United States Patent

Kinnan

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[54] **VIBRATORY EARTH ENGAGING SHANK**

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[52] **U.S. Cl.**.....**172/40,** 37/DIG. 18

[51] **Int. Cl.**.....**A01b 35/00**

[58] **Field of Search**.....172/40; 37/DIG. 18, 193; 173/49; 299/14; 61/72.6

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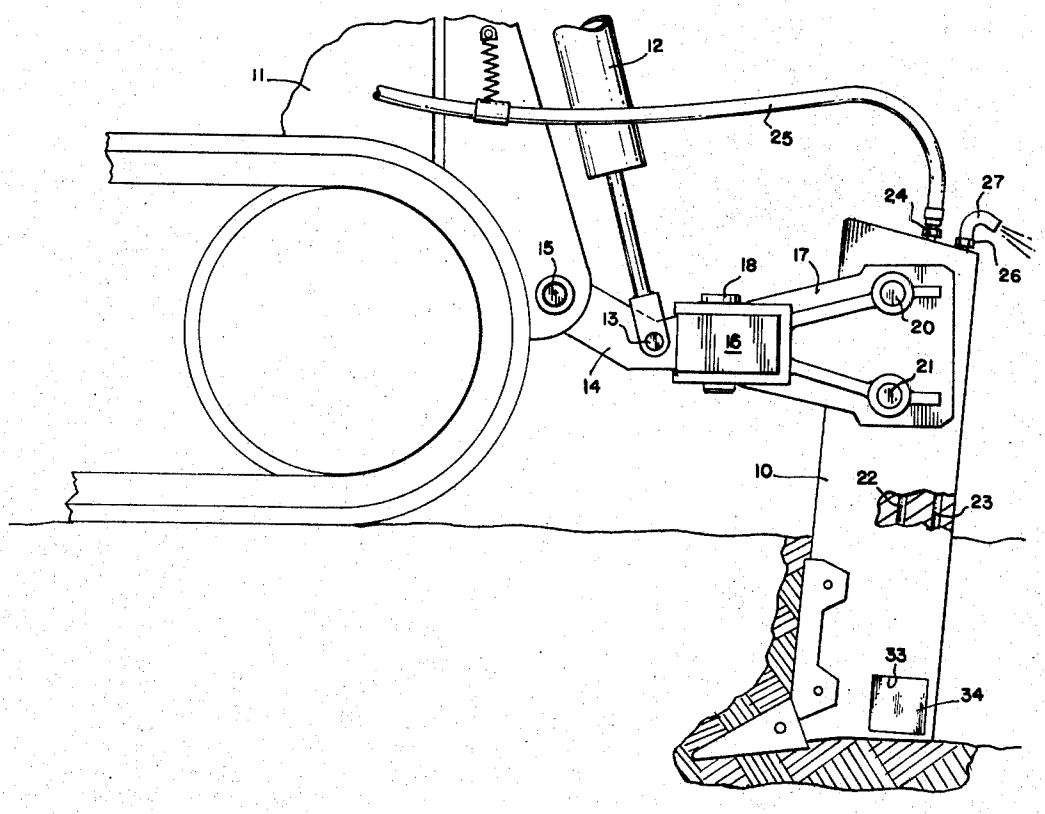
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[57] **ABSTRACT**

An earth engaging shank carried by a tractor for displacement of earthen material upon movement of the shank therethrough. A roller is embodied within the lower portion of the blade remote from the shank attachment to the tractor, to impart vibratory motion to said lower portion of the shank to facilitate passage through the earthen material. Air or hydraulic fluid under pressure powers the roller.

