TRENCHING ATTACHMENT FOR A TRACTOR OR THE LIKE

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ABSTRACT

A trenching attachment comprising a boom to be mounted on the rear end of a tractor, an endless chain having digging elements thereon carried by the boom, an actuator for moving the boom between transport and digging positions, and a belt for connecting a drive shaft for the chain to a power take-off shaft on the tractor.

8 Claims, 10 Drawing Figures
This invention relates generally to trenching apparatus, and, more particularly, to a trenching attachment for a tractor or the like.

Conventional trenching apparatus comprises a boom mounted on and extending rearwardly from a large vehicle, frequently of the track type. An endless chain having digging elements is carried on the boom so as to dig out a trench in the ground upon lowering of the boom and forward movement of the vehicle over the site in which the trench is to be dug. There is an increasing demand for apparatus of this type for digging relatively narrow trenches, such as those into which electrical conduit may be laid. However, the work to be performed does not justify the expense of using conventional trenching apparatus, and there is therefore a need for a relatively small trencher.

Furthermore, since many contractors and individuals who would have occasion to dig narrow ditches own or have access to relatively small, garden type tractors, such as those to the rear end of which various ground working parts, such as plows and rotary tillers, may be interchangeably mounted, there is a further need for a relatively small trenching attachment which also may be mounted thereon. Thus, although small, these tractors nevertheless have sufficient power to operate other, more massive and demanding types of ground working parts, such as trenchers. However, trenchers present unique problems of attachment due to the weight and length of the boom, as well as the depth to which it must dig into the earth, all of which tend to tilt the tractor about its rear wheels and thus detract from its tractive power.

An object of this invention is to provide a trenching attachment which is of compact construction and may be mounted on the rear of a tractor of this type without materially detracting from its tractive power.

A more particular object is to provide a trenching attachment which is of such construction that a large part of its weight is concentrated in an area adjacent the rear end of the tractor, thereby shifting its center of gravity to only a minor extent.

Another object is to provide such an attachment having an actuator for raising and lowering the boom which is so arranged as to permit the inner end of the boom to be close to the rear end of the tractor.

A further object is to provide such an attachment having an endless chain on the boom which is connected to the power take-off shaft on the tractor by a transmission which includes a belt from which tension may be relieved in a simple manner.

Still another object is to provide such an attachment having a boom of such construction as to permit easy installation and removal of the chain with respect to the boom, and thus facilitate replacement or repair of the chain.

In the drawings, wherein like reference characters are used throughout to designate like parts:

FIG. 1 is a side elevational view of the trenching attachment mounted on the rear end of a tractor (shown in broken lines) and with the boom thereof in transport position;

FIG. 2 is a view similar to FIG. 1, but with the boom in digging position;

FIG. 3 is a view of the rear of the trenching attachment, as seen along broken line 3—3 of FIG. 2, and with the boom in digging position;

FIG. 4 is an enlarged perspective view of a portion of the inner end and left side of the attachment, including the boom, but with certain other parts thereof removed and others shown in broken lines for purposes of illustration;

FIG. 5 is an elevational view of certain of the other parts of the inner end of the attachment which have been removed from FIG. 4, including a hand-operated lever for selectively engaging and disengaging the transmission between the power take-off shaft on the tractor and the drive shaft for the chain carried on the boom;

FIG. 6 is a side elevational view, on a smaller scale, of the transmission in engaged position;

FIG. 7 is a view similar to FIG. 6, but with the transmission in disengaged position;

FIG. 8 is an elevational view of the other side of trenching attachment, and illustrating the inner end of the boom in transport position;

FIG. 9 is a view similar to FIG. 8, but with the boom in digging position; and

FIG. 10 is an enlarged cross-sectional view of a portion of the boom, as seen along broken line 10—10 of FIG. 9.

