PATENT SPECIFICATION

Inventor: JOHN CLEMENT HAWKINS

748,459

Date of filing Complete Specification (under Section 3 (3) of the Patents Act, 1949) July 5, 1954.

Application Date July 14, 1953. *No. 19519/53.*

Application Date May 20, 1954. *No. 14793/54.*

Complete Specification Published May 2, 1956.

Index at acceptance:—Class 68(1), F3A2.

COMPLETE SPECIFICATION

Improvements in or relating to Ditching Machines

We, THE NATIONAL RESEARCH DEVELOPMENT CORPORATION, a corporation by Statute, an Organisation for the Promotion of Research and Development, of 1, Tilney Street, London, W.1, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to mechanical power operated ditching machines.

It is an object of the present invention to provide a machine which can be used for cleaning out silted and overgrown ditches, and which may also cut new ditches.

According to the present invention a ditching machine comprises a transverse beam adapted to be pivotally mounted by one end to one side of a vehicle so that it can rise and fall, a rotary cutter mounted on the outer end of the beam in a plane which is inclined to the direction of movement of the vehicle, and means for transmitting a drive to the rotary cutter.

The vehicle is preferably self-propelled for instance an agricultural tractor, but it could be a vehicle which is not self-propelled but is adapted to be pushed or towed by another vehicle. Preferably the power unit which propels the vehicle also provides the drive for the rotary cutter, for instance through a power-take-off, but an independent power unit for driving the cutter could be provided.

In operation, the vehicle is driven or moved along beside the edge of the ditch to be cleared, with the cutter in the ditch. As the cutter rotates it dislodges weeds, silt and other obstructions and flings the spoil out of the ditch.

The outer end of the beam may be at least partly supported by a supporting device such as a wheel, bogie or skid which runs along the ground. In a preferred form of the invention the supporting device is arranged to run along the bottom of the ditch. It is desirable that the vertical position of the supporting device should be adjustable relatively to the rotary cutter, for adjusting the depth of the cut. To reduce the load on the supporting device a spring may be provided between the beam and the vehicle which helps to support the weight of the beam without preventing the rise and fall of the beam.

A jack, for instance a hydraulic jack, is preferably provided between the beam and the vehicle for lifting the beam to raise the rotary cutter (and the supporting device if provided) above ground level when the vehicle is to be moved from place to place with the cutter inoperative.

In order to provide sufficient clearance between the outer end of the driving shaft and the nearside shoulder of the ditch, the driving shaft may terminate at a point well above the axle of the rotary cutter, the drive being transmitted from the driving shaft to the axle of cutter through transmission gearing comprising, for instance, a gear train or chain and sprocket mechanism. This transmission bearing should be enclosed in a casing to avoid contamination with dirt. It may also be arranged to provide a step-down speed ratio between the driving shaft and the rotary cutter.

It is desirable to incorporate an overload clutch in the drive to the rotary cutter which is arranged to slip when the cutter encounters excessive resistance.

The rotary cutter preferably has a plurality of cutting knives on its periphery, each cutting knife when viewed in cross-section in a radial plane containing the axis of the cutter being of approximately **U**-shaped form, one limb of the **U** being attached to the main body of the cutter with the base of the **U** projecting beyond

the periphery of the main body of the cutter on the side facing the direction of travel of the vehicle.

Preferably the cutter is provided with circumferentially spaced beater elements which lift and throw the spoil from the ditch. The leading surfaces of the beater elements may be curved out of the radial plane to increase the action of the beater elements in throwing the spoil clear of the ditch.

Although the main body of the cutter is preferably a disc, it may have apertures through it, or may comprise a rim portion and a hub portion connected together by spokes.

The invention may be performed in various ways, and one form of ditching machine embodying the invention will now be specifically described by way of example, with reference to the accompanying drawings, in which:—

Figure 1 is a front view of the machine;

Figure 2 is a plan view of the machine: and

Figure 3 is an enlarged perspective view of the rotary cutter.

