This application is a continuation-in-part of application Ser. No. 178,934, filed Mar. 12, 1962, and entitled, "Beet Topping Unit," now abandoned.

This invention relates to a new and improved beet topper which is particularly adapted for use as an attachment on a vehicle, such as a beet harvesting machine or tractor, in removing the foliage, trash and crown portions of sugar beets.

In harvesting sugar beets a beet topping unit is conventionally employed as a preliminary to the actual digging operation to sever and remove the crowns and top foliage portion of the beets. Customarily, the beet topper is comprised of a combination knife and finder wheel which will ride across the beet tops to perform this topping operation. In accordance with the present invention it has been found highly desirable to so construct and arrange a knife and finder wheel in relation to one another as to greatly improve both the topping and cleaning operations, and specifically in such a way that the wheel will yieldingly, but positively, engage and position the beets for cutting at the desired depth, then will subsequently clear or clean the severed portions so as to keep the knife and cutting area clean for further cutting.

It is another desired feature and objective of the present invention to make provision in a beet topping unit for maximum adjustability and flexibility so that it is possible to regulate and to keep uniform the depth of cut, notwithstanding unevenness of the beet rows and inconsistent level of the beet crowns above the ground.

A further objective of the present invention is to construct and arrange the knife blade in relation to the wheel for most positive and efficient cutting action, and in association therewith to provide means for guiding and directing the foliage and trash across the path of the finder wheel and knife for severance and discharge therefrom.

A still further object of the present invention is to provide a simple yet dependable and highly efficient beet unit conformable for use as a single or multiple row beet topper and characterized by its ability to be self-regulating and cleaning as well as to enable the elements comprising the unit to cooperate together to urge the beet tops, trash and foliage into position for cutting and discharge in a novel and improved manner.

It is an additional objective and purpose of this invention to provide a greatly simplified and improved beet topper unit incorporating a finder wheel composed of a yieldable high friction material and employing cooperation with an adjustable knife to carry out either high or low crowning operations, depending on the size of beets, in a novel and efficient manner and specifically in such a way that the wheel will pull the beet crown across the knife and discharge the severed crown portion, trash and foliage completely away from the knife to keep the knife area clean for further crowning operations.

The above and other objects, advantages and features of the present invention will become more readily understood from a consideration of the following detailed description taken together with the accompanying drawings, in which:

FIGURE 1 is a side elevational view of a vehicle including a preferred form of beet topper attachment devised in accordance with the present invention.

FIGURE 2 is an enlarged top plan view of the beet topper attachment and drive mechanism shown in FIGURE 1.

FIGURE 3 is an enlarged view of the preferred form of beet topper attachment and drive mechanism.

FIGURE 4 is a view partially in section taken on line 4-4 of FIGURE 3.

FIGURE 5 is a view partially in section taken on line 5-5 of FIGURE 2.

FIGURE 6 is a fragmentary side view in detail of a modified form of knife blade construction and a guide member used in association therewith; and

FIGURE 7 is a plan view of the modified form of device shown in FIGURE 6.

Referring in more detail to the drawings, there is shown by way of illustrative example in FIGURES 1-5 a preferred form of beet topper unit 10 in attached relation to a vehicle 4, here represented as a tractor, which defines a wheeled frame or motive source for the beet topper unit. For the purpose of describing the present invention, the vehicle includes a main drive axle 12 and front wheel 13. Of course, other suitable means may be employed to advance the beet topper along the beet rows, although for reasons to become apparent it is greatly preferred to push the unit ahead of the vehicle rather than to draw or pull it.

In utilizing the beet topper unit 10, a triple-row attachment is illustrated as being mounted beneath the vehicle frame, each unit or attachment having a main supporting frame 15 extending forwardly and horizontally from a common stationary frame 16 which traverses the substantial width of the main axle 12. From this, it will be seen that either one or a plurality of beet topper attachments may be employed as desired and depending to some extent upon the size and capacity of the vehicle. With the above in mind, each beet topper unit 10 is identical in construction and arrangement and correspondingly mounted on the common frame 16 for pivotal up anddown movement in relation to the main axle 12.

Broadly, in addition to the frame 15, each unit is comprised of a finder wheel 18 mounted on a drive axle 19 for rotation by means of a drive mechanism 20 passing between the main axle 12 and front axle 19. A knife holder assembly 22 is adjustably connected to the supporting frame 15 for positioning a topping knife 23 is centered, closely spaced relation beneath the finder wheel 18 so that cutting edge 24 of the knife extends transversely across and beneath the lower surface of the wheel.

