June 4, 1968 L. O. KELLEY 3,386,517

VIBRATOR RIPPER PLOWS

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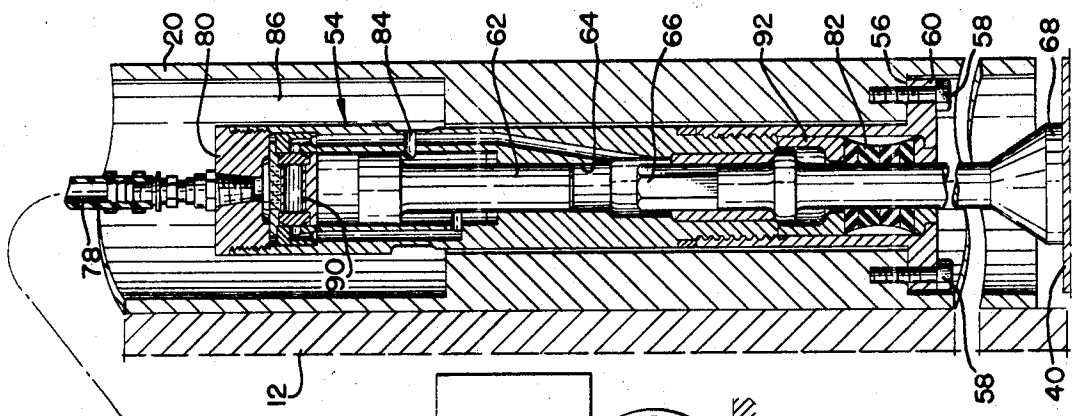


Fig. 2

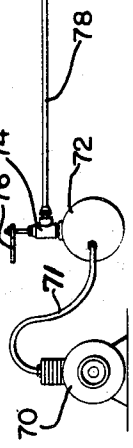
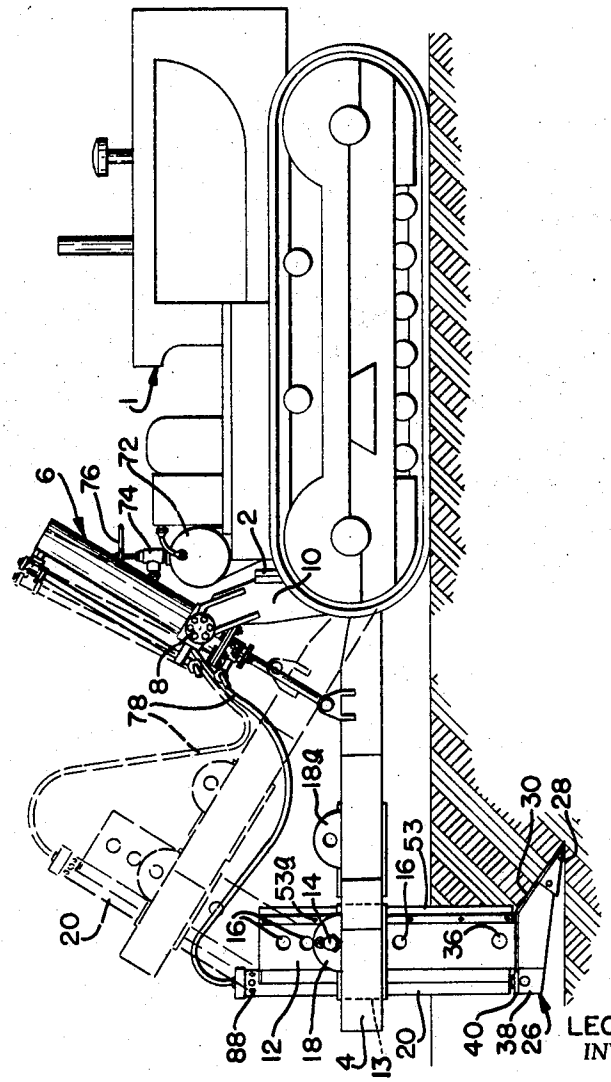