The machine shown in the drawings comprises three main parts, namely a vehicle 10 (in this case an agricultural tractor), a beam 11 and a rotary cutter 12.

The tractor 10 is modified to carry the beam 11 by having attached to it a supporting framework 13 which is provided on one side with brackets 14 serving as hinge supports for the beam 11 and on the other side with an abutment 15 for a compression spring 16 and a hydraulic jack 17. The tractor also has a modified power take-off such that a drive is obtained through a stub-shaft 18 from bevel gearing 19 at a point in front of the rear wheels of the tractor.

The beam 11 is mounted on hinge pins 20 in the brackets 14, the axis of suspension being across the top of the inner end of the beam. The bottom of the inner end of the beam is connected to the compression spring 16 and also to the piston of the hydraulic jack 17.

The beam consists of a lattice structure of tubular steel members, and at its outer end it is rigidly connected to a gear box 21. An input shaft 22 enters the top part of the gear box 21 and receives a drive from the stub-shaft 18 through a driving shaft 23 which is provided with a telescopic splined joint 24 and an overload clutch 25 which is designed to slip when there is an excessive resistance to rotation of the driving shaft. The stub-shaft 18 and the gear box input shaft 22 are at an angle to each other, and in consequence universal joints 26 and 27 are provided, respectively, at the inner and outer ends of the driving shaft 23.

The lower end of the gear box 21 carried a hollow driving axle for the rotary cutter 12. A drive is transmitted to this axle from the input shaft 22 through spur or chain gearing in the gear box, the purpose of the gear box being to enable the drive shaft 23 to have a sufficient clearance above the ground when the cutter 12 is in a relatively deep ditch. The gearing may provide a step-down speed ratio between the input shaft 22 and the axle.

A non-rotatable rod 28 extends through the hollow axle of the cutter, and is anchored at its inner end to the beam 11. Secured in a non-rotatable manner on the outer end of the rod 28 is an arm 29. At its forward end this arm carries a vertical sleeve 30 through which passes a rod 31 connected at its lower end to a bogie 32. The height of the rod 31 in the sleeve 30 is adjustable.

The rotary cutter 12 consists of two conical plates 33 and 34 secured to a circular rim 35. Bolted to the rim 35 are cutter knives 36. These cutter knives, when viewed in cross-section in a radial plane containing the axis of the cutter, are of approximately **U**-shaped form, one limb of the **U** being bolted to the rim 35 with the base of the **U** projecting beyond the rim on the side facing the direction of travel of the tractor. Between the cutter knives are beater elements 37. These do not project quite so far as the cutter knives 36 and serve to lift the spoil and throw it clear of the ditch. In order to prevent spoil from being thrown over the tractor, a deflector plate 38 may be mounted on the beam 11.

Although the beater elements 37 shown in the drawing are substantially radial, modified throwing characteristics may be obtained by altering the shape of the leading surfaces of these beater elements, for instance by making them of concave form.

The machine works as follows. When it is desired to drive the tractor to the place of use with the beam and cutter installed, the jack 17 is extended by pumping in oil from the hydraulic system of the tractor, so that the beam is rotated about the hinge 20 to raise the cutter 12 well clear of the ground. The tractor is then driven into a position alongside the ditch that requires clearing. Pressure is then relieved from the jack 17 to lower the cutter 12 into the ditch. Part of the weight of the beam and the cutter is supported by the spring 16, while the actual height of the cutter is determined by the bogie 32 coming to rest at the bottom of

the ditch. When the stub-shaft 18 is rotated by engaging the power take-off, it rotates the driving shaft 23 and consequently drives the cutter disc 12, which is geared to rotate in the direction of the arrow. The cutter knives 36 cut away silt, weeds and irregularities in the walls of the ditch, while the beaters 37 pick up the spoil which has been cut down or loosened by the cutters and fling it out of the ditch. The depth of cut can be varied by adjusting the height of the sleeve 30 in relation to the rod 31 of the bogie. The tractor is driven slowly forwards so that the cutter advances along the ditch. Any rise and fall of the bottom of the ditch is compensated for by vertical movements of the bogie 32. These cause the beam to rise and fall also, and in consequence the length of the driving shaft 23 varies, as permitted by the telescopic joint 24. Should the cutter encounter an immovable rock or other obstacle, the resistance to rotation will be such that the overload coupling 23 will slip, thereby preventing damage to the working parts. The noise made by the slipping of the overload clutch indicates immediately to the driver that excessive resistance is being encountered.