With reference now to the details of the above-described drawings, the trenching attachment, which is indicated in its entirety by reference character 20, is shown in each of FIGS. 1, 2 and 3 to be mounted on the rear end of a tractor 21 having a driver's seat 22, front and rear wheels for moving forwardly over the ground 24, and a power take-off 25 extending from the left side thereof. As previously mentioned, it is conventional with tractors of this type to mount various ground working attachments on the rear end thereof and to cause them to be operated by a suitable transmission between the power take-off shaft and a drive shaft on the attachment. As will be described to follow, the trenching attachment 20 includes a body 23 releasably connected to the rear end of the tractor, whereby it may be replaced by such other attachments, and a drive shaft 24 rotatably mounted on the body. The drive shaft is, in turn, connected to the power take-off shaft 25 by a suitable transmission so as to operate digging elements 26 mounted on an endless chain 27 carried on a boom 28 supported on the body for swinging between its alternate positions.

More particularly, and as will also be described to follow, the transmission may be disengaged when the chain is not to be operated as, for example, when it is raised to the transport position of FIG. 1. On the other hand, the transmission may be engaged so as to permit the boom 28 to be lowered into a position in which the digging elements will dig a trench T, as shown in each of FIGS. 2 and 3. The transmission is selectively engaged or disengaged by means of a lever 29 positioned to be operated by the tractor driver from his seat 22, and the boom is swung between transport and digging positions by means of an extendible and retractable actuator 30 connected between the body 23 and the boom and also conveniently located for manipulation by the tractor driver.

The endless chain 27 is of conventional construction and is so carried on the boom as to cause its digging elements to move in an upward direction along the front.
side of the chain and thus against the front end of the ditch, as shown in FIG. 2. During the digging operation, the tractor 21 is of course moved forward at a suitable speed, so that the earth raised by the digging elements may be piled at opposite sides of the ditch. To facilitate the latter, augers 31 are mounted on the boom and extend from opposite sides of the chain for causing earth raised by the digging elements to be moved laterally away from opposite sides of the trench.

The tractor 21 may be similar to a number of well known commercially available types, such as one manufactured by the Textron Division of the Homelite Company, and identified as the "T-12." This particular tractor has a vertical wall at its rear end (see FIGS. 8 and 9) from which four ears extend, as shown at 32A and 32B and at 33A and 33B. The purpose of these ears is to mount other types of earth working attachments on the tractor, and, in accordance with the present invention, they are also used for mounting the trenching apparatus of the present invention. Thus, as shown in FIG. 4, the body 23 of the trenching attachment includes a pair of laterally spaced-apart side walls 34 and 35, with the wall 34 being connected to the ears 32A and 33A, and the wall 35 connected to the ears 32B and 33B. Thus, as shown in FIG. 4, the upper front corners of each of the walls is provided with a hole therethrough alignable with a hole in the adjacent ear so that the ends of a rod 36A extending between the side walls may be passed therethrough. The lower front corners of the side walls are also provided with holes alignable with holes in the lower ears 33A and 33B to receive attaching pins 36B (see FIGS. 8 and 9). Thus, the body 23 may be disconnected from the tractor merely upon removal of the aforementioned rod and pins.

As also shown in FIG. 4, the inner end of the boom 28 is connected to a housing 37 which is in turn pivotally mounted on the drive shaft 24 which extends between and is journaled by the side walls 34 and 35. More particularly, the housing includes a pair of laterally spaced-apart side walls 38 and 39 which are disposed on the inner sides of the side walls of the body and extend in a direction therethrough aligned with holes in the side walls of the body to receive the ends of the shaft 24.

As shown in FIG. 4, the housing 37 also includes a front wall 40 and a top wall 41 extending between the side walls. The front wall has an angularly disposed flange at its lower end extending downwardly along the lower edge of the side plates 38 and 39, and a rubber flap 42 is connected to the rear edge of the top wall 41 for disposal across the open rear end of the housing. The purpose of the front and top walls of the housing and the flap 42 is to contain earth which is dug up by and flung off of the endless chain.