Fig. 1



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Fig. 3

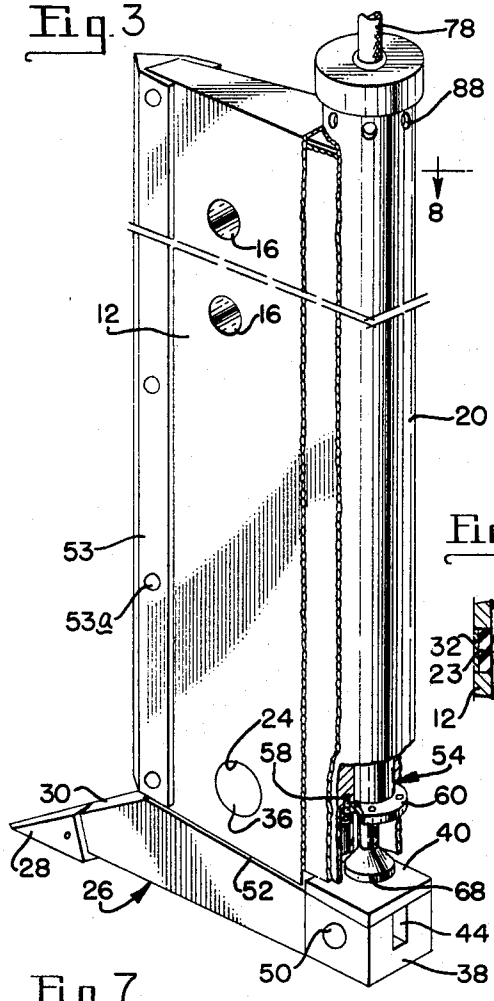


Fig. 4

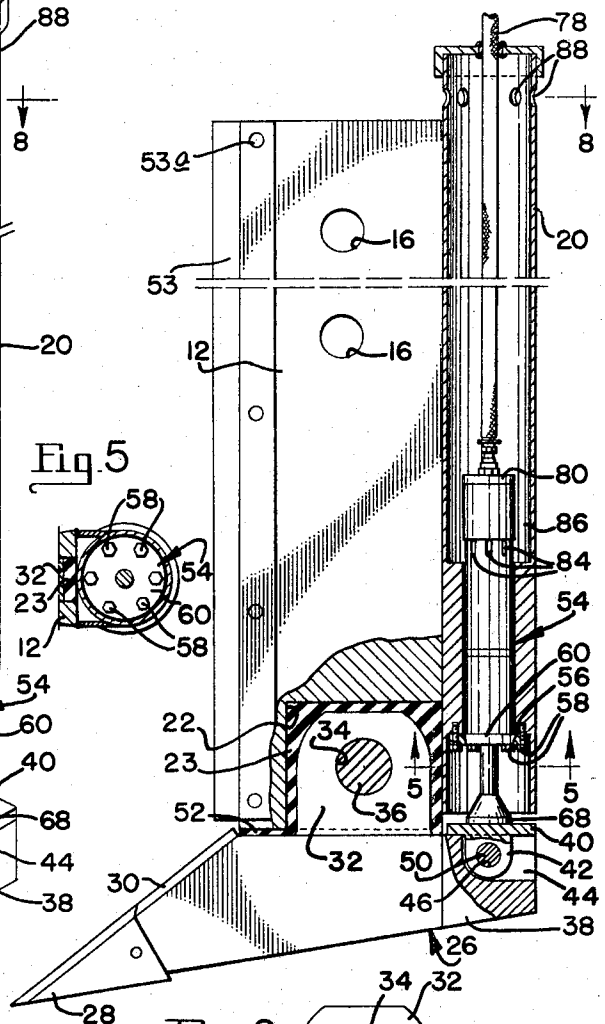


Fig. 5

Fig. 7

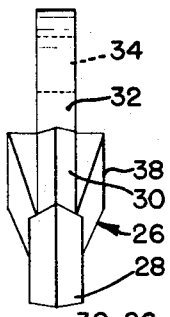


Fig. 6

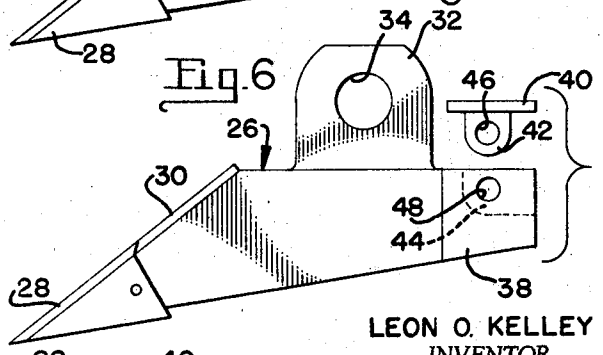
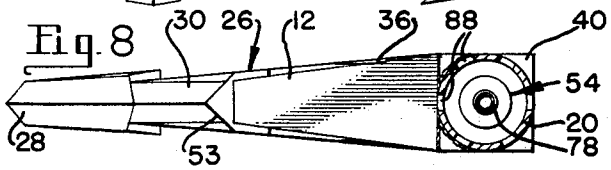


Fig. 8



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3,386,517

VIBRATOR RIPPER PLOWS

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7 Claims. (Cl. 172—40)

ABSTRACT OF THE DISCLOSURE

A ripper plow, the point of which may be vibrated to make it more adaptable for plowing deep furrows. The impact hammer movement of the plow point makes the plow more efficient in hardpan and rock. The vibrating point is moved about a horizontal axis by pneumatically actuated means, from the operator's seat on the plow. The vibrating attachment may be readily attached to a conventional ripper.

This invention relates to improvements in rippers and more particularly to vibrating rippers such as used in plowing deep furrows in the terrain, thereby to open a ditch for laying pipe lines, communication cables, and the like.

Various rippers have been proposed heretofore, but these, for the most part, have limitations as to the depth at which they could plow, and as to the material through which they could rip or plow.

In a general sense, most rippers were effective at normal depths, in conventional soil; however, when a terrain of highly compacted clay, hardpan or rock was encountered, it was often difficult to plow to the desired depth, as the point of such rippers had a tendency to wedge into the material being plowed, without breaking the material loose, which would hinder the forward movement of the traction element by which the ripper was being drawn.

