with a fitting 84 for connection to other suitable conduit means for delivery to the conduit 82 of coolant liquid from a suitable source of supply, such as a mobile tank or the like, not shown. The rotary fluid pressure operated motor 76 is provided with flexible fluid conduits or hoses 85 that are operatively connected to one of the pumps 33 or 34, flow of fluid to the motor 76 being controlled by conventional valve means not shown, but which may be assumed to be supported in the control board 12 and operated by a control member shown more, or less diagrammatically at FIG. 1. In view of the fact that the conduits or hoses 82 and 85 must be of sufficient length to reach the cutting head 75 when the boom 37 is in its maximum extended condition, means for supporting the conduits 82 and 85 intermediate their ends is provided. Such means comprises a rigid upright mast 87 including a lower tubular mast portion 88 welded or otherwise rigidly secured at its lower end to the plate-like member 11, and an upper portion 89 extending upwardly from the lower portion 88 and terminating in a laterally offset upper end 90. A pulley 91 is secured to the upper mast end 90 and has entrained therewith a flexible cable 92 one end of which is formed into a loop 93 through which the conduits 82 and 85 extend. The opposite end of the cable 92 is rigidly secured to a counterweight 94 loosely contained within the lower tubular mast portion 88 for free vertical movement therein. As the boom 37 is extended to its dotted line position of FIG. 2, the conduits 82 and 85 are moved to be disposed toward a generally parallel relationship with the boom 37, against bias of the counterweight 94. When the boom 37 is retracted to its position of FIG. 1 and its full line position of FIG. 2, the counterweight 94 moves downwardly in the tubular mast portion 88 to raise the intermediate portions of the conduits 82 and 85, so as to prevent the conduits 82 and 85 from becoming entangled in other members of the apparatus, or from dragging on the ground. A concrete median strip is shown in cross section in FIG. 2, and indicated generally at 95. As above indicated, median strips of this type are commonly formed from concrete poured into slip molds and devoid of expansion joints. For the purpose of providing transverse grooves at predetermined longitudinally spaced inter-
vals, the apparatus of this invention is driven along the roadway, stopped at said spaced intervals, and the cutting blade or saw 79 applied to the median strip. When it is desired to cut a given groove, the apparatus is properly placed relative to the median strip 95, the boom 37 raised by manipulation of the valve control members 73 and 74 and extended so that the cutting blade or saw 79 overlies the top of the median strip 95. The motor 76 is then energized to impart rotation to the cutting blade 79 and the boom is lowered so that the cutting blade 79 engages the top of the median strip 95 and cuts its way downwardly therein to produce a transverse groove 96 in the top of the median strip 95. The depth of the groove 96 is determined by engagement of the median strip 95 by the outer peripheral surface of a rotary guide or gauge wheel 97 journaled on the shaft 77 adjacent one side of the cutting blade or saw 79. The boom 37 is extended or retracted as desired, so that the groove 96 extends across the entire width of the median strip 95. Upon completion of the groove 96, the boom 37 is manipulated so that the cutting blade 79 produces a groove portion 98 that extends downwardly in the side of the median strip 95 facing the machine. Preferably, during the cutting of the groove 96 and 98, the control members 73 and 74 are manipulated so that the head or outer end of the boom 37 descends under action of gravity, so that undue pressure on the cutting blade 79 is avoided. It will also be appreciated that, during cutting of the groove portion 98, only sufficient fluid pressure is maintained within the telescoping cylinders 56–59 to maintain the guide wheel 97 in rolling engagement with the adjacent side wall surface of the median strip 95. Also, during operation of the blade driving motor 76, coolant liquid is supplied to the cutting blade 79 through the conduit 82. After a predetermined number of cross grooves 96 and groove portions 98 have been cut in one side of the median strip 95, the apparatus or machine is moved to the opposite side of the median strip 95 and groove portions 99 are cut in the opposite side of the strip 95, in alignment with the grooves 96 and groove portions 98.