As best shown in FIGS. 8 to 10, the boom 28 includes inner and outer sections 28A and 28B which are arranged end-to-end and adapted to be moved toward one another, in a manner to be described to follow, to permit shortening of the boom from the normal extent shown in the drawings when it is desired to move the chain 27 therefrom. The inner section 28A of the boom includes a pair of arms having their inner ends welded to the side plates 38 and 39 of the housing 37, as shown in FIG. 4, and a threaded pin 43 extending from their outer ends. The outer section 28B of the boom, on the other hand, comprises a bar having a hole 44 on its inner end to receive the outer end of the threaded pin 43, and a pair of spaced-apart arms 45 on its outer end to receive a sprocket 46 drivingly engaged with the outer end of the chain 27 and rotatably mounted on the arms by means of a pin 47. As also shown by broken lines in FIG. 4, a sprocket 48 is mounted on the shaft 24 for rotation therewith intermediate the side walls of the housing 37 and is drivingly engaged with the inner end of the chain 27 so as to cause it to move in the desired direction in response to rotation of the shaft.

As best shown in FIG. 10, a pair of nuts 49 and 50 are threaded onto the rod 43 intermediate the opposite ends of the boom sections 28A and 28B, so that rotation of these nuts in a direction to approach the outer end of the pin 43 will cause the boom section 28B to move away from the boom section 28A and thus effectively increase the length of the boom to provide the desired tension in the chain. On the other hand, the nuts 49 and 50 may be backed off or moved away from the end of the pin 43 so as to effectively shorten the boom when, for example, it is desired to remove the chain from the boom. As indicated in FIGS. 8 and 9, a set screw 43A extends through the boom section 28B for holding the boom sections in a selected position.

One end of the actuator 30 is pivotally connected to a post 51 mounted on and extending upwardly from the wall 35 on the right-hand side of the body 23. The opposite end of the actuator is in turn pivotally connected to a link or arm 52 connected to the right-hand side wall 39 of the housing 37. Thiradly, the actuator may be retracted to swing the boom 28 to transport position, as shown in FIG. 8, and extended to swing the boom to digging position, as shown in FIG. 9. The actuator may be of any suitable type, such as one which is operated by means of an electric motor 53 carried on its end mounted on the post 51 and thus in the position to be manipulated by the tractor driver.

As best shown in FIG. 4, the inner end of the link 52 is connected to the housing plate 39 by means of a pin 54 and is prevented from pivoting relative to the wall 39, in response to extension and retraction of the actuator 30, by means of a pin 55 connecting it to a portion of the wall 39 radial of the pin 54. More particularly, the pin 55 is adapted to connect the link 52 with the wall 39 by extension through one of two holes 56 and 57 formed in the wall 39 which are arranged on an arc shorter about the axis of the pin 54. As will be appreciated from a comparison of FIGS. 8 and 9, the selective connection of the link 52 with the holes will permit the boom to be swung through an angle greater than would be possible if the link were connectible to only one of the holes, whereby the actuator, and thus the inner end of the boom, may be placed quite close to the rear end of the tractor since interference between the actuator and the body on which the boom is pivotally mounted is avoided.

Thus, as shown in FIG. 8, the link 52 is connected to the hole 57 when the actuator is retracted to swing the boom to transport position. However, intermediate this position and the digging position of FIG. 9, the actuator is stopped, the pin 55 is removed from the hole 57 and fitted within the hole 56, and the actuator is then further extended to swing the boom toward digging position. Ordinarily, this interchange of pin connections is made during such time that the boom occupies a generally horizontal position intermediate those of FIGS. 8 and 9. Obviously, it would be necessary to interrupt re
traction of the actuator 30 in approximately the same position of the boom to permit a reverse interchange of pin connection during swinging of the boom to transport position.

As shown, the inner end of the link is forked so as to straddle the side wall 37 of the housing, and thereby strengthen the connection between the link and the housing provided by pins 54 and 55. Thus, the inner side of the link extends between the wall 39 of the housing and the wall 35 of the body of the attachment.

The augers 31 are mounted on an intermediate sprocket 58 which is in turn rotatably mounted on the inner boom section 28. Thus, as shown in FIGS. 8 and 9, sprocket 58 is drivenly engaged with the chain 27 so as to transmit rotation of the chain to the augers.