The present ripper is so constructed, that an impact hammer such as is driven by high pressure air, is utilized to exert a vibratory motion to a hammer or ram which acts on an anvil to transmit vibratory motion to the point of the ripper. In so doing, the material being plowed is more readily loosened, which enables the plowing or ripping of the terrain at a much more rapid rate, than if the vibratory motion to the ripper point were not imparted.

An object of this invention is to provide a ripper plow, the point of which may be vibrated, which vibratory movement may be readily manipulated from the operator's seat, thereby to vary the intensity of the vibration in accordance with the terrain being plowed.

Another object of the invention is to provide a pneumatically actuated vibrator for vibrating the point of a ripper plow about a horizontal axis.

Still another object of the invention is to provide vibration to the point of a ripper plow, which vibration attachment may be readily attached to a conventional ripper, with a minimum of alteration thereto.

Still a further object of the invention is to provide a vibrator attachment for a ripper, which attachment may be readily removed for repair or replacement in a minimum of time.

Yet another object of the invention is to provide a vibrator cylinder attachment for a ripper, which attachment is of compact construction and which is powerful in operation.

Still a further object of the invention is to provide a vibrator attachment for a ripper plow, wherein the vibrator element is not directly attached to the movable portion of the ripper plow.

Still another object of the invention is to provide a ripper shank which has a pivoted plow point thereon, which plow point is movable about a horizontal axis by impacts imparted by an air hammer.