It will be appreciated that numerous modifications may be made to the construction specifically described without departing from the invention. For instance, if the design of the vehicle is such that the drive for the cutter can be made to pass through a point which lies on the pivotal axis of the beam it is not necessary to provide a telescopic joint in the driving shaft.

The beam may be provided near to its outer end with power-driven or land-driven cutters, or with fixed coulters or tines, to improve the shape of the ditch, or to cut a passage for easier discharge of spoil, or for both these purposes.

In another modification the cutter disc is mounted on the end of a driving shaft which is connected to the power take-off of the vehicle through a single universal joint, this shaft being supported in a bearing carried on the outer end of the beam.

As a further modification, the bogie 32 running along the base of the ditch could be replaced by a bogie which runs along the ground outside the ditch and on which the beam is supported by means of an adjustable strut. Another modification comprises replacing the bogie by a wheel or by a skid.

What we claim is:—

1. A ditching machine comprising a transverse beam adapted to be pivotally mounted by one end to one side of a vehicle so that the beam can rise and fall, a rotary cutter mounted on the outer end of the beam in a plane which is inclined to the direction of movement of the vehicle, and means for transmitting a drive to the rotary cutter.

2. A ditching machine as claimed in Claim 1 in which the vehicle is self-propelled and the power unit thereof also provides the drive for the rotary cutter.

3. A ditching machine as claimed in Claim 1 or Claim 2 in which the outer end of the beam is at least partly supported by a supporting device which runs along the ground.

4. A ditching machine as claimed in Claim 3 in which the supporting device is arranged to run along the bottom of the ditch.

5. A ditching machine as claimed in Claim 3 or Claim 4 in which the vertical position of the supporting device is adjustable relatively to the rotary cutter, for adjusting the depth of the cut.

6. A ditching machine as claimed in any of the preceding claims in which a spring is provided between the beam and the vehicle which helps to support the weight of the beam without preventing the rise and fall of the beam.

7. A ditching machine as claimed in any of the preceding claims in which a jack is provided between the beam and the vehicle for lifting the beam to raise the rotary cutter above ground level when the vehicle is to be moved from place to place with the cutter inoperative.

8. A ditching machine as claimed in any of the preceding claims in which the driving shaft for the rotary cutter terminates at a point well above the axle of the rotary cutter, the drive being transmitted from the driving shaft to the axle of the cutter through transmission gearing.

9. A ditching machine as claimed in Claim 8 in which the transmission gearing provides a step-down speed ratio between the driving shaft and the rotary cutter.

10. A ditching machine as claimed in any of the preceding claims in which there is an overload clutch in the drive to the rotary cutter which is arranged to slip when the cutter encounters excessive resistance.

11. A ditching machine as claimed in any of the preceding claims in which the rotary cutter has a plurality of cutting knives on its periphery, each cutting knife when viewed in cross-section in a radial plane containing the axis of the cutter being of approximately U shaped form, one limb of the U being attached to the main body of the cutter with the base

the ditch. When the stub-shaft 18 is rotated by engaging the power take-off, it rotates the driving shaft 23 and consequently drives the cutter disc 12, which is geared to rotate in the direction of the arrow. The cutter knives 36 cut away silt, weeds and irregularities in the walls of the ditch, while the beaters 37 pick up the spoil which has been cut down or loosened by the cutters and fling it out of the ditch. The depth of cut can be varied by adjusting the height of the sleeve 30 in relation to the rod 31 of the bogie. The tractor is driven slowly forwards so that the cutter advances along the ditch. Any rise and fall of the bottom of the ditch is compensated for by vertical movements of the bogie 32. These cause the beam to rise and fall also, and in consequence the length of the driving shaft 23 varies, as permitted by the telescopic joint 24. Should the cutter encounter an immovable rock or other obstacle, the resistance to rotation will be such that the overload coupling 23 will slip, thereby preventing damage to the working parts. The noise made by the slipping of the overload clutch indicates immediately to the driver that excessive resistance is being encountered.

