Aug. 15, 1950 F. J. SCHMIDT 2,519,077

TRENCH DIGGING MACHINE

Original Filed June 20, 1947 3 Sheets-Sheet 1

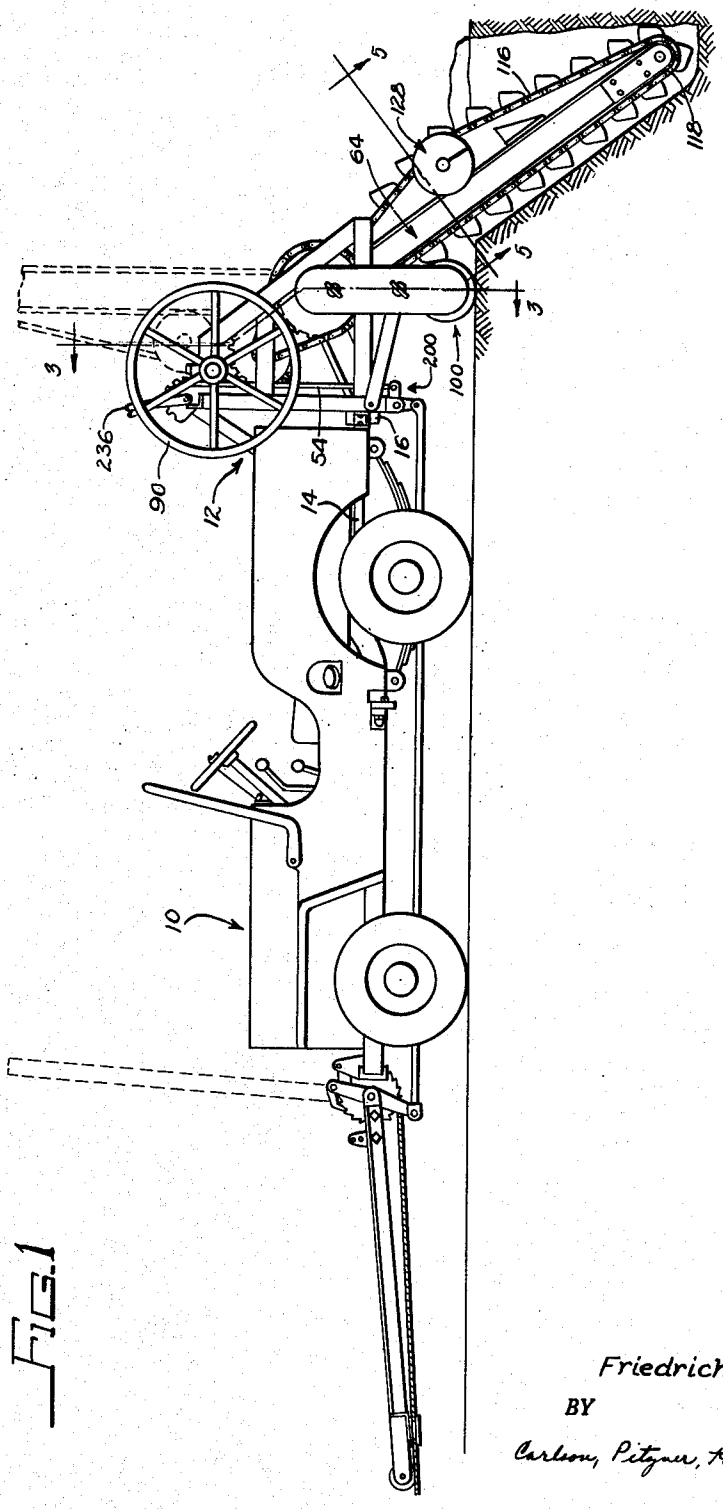


Fig. 1

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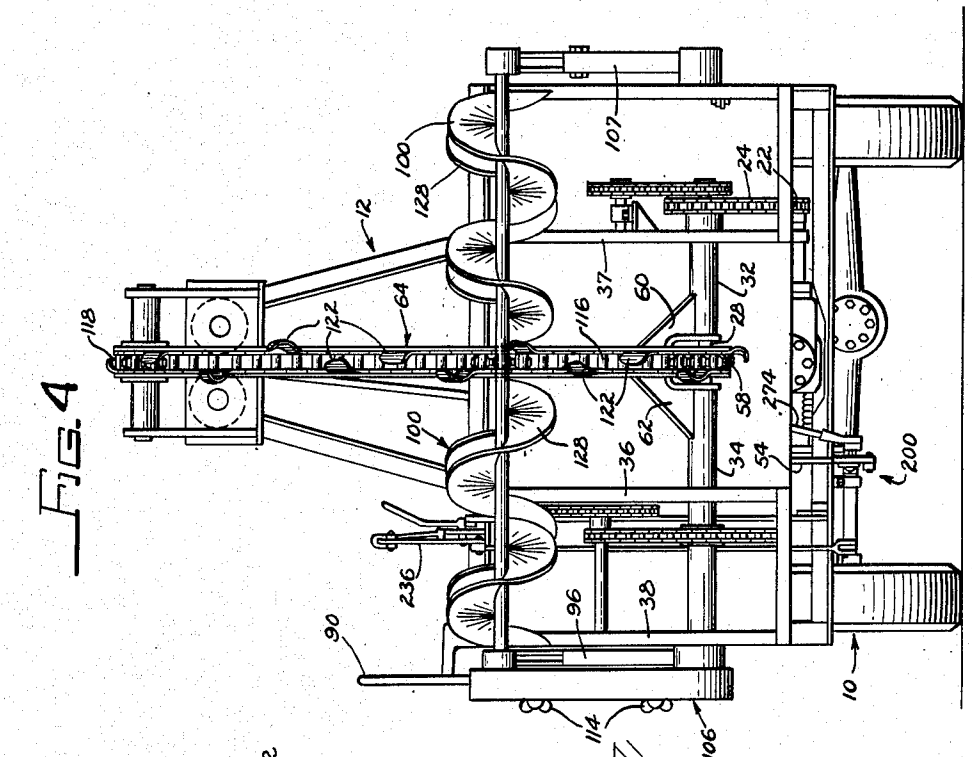