Yet a further object of the invention is to provide a movable ripper point which is mounted to pivot about a horizontal axis to permit vibration thereof, and which ripper point has a renewable impact surface detachably connected thereto.

Another object of the invention is to provide an air actuated vibrating ripper plow point, which is simple in construction, easy to operate, effective in operation, is relatively low in the cost of production, and which will withstand the rugged use to which it is subjected.

With these objects in mind and others which will become manifest as the description proceeds, reference is to be had to the accompanying drawings in which like reference characters designate like parts in the several views thereof, in which:

FIG. 1 is a side elevational view of a traction element, such as a crawler type tractor, to which a ripper is attached, showing the ripper in full outline in plowing position in the terrain, the ripper being shown in raised position in dashed outline;

FIG. 2 is a diagrammatic view of the air system, showing an enlarged sectional view through an air hammer actuating mechanism, with portions of the ripper shank and portions of the impact anvil being shown, and showing certain parts as being broken away or shortened, other parts being shown in elevation;

FIG. 3 is a perspective view of the ripper shank, shown apart from the ripper frame and the traction element, with parts broken away and shortened, and with parts shown in section to bring out the details of construction;

FIG. 4 is a side elevational view of the ripper shank, shown apart from the ripper frame and traction element, with parts being broken away and with parts shown in section, and showing an air hammer secured in place;

FIG. 5 is a sectional view taken on the line 5—5 of FIG. 4, looking in the direction indicated by the arrows;

FIG. 6 is a side elevational view of the ripper point and impact receiving anvil shown apart from the ripper shank, and showing the ripper anvil in exploded relation with respect to the ripper point;

FIG. 7 is a front elevational view of the ripper point as shown in FIG. 6; and

FIG. 8 is a sectional view taken on the line 8—8 of FIG. 4, looking in the direction indicated by the arrows.

With more detailed reference to the drawings, the numeral 1 designates generally a prime mover, such as a track laying tractor of the general type known as a "Caterpillar." The prime mover 1 has a mounting plate 2 attached to the rear end thereof, to which mounting plate 2 is attached a ripper plow frame 4, which frame 4 is of the same general character as the frame of "Ripper Plows" shown in the patent to Carlton O. Kelley, issued Mar. 5, 1957, No. 2,783,699. The ripper frame is raised and lowered by a hydraulic system, including rams 6, as will be seen in FIG. 1, similar to the system in the above designated patent. The rams of the present hydraulic system are pivotally mounted on a trunnion 8 on an upstanding support frame 10.

In the present device, only one ripper plow shank 12 is shown mounted within the frame 4. The shank 12 passes through a socket 13 within ripper frame 4 and a pin 14 passes through an apertured lug 18 on frame 4 and through one of the several holes 16 which are formed in shank 12, so as to maintain the ripper shank 12 in fixed relation with respect to frame 4. The ripper frame 4 of the present device, and as shown in the above mentioned patent, has outwardly and rearwardly extending frame members other than a center frame member, however, in the present instance, only the center frame member is shown to have a ripper shank therein. How-

ever, apertured lugs 18*a* and corresponding sockets are shown in the other portions of the frame 4, in which additional ripper shanks may be positioned. The ripper shank 12 has a tubular member 20 secured to the rear side thereof, as is fully illustrated in FIGS. 3, 4, 5, and 8. The tubular member 20 extends to a point near the lower end of ripper shank 12. The shank 12 has a recess 22 formed therein, with a transverse aperture 24 passing through the lower portion thereof and through recess 22.