It will be appreciated that numerous modifications may be made to the construction specifically described without departing from the invention. For instance, if the design of the vehicle is such that the drive for the cutter can be made to pass through a point which lies on the pivotal axis of the beam it is not necessary to provide a telescopic joint in the driving shaft.

The beam may be provided near to its outer end with power-driven or land-driven cutters, or with fixed coulters or tines, to improve the shape of the ditch, or to cut a passage for easier discharge of spoil, or for both these purposes.

In another modification the cutter disc is mounted on the end of a driving shaft which is connected to the power take-off of the vehicle through a single universal joint, this shaft being supported in a bearing carried on the outer end of the beam.

As a further modification, the bogie 32 running along the base of the ditch could be replaced by a bogie which runs along the ground outside the ditch and on which the beam is supported by means of an adjustable strut. Another modification comprises replacing the bogie by a wheel or by a skid.

What we claim is:—

1. A ditching machine comprising a transverse beam adapted to be pivotally mounted by one end to one side of a vehicle so that the beam can rise and fall, a rotary cutter mounted on the outer end of the beam in a plane which is inclined to the direction of movement of the vehicle, and means for transmitting a drive to the rotary cutter.

2. A ditching machine as claimed in Claim 1 in which the vehicle is self-propelled and the power unit thereof also provides the drive for the rotary cutter.

3. A ditching machine as claimed in Claim 1 or Claim 2 in which the outer end of the beam is at least partly supported by a supporting device which runs along the ground.

4. A ditching machine as claimed in Claim 3 in which the supporting device is arranged to run along the bottom of the ditch.

5. A ditching machine as claimed in Claim 3 or Claim 4 in which the vertical position of the supporting device is adjustable relatively to the rotary cutter, for adjusting the depth of the cut.

6. A ditching machine as claimed in any of the preceding claims in which a spring is provided between the beam and the vehicle which helps to support the weight of the beam without preventing the rise and fall of the beam.

7. A ditching machine as claimed in any of the preceding claims in which a jack is provided between the beam and the vehicle for lifting the beam to raise the rotary cutter above ground level when the vehicle is to be moved from place to place with the cutter inoperative.

8. A ditching machine as claimed in any of the preceding claims in which the driving shaft for the rotary cutter terminates at a point well above the axle of the rotary cutter, the drive being transmitted from the driving shaft to the axle of the cutter through transmission gearing.

9. A ditching machine as claimed in Claim 8 in which the transmission gearing provides a step-down speed ratio between the driving shaft and the rotary cutter.

10. A ditching machine as claimed in any of the preceding claims in which there is an overload clutch in the drive to the rotary cutter which is arranged to slip when the cutter encounters excessive resistance.

11. A ditching machine as claimed in any of the preceding claims in which the rotary cutter has a plurality of cutting knives on its periphery, each cutting knife when viewed in cross-section in a radial plane containing the axis of the cutter being of approximately **U** shaped form, one limb of the **U** being attached to the main body of the cutter with the base

* C L M S *

of the U projecting beyond the periphery of the main body of the cutter on the side facing the direction of travel of the vehicle.

12. A ditching machine as claimed in Claim 11 in which the cutter is provided with circumferentially spaced beater elements which lift and throw the spoil from the ditch.

13. A ditching machine as claimed in Claim 12 in which the leading surfaces of the beater elements are curved out of the radial plane to increase the action of the beater elements in throwing the spoil clear of the ditch.

