United States Patent

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a corporation of Minnesota. by mesne assignment to

[54] **VIBRATORY RIPPER PLOW**
3 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **172/40,** 61/72.6; 172/264, 172/710
[51] **Int. Cl.** **A01b 35/06**
[50] **Field of Search** ..... 172/40, 464, 264, 710, V.D; 61/72.6

[56] **References Cited**

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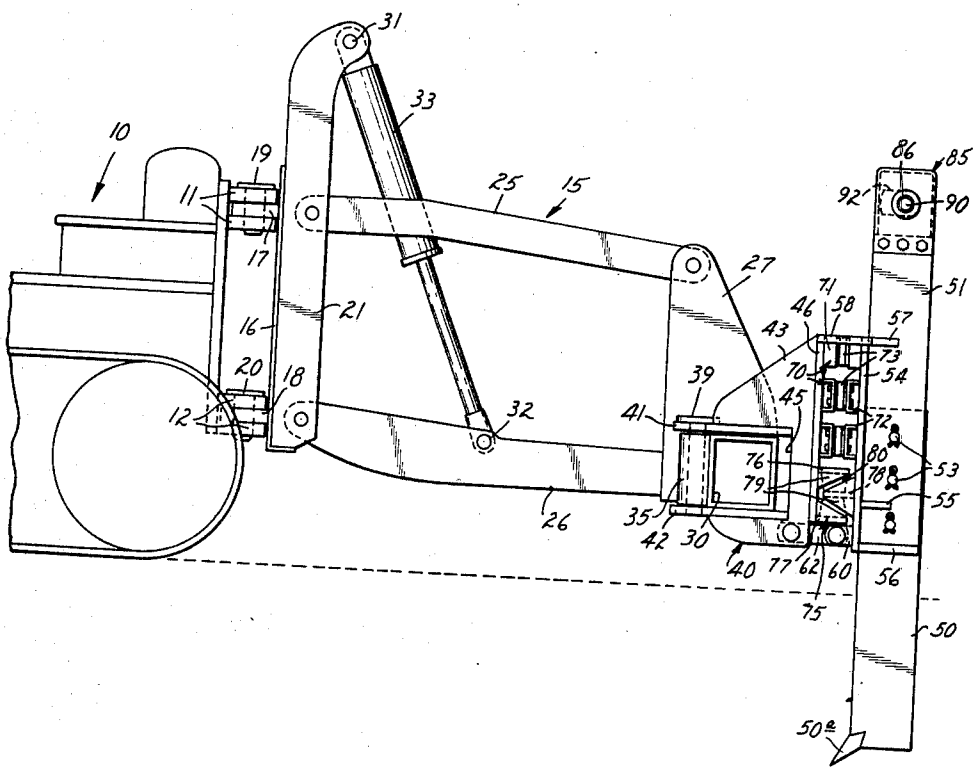
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ABSTRACT: An elongated ripper plow blade attached to an intermediate member by a mechanical link allowing limited vertical movement and a plurality of resilient pads designed to enhance vibratory movement and the intermediate link being connected to a vertically movable frame so as to allow limited rotary movement thereof about a vertical axis. A hydraulically operated rotary eccentric attached to the plow blade to produce vibratory movement of the plow blade to enhance the ripping or plowing action.