As shown in FIG. 4, the drive shaft 24 extends outwardly from the left-hand wall 34 of the body to a position rearward of the power take-off shaft 25 on the tractor. As best shown in each of FIGS. 8 and 9, a relatively large gear 59 is connected to the outward extension of the shaft 24 for rotation therewith. The gear 59 is in turn drivenly engaged with a relatively small gear 60, and both gears 59 and 60 are contained within a gear box 61. A shaft 62 on the gear 60 extends out of the gear box 61 on its inner side, and a relatively large pulley 64 is connected thereto for rotation therewith in generally longitudinal alignment with a smaller gear 65 releasably connected to the power take-off shaft 25. A belt 66 is disposed about the pulleys, so that when the pulleys are arranged to apply tension to the belt (FIG. 6), rotation of the shaft 25 is transmitted to the pulley shaft 62 and thus through the gears 59 and 60 to the drive shaft 24. The pulleys and gears are of such size as to provide the desired speed reduction between the power take-off shaft and the drive shaft.

The axis of the shaft 62 on which pulley 64 and gear 60 are mounted is disposed forwardly and above the axis of drive shaft 24, and the pulley 64 and gear 60 are swingable about the axis of shaft 24 from the position shown in FIG. 6, wherein desired tension is placed in the belt 66 for engaging the transmission between the power take-off shaft and the drive shaft 24, and the position of FIG. 7, wherein the axis of the shaft 62 has moved toward the power take-off shaft 25 so as to relieve tension of the belt 66 and thus disengage the transmission.

As will be appreciated, due to the position of the pulley 64 and gear 60 intermediate the shafts 24 and 25, there is a tendency for the gear box to swing counterclockwise about the axis of the shaft 24. The pulley 64 is held against such rotation, when it is disposed in its transmission engaging position of FIG. 6, by means of linkage connecting the body 23 to the gear box 61. For this purpose, a bracket 67 extends outwardly from the wall 34 of the body to provide a forwardly extending flange 68 in generally vertical alignment with the inner side of the gear box 61. The aforementioned linkage includes a pair of links 69 and 70 which are pivotally connected to one another by a pin 71 and to the flange 68 and gear box 61 by pins 69A and 70A, respectively. When the links are moved to the right to spread the pins 69A and 70A, the pulley 64 is swung in a counterclockwise direction from the position of FIG. 7 to that of FIG. 6. Then, as pulley 64 moves into position to apply the desired tension to the belt 66, the axis of pin 71 between the links moves over center to the right or rearwardly of an imaginary line “X” passing through the axes of the pins 69A and 70A, so as to hold the pulley 64 in tensioning position, at least until such time that the links are moved out of over-center position.

When the links are moved out of their over-center position and to the position of FIG. 7, so as to relieve tension in the belt 66, they are held in such position so as to prevent further counterclockwise movement of the gear box by means of a bar 71A which is fixed to and extends upwardly from the shaft 68. That is, as best shown in FIG. 5, the pin 70A connecting the link 70 to the pulley 64 moves into engagement with the upper end of the bar 71A so as to be supported thereby. The linkage is moved between the positions of FIGS. 6 and 7, which positions are also shown by the solid and broken lines of FIG. 5, by means of the hand lever 29 which forms an upward continuation of the link 69. The link 70 is longitudinally extendible and retractable to permit adjustment of tension in the belt.

