

[54] **RIPPER ASSEMBLY**

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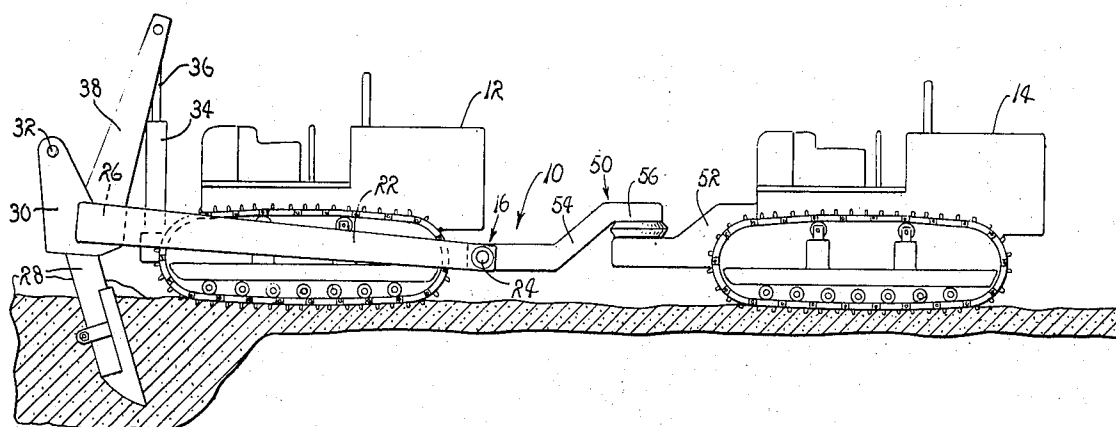
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