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SHEET 1 OF 3

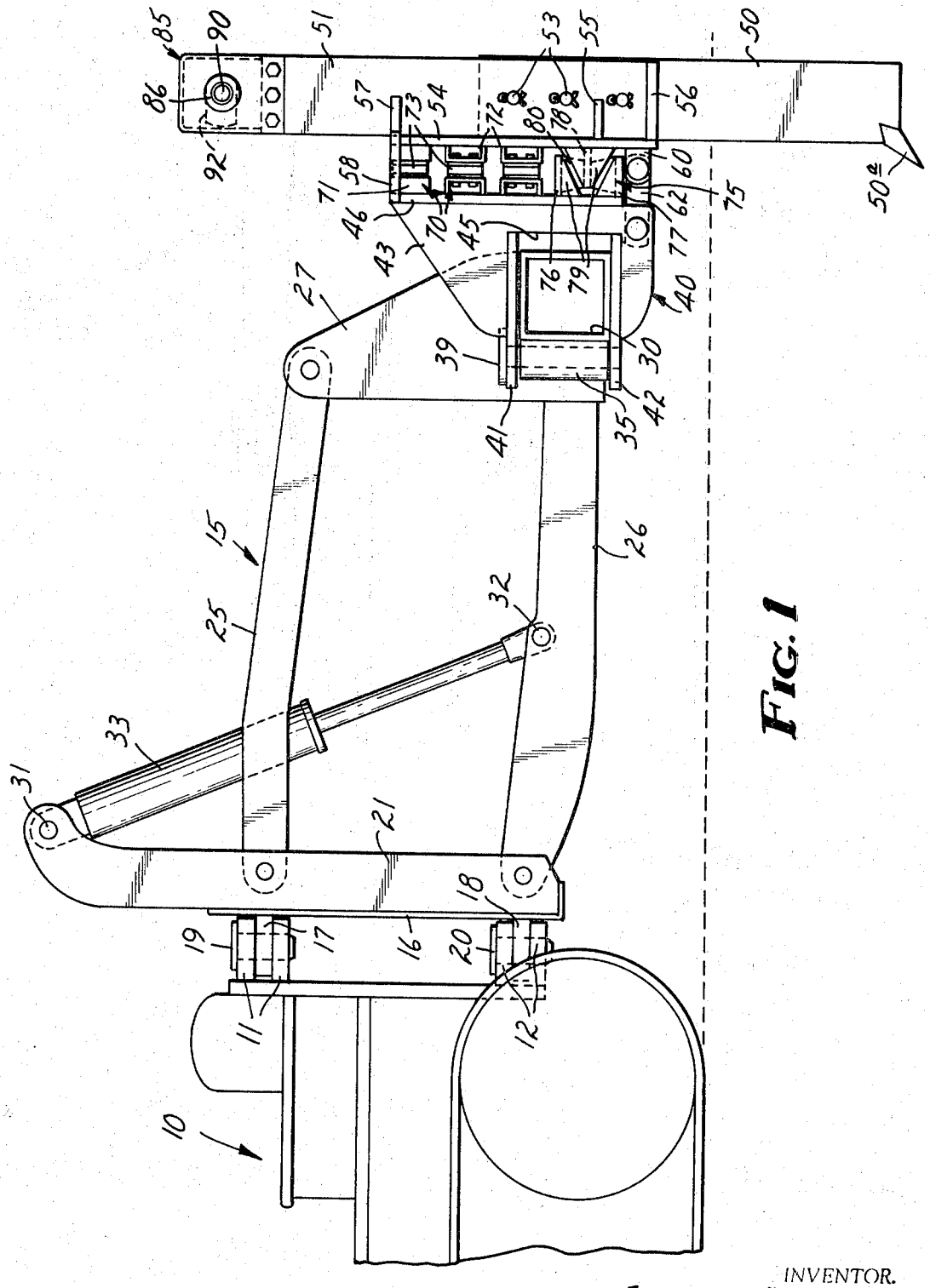