A detachable vibrator plow 26 has a sharpened point 28 and an upwardly inclined, dirt engaging portion 30. The upper face of the vibrator plow 26 has a lug 32 formed on the upper side thereof, which lug is apertured, as indicated at 34. The aperture 34 is adapted to register with aperture 24 in the lower portion of shank 12, when the lug 32 is positioned within recess 22. With the apertures 24 and 34 in register, a pivot pin 36 is passed therethrough to hold the vibrator plow 26 in pivoted relation with respect to ripper shank 12 which mounts the air hammer mechanism 54. A portion 38 of the vibrator plow 26 extends horizontally rearward of shank 12 and has a wear receiving anvil 40 positioned on the upper face thereof, which anvil 40 has a lug 42 extending into a recess 44 formed in the vibrator plow 26. When the anvil 40 seats on the upper face of the rearwardly extending portion 38 of the vibrator plow 26, an aperture 46 in lug 42 will register with the aperture 48 in the rear portion 38 of vibrator plow 26, whereupon, a pin 50 may be passed therethrough to hold the anvil 40 in secure relation therewith.

With the vibrator plow 26 pivotally mounted on shank 12, a space 52 will be present between the lower end of shank 12 and the upper face of vibrator plow 26. This will enable arcuate movement between the vibrator plow 26 and the lower end of shank 12 about pin 36 as a pivot.

The recess 22 and space 52 are each filled with an elastomer material 23, with the exception of a hollow portion formed therein to receive lug 32. The elastomer material is preferably a rubber-like material which has the hardness of at least that of vulcanized tread rubber, and when the ripper plow 26 is attached to shank 12, it is preferable that the hollow portion within the elastomer material 23 be of a size smaller than the size of lug 32 so the pieces will have to be assembled under pressure, such as is exerted by a hydraulic ram, to enable apertures 24 and 34 to be brought into register. In this manner, vibratory action may be imparted to point 28 of ripper plow 26, and the ripper plow will regain normal position to receive additional impacts, due to the resiliency of elastomer material 23.

The ripper plow shank 12 has a removable wear point 53 on the forward face thereof, which wear point is preferably hard surfaced to resist abrasive action of the formation, when moved through the terrain. The wear point 53 is apertured at spaced intervals along the length thereof to receive pins 53*a* therethrough and through complementary apertures in the forward edge of ripper shank 12. By having the ripper shank constructed in this manner, the life of the shank may be materially lengthened, as the greatest wear occurs on the forward edge thereof.

A conventional air hammer mechanism, designated by the numeral 54, has a flange 60 thereon, which air hammer mechanism is positioned within tubular member 20 and seats upwardly against a shoulder 56 within tubular member 20. The air hammer mechanism 54 is secured in place by cap screws 58, which cap screws pass through apertures within the flange 60 on the lower end of the cylinder of the air hammer mechanism 54.

Various air hammers, such as jack hammers and the like, are manufactured by different manufacturers, one of such air hammers is manufactured by the Thor Power Tool Company. One of the characteristics of one of the air hammers manufactured by this company is the driving of a piston, similar to the piston 62 within cylinder 64, under high impact, against a tool bar 66. The tool bar, in the present instance, shows a mushroomed hammer end 68 on the lower end thereof, the lower end of which mushroomed hammer is adapted to engage the anvil 40, as will best be seen in FIGS. 2, 3 and 4.

An air compressor 70 is mounted on and driven by the traction element 1 in a conventional manner (which drive is not shown) which will direct air under pressure through conduit 71 into tank 72. The tank 72, preferably, has a control valve 74 thereon, which valve 74 is opened and closed by a valve lever 76, to control the flow of air outward through the control valve 74 and into a conduit 78, which conduit 78 leads to the head 80 of the air hammer mechanism 54. The valve mechanism of the air hammer will automatically introduce and exhaust air under pressure at a rapid rate, which will cause a hammering action on anvil 40, which will cause the point 28 of vibrator plow 26 to vibrate rapidly.

The air hammer mechanism is shown to have resilient cushion members 82 in the lower end thereof to return the tool bar 66 toward the upper end of cylinder 64. As the air hammer 68 of the air hammer mechanism 54 operates, air is exhausted through ports 84 into annular space 86 in tubular member 20, upward to be exhausted through holes at the upper end of tubular member 20.