The supporting frame 15 and common frame 16 are designed to support the finder wheel and topping knife 23 for forward advancement along the ground surface and in such a way that the knife and finder wheel are able to closely follow the irregular contour of the beet rows. Accordingly, the frame 15 is positioned to extend forwardly in a horizontal direction from the drive axle so that the wheel 18 and knife holder assembly 22 are free to ride or pivot in substantially a vertical direction. To this end, the common frame 16 includes mounting blocks 25 disposed on the drive axle 12, and a pair of outer, spaced brackets 26, each defined by a vertical brace 27 and a lower horizontal brace 28, are supported by the blocks 25. An intermediate jackshaft 29 is journaled for rotation in outside bearing blocks 30, which are mounted on the brackets 26, and inside bearing blocks 30', which are connected to a bracket 31 for the supporting frame 15. The bracket 31 is in the form of an angle-iron traversing the substantial width of the vehicle between the main brackets 26 to act as a means of pivotal connection for each frame 15. In turn, each individual supporting frame 15 includes a forwardly extending, longitudinal beam 32 having a cross member in the form of a sleeve 33 journaled on a pivot pin 34, the latter being mounted
by means of plates 35 and limit pins 36 on the bracket 31. Reinforcing bars 38 extend angularly between each beam 32 and crown 33, merely to support the beam against sidewise thrust. In this manner, the beam is free to swing upwardly and downwardly about the pivot pin 34.

In order to drive the finder wheel 18, the axle 19 is mounted at the forward distal end of the beam 32 in a bearing 41 secured to the underside of the beam, and carries a sprocket wheel 41 forming a part of the drive mechanism. Preferably a chain drive is employed including a drive sprocket wheel 42 on the main drive axle 12 which rotates the jackshaft 29 through a chain 44 trained over a sprocket wheel 45, of reduced size, on the jackshaft. The jackshaft then drives the axle 19 through an intermediate sprocket 46 and chain 47 trained over the sprocket 41. The speed of rotation is increased through the drive mechanism to rotate the finder wheel at a rate faster than the ground speed of the vehicle, and in a direction corresponding with the forward advancement of the vehicle, to most effectively discharge the severed crowns away from the knife and to keep the cutting area clear at all times.

As an important feature of the present invention, the finder wheel 18 is composed of a flexible or resilient material having the characteristics of high friction and yieldability, in order to compensate for differences in size and depth of the beet crowns, while positively urging the crowns through the knife cutting area. In the preferred form, an inflatable rubber tire is employed which will afford the desired flexible, but positive engagement with the tops. Thus, inflation can be regulated to provide the necessary "give" or yield during the topping operation; and, the outer, tooth-engaging tread surface of the tire, being defined by closely spaced flexible ribs composed of a rubber or rubber-like material, will under rotation frictionally engage the beet crowns and tops to positively urge them through and beyond the cutting area. As an alternative, a semi-pneumatic tire or a high friction, resilient tread section applied over a metal wheel would lend somewhat similar results, but not as effectively as the inflatable tire. The tire will be largely governed in size and diameter by the disposition of the frame in relation to the ground surface since the tire should be located in spaced, adjacent relation above the ground surface permitting enough room for the knife to be centered beneath the tire with a slight amount of clearance to allow passage of the beet tops therebetween.

Another feature of the present invention resides in the particular disposition and arrangement of the knife holder assembly in relation to the unit and particularly finder wheel 18. As best shown from FIGURES 2-4, the knife holder assembly 22 is comprised of a one-piece knife support member, in the form of a generally U-shaped bar, having an upper horizontal length 50 and a lower, relatively short horizontal length 51 interconnected by an angularly extending intermediate length 52 slanting downwardly and rearwardly from the upper length 50. The topping knife is connected such as by bolts 53 at one end to the rearward end of the lower length 51 and tapers away from the member 51 transversely beneath the tire 18. In this relation, the forward part of the knife support unit will project forwardly beyond the front surface of the finder wheel to define the initial point of engagement between the unit and the beet tops and as described will tend to urge the leaves and foliage downwardly into engagement with the tire and through the knife cutting area.