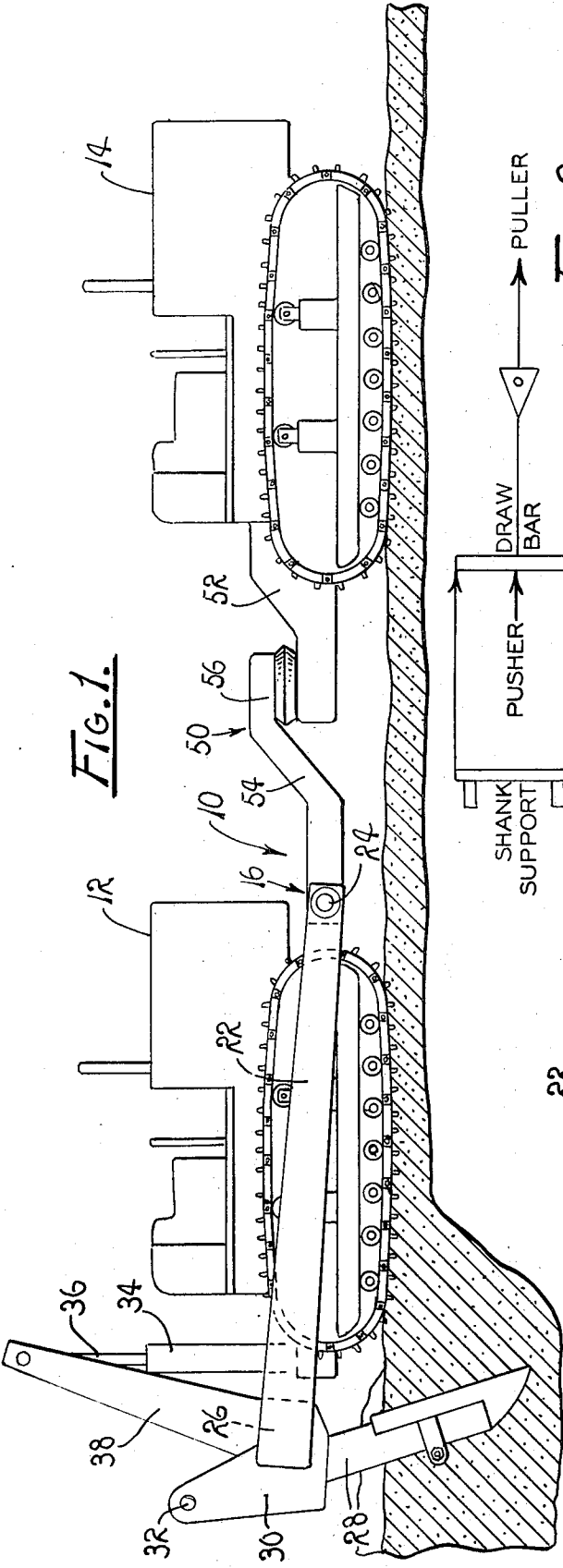
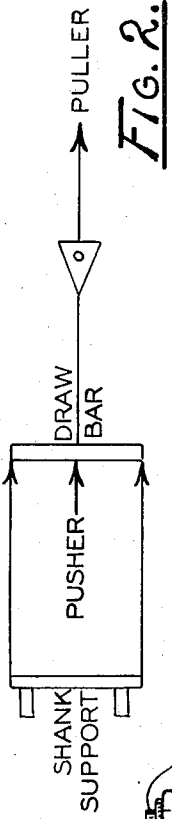
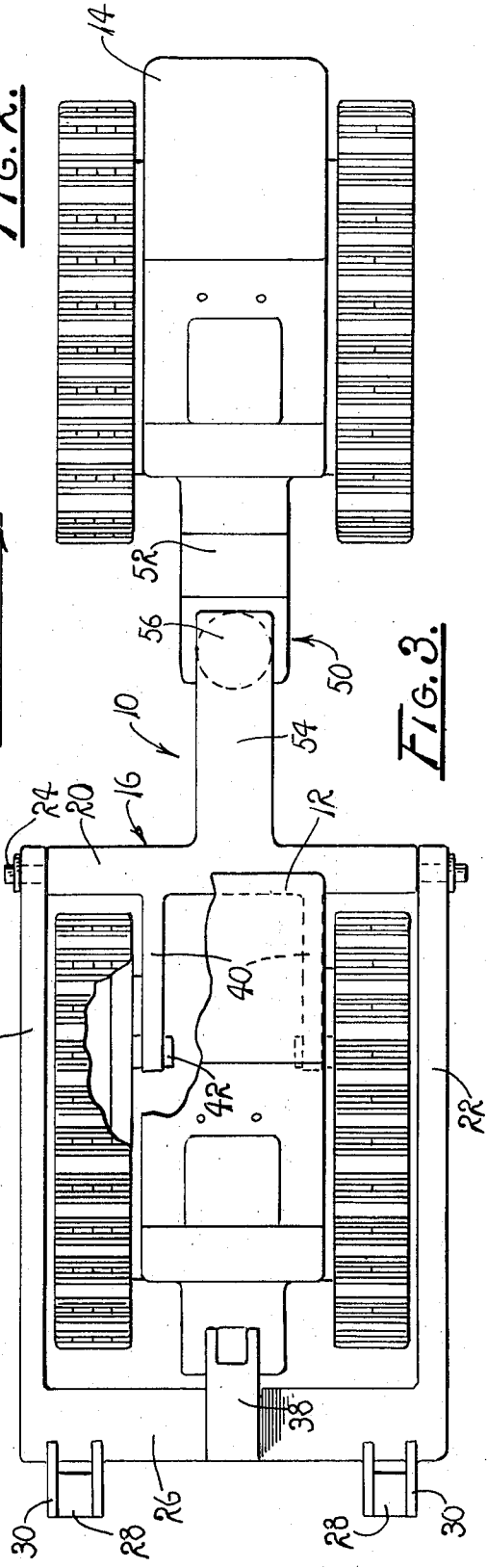
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[57] **ABSTRACT**