FIG. 1

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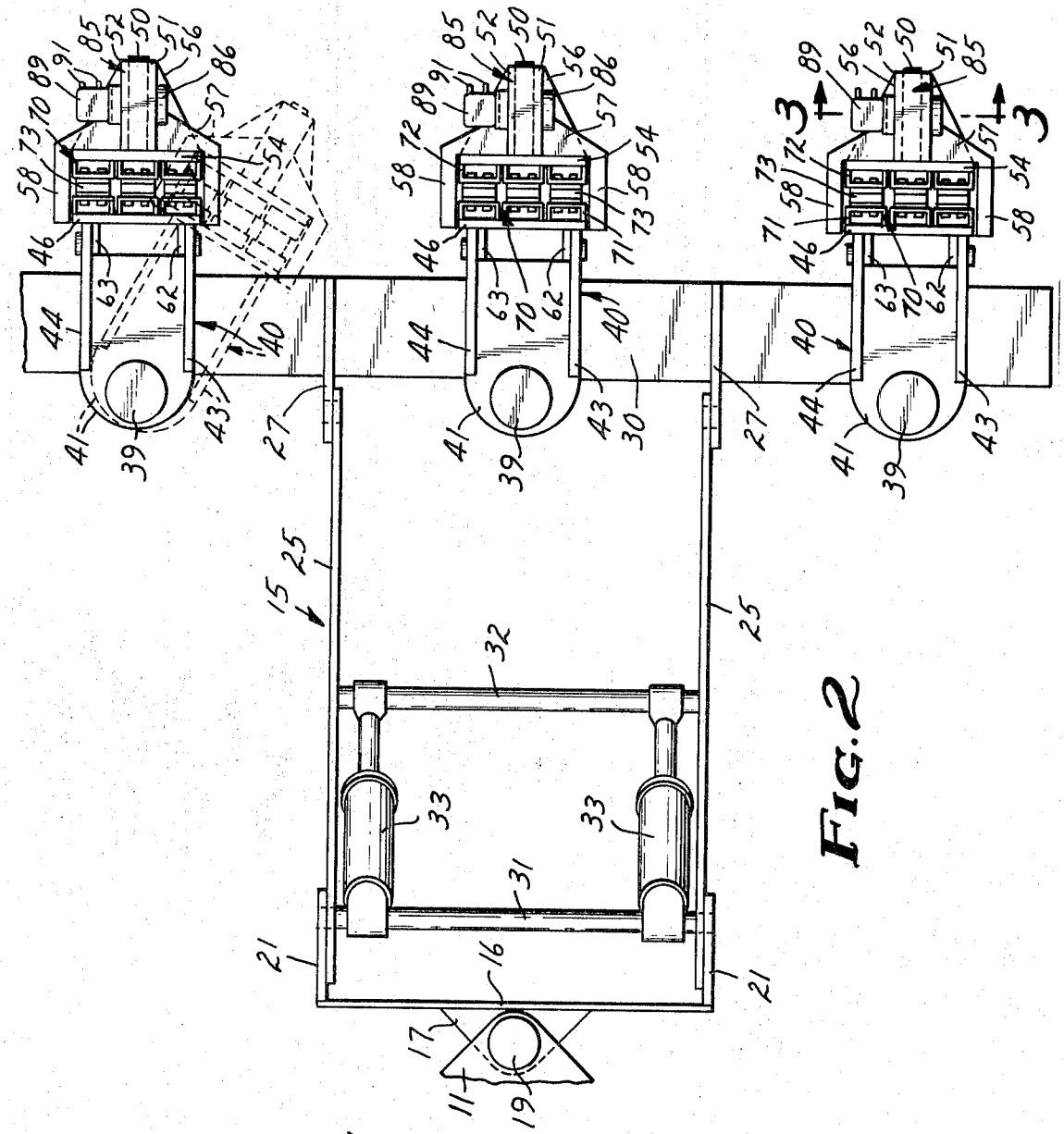