2 Claims, 6 Drawing Figures



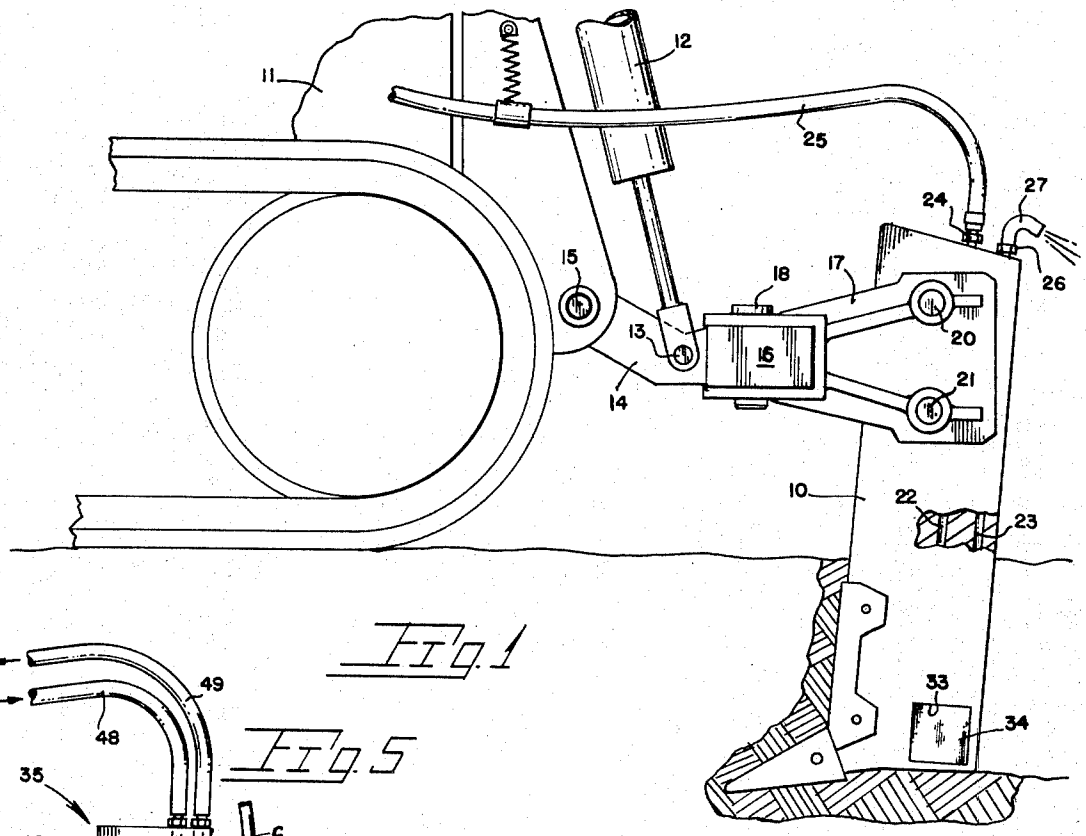


Fig. 1

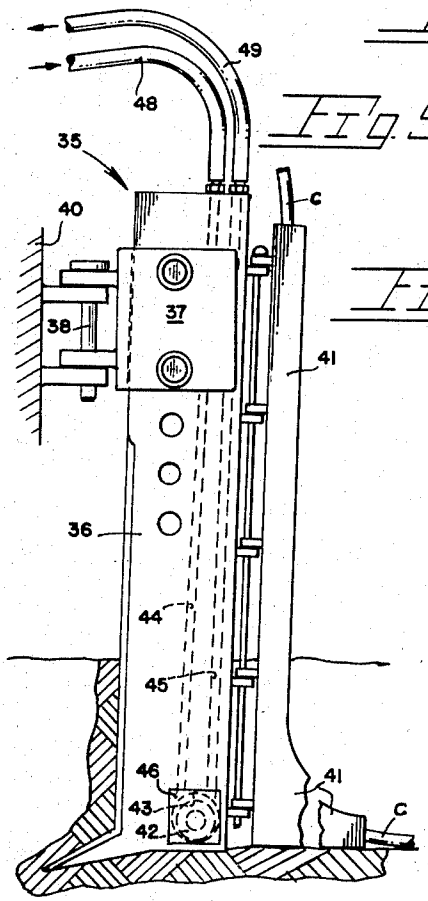


Fig. 5

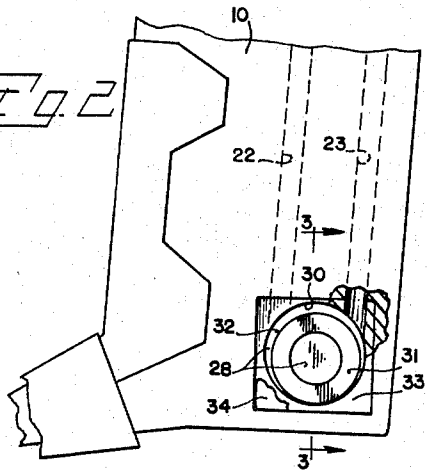


Fig. 2

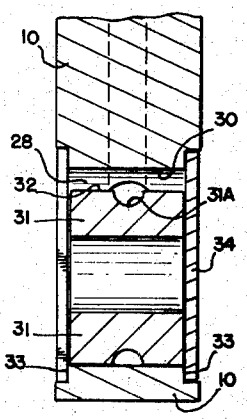


Fig. 3

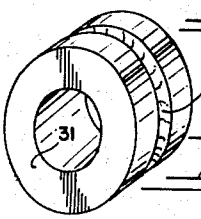


Fig. 4

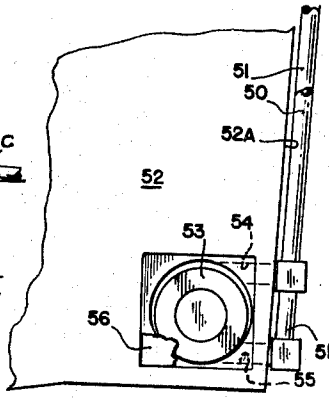


Fig. 6

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VIBRATORY EARTH ENGAGING SHANK

BACKGROUND OF THE INVENTION

The present invention relates generally to earth working tools and more particularly to an earth working tool embodying and internal, orbiting roller for imparting vibratory motion to the tool. More particularly the present invention is concerned with those tooth-like shanks used for ripping earth and rock formations as well as other like instruments for forming kerfs in the ground surface for the reception of electrical conduits.

In the present art it is common practice to impart vibratory motion in a limited way to an earth engaging blade for the purpose of reducing the motive force necessary to draw said blade through the ground surface. It is widely accepted that vibration of such ground engaging blades facilitates blade passage by reason of the fact that the earthen particles immediately forward of the blade are put into fluid motion prior and during blade passage. Further, in most common applications, the greater the amplitude and higher the frequency imparted to the blade or shank, the greater the reduction in motive force required to draw the blade through the ground. Stated in another way for a given tooth size and tooth penetration less draw bar pull will be required permitting more efficient working of the tool. While it is accordingly advantageous to apply substantial vibratory forces to the blade or shank a primary limitation to imparting such forces is the degree of vibration transmitted through the blade attachment to associated tractor equipment. Since all such blades obviously must be securely affixed to the prime mover for transmitting the necessary horizontal thrust to the blade vibratory movement of the blade is also transmitted through the blade attachment fittings and ultimately to the prime mover which is highly undesirable.

In ripping of rocky ground where blade or shank impact is high, where the use of a vibrator is highly desirable, such use is restricted by reason of vibratory motion ultimately "telegraphing" back to the tooth carrying vehicle. Effects of prolonged vibration suffered by heavy equipment operators also restrict the use of vibrated shanks.

While efforts have been made to isolate the vibratory instrument from its supporting vehicle these for the most part have been unsatisfactory for the reason that the resilient means utilized between the tooth and the vehicle is subject to rapid deterioration. In view of the very substantial loads imparted to such earth working tools isolating of the vibratory tooth from the vehicle has not been achieved in a practical manner and hence the use of vibrating tooths or shanks has had limited application.