Fig. 4

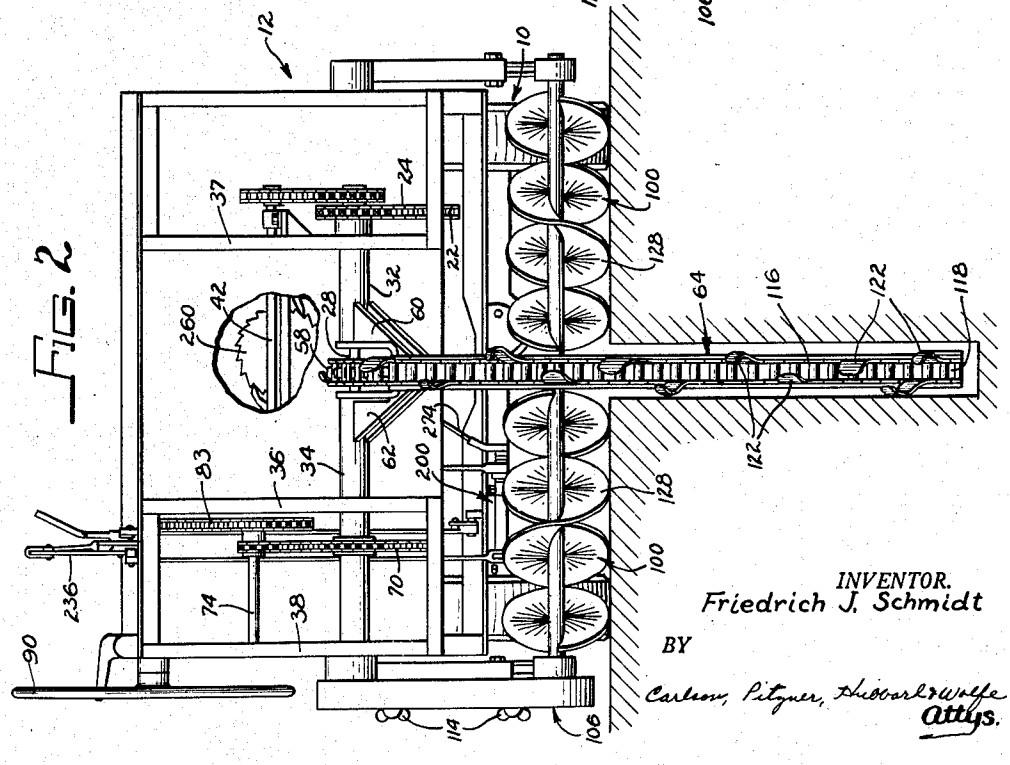


Fig. 2

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TRENCH DIGGING MACHINE

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FIG. 3

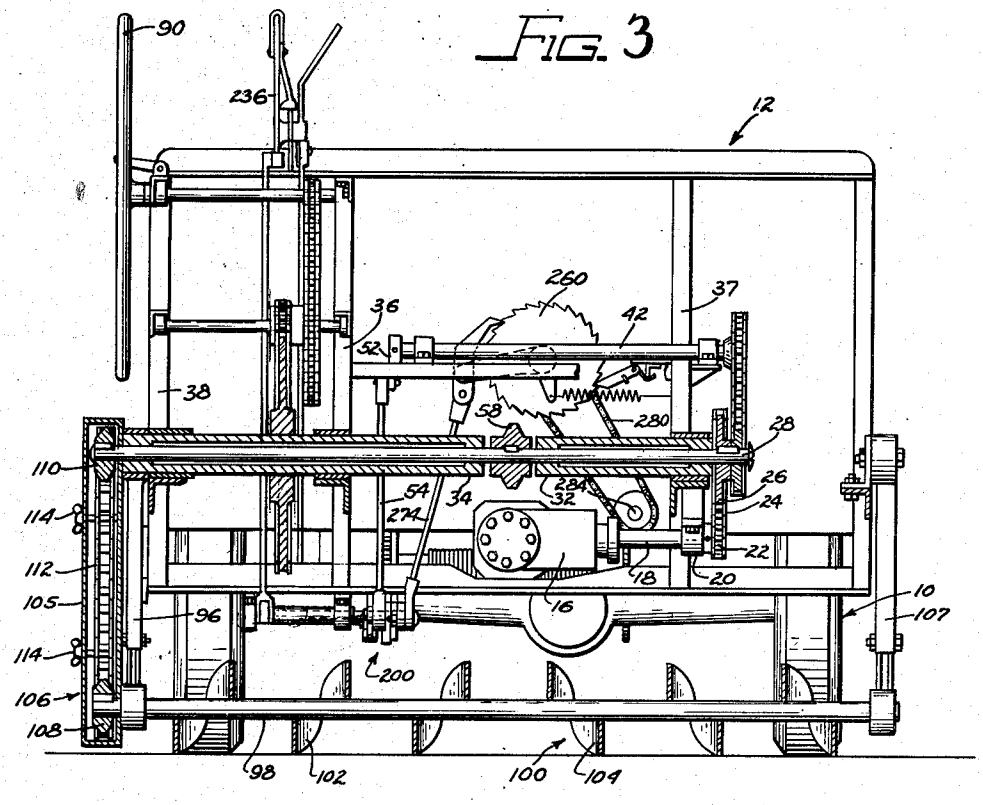
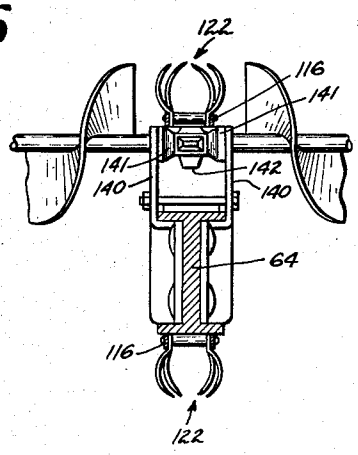


FIG. 5



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Patented Aug. 15, 1950 2,519,077

UNITED STATES PATENT OFFICE

2,519,077

TRENCH DIGGING MACHINE

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Original application June 20, 1947, Serial No. 755,825. Divided and this application October 28, 1949, Serial No. 124,048

6 Claims. (Cl. 37—90)

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The invention pertains to trenchers and more particularly to means for disposing of dirt elevated to the surface.