The knife 23 has its cutting edge 24 centered in closely spaced relation beneath the finder wheel, and to provide the necessary adjustment and support for the knife the upper horizontal length 50 is inserted within a hollow-box shaped frame 55 and clamped therein by means of upper and lower oppositely directed adjustment screws 56 and 57 respectively. The upper screws 56 extend through the top of the frame 55 at opposite ends thereof and in alignment with a corresponding pair of lower adjustment screws 57. It will be evident that by regulating the inward and outward adjustment of the screws it is possible to control the vertical distance between the knife 23 and lower surface of the finder wheel. In addition, the knife cutting edge can be tilted up or down for special topping operations merely by adjusting the rear pair of screws in relation to the front pair. Moreover, the knife is centered beneath the lower extremity of the tire by loosening the screws and sliding the upper length 50 longitudinally or horizontally in relation to the frame 55. In this position the cutting edge is angled slightly so as to travel forwardly from its point of connection on the lower section 51 across and beneath the bottom surface of the tire, as best seen from FIGURES 2 and 4, so that the knife will tend to slice through the beet tops. Accordingly, in centered relation, the intermediate portion of the knife cutting edge is centrally located beneath the lowest center point on the tire; and, when the tire surface moves into engagement with the beet tops and forces them through the cutting area, the tread surface will flatten to some extent to exert the greatest pressure on the beet tops through the cutting area. Furthermore, the tire will maintain firm engagement with the beet tops upon cutting so as to beyond the knife and to discharge it rearwardly for collection by suitable pickup attachments located at the rear of the tractor. Although not shown, these attachments are conventionally employed and will serve to pick up all tops, loose leaves and trash for delivery to the sides of the topped rows for subsequent removal.

To suspend the forward end of the topping unit in spaced inoperative relation above the ground, suitable means including a conventional power lift, not shown, connected to a chain 60 may be employed. To begin the topping operation, the lift and chain are released so that the knife 23 will ride freely along the ground. The disposition of the knife and finder wheel will be such that the finder wheel will rise and fall according to the level of the beet tops above the ground, and the knife will follow the up and down movement of the finder wheel to perform the same uniform depth of cut each time. In this relation, preferably the tire is under relatively low inflation, or less than full inflation, so that it will yield appreciably as it engages the beet tops between the knife and wheel. Accordingly, the cutting depth can be controlled not only through the adjusting frame but also by the amount of inflation in the tire. Use of a high friction material such as the tire tread surface formed of closely spaced flexible ribs is highly advantageous, also, in that it eliminates special ribs or projecting elements which would otherwise have a tendency to enter the tops making it difficult to release or discharge the tops once severed by the cutting knife. As a further advantage in the topping operation, the knife will have performed approximately one-half the cut when the beet top is centered beneath the lowest extremity of the wheel and the knife, or in other words, firmest engagement is established at the center of the beet top where cutting is more difficult. The tapered form of the knife will also lend a slicing action to the operation and tend to force the severed top outwardly upon cutting for discharge away from the tire in an outward and rearward direction.

It is preferable to combine a group of beet toppper units in order to top several rows at a time, as in the preferred form, and thus afford the operator plenty of time to stay ahead of the beet digging equipment. As a result, the units may be advanced at the desired rate of speed, and it is preferable to operate the units at a somewhat slower pace than the digging equipment since the units will perform much more effectively. As previously mentioned, by employing multiple row devices in connection with conventional pick-up row attachments mounted at
the rear of the tractor the severed portions including the foliage and trash can be picked up and delivered to the side of each topped row then later removed with the aid of other equipment.

In FIGURES 6 and 7, a modified form of topping knife 23 is illustrated in attached relation to a relatively short horizontal bar 51. Although not shown, that bar 51 may form the lower horizontal extremity of a frame, such as the knife holder assembly 22 shown in FIGURES 1 to 5. The topping knife is in the form of a flat, elongated plate connected to one end by means, such as bolts 53, to the underside of the bar 51 to extend transversely or laterally beneath the drive or fender wheel 18 represented in dotted form in FIGURE 7. The front side of the knife is provided with angularly extending cutting edges 65 and 66 intersecting one another to form a corner or notch 68. It will be noted that the outer leading edge 65 extends in spaced relation beneath the bottom surface of the tire or wheel 18 at a slight trailing angle to the transverse direction, whereas the inner edge angles inwardly and from the corner 68 toward the bar so as to form an obtuse included angle between the inner and control, of a resilient guide member 70 secured to the bar 51 just forwardly and above the topping knife to yieldingly urge any trash or foliage passing inwardly of the wheel to move outwardly beneath the path of advancement of the wheel for cutting and subsequent discharge so as not to build up or collect in the area between the wheel and bar. To this end, the guide member 70 is defined by an elongated spring element or rod having a front coiled end 71 attached by bolt 72 to the upper surface of the bar 51, and a downwardly and outwardly curving free end 74 terminating above the intersecting edge or corner 68. The guide member is made to flex or bend out of the way in order not to interfere with passage of the beet crowns and solid portions across the knife while catching and throwing the lighter trash and foliage materials over into the main path of travel of the wheel for discharge. In this relation, the guide 70 will cooperate with the inner cutting edge in forcing the material outwardly beneath the wheel, at which point the outer cutting edge 65 and drive wheel 18 operate together to cut and discharge the materials rearwardly and outwardly away from the knife. The intersecting edge or corner 68 cooperates with the outer cutting edge due to the abrupt change in direction at this point whereby the cutting edge due to yil become snagged or caught momentarily by the corner until the drive wheel forces the material across the knife for cutting and discharge.