It will be appreciated that curbs not shown, but provided in many concrete street and road constructions, may be grooved in the same manner as the median strip 95, it being only necessary to lower the boom 37 into engagement of the cutting blade 79 with the curb, not shown. When it is desired to move the machine from one location to another, the boom 37 is preferably moved to its generally level and fully retracted condition as shown in FIGS. 1 and 2, so that a minimum of space on the road is taken up by the machine. Further, as indicated by broken lines in FIG. 1, the boom 37, together with the turntable 45, may be pivotally moved to a storage position, on the axis of the pivot bolt 46, to a storage position wherein the boom 37 extends longitudinally of the frame 1, as shown by broken lines in FIG. 1. In this storage position of the boom 37, the cutting head 75 is disposed to overlie the pumps 33 and 34 behind the engine 8.

While we have shown and described a commercial embodiment of our concrete median and curb sawing machine, it will be understood that the same is capable of modification without departure from the spirit and scope of the invention, as defined in the claims.

What is claimed is:

1. A concrete median and curb sawing machine comprising:

   a. a mobile frame;

   b. a longitudinally extensible and retractable boom operatively extending generally transversely of the direction of traveling movement of the frame and having inner and outer ends;

   c. mounting means mounting the boom adjacent its inner end on said frame structure for pivotal movements of said boom on a generally horizontal axis extending transversely of the boom;

   d. means for imparting pivotal movement to said boom on said generally horizontal axis;

   e. a disk-like cutter element;

   f. means journaling said cutter element on the outer end of said boom for rotation on an axis parallel to said horizontal axis of pivotal movement of said boom relative to said frame;

   g. a rotary guide wheel journaled on the outer end of the boom on the extended axis of said cutter element and having a radially outer circumferential surface engaging the surface of material to be cut by said cutter element to control the depth of cut made by said cutter element;

   h. and means for imparting cutting rotation to said cutter element;

2. The machine defined in claim 1 in which said boom comprises a plurality of telescoping boom sections, characterized by fluid pressure operated cylinder and piston means for imparting boom extending and retracting movements to said boom sections.

3. The machine defined in claim 2 in which said boom sections are hollow, said cylinder and piston means being disposed longitudinally within said boom.

4. The machine defined in claim 1 in which said mounting means comprises a base member mounted on said mobile frame for rotation on a generally vertical axis, said boom being pivotally mounted on said base member on said generally horizontal axis, whereby said boom may be pivotally moved generally upwardly and downwardly and swung on said generally vertical axis between an operative position generally transversely of said frame and a storage position generally parallel to the direction of movement of said frame.

5. The machine defined in claim 1 characterized by ground-engaging wheels supporting said frame, a pair of fluid pressure operated motors operatively connected to a pair of said wheels for driving said frame, pump means for supplying fluid under pressure to said motors, and an engine drivingly connected to said pump means.

6. The machine defined in claim 5 in which said wheels include a pair of steerable wheels, characterized by a fluid pressure operated steering motor operatively connected to said pump means for imparting steering movements to said steerable wheels.

7. The machine defined in claim 5 in which said means for imparting cutting rotation to said cutter element comprises a fluid pressure operated cutter drive motor mounted on said outer end of the boom and having a rotary shaft connected to said cutter element, and conduit means operatively connecting said rotary motor to said pump means.

8. The machine defined in claim 7 in which said conduit means comprises flexible tubing extending between said cutter drive motor and said pump means, and a supporting device for supporting said tubing intermediate the opposite ends thereof in all positions of extension and contraction of said boom.
9. The machine defined in claim 8 in which said supporting device comprises a mast extending upwardly from said frame, a pulley on the upper end of said mast, a flexible cable element entrained over said pulley and having opposite ends one of which is secured to said conduit means, and a counterweight connected to the other end of said cable.

10. The machine defined in claim 9 in which said mast includes a tubular portion, said counterweight being disposed for vertical movements axially within said tubular portion.