FIG. 2

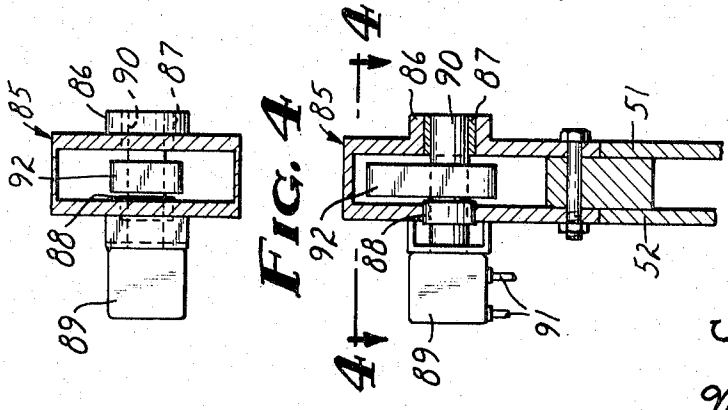


FIG. 4

FIG. 3

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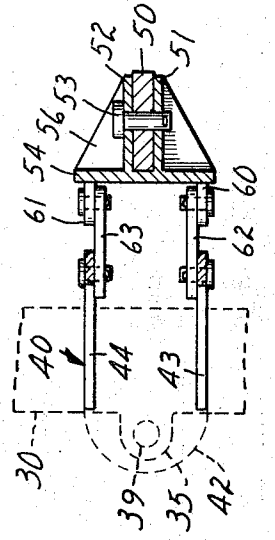