14. A ditching machine substantially as specifically described with reference to the accompanying drawings.

KILBURN & SRODE,
Agents for the Applicants.

PROVISIONAL SPECIFICATION
No. 19519, A.D. 1953.

Improvements in or relating to Ditching Machines

We, THE NATIONAL RESEARCH DEVELOPMENT CORPORATION, a corporation by Statute, an Organisation for the Promotion of Research and Development, of 1, Tilney Street, London, W.1, do hereby declare this invention to be described in the following statement:—

This invention relates to mechanical power operated ditching machines.

It is an object of the invention to provide a machine which can be used for cleaning out silted and overgrown ditches, and which may also cut new ditches.

According to one aspect of the present invention a ditching machine comprises a self-propelled vehicle, for example a farm tractor a rotary disc cutter mounted on a shaft, means for driving the shaft, and means for adjusting the attitude of the shaft and thus of the cutter by swivelling the shaft about a substantially vertical axis and adjustably fixing it in any of two or more attitudes on one side of the longitudinal centre line of the vehicle.

The ditching machine preferably includes means for adjusting the height of the cutter by swivelling the shaft about a substantially horizontal axis.

In a preferred construction the cutter shaft is driven at one end from the main power unit of the vehicle through a universal coupling, and is supported near to the other end in a bearing adjustably mounted in a bracket which is hingedly supported from the framework or chassis of the vehicle, the axis of the hinge lying generally horizontal and passing substantially through the universal coupling. In this case the bracket may be supported at a point displaced from the hinge on a jockey wheel, skid or like support, arranged to engage the ground at one side of the vehicle, and the machine may include means for adjusting the height of the bracket above the jockey wheel or other support, as by means of a hydraulic jack.

In an alternative construction the pivotal movements of the bracket about its hinge connection to the vehicle are controlled by a hydraulic ram or the equivalent so as to vary the vertical position of the cutter in relation to the vehicle.

The rotary disc cutter is preferably provided with cutting knives circumferentially spaced around its periphery. According to another preferred feature of the invention each cutting knife when viewed in cross sections containing the axis of the cutter extends generally radially outwards and is provided with a curved formation extending generally axially away from the cutter, and preferably the extremity of each cutting knife when viewed in cross sections containing the axis of the cutter is inwardly turned towards the axis of the cutter.

Thus the cutting knives when looking towards the cutting edges, are preferably of approximately U-shaped form, one limb of the U being attached to one side of the cutter disc so that the base of the U projects out beyond the periphery of the disc.

Furthermore the cutter is preferably provided with circumferentially spaced generally radial flanges or brackets, constituting beater elements which act to lift and scatter the spoil from the ditch.

According to another preferred feature of the invention the arrangement is such that the cutter lies approximately on or adjacent the axis of the rear axle of the vehicle, so as to minimise the effect of small steering errors.

A ditching machine according to the invention preferably includes a pointer supported adjacent the front end of the vehicle and arranged to lie substantially directly ahead of the cutter, to assist the vehicle operator in manoeuvering the vehicle.

According to another aspect of the invention a ditch-cleaning or digging attachment for a self-propelled vehicle,

* C L M S *

for example a farm tractor, comprises a cutter arranged and operating in any manner as set forth above.

The invention may be performed in various different ways but one specific embodiment will now be described by way of example as applied to a ditching attachment for a farm tractor.

In the present example the tractor is of the normal kind with front wheel steering and a pulley shaft and driving pulley provided on the off-side of the main engine unit approximately midway between the front and rear wheels. The tractor also includes the usual hydraulic "lift".

For the purposes of the invention the driving pulley is removed and a subsidiary gear box is connected to this pulley shaft, and is arranged to drive a rotary cutter shaft through a universal coupling. Thus the normal manual control for operating the pulley shaft can be used to engage the drive to the cutter shaft when desired.

The length of the cutter shaft is approximately equal to the overall length of the tractor, and it is supported adjacent its end remote from the gear box in a bearing mounted in a support which is adjustably secured to a bracket hingedly connected to the chassis of the tractor.