An object of the invention is to provide a trencher having an improved swinging beam construction including a conveyor capable of forming the elevated earth into ridges separated from and parallel to the resulting trench. A related object of the invention is to provide a trencher having a beam mounting both digging and conveying elements and having means for driving the same but which may be made roadable simply by swinging the beam into its upraised position. A further object is to provide an improved conveyor which is coupled in a novel manner to an associated digger of the endless chain type.

Additional objects and features of novelty will become apparent to those skilled in the art by reference to the following description and the drawings, in which:

Figure 1 is an elevational side view showing an embodiment of the present invention mounted on a tractive vehicle.

Fig. 2 is a rear elevational view of the trenching device shown in Fig. 1.

Fig. 3 is a cross-section of the device taken along the line 3—3 in Fig. 1.

Fig. 4 is a rear view of the trencher with the beam and conveyors elevated for transport.

Fig. 5 is a detailed view taken along the line 5—5 in Fig. 1, showing the manner of driving the auger conveyor.

Referring now in detail to the illustrated preferred embodiment of the present invention, like reference characters are used throughout to illustrate similar elements. This invention has been conceived and developed to fill the need for a trench digging machine having a conveyor arrangement which is not only small and more portable than conventional conveyors but which may be sold at a fraction of the cost. The illustrated embodiment of the invention is most advantageously applied where a trench having smooth accurately formed side walls is required, bounded by a cleared strip, with the loosened earth piled neatly in ridges running parallel to the trench. The present construction is eminently suited for power digging of trenches for underground feeder lines required for gas, water and electricity. The cleared strip provides a work space for preliminarily arranging the feeder lines and insures that loose dirt will not fall into the trench while the lines are being installed.

The machine is highly portable as it can be quickly engaged in or disengaged from its digging position and can be moved from one job or "set" to another simply by raising the beam and associated conveyors to transport position. This renders the trencher roadable and the entire unit may travel to the next job at high speed without regard for the digging and conveying mechanism.

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Referring now to the drawings, a small conventional vehicle 10 immediately recognizable as a conventional "Jeep" from an inspection of Fig. 1, is utilized as a power source. A frame or support 12 is provided on the rear portion of the vehicle which is so constructed as to enable it to be detached with relatively little effort. A power take-off shaft 14 extends from the transmission rearwardly into a power take-off gear box 16, conventionally known as a belt pulley drive. A shaft 18 (Fig. 3) extends from the gear box 16 and is journaled on the frame in a bearing 20. A sprocket wheel 22 is rigidly secured to the shaft 18 and serves to drive a sprocket chain 24. The latter chain is trained about a larger sprocket wheel 26 which is secured to a main driving or cross-shaft 28. The shaft 28 is telescoped within sleeves 32 and 34, which are rigidly connected together and journaled in suitable bearings seated in apertures provided in members 36, 37 and 38 of the frame 12.

Upon actuation of the prime mover within the vehicle 10, torque is transmitted through the shaft 18 and sprocket wheel 22 to the shaft 28, the sleeves remaining stationary.

For the purpose of driving the vehicle forwardly at a slow rate of speed, power is tapped from the main cross-shaft 28. The manner in which this is accomplished is covered in some detail in my copending patent application Serial No. 755,825, filed June 20, 1947, of which this application is a division and to which reference is made. For present purposes it will suffice to say that the shaft 28 is drivingly coupled to a second cross-shaft 42 which rotates at a slower speed. A crank 52 is provided at the end of the shaft 42 which serves, through a linkage 54, 274, to drive a ratchet wheel 260. The latter rotates intermittently at a rate which is determined by a stroke adjusting mechanism indicated generally at 200 and under the control of an adjusting lever 236. Rotational movement of the ratchet wheel is transmitted to the vehicle wheels by a chain 280 and shaft 284, the latter having provision at its forward end for coupling to the main drive shaft of the vehicle.

Having understood the means for producing vehicle movement, attention may now be given to

construction of the beam, digger chain and conveyor mechanism toward which the present application is particularly directed. The beam, indicated at 64, is mounted for fore and aft swinging movement about the transverse shaft 28. To this end it is mounted on brackets 60, 62, which are secured to the opposed ends of the sleeves 32, 34 (see Fig. 4). The beam and opposed sleeves thus constitute a rigid T-shaped unit enabling the beam to be swung so that it extends rearwardly and downwardly from the vehicle. Alined with the beam between the sleeves 32, 34, and keyed to the drive-shaft 28 is a drive sprocket wheel 58. Mounted in a corresponding position at the lower end of the beam is an idler sprocket 118. An endless loop of digger chain 116 is trained over the sprocket wheels and carries digger blades 122 thereon for engaging the earth with a broaching action and for elevating the loosened earth to the surface.