FIG. 6

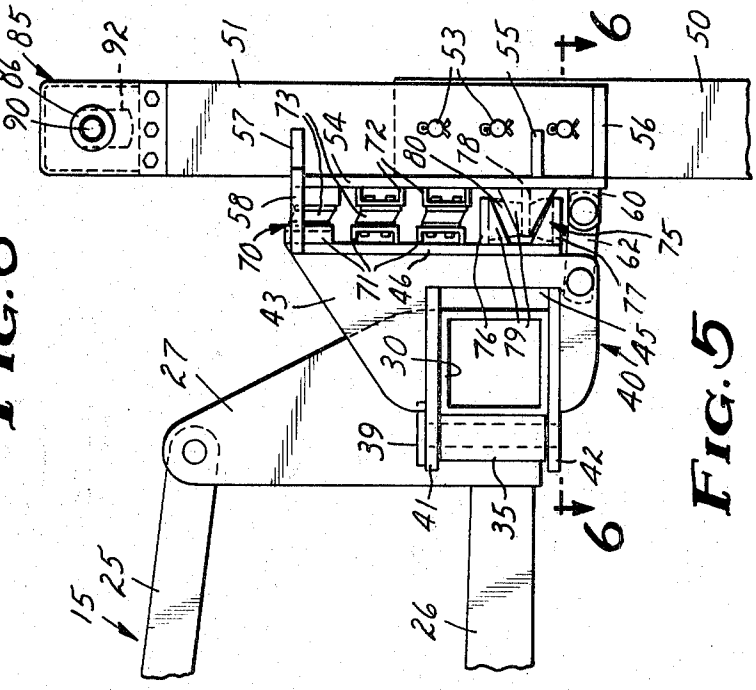


FIG. 5

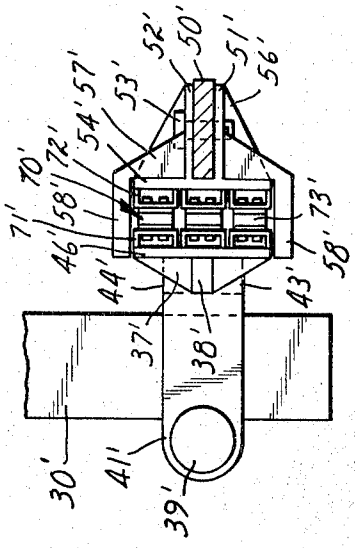


FIG. 8

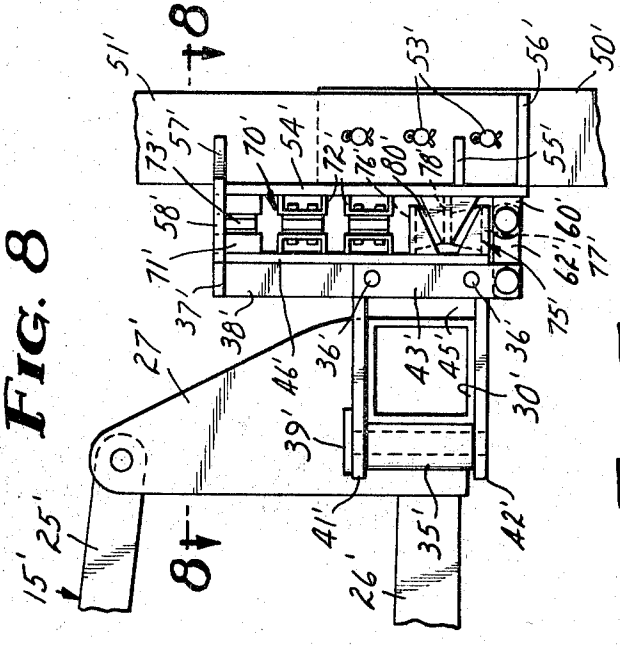


FIG. 7

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VIBRATORY RIPPER PLOW

BACKGROUND OF THE INVENTION

1. Field of the Invention

Ripper plows in general are heavy-duty plows utilized to break up exceptionally hard ground, rocky soil, old road beds and the like for construction or other improvements thereon. The ripper plows are utilized simply to break up the soil and any additional work is generally performed with additional tools or implements.

2. Description of the Prior Art

In the prior art ripper plows generally consist of a blade fixedly attached to a frame which may have wheels thereon or may be fixedly attached to a tractor or the like. The ripper plow is then utilized to break up the ground by shear brute force. Since ripper plows are utilized to break up exceptionally hard or rocky ground, there are exceptionally large forces on the various parts of the plow and the tractor during usage thereof. These large forces produce much breakage and damage to the equipment. Also, in many instances the plow blade is engaged in the ground so that forward movement is literally impossible and the tractor must be reversed to disengage and loosen the blade. This engagement of the blade and consequent reversal of the tractor produces great strain on the equipment and consumes much valuable time.

SUMMARY OF THE INVENTION

The present invention pertains to a vibratory ripper plow apparatus which includes a frame having at least a rear portion thereof which is vertically movable, an elongated ripper plow blade, means mounting the blade on the frame for limited rotational movement about a vertical axis and for vibratory movements, and means attached to the plow blade for producing vibratory movements therein.

It is an object of the present invention to provide a new and improved vibratory ripper plow.

It is a further object of the present invention to provide a ripper plow having a blade mounted so that it is free to vibrate in at least a vertical direction.

It is a further object of the present invention to provide a ripper plow having vibratory means attached thereto for providing vibrating motion therein.

These and other objects of this invention will become apparent to those skilled in the art upon consideration of the accompanying specifications, claims and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring to the drawings, wherein like characters indicate like parts throughout the figures:

FIG. 1 is a view in side elevation of the present ripper plow apparatus;

FIG. 2 is a view in top plan of the apparatus illustrated in FIG. 1;

FIG. 3 is an enlarged sectional view as seen from the line 3–3 in FIG. 2;

FIG. 4 is a sectional view as seen from the line 4–4 in FIG. 3;

FIG. 5 is a view in side elevation similar to FIG. 1, parts thereof removed, illustrating the apparatus in a different position;

FIG. 6 is a sectional view as seen from the line 6–6 in FIG. 5;

FIG. 7 is a view in side elevation similar to FIG. 5 illustrating a different embodiment; and

FIG. 8 is a sectional view as seen from the line 8–8 in FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings the numeral 10 generally designates draft means; which for exemplary purposes is illustrated as tread-type tractor. Upper and lower clevis-type hitches 11 and 12, respectively, are fixedly attached to the rear of the tractor 10. It should be understood that the particular draft means utilized and the hitch connecting the apparatus to the draft means do not form a portion of this invention and are illustrated simply for purposes of explanation.