The bracket is formed of hollow tubular steel members and is in plan view generally of **A** formation, the two ends of the legs of the **A** being pivotally attached to hinge connections secured to the chassis of the tractor in front and in rear of the off-side rear wheel. The axis of the two hinge connections is parallel to the longitudinal centre line of the tractor and passes through the centre of the universal coupling connected to the gear box, to permit the bracket and the cutter shaft to swivel together about this axis. The "cross-stroke" of the **A** is constituted by a strengthening cross-strut secured to the two legs of the bracket by welding, and the apex of the **A** is formed by a further cross-strut constituting an adjusting bar, inclined somewhat to the axis of the tractor rear axle, and perpendicular to the normal or central position of the cutter shaft.

The adjusting bar is provided with a series of spaced bolt holes, each arranged on a radius from the universal coupling connected to the gear box, and the support for the bearing at the remote end of the cutter shaft is provided with fastening bolts to engage these holes. Thus the attitude of the cutter shaft as viewed in plan, may be adjusted by swivelling the shaft about the universal coupling and by varying the position of the bearing support along the adjusting bar. The dimensions of the bracket are preferably such that in its normal or central position the cutter shaft lies at an angle of approximately 45° with the longitudinal centre line of the tractor and the dimensions of the adjusting bar may be such as to permit the cutter shaft to be moved through approximately 10° on either side of this central position. The disc cutter on the remote end of the cutter shaft is thus at all times on or adjacent to the axis of the fixed rear axle of the tractor, so minimizing the result of small steering errors.

The pivotal movements of the bracket about its hinge connections may be controlled in a number of different ways so as to control the vertical position of the cutter. In the present example an auxiliary wheel or skid, is carried on a second bracket below the first bracket, the second bracket being hingedly connected to the chassis of the tractor at the same hinge connections. A vertical strut secured to the second bracket is connected at its upper end to a part connected to the strengthening cross-strut of the first bracket, so that vertical movements of the auxiliary wheel due for example to irregularities in the ground are reflected by corresponding movements of the first bracket. Means may be provided for varying the effective length of the vertical strut, so as to vary the effective height of the cutter, and in the present example the strut is formed as part of a telescopic hydraulic jack, which may be operated from the standard tapping normally provided on the hydraulic lift of the tractor. The auxiliary wheel or skid may be arranged to run on the ground to one side of the ditch, or it may run in the ditch either ahead of or behind the cutter. In another alternative the auxiliary wheel and second bracket are dispensed with, and the horizontal position of the first bracket is controlled by a direct mechanical connection to the hydraulic lift of the tractor. In a further alternative the same mechanical connection to the hydraulic lift may be combined with an automatic regulating device to maintain the depth of cut constant or to maintain the draft or torque constant by varying the depth of cut.

The end of the cutter shaft remote from the gear box on the tractor chassis is connected for rotation with a rotary disc-type cutter, which is formed from two dished or conical members united to one another around their periphery. A number of curved cutting knives are secured to the "leading" face of the cutter and circumferentially spaced around its periphery. Each knife is, when viewed in

cross sections containing the axis of the cutter, of curved semi-circular formation, one end of the knife being secured flush to the leading face of the cutter, while the knife itself extends first radially outwards, then axially away from the leading face towards the gear box on the tractor, and then radially inwards towards the axis of the cutter. The radius of curvature of the curved portion of each knife is preferably approximately 4".

In the present example eight knives are provided, and an equal number of beater elements are arranged around the periphery of the cutter and equally spaced betwen the knives. Each beater element is in the form of an L section bar, one flange of the L being secured as by bolts to the leading face of the cuter while the other flange of the L is arranged to lie generally in a radial direction and projecting axially away from the leading face.

The combination of cutting knives and beater elements on the cutter act to cut material and spoil from the ditch and to lift this and scatter it away from the ditch.

The cutter may be provided with cutting knives or beater elements on either or both of its faces, and the cutter may be rotated in either direction.