An improved ripper assembly for deep-ripping materials such as hardpan and the like characterized by a drawbar for supporting a plurality of ripper shanks, said drawbar being of a U-shaped configuration and including a pair of leg segments extended along opposite sides of a pusher tractor, and a transverse base segment integrally related to said legs and forming a pull bar mounted on the pusher tractor in a forward disposition, and linkage coupling the drawbar with a puller tractor, whereby the pusher and puller tractors concurrently apply horizontally directed forces to said drawbar for driving said shanks through the material.

5 Claims, 3 Drawing Figures





RIPPER ASSEMBLY

BACKGROUND OF THE INVENTION

The invention relates to rippers and more particularly to an improved ripper assembly configured to be driven by a pair of crawler tractors coupled therewith in a push-pull configuration.

Of all of the obstacles to profitable farming, one of the most serious to farmers throughout the Western United States is the existence of a layer of hardpan located to depths of two to seven feet below the surface of substantially tillable soil. Hardpan, of course, is a geologically formed strata of extremely compressed and chemically bonded clay and iron oxide mixture. Since roots cannot penetrate hardpan, it is common practice to disturb the hardpan utilizing deep-ripping techniques. This technique is typified by pulling broad ripper shanks through the hardpan. In most cases the required depth for ripping can be reached in a single pass. This necessitates use of equipment of adequate strength and power.

In practice, it has been found that large crawler tractors coupled in tandem meet the power requirements and that massive shanks suitable for deep-ripping can be fabricated with minimum difficulty. However, as is well known to those familiar with ripping hardpan in the Western United States, great difficulty is encountered in avoiding metal fatigue and equipment failure when multiple crawler tractors, of adequate ratings, are coupled with shanks of an adequate size for ripping deep hardpan in single passes. For example, where crawler tractors are coupled in a tandem relationship employing only rear hitches, or those oriented for towing, there is a distinct tendency for the supporting structure to fracture with an attendant failure of the hitches. In other words, sections often are torn from transmission cases to which the hitches are coupled.

Consequently, operators attempting to perform deep-ripping operations for disturbing hardpan, utilizing currently available crawler tractors and ripper assemblies coupled in tandem, frequently experience substantial losses in operating time, as well as substantial repair and maintenance costs.

It is, therefore, the purpose of this invention to provide an improved ripper assembly adapted to be mounted on power units, including wheeled tractors, crawler tractors and the like and suited for use in ripping materials of a general nature, including various types of soils, at various depths, rock strata and tundra, and particularly suited for use in performing deep-ripping operations for disturbing hardpan utilizing currently available tractors coupled in a push-pull, tandem configuration, the rearmost tractor being hereinafter referred to as a pusher tractor, while the foremost tractor is referred to as a puller tractor.

OBJECTS AND SUMMARY OF THE INVENTION

It is an object of the instant invention to provide an improved ripper assembly for use in performing ripping operations.

It is another object of the instant invention to provide an improved ripper assembly for use with crawler tractors coupled in tandem.

Another object of the instant invention is to provide an improved ripper assembly adapted to be mounted

on a pusher tractor and coupled with a puller tractor for deep-ripping hardpan.

Another object is to provide an improved ripper assembly adapted to be pushed by a first tractor and pulled by a second tractor for ripping hardpan at substantial depths.

These and other objects and advantages are achieved through the use of an improved ripper assembly which includes a drawbar of a substantially U-shaped configuration, which includes a pair of parallel legs coupled together by a base segment, forming a pull bar mounted on a pusher tractor in a wrap-around relationship, and an articulated force transfer linkage extending forwardly from the base segment into a coupled relationship with a puller tractor, as will become more readily apparent by reference to the following description and claims in light of the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevation of the improved ripper assembly which embodies the principles of the instant invention, coupled with a pair of crawler tractors arranged in a push-pull, tandem configuration.

FIG. 2 is a force diagram of the forces applied to the ripper assembly by a pair of crawler tractors arranged in a push-pull, tandem configuration.

FIG. 3 is a top plan view of the ripper assembly, coupled with a pair of crawler tractors in the manner depicted in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now, more specifically, to the drawing, there is shown in FIG. 1 an improved ripper assembly, generally designated 10, which embodies the principles of the instant invention. As shown, the ripper assembly 10 is coupled with a pair of tractors 12 and 14 arranged in a push-pull, tandem configuration, with the rearmost tractor 12 being referred to as a pusher tractor, while the foremost tractor 14 is referred to as the puller tractor.

In practice, the tractors 12 and 14 are of the so-called crawler or track laying type, however, it should be apparent that other types of tractors can also be employed. Therefore, while the tractors 12 and 14 are depicted as crawler tractors, it is to be understood that the ripper assembly 10 can be employed with other types of prime movers, including wheeled tractors and the like.

The ripper assembly 10 includes a drawbar generally designated 16 of a U-shaped configuration. In practice, the drawbar 16 includes a base segment 20, which serves as a pull bar, and a pair of rearwardly extended legs 22 arranged in substantial parallelism. As a practical matter, the base segment 20 is a rigid, heavy duty structural beam to the distal ends of which is pivotally coupled the legs 22. A suitable trunnion 24 is employed for coupling each of the legs 22 to the base segment 20 in a manner such that pivotal oscillation is accommodated about an axis orthogonally related to the longitudinal axis of symmetry of the legs 22.