By the removal of pin 36 from ripper plow shank 12, the vibrator plow 26 may be removed from the ripper shank 12, and the removal of the vibrator plow 26 gives access to bolts 58 which extend through flange 60 and are screw threaded into the shouldered portion 56 of tubular member 20. These bolts 58 may then be removed, whereupon, the air hammer mechanism 54 may be removed from the lower end of tubular member 20, thereby giving ready access to the air hammer mechanism for the repair or replacement of parts, should they become worn or broken. By reversing this procedure the mechanism may be reassembled. The anvil 40 may also be readily removed by removal of pin 50, or reassembled by replacement of the pin 50, as will best be seen in FIGS. 3, 4 and 6.

Operation

To operate the vibrating ripper plow, the traction element 1 is moved over the terrain as indicated in FIG. 1, and with the point 28 of vibrator plow 26 lowered to the desired depth, as indicated in full outline in FIG. 1, the traction element 1 is moved ahead and simultaneously, air under pressure, is directed from compressor 70 into tank 72, thence through open valve 74, which valve 74 is controlled by lever 76, thus air is directed from valve 74 through conduit 78, into the upper end 80 of air impact hammer mechanism 54 and through valving mechanism 90, which is conventional in air hammers of this character, whereupon the piston 62 is driven downward against the upper end of tool bar 66, which drives the tool bar downward against sleeve 92 and against resilient cushion members 82, which piston 62 will drive the impact hammer 68 against the upper face of anvil 40, whereupon the automatic or sequencing valving mechanism 90 will intermittently direct air onto the upper face of piston 62 to cause a rapid succession of impact blows by hammer 68 on anvil 40, whihc will drive the rear portion of vibrator plow 26 downward, to cause the pivotal movement of vibrator plow 26 about pivot pin 36, which will cause the lifting of point 28 with impact intensity which will cause the rock or hard material being plowed to be loosened or broken, whereupon, as the traction element 1 moves forward, the point will be moved downward during the upward movement of tool bar 66 and piston 62.

By vibrating the point 28 the ripper may be pulled through rock and hard soil with less power than it is possible to do if the point was not being vibrated. The present ripper is capable of ripping trenches for pipelines, communication cables, power lines that are buried underground, and all other trenching operations which usually require trenches or ditches ripped in the earth's surface

to a depth greater than is usually possible by conventional plows.

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

1. In an earth engaging ripper plow for opening a furrow within the terrain and in combination with a traction element;
(a) a frame,
(b) a ripper plow shank mounted on said frame,
(1) said ripper plow shank having a recess formed in the lower end thereof,
(2) said shank being apertured transversely near the lower end thereof so said apertures will intersect said recess,
(c) an element of elastomer material fitted within said recess in said ripper plow shank,
(1) said element of elastomer material having a recess formed therein,
(d) a ripper plow,
(1) an upstanding aperture lug on a side of said ripper plow,
(2) said apertured lug adapted to fit in complementary relation within said recess within said element of elastomer material so said aperture will register with said transverse aperture in the lower end of said ripper shank, and
(e) a pin adapted to pass through said transverse apertures in said shank and said lug to mount said lug in said element of elastomer material in pivoted relation with respect thereto.

2. In a vibrating ripper plow for use with a prime mover;
(a) a frame,
(b) a ripper plow shank mounted on said frame,
(1) said ripper plow shank having a recess formed in the lower end thereof,
(2) said shank being apertured transversely near the lower end thereof so said apertures will intersect said recess,
(c) a ripper plow,
(1) an upstanding apertured lug on the upper side of said ripper plow intermediate the length thereof,
(2) said apertured lug being adapted to fit in complementary relation within said recess so said aperture will register with said transverse apertures in the lower end of said ripper shank,
(d) a pin adapted to pass through said transverse apertures in said shank and through the aperture in said lug to mount said lug within said recess in pivoted relation with respect thereto,
(e) said rear portion of said ripper plow extending laterally outward rearwardly of said shank,
(f) a vibrating hammer mounted on the rear portion of said shank at right angles to said rearwardly extending portion of said ripper plow to impart impact blows to the rearwardly extending portion of said ripper plow.