It will be understood that the rotary disc cutter will cut a ditch of elliptical cross-section, the width-depth ratio of the ditch being variable by adjusting the position of the cutter shaft bearing along the adjusting bar.

KILBURN & STRODE,
Agents for the Applicants.

PROVISIONAL SPECIFICATION
No. 14793, A.D. 1954.

Improvements in or relating to Ditching Machines.

We, THE NATIONAL RESEARCH DEVELOPMENT CORPORATION, a corporation by Statute, an Organisation for the Promotion of Research and Development, of 1, Tilney Street, London, W.1, do hereby declare this invention to be described in the following statement:—

This invention relates to mechanical power operated ditching machines.

It is an object of the invention to provide a machine which can be used for cleaning out silted and overgrown ditches and which may also cut new ditches.

According to the present invention a ditching machine comprises a vehicle, a transverse beam pivotally mounted by one end to one side of the vehicle so that it can rise and fall, a cutter disc mounted on the outer end of the beam in a rotatable manner and in a plane which is inclined to the direction of movement of the vehicle, and means for transmitting a drive to the disc.

The vehicle is preferably self-propelled for instance an agricultural tractor, but it could be a vehicle which is not self-propelled but is adapted to be pushed or towed by another vehicle. Preferably the power unit which propels the vehicle also provides the drive for the cutter disc, for instance through a power take-off, but an independent power unit for driving the disc could be provided.

In operation, the vehicle is driven or moved along beside the edge of the ditch to be cleared, with the cutter disc in the ditch. As the cutter disc rotates it dislodges weeds, silt, and other obstructions and flings them out of the ditch.

The outer end of the beam may be at least partly supported by a wheel, bogie or skid. In a preferred form of the invention the wheel, bogie or skid is mounted so that it runs along the bottom of the ditch. It is desirable that the height of the wheel, bogie or skid should be adjustable relatively to the cutter disc, for the purpose of adjusting the depth of the cut. To reduce the load on the wheel, bogie or skid a spring may be provided between the beam and the vehicle which helps to support the weight of the beam without restricting the rise and fall of the beam.

A lifting device, for instance a hydraulic ram, is preferably provided for lifting the beam to raise the cutter disc and the wheel, bogie or skid above ground level when the vehicle is to be driven from place to place.

It is an advantage to arrange for the drive for the cutter disc to pass through a point which lies on the pivotal axis of the beam, since if this is not done it is necessary to provide means for permitting at least one element in the transmission to vary in length, for instance by providing a telescopic splined coupling in a driving shaft running out from the vehicle to the outer end of the beam, in order to allow for the rise and fall of the beam.

In order to provide sufficient clearance between the outer end of the driving shaft and the nearside shoulder of the ditch, the driving shaft may terminate at a point well above the axis of the cutter disc, the drive being transmitted from the driving shaft to a stub shaft which

supports the cutter disc through a chain and sprocket mechanism. This gear train or chain and sprocket mechanism should be enclosed in a casing to avoid contamination with dirt. It may also be arranged to provide a step-down gear ratio between the driving shaft and the cutter disc.

It is desirable to incorporate an overload clutch in the drive to the cutter disc which is arranged to slip when the cutter disc encounters excessive resistance.

The beam may be provided near to its outer end with power-driven or land-driven cutters, or with fixed coulters or tines, to improve the shape of the ditch or to cut a passage for easier discharge of the spoil or for both these purposes.

The cutter disc may be described in the provisional specification of British Patent Application No. 19519/53, but in some cases the beater elements on the disc may be modified by providing them with leading surfaces which are suitably curved to increase the action of the beater elements in throwing the dislodged soil, weeds and the like clear of the ditch. Although the cutter disc is preferably a solid disc, it may have apertures through it or comprise a rim portion and a hub portion connected together by spokes.

KILBURN & STRODE,
Agents for the Applicants

Leamington Spa: Printed for Her Majesty's Stationery Office, by the Courier Press.—1956.
Published at the Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.