The present invention relates to a field tile cleaner and, more specifically, the invention pertains to a tractor driven field tile cleaner device.

One of the primary objects of this invention is to provide a field tile cleaner with means for connecting the same with the power takeoff shaft of a tractor.

Another object of this invention is to provide a field tile cleaner having a flexible driven shaft connected with the power takeoff shaft of a conventional tractor through an intermediate clutch device conveniently mounted on the drawbar of the tractor.

A further object of this invention is to provide a field tile cleaner of the type generally referred to supra wherein the clutch device is of the slip type which emits an audible alarm when the torque on the driven shaft raises to such a degree that continued applied torque may cause it or connectors connecting several links of the driven shaft together to fracture.

A further object of this invention is to provide, in combination with the above mentioned clutch device, a brake means for, optionally, holding the driven rod under the torque applied thereto or for slowly releasing the driven rod from the applied torque.

Still another object of this invention is to provide in a device of the type described above, a gear type slip clutch normally held in driving relation under adjustable tension means.

This invention contemplates, as a still further object thereof, the provision of a tractor-driven field tile cleaner device which is non-complex in construction and assembly, inexpensive to manufacture, and durable in use.

Other and further objects and advantages of the instant invention will become more evident from a consideration of the following specification when read in conjunction with the annexed drawings, in which:

Figure 1 is a top plan view of a tractor-driven field tile cleaner device constructed in accordance with the teachings of the present invention;

Figure 2 is a side elevation view of the tractor-driven field tile cleaner device illustrated in Figure 1, and partly in cross-section, the view being taken substantially on the horizontal plane of line 2-2 of Figure 1, looking in the direction of the arrows;

Figure 3 is an enlarged detail cross-sectional view taken substantially upon the vertical plane of line 3-3 of Figure 1, looking in the direction of the arrows;

Figure 4 is an end elevation view, partly in cross-section, taken substantially on the vertical plane of line 4-4 of Figure 3, looking in the direction of the arrows;

Figure 5 is an exploded perspective view of the cooperating gear-type slip clutch disk; and

Figure 6 is a fragmentary perspective view of the brake lever and holding means thereof.

Referring now more specifically to the drawings, reference numeral 10 designates, in general, a conventional farm tractor having at the rear end thereof a pair of laterally extending axial housings 12 on which are fixedly secured a pair of longitudinally spaced abutment members 14, 16, respectively. Reference numeral 24 denotes a substantially U-shaped drawbar having an arcuate bight 26 provided with a plurality of arcuatey spaced transversely extending openings 28 extending therethrough. A pair of laterally spaced substantially parallel arms 30, 32 project, respectively, from the opposite ends of the bight 26, and the outer ends of the arms 30, 32 are rigidly secured to the lower ends of the abutment members 14, 16, respectively, the arms extending laterally therefrom at substantially right angles with respect thereto (see Figure 2).

An elongated substantially rectangular support plate 34 is pivotally connected at 36 to the lower end of the transmission housing 38 and extends across the arcuate bight 26. The support plate 34 is provided with a transversely extending opening 40 adapted for selective alignment with one of the openings 28. The selected adjusted position of the support plate 34 is maintained by a bolt 42 which extends through the opening 40 and the selected one of the openings 28. Nut 44 provides inadvertent or accidental displacement of the bolt 42 from the aforementioned openings.

Reference numeral 46 denotes a clutch device constructed in accordance with this invention. The clutch device 46 is seen to comprise a substantially U-shaped support member 48 having a substantially rectangular bight portion 50 from the ends of which project, respectively, a pair of normally vertically extending substantially parallel side arms 52, 54.

The bight portion 50 is apertured at 56 at longitudinally spaced intervals, the apertures 56 being aligned with the apertures 58 extending through the outer end of the support plate 34 and is secured thereto by means of the bolts 60 and nuts 62.

A support bracket 64 is bolted at 66 or otherwise rigidly secured to the side arm 52 and at its upper end is integrally formed with a transversely extending substantially hollow open ended cylindrical sleeve 68. The sleeve 68 is co-axially aligned with a second substantially hollow open ended cylindrical sleeve 70 which extends transversely of the side arm 54 at the upper end thereof with which it is integrally connected. As is seen in Figure 3, the sleeve 70 is fitted with a hollow cylindrical bushing 72 in which is mounted for rotation one end of a drive shaft 74.