When tension in the belt 66 is relieved, its upper and lower runs will have a tendency to bow upwardly and downwardly, respectively. As a result, the opposite ends of the belt 66 will tend to maintain fairly tight engagement with the pulleys 64 and 65. Obviously, this is not desired, even though such tight engagement of the belt with the pulley 65 will not transmit rotation to shaft 24, because it nevertheless causes wear on the belt 66. To reduce this wear, a bracket 72 having outwardly extending bars 73 on its upper and lower ends is connected to the side of the tractor 21 in such a position as to dispose such bars respectively above and below the upper and lower runs of the belt. More particularly, these bars are spaced from the belt when tension is applied thereto, but are sufficiently close to the belt as to engage with the upper and lower runs thereof when tension on the belt is relieved and its upper and lower ends are bowed outwardly. In this way, the parts 73 limit the bowing of the belt, and thus relieve engagement between the ends of the belt and the pulleys, and particularly between the left-hand end of the belt and the pulley 65.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent in the apparatus.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims. As many possible embodiments may be made of the present invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. A trenching attachment for a tractor or the like having a power take-off shaft, comprising a body releasably connectible to the rear of the tractor, a boom pivotally mounted on the body for swinging between transport and digging positions, a chain having digging elements carried by the boom, a drive shaft rotatably mounted on the body, means connecting the chain to the shaft for driving same, a first pulley releasably connectible to the power take-off shaft of the tractor, a
second pulley, a belt about the pulleys, a first gear connected to the second pulley for rotation therewith, a second gear drivingly engaged with the first gear and connected to the drive shaft mounted on the body for rotating it, a box about the gears, said gear box being swingable about the axis of the second gear between a first position in which the second pulley applies tension to the belt and a second position in which the second pulley is moved forwardly toward the power take-off shaft to relieve tension in the belt, and means for moving the gear box between said first and second positions.

2. Apparatus of the character defined in claim 1, wherein the connecting means includes a pair of links pivotally connected to one another and to the gear box and body, the axis of pivotal connection of the links being forward of an imaginary line extending through their pivotal axes of connection to the gear box and body, when the box is in the first position, and being rearward of said line, when the box is in the second position, and means on the body for supporting the gear box in said second position.

3. Apparatus of the character defined in claim 1, including bars connectible to the tractor in position to extend respectively above and below the upper and lower runs of the belt so as to limit bowing in such runs when the tension in the belt is relieved and thereby prevent excessive running of the belt about the first pulley.

4. A trenching attachment for a tractor or the like having a power take-off shaft, comprising a body releasably connectible to the rear of the tractor, a drive shaft mounted on said body, a boom, means pivotally mounting the boom on the body, an endless chain having digging elements carried by the boom, means connecting the chain to the drive shaft on the body for rotation in response thereto, means on the body for swinging the boom between transport and digging positions, and means for connecting the power take-off shaft to the drive shaft on the body, said body having a pair of laterally spaced-apart side walls, the drive shaft extending between and being rotatably mounted on the side walls, and the means pivotally mounting the boom on the body comprising a housing having a pair of laterally spaced-apart side walls pivotally mounted on the drive shaft, and front and top walls extending between the side walls.

5. A trenching attachment for a tractor or the like having a power take-off shaft, comprising a body having a pair of laterally spaced-apart side walls releasably connectible to the rear of the tractor, a drive shaft extending between and rotatably mounted on said side walls, a housing having a pair of laterally spaced side walls pivotally mounted on the drive shaft and front and top walls extending between the side walls of the housing, a boom having its inner end mounted on the side walls of the housing and extending rearwardly therefrom, a first sprocket mounted on the drive shaft for rotation therewith, a second sprocket rotatably mounted on the outer end of the boom, an endless chain having digging elements drivingly engaged about the sprockets, an extendible and retractable actuator connected between the body and housing for swinging the boom between transport and digging positions, a first pulley releasably connectible to the power take-off shaft of the tractor, a second pulley, a belt about the pulleys, reduction gears connecting the second pulley to the drive shaft, a gear box about the gears, and means supporting the gear box from the body.

6. A trenching attachment of the character defined in claim 6, wherein the gear box supporting means includes means for swinging the gear box about the axis of the drive shaft so as to shift the second pulley between positions applying desired tension to the belt.

7. A trenching attachment for a tractor or the like, comprising a body releasably connectible to the rear of the tractor, a boom pivotally mounted on the body for swinging between a transport position and a digging position, an endless chain having digging elements thereon carried on the boom, means for swinging said boom between said positions, including a reciprocable actuator pivotally connected at one end to the body, means on the boom providing a pair of holes, and a link pivotally connected at one end to the boom and at the other end to the opposite end of the actuator and having a hole therein intermediate its pivotal connections which is selectively connectible to either hole on the boom, said holes on the boom being arranged to permit adjustment of the angle through which the boom is swung in response to a given extension of the actuator.

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