The plow apparatus includes a frame generally designated 15 having a vertical plate 16 positioned generally perpendicular to the direction of travel. The plate 16 has two spaced apart horizontal plates 17 and 18 with vertical holes therethrough which mate with the hitches 11 and 12 to receive pins 19 and 20 therethrough. A pair of elongated members 21 are affixed to the plate 16 along one edge thereof by welding or the like so as to extend the vertical length of the plate 16 and a substantial distance thereabove and to project rearwardly therefrom. Each of the elongated members 21 are hooked slightly rearwardly at the upper end thereof for purposes which will be explained presently. The frame 15 also includes two upper elongated members 25 pivotally pinned to the elongated members 21 so as to extend generally horizontally rearwardly and in a parallel spaced apart relationship. A second lower pair of elongated members 26 are pivotally pinned to the members 21 so as to extend generally horizontally rearwardly in a parallel spaced apart relationship. The elongated members 25 and 26 are pivotally attached adjacent their rearmost ends to a pair of parallel spaced apart plates positioned in a generally vertical direction and parallel to the direction of movement. Each of the plates 27 has a generally rectangular shaped notch in the lower edge thereof and an elongated beam 30 is fixedly engaged therein by welding or the like so as to extend generally horizontal and perpendicular to the direction of motion.

Holes are provided through the elongated members 21 adjacent the upper ends thereof in the rearwardly hooked portions and a rod 31 is fixedly engaged therethrough. Holes are also provided through the members 26 approximately midway between the front and rear ends thereof and a rod 32 is fixedly engaged therethrough. A pair of hydraulic presses 33, each having a cylinder pivotally connected to the rod 31 and a connecting rod attached at one end to a hydraulic piston within the cylinder is pivotally attached at the free end to rod 32, so that actuation of the hydraulic presses 33 produces vertical movement of the plates 27 and the horizontal beam 30.

The beam 30 has one or more hollow cylinders 35 fixedly attached, with the axes thereof generally vertical, to the front edge of the beam 30 by some means such as welding or the like. The hollow cylinders 35 form hitches and in general have an axial length approximately equal to the vertical thickness of the beam 30. Intermediate members 40 are pivotally attached to the beam 30 by means of pins 39 extending through the hollow cylinders 35. While three cylinders 35 and three intermediate members 40 are illustrated in the present embodiment it should be understood that any number of cylinders might be attached to the beam 30 and the number of intermediate members 40 and plows attached thereto are limited only by the particular task being performed and the amount of power available from the draft means.

Each of the intermediate means 40 are constructed so as to be approximately similar and include upper and lower generally horizontal plates 41 and 42 spaced vertically apart a distance slightly greater than the vertical width of the beam 30. A pair of generally vertically positioned plates 43 and 44 are fixedly attached to opposite sides of the horizontal plates 41 and 42, by welding or the like, and each of the vertical plates 43 and 44 has a rectangular shaped notch 45 in the front surface thereof, which coincides with the area between the horizontal plates 41 and 42. Each of the horizontal plates 41 and 42 has a hole therethrough adjacent the front edge to receive the pin 39 through the holes therein and one of the hollow cylinders 35. The beam 30 is positioned in notch 45 between the horizontal plates 41 and 42 and the length of the notch 45 in the direction of movement is sufficient to allow limited pivotal movement of the intermediate member 40 about the pin 39. A vertical plate 46 is affixed to the rear edges of the vertical plates 43 and 44, by some means such as welding or the like to present a flat rearwardly directed surface.

An elongated plow blade 50 having a sharpened plow point 50*a* at the lower forward corner thereof is affixed between two vertically upwardly extending generally rectangular shaped

supports 51 and 52. The supports 51 and 52 are pinned to the upper end of the blade 50 by means of a plurality of pins 53 so that the blade 50 extends generally vertically downwardly a substantial distance below the apparatus while the supports 51 and 52 extend generally vertically upwardly above the apparatus. A plate 54 is affixed to the forward edges of the supports 51 and 52, by welding or the like, so as to be generally coextensive and parallel with the plate 46 but spaced rearwardly therefrom. A plurality of fillets 55 and 56 are fixedly engaged between the supports 51 and 52 and the plate 54 to provide the assembly with sufficient strength to withstand the rigors of plowing. A third pair of fillets 57 are fixedly engaged between the upper edge of the plate 54 and the supports 51—52 and each of the fillets 57 includes a generally horizontal arm 58 which extends forwardly from the plate 54 past the plate 46 when the apparatus is correctly positioned. The arms 58 of the fillets 57 prevent transverse horizontal movement of the blade 50 and supports 51—52 during operation thereof.