The construction and operation of the digger blades is set forth in my copending divisional application, Serial No. 124,047, filed October 28, 1949. For the present purposes it will suffice to say that the digger blades are formed of curved plates of metal having a sharpened leading edge and free of pockets or bucket-like receptacles for catching the loosened earth. As a further feature, the cutter blades are arranged alternately on the sides of the chain with successive pairs having a different width or lateral span. One might well wonder how the blades, being arranged in non-opposing relation on the chain and free of scoops or the like, can be effective to elevate the earth to the surface. It is believed that the elevation can be explained by the repeated urging or impact imparted to the earth by the successive blades and the drag of the chain itself. The fact that the channel cut by the blades is considerably inclined aids in the process. The jamming and clogging associated with bucket type cutters, particularly under wet and clayey conditions, cannot occur. Instead of being carried to the top of the loop of chain and being discharged by inversion, the loosened earth is propelled to the surface and scattered rather freely adjacent the edges of the trench.

In order to discharge loose dirt outwardly from the center line of the trench ahead of the beam 64 for preliminarily leveling, a horizontal auger 100 is provided (see Fig. 3) having a shaft 98 and oppositely directed flights 102, 104 thereon. The shaft 98 is supported at each of its ends by swinging drop links 96, 107, respectively, the drop link 96 having adjacent thereto a housing 106 provided with a detachable cover 105. It may be observed that the drop links 96, 107, are formed of two relatively slidable portions enabling the level of the auger 100 to be initially adjusted. For establishing a driving connection between the shafts 28, 98, the shafts being provided with sprocket wheels 110, 108, which lie within the housing 106 and which are in mesh with a sprocket chain 112. Since the auger 100 is driven from the main drive-shaft 28, it will be apparent that its speed is synchronized relative to the speed of the digger chains. The housing includes a cover 105 for the obvious purpose of providing access, such cover being secured by wing nuts 114. Since the link 96, which supports the auger 100, and the associated housing 106 are rigid with the sleeve 34, and consequently the beam 64, the auger 100 and the beam will move as a unit. Thus, when the beam is swung from the digging position shown in Fig. 2 to the transport position shown in Fig. 4, the auger 100 will also swing upwardly to a position substantially above earth level and it will not interfere in any way with the high speed travel of the vehicle from job to job.

Further in accordance with the invention, an auger having oppositely directed flights is mounted along the rear edge of the beam and arranged to be driven directly by the digger chain 116. In this position the auger is automatically lowered into the scraping or sweeping engagement with the earth upon lowering of the beam into its cutting position. The auger is indicated at 128 and the manner of mounting and driving same is illustrated in detail in Fig. 5. The auger mounting includes brackets 140 which are clamped or otherwise fixed to the rear edge of the beam 64 and include suitable bearings 141. The bearings are spaced from one another and a sprocket wheel 142 for driving the auger is mounted between them in position to be engaged by the sprocket chain 112. Since the sprocket wheel is of small size, it will be apparent that the auger 128 is driven at relatively high speed in unison with the chain; thus the remaining dirt which has not already been laterally discharged by the auger 100 is formed into a pair of well defined ridges, providing a well cleared path on each side of the trench. Since the driving wheels, digger chain and conveyors are all coupled together for movement in unison, the cutting and conveying are automatically coordinated with one another so efficient operation may be had over a relatively wide range of engine speed.

After digging has been completed, the beam and the associated augers are swung upwardly into the transport position disclosed in Fig. 4 by means of brackets 60, 62. To swing the beam and augers upwardly means are provided for rotating the sleeves 32, 34 on which the beam 64 is mounted. In the present instance this is effected by a handwheel 90 together with a series of sprocket wheels and sprocket chains to provide sufficient mechanical advantage. As shown in Fig. 2, two sprocket chains are used, indicated at 70 and 83 and coupled together by means of sprocket wheels mounted on a countershaft 74. Any suitable means may be provided for locking the handwheel and thus the beam in its elevated position.