A brake drum 76 is mounted on the shaft 74 for rotation therewith and is seen to include a back circular plate 78 having a rearwardly facing cylindrical flange 80 at the circumferential marginal edge thereof. The plate 78 is also integrally connected with the forwardly projecting substantially hollow hub 82 surrounding the shaft 74 and is connected thereto by a pin 84 which extends diametrically therethrough. A spacer washer 86 is interposed between the adjacent ends of the sleeve 70 and the hub 82. The back plate 78 is also provided with a plurality of arcuately spaced openings 88 to serve a function to be described.

Reference numerals 90 and 92 designate a pair of identically constructed clutch elements. Hence, a description of one is a description of the other.

Referring now to the clutch elements 92, it is seen that the same includes a substantially cylindrical main body portion 94 having an axial bore 96. A plurality of arcuately spaced lugs 98 project laterally from one side of the main body portion 94 and its other side is formed with a plurality of arcuately spaced teeth 100. The diameter of the shaft 74 is seen to be less than the diameter of the bores 96 of the clutch elements 90, 92.

As is seen in Figure 3, the clutch element 92 surrounds the shaft 74 in spaced relation relative thereto with the
The clutch element 92 also surrounds the shaft 74 in spaced relation relative thereto and is supported thereabout by means of a centrally apertured radial flange 106 integrally formed with one end of an elongated substantially hollow cylindrical shaft 108 having opposed open and closed ends thereof extending through the openings formed in the back plate 78. The clutch element 90 normally mesh with the gear teeth 100 of the clutch element 92 and the lugs 98 of the former project through radially spaced openings 110 extending transversely through the flange 106.

Referring again to Figure 3 of the drawings, it is seen that the shaft 108 is telescoped over the shaft 74 and carries a centrally apertured disc 102 which engages the rear face of the radial flange 106. The back plate 78 and the disc 102 are provided with arcually spaced and aligned openings through which extend elongated screws 114 surrounded by helicoidal springs 116. One end of the springs 116 engage against the disc 102 and the other ends thereof abut against washers 118 carried by the screws 114. The compression of the springs 116 is adjusted by nuts 120 which are threaded on the screws 114 for engagement against the washers 118.

The shaft 108 is journaled for rotation within the sleeve 68 and the closed end thereof is provided with a split coupler 122 comprising clamping members 124, 126 held in clamping relation by means of a screw 128 threaded therethrough. The elements 124, 126 are each formed with the confronting, aligned, semi-circular recesses 130, 132, respectively, and the element 126 is provided with a radial bore 134 which is in open communication with the inner end of the recess 132.

A torque brake is indicated in general by reference numeral 136 and includes an arcually shaped resilient metallic band 138 disposed in spaced confronting relation relative to the outer side of the circular flange 80. One end of the band 138 is looped around an anchor pin 140 the opposed ends of which are supported on and carried by a pair of side arms 142, 144 of a bracket having a bight 146 secured to the bight 80. The end of the band 138 is connected to one end of a helicoidal tension spring 150, the other end of the spring 150 being connected to one end of screw 152. The other end of the screw 152 slidably extends through the gear 90 and is held against displacement by a wing nut 154 and also serves as means for adjusting the tension of the spring 150. The band 138 is provided with a liner 156 which normally lightly engages, under the tension of spring 150, the confronting side of the flange 80.

An eye element 158 is secured to the aforementioned other end of the band 138. One end of a link 160 is swivelly connected to the eye element 158, and the other end of the link 160 is connected in a similar manner to an eye 162. The eye element 162 is rigidly secured to one end of a brake lever 164 pivotally connected at 166 intermediate its ends to the bight 80. The other end of the lever 164 extends through a rack type slot 168 having a tab 170 adjacent one end thereof. To facilitate the operation of the lever 164 the outer end thereof is provided with a knob or handle 172.