A pair of small connecting plates 60 and 61 are fixedly attached to the forward surface of the plate 54 adjacent the lower edge thereof so as to be approximately parallel and spaced rearwardly from the plates 43 and 44 of the intermediate member 40. One end of a first elongated link 62 is pivotally attached to the outwardly extending end of the connecting plate 60 and the opposite end is pivotally attached to the lower portion of the plate 43. One end of a second link 63 is pivotally attached to the outwardly extending end of the connecting plate 61 and the other end is pivotally attached to the lower portion of the plate 44. The length of links 62 and 63 is such that the links 62 and 63 are approximately horizontal when the plates 46 and 54 are approximately coextensive and parallel. Further, the links 62 and 63 attach the assembly holding the blade 50 to the intermediate member 40 while allowing limited vertical movement of the blade 50.

A plurality of resilient pads generally designated 70 are affixed between the plate 46 and the plate 54 in the following manner. Each resilient pads 70 includes a bracket 71 having a generally U-shaped cross section affixed to the rearward surface of the plate 46 so as to present a generally flat rearwardly directly surface, a bracket 72 affixed to the plate 54 so as to present a forwardly directed flat surface, and a resilient member 73 engaged therebetween. In the present embodiment the resilient members 73 include a block of rubber or the like having a metal plate with a plurality of threaded holes therethrough bonded to opposite surfaces of the block of material. The resilient members 73 are affixed to the flat surfaces of the brackets 71 and 72 by means of a plurality of bolts engaged through holes in the brackets 71 and 72 and threadedly engaged into the metal plates of the resilient members 73. In the present embodiment there are three resilient pads 70 spaced apart along a horizontal line adjacent the upper edges of the plates 46 and 54, two resilient pads 70 spaced apart immediately therebelow and two more resilient pads 70 spaced apart below the second pair. There are no resilient pads 70 in the center positions of the two lower rows of pads because of the inconvenience in replacing the resilient members 73 upon the wearing thereof. The resilient pads 70 enhance the vibratory movement of the blade 50 and supports 51—52 during operation of the apparatus.

The resilient pads 70 may be utilized exclusively between the plates 46 and 54 or a second type of resilient pad generally designated 75 may be utilized in conjunction therewith. The resilient pads 75 include a pair of horizontal plates 76 and 77 spaced apart vertically and attached adjacent one edge to the rear surface of the plate 46. A third horizontal plate 78 is affixed to the front surface of the plate 54 so as to be positioned generally between and equally spaced from the plates 76 and 77. Fillets 79 are affixed between each outer edge of the plates 76 through 78 and the surfaces of the plates 46 or 54 to which they are attached. A pair of resilient members 80, constructed in the fashion somewhat similar to the resilient members 73 but containing a block of resilient material therebetween which is somewhat longer and formed generally like a truncated pyramid, are affixed between the plates 76—78 and the plates 77—78 in a fashion similar to that described for the resilient pads 70. Thus, the resilient pads 75 are constructed to enhance and limit vertical movement of the blade 50 and the attached members relative to the intermediate member 40.