The distal ends of the legs 22 are coupled through a transversely oriented support beam 26 upon which is mounted a plurality of ripper shanks 28. Since the ripper shanks form no specific part of the instant invention, the specific structure employed in mounting the ripper shanks 28 is omitted in the interest of brevity.

However, as shown, the shanks 28 are pinned at their uppermost ends to suitably provided receiver brackets 30, utilizing clevis pins 32 in a manner well understood by those familiar with the exigencies of deep-ripping operations.

In practice, an hydraulic slave cylinder 34 is provided for raising the support beam 26 in order to extract the shanks 28 from the soil. As employed, the slave cylinder 34 includes an axially reciprocable shaft 36 pinned at its distal end to a vertically oriented beam 38, the base of which is welded or otherwise rigidly affixed to the support beam 26. The slave cylinder 34, of course, is coupled within a suitable hydraulic circuit, not shown, which includes a selector valve appropriately located for affording an operator access thereto. The base of the cylinder 34 is pinned to the tractor 12 in any suitable manner. Consequently, appropriate manipulation of the selector valve serves to impose selected states of operation on the slave cylinder 34. Thus, the shaft 36 of the slave cylinder 34 is extended for lifting the shanks 28, via the transverse support beam 26 while retraction of the shaft causes the shanks 28 to penetrate the soil as the beam 26 is lowered. Of course, the lifting and lowering of the shanks serve to impart oscillation to the legs 22. Such is, of course, accommodated by the trunnions 24.

The pusher tractor 12 is coupled to the base segment 20 of the drawbar 16 through a force transfer link 40, formed of a pair of parallel arms, not designated, welded at their base ends to the base segment 20 and extended rearwardly therefrom. As a practical matter, the force transfer link 40 is pinned to the tractor 12 by a pair of trunnions 42. Where the tractor 12 is a crawler tractor, the force transfer link 40 is coupled with the tractor in a manner quite similar to that in which a so-called dozer blade is coupled with the tractor. Consequently, the link 40 preferably is mounted on the tractor 12 employing the structure provided for mounting thereon a dozer blade.

In any event, it is to be understood that the pusher tractor 12 functions in a pushing mode for applying a pushing force against the drawbar 16, through the force transfer link 40. Thus, the force transfer link 40 acts in compression for transferring a propelling force, developed by the tractor 12, to the drawbar 16.

Extended forwardly from the base segment 20 of the drawbar 16, there is an articulated force transfer linkage 50. The force transfer linkage 50 includes a tow bar 52, fixedly mounted on rearmost portions of the puller tractor 14, and a tongue 54 which is rigidly fixed to the drawbar 16. The tongue 54 and the tow bar 52 are, in practice, united by any suitable means, including a ball-joint 56, which permits the tongue 54 to pivot with respect to the tow bar 52 in order to facilitate independent steering of the tractors 12 and 14. Since the particular structure employed in coupling the tow bar 52 with the tongue 54 can be varied, a detailed description thereof is omitted in the interest of brevity. However, it is to be understood that the tongue and tow bar collectively form an articulated linkage which permits the tractors 12 and 14 to move simultaneously in different directions as pivoting of the tongue relative to the tow bar 52 is accommodated.

It should, at this point, be readily apparent that the force transfer linkage 50 acts in tension for transferring a pulling force to the drawbar 16, as the force transfer link 40 concurrently applies a pushing force thereto.

Thus, it is possible to drive the ripper assembly 10 through hardpan soil utilizing tandem tractors arranged in a push-pull configuration, so that the stress developed in the structure employed in coupling the ripper assembly with the tractors, particularly the pusher tractor 12, is minimized.

OPERATION

It is believed that in view of the foregoing description, the operation of the device will be readily understood and it will be briefly reviewed at this point.