After the trench is dug and the installation of cable or the like has been completed, a single pass with a conventional scraper on each side of the trench is sufficient to replace the earth which has been removed. It will be apparent that the earth may be watered down between passes if desired to meet contractural requirements.

I claim as my invention:

1. In a trencher, a frame for mounting on a traction vehicle, a beam arranged on said frame to extend rearwardly and downwardly into the earth and having an endless loop of cutter chain surrounding the same and trained about the ends thereof, first and second augers laterally centered with respect to said beam and having oppositely directed flights thereon, said first auger being located adjacent the earth level forwardly of said beam and said second auger being located at earth level rearwardly of said beam and symmetrically arranged with respect to said first auger, and means for simultaneously driving said cutter chain and said augers so that the earth elevated by said cutters is moved laterally in each direction to provide a clear path on each side of the trench.

2. In a trencher, a frame for mounting on a

traction vehicle, a beam pivoted on said frame to swing rearwardly and downwardly into the earth and having an endless loop of sprocket chain surrounding the same and trained about the ends thereof, means for simultaneously driving said sprocket chain and advancing said beam broadwise, cutters on said loop of chain extending outwardly therefrom for cutting the earth, a horizontal auger laterally centered with respect to said beam and having oppositely directed flights thereon, said auger having a shaft journaled on said beam along the upper edge thereof and so positioned that said auger is located at earth level at the rear of said beam when the latter is swung downwardly into digging position, said auger shaft having a sprocket wheel engaged by said chain for driving said auger at a speed proportional to the speed of the cutter chain to clear a path on each side of the trench produced by said cutter chain.

3. In a trencher for mounting on a tractor or the like having a power take-off, the combination comprising a frame, a beam arranged to extend rearwardly and downwardly therefrom into the earth in trenching position, a loop of cutter chain trained about the ends of said beam and having a drive connection with said power take-off, an auger transversely mounted on the mid-portion of said beam and journalled for rotation thereon so as to be in sweeping engagement with the earth when the beam is in trenching position, said auger having oppositely directed flights, and means for driving said auger from said power take-off for rotation in a direction to sweep the earth away from the trench produced by said cutter chain.

4. In a trencher for mounting on a tractor or the like having a power take-off, the combination comprising a frame, a beam arranged to extend rearwardly and downwardly therefrom into the earth in trenching position, a loop of cutter chain trained about the ends of said beam and having a drive connection with said power take-off, an auger transversely mounted on the mid-portion of said beam within said loop of chain and journalled for rotation thereon so as to be in sweeping engagement with the earth when the beam is in trenching position, said auger having oppositely directed flights and means for rotatively coupling said auger to the loop of chain for rotation in a direction to sweep the earth away from the trench produced by said cutter chain.

5. In a trencher, a frame for mounting on a traction vehicle, a beam arranged on said frame

to extend rearwardly and downwardly into the earth and having an endless loop of cutter chain surrounding the same and trained about the ends thereof, first and second augers laterally centered with respect to said beam and having oppositely directed flights thereon, said first auger being located adjacent the earth level forwardly of said beam and said second auger being located at earth level rearwardly of said beam and symmetrically arranged with respect to said first auger, means for simultaneously driving said cutter chain and said augers so that the earth elevated by said cutters is moved laterally in each direction to provide a clear path on each side of the trench, said beam being pivoted at its upper end, and means for swinging said beam and associated augers upwardly into a transport position clear of the earth.

6. In a trencher for mounting on a tractor having a power take-off, the combination comprising a frame, a cutter drive shaft coupled to said power take-off, said cutter drive shaft extending transversely in said frame and having a sprocket wheel mounted for rotation therewith, a beam pivoted in said frame for rotation about said cutter drive shaft between a lowered trenching position and an upraised transport position, said beam having a sprocket wheel journalled at the lower end thereof, a cutter chain having cutters thereon and trained around said sprocket wheels, an auger conveyer having a shaft transversely arranged at the mid-portion of said beam and having its central portion journalled thereon, said conveyer having oppositely directed flights, said conveyer shaft having a sprocket wheel at the central portion thereof and arranged to engage the underside of said chain so that the auger conveyer is driven in unison with the movement of said cutter blades.

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