A vibratory means generally designated 85 is attached to the upper ends of the supports 51 and 52 and includes the following parts. The supports 51 and 52 have extensions affixed thereto forming a part thereof with coaxial holes formed therethrough and the axes thereof extending generally perpendicular to the direction of motion. A hub 86 is affixed to the outer surface of the support 51 coaxial with the hole therethrough and a sleeve bearing 87 is engaged through the hub 86 and the hole in the support 51. Similarly a sleeve bearing 88 is affixed in the hole through the support 52. A hydraulic motor 89 is affixed to the outer surface of the support 52 with the shaft 90 thereof rotatably engaged in the bearings 87 and 88. The hydraulic motor 89 may be connected to a hydraulic pump on the tractor 10 by means of conduits 91. An eccentric weight 92 is attached to the shaft 90 between the supports 51 and 52 for rotation therewith. When the hydraulic motor 89 is energized through the conduits 91 the shaft 90 and eccentric weight 92 rotate causing vibration of the supports 51—52 and the blade 50 of the plow apparatus. It should be understood that other types of vibratory means might be designed by those skilled in the art and all such means which perform the functions of this invention come within the scope thereof.

In FIGS. 7 and 8 a second embodiment of the present invention is illustrated wherein parts similar to the aforedescribed embodiment are designated with similar numerals having a prime added to indicate the second embodiment. In the second embodiment a pair of generally vertical elongated bars 43′ and 44′ are substituted for the plates 43 and 44 and are fixedly attached to the horizontal plates 41′ and 42′ in a similar fashion. The vertical elongated bars 43′ and 44′ are spaced apart horizontally and positioned so the rear edges thereof butt against the front surface of the plate 46′. A third elongated bar 38′ is attached to the front surface of the plate 46′ in a generally vertical orientation so as to be positioned between the bars 43′ and 44′. Fillets 37′ are affixed, by welding or the like, between the sides of the bar 38′, adjacent the upper and lower ends thereof and the front surface of the plate 46′ to provide the bar 38′ with the amount of strength required for plowing. The bars 43′ and 44′ are fixedly attached to the bar 38′ by means of pins 36′ extending therethrough. The remainder of the apparatus in the second embodiment, illustrated in FIGS. 7 and 8, is similar to the apparatus of the first embodiment and operates in a similar fashion.

Thus, I have disclosed a vibratory ripper plow having a blade mounted for limited rotary movement about a vertical axis and for vibratory motion through a plurality of resilient pads. In addition, the blade is provided with vibratory motion by means of a vibratory device attached thereto. Because of the vibration of the plow blade, less friction is encountered during plowing operations and a greater ground breaking action is provided with less required force. Because less force is required there is less resulting breakage and damage to the plowing apparatus.

While I have shown and described a specific embodiment of this invention, further modifications and improvements will occur to those skilled in the art. I desire it to be understood, therefore, that this invention is not limited to the particular form shown and I intend in the appended claims to cover all modifications which do not depart from the spirit and scope of this invention.

I claim:

1. Vibratory ripper plow apparatus comprising:
   a. an elongated member oriented generally vertically and having a lower portion forming a ripper plow blade;
   b. vibration generating means affixed adjacent the upper end of said elongated member for producing vibratory movements of said elongated member;

c. mounting frame means having a clevislike hitch affixed thereto for attaching said frame means to a draft device and allowing limited pivotal movements about a generally vertical axis;

d. a connecting link pivotally affixed adjacent one end to said elongated member below the longitudinal center of said elongated member and pivotally affixed adjacent the other end to said mounting frame means, the pivotal movements of each end of said link being about generally horizontal axes for allowing limited vertical movement of said elongated member relative to said mounting frame means; and

e. resilient pad fixedly engaged between a generally vertical portion of said mounting frame means and a parallel generally vertical portion of said elongated member, said pad means for substantially isolating the vibratory movements of said elongated member from said mounting frame means.

2. Vibratory ripper plow apparatus as set forth in claim 1 wherein the mounting frame means includes parallelogram-type apparatus for raising and lowering the plow while retaining the elongated member in a substantially vertical orientation.

3. Vibratory ripper plow apparatus as set forth in claim 1 wherein the resilient pad means includes a plurality of spaced apart pads.