Various other modifications may be made in the present invention, for example, in the particular manner of attachment to the vehicle or other motive source provided. It has been found preferable to mount the unit, as shown, so that it is driven and advanced from the rear, rather than being pulled or drawn. Thus, the unit is powered from the rear and positively advanced ahead of the vehicle so that the fender wheel will more easily seek its own level in relation to the bars; also the operator can more closely watch the entire operation and control accordingly. Furthermore, by positioning the eet topping units at the forward part of the vehicle any necessary auxiliary equipment can be drawn behind the same vehicle without interfering with the topping operation. Nevertheless, if desired, it will be apparent that the units may as easily be placed at the rear of the vehicle while retaining most of the advantages and characteristics as hereinbefore set forth. Accordingly, it will be understood that the above and a number of modifications and changes may be made in the construction and arrangement of parts comprising the present invention without departing from the scope thereof as defined by the appended claims. What is claimed is:

1. In a beet topping device mounted in attached relation to a tractor of the type having an elongated narrow chassis with a front center wheel member and a rear drive axle provided with spaced apart rear drive wheels, the combination therewith comprising a series of beet topper units including a common, relatively stationary support being mounted forwardly of and in spaced parallel relation to the rear drive axle and extending transversely across the substantial width of the tractor, a plurality of pivotal support members being pivotally connected to said stationary support for forward substantially horizontal extension therefrom in uniformly spaced, parallel relation to one another across the substantial width of the tractor and being pivotally independent of one another on said stationary support, each of said topper units further including a topping knife assembly depending downwardly from the forward end of each pivotal support member, each knife assembly having a topping knife with a front cutting edge extending in horizontal transverse relation to the direction of movement of the tractor, a drive wheel being mounted for rotation on each pivotal support member in spaced, centered relation above the front cutting edge for engagement with the beet tops, said topping knives and associated drive wheels being suspended from said pivotal support member at uniformly spaced transverse intervals across the substantial width of the tractor and with the spacing therebetween corresponding to the spacing between beet rows, and drive means being drivingly connected to each of said drive wheels to simultaneously rotate said drive wheels in a direction urging the beet tops in each row toward and by the respective topping knives for topping and discharge therefrom.

2. In a beet topping device according to claim 1, each drive wheel being defined by an inflatable tire having an outer beet-engaging tread surface defining a continuous series of closely spaced flexible ribs, a holder assembly for each topping knife, and supporting means on each pivotal support member removably supporting said holder assembly including adjusting members engaging said holder assembly to provide for vertical and angular tiltting adjustment of said knife in relation to said wheel.

3. In a beet topping device according to claim 1, each topping knife including a front cutting edge extending laterally in closely spaced relation beneath each fender wheel for cutting engagement with the beet tops, and a flexible guide member mounted in spaced relation above topping knife and extending angularly in a rearward direction whereby to yieldingly urge the beet tops into the path of travel of said wheel over said topping knife.

4. In a beet topping device according to claim 1, each knife being provided with front intersecting cutting edges including an outer cutting edge extending laterally beneath the fender wheel and an inner cutting edge extending forwardly and inwardly toward said frame from the point of intersection with the outer cutting edge.

5. In a beet topping device adapted for mounting on a vehicle for forward advancement therewith having a frame and a fender wheel mounted on the frame for yielding engagement with the beet tops, a knife holder assembly being in the form of a generally U-shaped bar having an upper horizontal portion adjustably mounted on said frame, an intermediate portion inclining downwardly and rearwardly in front of said fender wheel and a lower knife-supporting portion extending rearwardly from said intermediate portion, a beet topping knife connected at one end to said lower knife-supporting portion for horizontal extension in transverse relation to the direction of movement of the vehicle and being disposed in spaced relation beneath the fender wheel for cutting engagement with the beet tops, said topping knife being provided with front intersecting cutting edges including an outer cutting edge extending laterally beneath the fender wheel and an inner cutting edge extending forwardly and inwardly toward said frame from the point of intersection with the outer cutting edge, and resilient means secured to said knife-supporting portion and extending rearwardly above and forwardly
of the inner cutting edge of said topping knife whereby to yieldingly urge the beet tops into the path of advancement of said finder wheel.

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