3. A vibrating ripper plow for use with a prime mover, as defined in claim 2 wherein;
(a) a vibrating hammer is air actuated,
(b) said ripper shank has a tube on the rear side thereof to mount said air actuated hammer, and
(c) said air actuated hammer being detachably secured in said tube on the rear side of the ripper plow shank.

4. A vibrating ripper plow for use with a prime mover, as defined in claim 3 wherein;
(a) said rearwardly extending portion of said ripper plow has a longitudinal groove formed in the upper side thereof,
(b) said ripper plow has a transverse aperture formed therein and intersecting said longitudinal groove in said ripper plow,
(c) a plate forming an anvil and having an apertured lug thereon,
(1) said anvil adapted to seat on the rear portion of said ripper plow so said apertured lug will extend into said longitudinal groove so the transversely formed apertures in said ripper plow will register with the aperture in said lug, when said anvil is seated on the rear portion of said ripper plow so as to be in position to receive blows, at a right angle thereto, from said vibrating hammer, and
(2) a pivot pin fitted in said apertures.

5. A vibrator ripper plow for use with a prime mover, which ripper plow comprises;
(a) an elongated ripper shank,
(b) a vibrator plow pivotally connected to the lower end of said ripper shank,
(c) a tubular member secured along the rear side of said ripper shank,
(1) said tubular member having screw-threaded holes formed therein,
(d) an air actuated impact hammer seated within said tubular member,
(1) said air actuated hammer having an outwardly extending, apertured flange near the lower end thereof,
(i) the apertures in said flange being adapted to register with the screw-threaded holes in said tubular member,
(2) screw-threaded bolts adapted to pass through said apertures in said flange to threadably engage within the screw-threaded holes in said tubular member to detachably secure said air actuated impact hammer within said tubular member,
(e) an air pressure supply.
(f) a conduit leading from said air pressure supply to said impact hammer,
(g) valve means for controlling the air from said air pressure supply to said air impact hammer, and
(1) said air impact hammer being adapted to direct intermittent blows upon the rear portion of said vibrator plow upon said valve in said conduit being opened.

6. A vibrator ripper plow for use with a prime mover, which ripper plow comprises;
(a) an elongated ripper shank,
(1) the lower portion of said ripper shank having a recess formed therein,
(b) a vibrator ripper plow pivotally connected to said shank on the lower end thereof,
(1) said vibrator ripper plow having an upstanding, apertured lug on the upper side thereof,
(2) said ripper shank having a transverse aperture formed therethrough and through said recess in position to register with the aperture in said upstanding lug, when said lug is in one position,
(3) pivot pin means passing through said aperture in said ripper shank and said aperture in said upstanding lug on said vibrator ripper plow to secure said vibrator ripper plow in operative relation on said ripper shank,
(c) a tubular member secured along the rear side of said ripper shank,
(d) an air actuated impact hammer seated within said tubular member and being detachably connected thereto,
(e) an air pressure supply,
(f) a conduit leading from said air pressure supply to said air actuated impact hammer,
(g) valve means in said conduit for controlling the air from said air pressure supply to said impact hammer, and
(1) said air hammer being adapted to direct intermittent, impact blows upon the rear portion of

said vibrator plow, upon said valve in said conduit being opened.

7. In an earth engaging ripper plow for opening a furrow within the terrain and in combination with a traction element as defined in claim 1 wherein;

(a) said elastomer material within said recess having a recess formed therein, which recess is normally smaller than said lug on said ripper plow, so when said lug is fitted in said recess in said elastomer material said lug will be held in binding engagement with respect thereto.

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