One end of a driven flexible shaft or field rod 174 terminates in an enlarged boss 176 having a cylindrical socket 178 extending inwardly from the outer end thereof. The socket 178 receives therein the outer end of the shaft 74. The driven shaft 174 is connected in driving relation by means of a shear pin 180 that extends diametrically threethrough. The other end (not shown) of the driven shaft 174 terminates in the conventional helicoidal cutter.

One end of a split coupler 182 is provided with an enlarged boss 184 having a socket 186 extending inwardly from the outer end thereof, the socket 186 telescopically receiving therein the terminal end of the power takeoff shaft 188 of the tractor 10. The coupler 182 is connected for rotation with the power takeoff shaft 188 by means of a bolt 190 extending diametrically through. The other end of the coupler 182 is provided with clamping elements identical with respect to the clamping elements of the coupler 122, and the former are distinguished from the latter by the addition of a prime mark to each. As reference numeral 192 designates a substantially U-shaped connecting rod having a bight portion 194 from the ends of which, respectively, project a pair of side arms 196, 198. The arm 196 is received within the radial bore 134 with an adjacent portion thereof disposed in the semi-circular recesses 130, 132 and is held clamped between the elements 124, 126 by the bolt 128.

In a similar manner the arm 198 extends through the bore 134 and a portion of the rod 192 adjacent thereto is disposed within the semi-circular recesses 130, 132 and is held clamped between the elements 124, 126 by the bolt 128.

As is seen in Figure 4, the bight 50 has secured thereto lugs 200 to which are releasably secured by means of screws 202, a housing 204. Operators of field tile cleaners have long been cognizant of the danger which attends the use thereof. In conventional rigs, it is not uncommon that the helicoidal cutter will encounter roots or other obstructions which inhibits or completely halts the rotary and forward movement thereof. Under such conditions, a high torque is built up in the driven shaft 174 and the presence thereof is usually not made known to the operator until the shear pin 180 is broken. However, and is more frequently the case, the operator of the field tile cleaner will substitute a nail, screw, or bolt for the shear pin 180, the substitution having a much higher shear strength than the shear strength of the shear pin designed for the assembly. Consequently, when the helicoidal cutter encounters an obstacle and no longer rotates or rotates at a speed much lower than the cutter was originally designed for, a very high torque is developed in the shaft 174 which goes unnoticed by the operator until the same makes its presence known by effecting a fracture of coupling elements between links of the field rods 174, such fracturing being accompanied by a high explosive force, and/or through the actual fracturing of the field rod per se. In such cases, the fracturing of the couplings causes the pieces thereof to be hurled through the air and constitutes a hazard which may result in physical harm to the operator of the device. Likewise, the sudden release of the torque developed in the field rod 174 resulting from its fracture will cause the same to slip around wildly and constitutes another potential source of injury to the operator. These hazards and dangers are completely eliminated in the device described above.

To utilize this invention the field rod 174 is inserted in the tile to be cleaned in the usual conventional manner and the power takeoff shaft 188 is connected in driving relation with the tractor motor in the conventional manner, the tractor motor running at, as a general rule, its idle speed. This speed is slow enough to prevent the brake band 156 from becoming unduly heated and does not cause excessive wear.

The power takeoff shaft 188 normally rotates the brake drum 80 in a counterclockwise direction, reference being made to Figure 4 of the drawings. Now let it be assumed that the helicoidal cutter has encountered an obstacle which prevents its rotation and forward movement in the tile being cleaned. The continued rotation of the power takeoff shaft 188 will develop a high torque in the flexible shaft 174. As the torque reaches a critical degree the tension of the springs 116 is overcome and the clutch elements 90, 92 to slip relative to each other. The slippage of the elements 90, 92 produces a chatter as the teeth 109 thereof pass one another thereby creating an audible alarm. Upon hearing the chatter the operator immediately thereafter renders the power takeoff.
2,910,188

5 shaft 188 inoperative. With the tension of the springs 116 being overcome, the brake drum 80 now turns or spins in a clockwise direction which, due to the friction existing between the drum 80 and the brake lining 156, taken together with the tension exerted by the spring 150, causes the brake band 138 and the liner 156 to close more tightly and firmly against the brake drum 80. This, increases the friction between the brake liner 156 and the brake drum 80 to effect a slow down in the reverse spinning movement of the drum 89 so that the recoil of the shaft 174 is materially reduced. Under some circumstances, and depending upon the tension of the spring 150 the reverse rotation of the drum 80 will be fully stopped. It will be understood from the foregoing description that the slowing down of the recoil or its actual stoppage is automatically achieved.