SUMMARY OF THE INVENTION

The present invention is embodied within a vibratory earth engaging tooth wherein an orbiting roller is housed in the tooth remote from the vehicle attachment point in the earth engaging portion of the tooth. The roller is of a size to be housed within the tooth without increasing the sectional dimension of the tooth. The tooth width does not exceed the width of standard, non-vibrating teeth. Pressurized fluid delivery is provided along the shank to drive the roller.

The roller does not require servicing and hence the same may be housed in a permanent manner within the tooth shielded from foreign particles. If desired the roller may be confined laterally by removably mounted plates to allow access for purposes of roller substitution to permit adapting of the shank or tooth to the specific job at hand.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawing:

FIG. 1 is a side elevational view of an earth engaging shank shown operatively disposed behind a prime mover,

FIG. 2 is an enlarged detail view of the lower end shank of FIG. 1 with fragments broken away for purposes of illustration,

FIG. 3 is a vertical sectional view taken along line 3—3 of FIG. 2,

FIG. 4 is a perspective view of the roller element removed from the shank,

FIG. 5 is a side elevational view of a cable plow assembly shown removed from its prime mover and showing an earth engaging shank embodying the present invention, and

FIG. 6 is a view similar to FIG. 2 showing a modification having external fluid conduits on the shank.

DESCRIPTION OF PREFERRED EMBODIMENTS

With continuing reference to the accompanying drawing wherein like reference numerals indicate parts similarly identified in the following specification, the reference numeral **11** indicates a tractor equipped in the conventional manner with hydraulic means at **12** coupled at its rod end at **13** to a rearwardly trailing arm **14** which in turn is pivotally attached at **15** to the tractor frame. The arm **14** terminates rearwardly in a box beam arrangement **16** along which the following described structure may be laterally positioned to suit the job at hand. A tooth holder bracket **17** is attached at its forward end to receive a pin member **18** securing the holder framework to the box beam **16**. The foregoing structure comprises no part of the present invention and is deemed typical of means for mounting an earth engaging tooth on a prime mover.

The reference numeral **10** indicates an earth engaging shank in the nature of a ripper tooth positionably carried by the prime mover **11** shown as a track equipped tractor. Pins **20** and **21** extend transversely through the shank to mount same in a secure manner within the bracket **17**.

Extending longitudinally of the shank **10** is a bore **22** terminating upwardly in communication with a hose coupling at **24** to which in turn a length of hose indicated at **25** is attached. The unseen end of hose **25** is in communication with an air compressor for powering the present form of the invention. A second bore at **23** terminates upwardly in a fitting **26** serving to attach a segment of conduit **27** the latter constituting a fluid exhaust member.

With reference to FIG. **3** the lower end of the bores **22** and **23** terminate in communication with an internal area **28** defined by an annular wall **30**, the axis of said wall being perpendicular to the longitudinal axis of the blade. As shown, the internal area **28** is located adjacent the lower end of the shank **10** and accordingly remotely spaced below the attachment means **17** and pins **20** and **21** for the tooth. With attention again to

FIG. 3, a roller at 31 has an external circumferential surface 32 of an outside diameter somewhat less than the annular wall 30 formed in shank 10. Accordingly, roller 31 is mounted for eccentric travel in a plane parallel to the longitudinal axis of shank 10.

Inset areas at 33 are provided on both sidewalls of the shank 10 within which areas removable cover plates at 34 are mounted. Suitable sealing means are provided intermediate the plates 34 and the inset surfaces 33.