With the ripper assembly 10 coupled through the link 40 with the pusher tractor 12, in a substantially confining relationship, and coupled with the puller tractor 14, through the force transfer linkage 50, the ripper assembly is prepared for operation in a selected field. As the tractors 12 and 14 advance through the selected field, the slave cylinder 34 is activated for retracting the shaft 36, whereupon the legs 22 of the drawbar 16 pivot about the trunnions 24 for thus permitting the shanks 28 to penetrate the soil to a desired depth. The force required to propel the shanks through the hardpan being ripped is transferred concurrently from the pusher tractor 12 and the puller tractor 14 to the drawbar 16, as the tractors 12 and 14 are caused to advance. Thus, the force transfer link 40 is placed in compression as the tractor 12 pushes the drawbar 16, while the force transfer linkage 50 is placed in tension as the tractor 14 pulls the drawbar 16.

In view of the foregoing, it should readily be apparent that by employing an articulated drawbar 16 configured to be received by a pusher tractor, in a wrap-around relationship, and attached for towing to a puller tractor, it is possible to transfer massive forces simultaneously derived from a plurality of tractors to a common tow bar without subjecting supporting structure to stress-induced damage.

Although the invention has been herein shown and described in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the illustrative details disclosed.

Having described our invention, what we claim as new and desire to secure by Letters Patent is:

1. An improved ripper assembly comprising:

A. an elongated pull bar;

B. a pair of mutually spaced, elongated legs arranged in substantially spaced parallelism and extended orthogonally from said pull bar, each leg being characterized by a base end portion pivotally connected with an end portion of said pull bar and a distal end portion remotely related to the base end portion thereof;

C. means for connecting a ripper shank to said legs including a beam extended between the distal end portions of the legs and rigidly connected thereto;

D. first connecting means for connecting said pull bar with a first given tractor including a pair of rigid, elongated arms connected with said pull bar and extended therefrom in substantial parallelism with the legs of said pair; and

E. second connecting means for connecting said pull bar with a second given tractor including a force transfer linkage connected with the pull bar and extended orthogonally therefrom in a direction sub-

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stantially opposite to that in which said pair of arms is extended.

2. The ripper assembly of claim 1 wherein said force transfer linkage is an articulated linkage.

3. An improved ripper assembly for deepripping strata at substantial depths beneath the surface of a body of soil comprising:

- A. a draw bar of a substantially U-shaped configuration including a pair of pivotal legs, each of said legs being characterized by a base end and a distal end remotely related to the base end and further characterized by a length greater than the length of a given tractor, said legs being disposed in substantial parallelism and spaced apart a distance sufficient for receiving the given tractor therebetween, and means including a transversely oriented pull bar interconnecting said legs at the base ends thereof;
- B. means adapted to mount said draw bar on said given tractor with the pull bar disposed forwardly of the tractor and the distal ends of the legs disposed rearwardly thereof;
- C. an articulated force transfer linkage for coupling said draw bar with another tractor disposed forwardly of said pull bar, including a first link coupled at one end thereof to said other tractor and a second link pivotally connected with said first link and connected with said pull bar; and
- D. means including a support beam extended between the distal ends of said legs for supporting a ripper shank rearwardly of the given tractor.

4. The assembly of claim 3 wherein said means for mounting said draw bar on said given tractor comprises a pair of rigid arms integrally connected with said pull

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bar and rearwardly extended therefrom, and means including a pair of laterally spaced trunnions for connecting said arms to said given tractor.

5. In combination with a first and a second tractor arranged in fore-and-aft alignment, an improved ripper assembly for deep-ripping strata at substantial depths beneath the surface of a body of soil comprising:

- A. a pull bar extended transversely between said first and second tractors, and a pair of laterally spaced legs, each leg being characterized by a base end pivotally connected with one end of said pull bar and a distal end disposed rearwardly of said first tractor;
- B. means for connecting said pull bar with said first tractor including a pair of laterally spaced arms integrally connected to said pull bar and extended rearwardly therefrom, and means including a pair of trunnions mounted on said first tractor, at opposite sides thereof, for receiving the extended arms in a coupled relationship;
- C. means for connecting said pull bar with said second tractor, including a first link integrally connected with the pull bar and extended forwardly therefrom, a second link pivotally coupled to said first link, and means for coupling said second link with said second tractor;
- D. means for mounting a ripper shank on said ripper assembly including a transversely oriented shank-supporting beam integrally connected with the distal ends of said legs, rearwardly of said first tractor; and
- E. means for raising and lowering said shank-supporting beam.

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