The operator now places the tractor in gear and drives it forwardly in order to pull the farm rod out of the tile together with its load of roots and dirt.

Under the above described conditions, the lever 164 extends through the slot 168 in that portion thereof above which appears the legend "Automatic." Let it be now assumed, as a further condition, that the field rod has encountered an obstruction and the operator desires to effect an uncoupling thereof and found that the brake 136 was holding the drum 80 under tension. The operator now moves the lever 164 from its position shown in Figure 6 of the drawings and moves the same laterally to the left for engagement behind the tooth 170 under the legend "Free." The pivotal movement of the lever 164 introduces movement into the link 168, which, in turn, forces the brake band 138 to move away from the brake drum 80 thereby relieving the tension on the field rod. The field rod may also be driven with the lever 164 in the above described position when the user thereof is relatively certain that no serious obstacle will be encountered. However, should an obstruction not foreseen be met during the tile cleaning operation, the operator is immediately made aware thereof through the slippage of the two clutch elements 90, 92 which causes the aforementioned audible alarm.

The above described operation of the device to which this invention presupposes, of course, that the shear pin 188 is too heavy to serve its intended function.

Reference numerals 206, 208 designate lubricating fittings of conventional design for lubricating the shafts 74 and 108, respectively.

Having described and illustrated one embodiment of this invention in detail, it will be understood that the same is offered merely by way of example, and that this invention is to be limited only by the scope of the appended claims.

What is claimed is:

1. A slip type overload release coupling for interposition between a rotary power source including a rotatable shaft and a flexible driven first shaft, said coupling comprising a pair of substantially annular clutch elements having normally meshing gear teeth disposed in confronting relation relative to each other, a drive shaft extending through said annular clutch elements and coaxially aligned therewith, the opposed ends of said drive shaft projecting beyond the remote side of said annular members, a substantially circular back plate fixedly secured to said drive shaft for rotation therewith, means on one of said annular clutch elements to connect the same to said circular plate, means connecting said plate in driving relation with said first driven shaft, means connecting said first driven shaft with a flexible second driven shaft, a hollow tubular driving shaft telescoped over a portion of said first driven shaft and having a flanged inner end, means connecting the other of said clutch elements in driving relation with respect to said driving shaft, a centrally apertured disc mounted on said hollow tubular driving shaft and engaging in said flange, said disc normally rotating with said flange, resilient means connecting said disc with said plate and constantly urging said disc to move in a direction toward said plate, and means on the hollow tubular driving shaft to connect the latter with said rotary power source, said resilient means yielding in the presence of an excessive torque on said flexible driven shaft to permit said hollow tubular driving shaft and its associated clutch element to move axially on said first driven shaft away from the other of said clutch elements to permit relative rotation therebetween.

2. A slip type overload release coupling as defined in claim 1, and said plate having a laterally extending circumferential flange comprising a brake drum, a torque brake including a brake band substantially embracing said drum and having a brake band lining fixedly secured thereto and normally lightly engaging said drum, said torque brake becoming effective to prevent said drum from rotating relative to said band upon the excess heating and expansion of said liner.

3. A slip type overload release coupling as defined in claim 2, and adjustable tension means connected with said band to control the engagement pressure of the lining on said drum.

References Cited in the file of this patent

UNITED STATES PATENTS
1,875,046 Le Tournant Aug. 30, 1932
2,225,129 Osborn Dec. 17, 1940
2,292,712 O'Leary Aug. 11, 1942
2,333,553 Potgieter et al. Nov. 2, 1943
2,802,554 Bohnhoff et al. May 13, 1957

FOREIGN PATENTS
307,996 Italy May 20, 1933
254,457 Switzerland Dec. 16, 1948

OTHER REFERENCES
"Successful Farming," February 1956, page 172 (note "Farm-Rod" ad of Roto-Rooter Co.). Copy in Div. 27.