The roller 31 may have a continuous outer annular surface or be provided with a circumferentially extending groove, as at 31A in FIGS. 3 and 4, providing increased frictional area for impinging fluid with said groove providing for a continuous flow about the roller 31. Accordingly the constant circular flow of fluid about roller 31 drives the roller about annular wall 30. The orbiting axis of roller 31 moves about the axis of the annular wall 30. The exhaust flow of pressurized fluid is discharged from the upper end of bore 23 to the atmosphere in FIG. 1 where the unit is shown pneumatically powered. Alternately, as shown in FIG. 6, wherein the roller is described as hydraulically powered a reservoir return line is provided. While not shown it will be obvious that air supply line 25 will be in circuit with suitable controls for regulating the air flow from a source to the tooth 10. The frequency as well as the force exerted by the roller against the annular wall 30 is directly proportional to the flow of air through inlet bore 22.

With attention to FIG. 5 the cable plow assembly as indicated generally at 35 includes a shank 36 mounted at its upper end within a bracket 37. As is conventional with cable plow assemblies the shank and its bracket 37 are mounted for swinging movement about the upright axis of a pivot pin 38. Cable plow assemblies are carried by a positionable member 40 which in turn is typically carried by the prime mover not shown. Trailing rearwardly from the cable plow tooth is an elongate cable shoe 41 through which the cable C, being laid, passes for ultimate placement within the ground kerf cut by the tooth 36. Such cable shoes are in most cases hingedly carried by the cable plow tooth.

As in the first described form of the invention the structure externally attached to the tooth forms no part of the present invention.

In similarity to the first described form of the invention a roller at 42 is housed within the lower ground engaging portion of blade 36 for orbital movement about an annular wall 43. In view of the similarity with the first described form of the invention a further description is not believed necessary. Bores at 44 and 45 in FIG. 6 provide a passageway for the flow of pressurized fluid from a conduit 48 to roller 42 and for discharge of the fluid to a return line 49. Line 49, in turn, returns the fluid to a hydraulic fluid reservoir on the prime mover. Cover plates as at 46 enclose the roller 42 and the opening defined by annular wall 43.

A further modification is shown in FIG. 6 wherein a pair of externally mounted rigid conduits 50 and 51 are affixed to the trailing edge 52A of a blade 52. A roller 53 is powered by an airflow entering via an inlet 54 and exhausting via outlet 55. Cover plates as at 56 close the roller receiving opening in the blade. The upper ends of the conduits 50 and 51 terminate in retained attachment to blade 52 and thereat receive supply hoses similar to those indicated at 48 and 49. Alternatively, of course, the exhaust conduit for an air driven roller may exhaust to the atmosphere as shown in FIG. 1.

The term "fluid" as used herein encompasses both hydraulic fluid and air applied to the roller in the different forms of the invention.

While I have shown various embodiments of the invention it will be apparent to those skilled in the present art that the invention may be embodied still otherwise without departing from the spirit and scope of the invention.

Having thus described the invention what I desire to secure under a Letters Patent is:

1. A vibratory earth engaging shank carried in an upright position by a prime mover with a lower portion of the shank extending below the ground surface for forming a narrow kerf therein for the subsequent deposit of an electrical conduit, said shank having fluid carrying passageways extending therealong with one of said passageways adapted to receive a pressurized fluid flow from a source carried by the prime mover, an annular wall formed within and adjacent the lower end of the shank, said passageways terminating in tangential openings in said wall in communication with a space defined by the wall, a roller of a lesser width than that of the shank disposed for orbital rolling engagement about said annular wall in response to a pressurized fluid flow being discharged through one of said tangential openings to impart vibratory motion to the lower end of the shank along vectors coplanar with the shanks major axis advantageously remote from the attachment point of the shank to the prime mover thereby lessening the transfer of vibratory motion to the latter during a kerf forming operation, inset areas also formed within said ground engaging portion of the shank adjacent the wall defining portion of the shank, closure plates removably mounted with said inset areas having their outer surfaces substantially coplanar with the shank sidewalls with said plates permitting access to said roller for servicing or replacement of same with a roller imparting different vibratory characteristics to the shank.

2. The vibratory earth engaging shank as claimed in claim 1 wherein said passageways are embodied within conduits extending exteriorly along the trailing edge of the shank.

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