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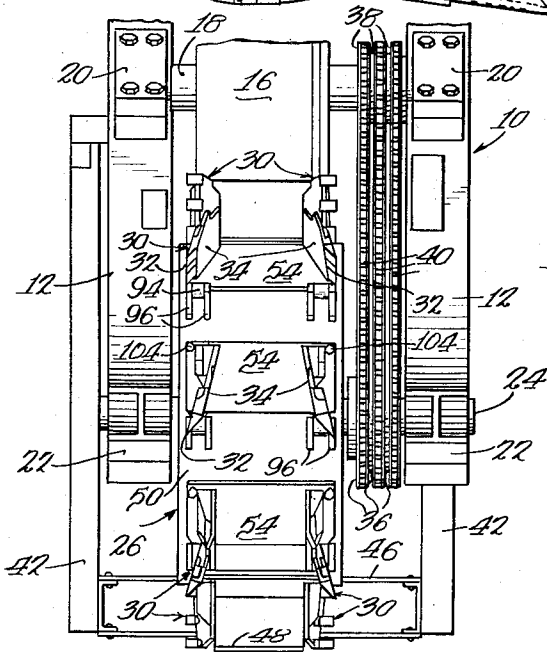
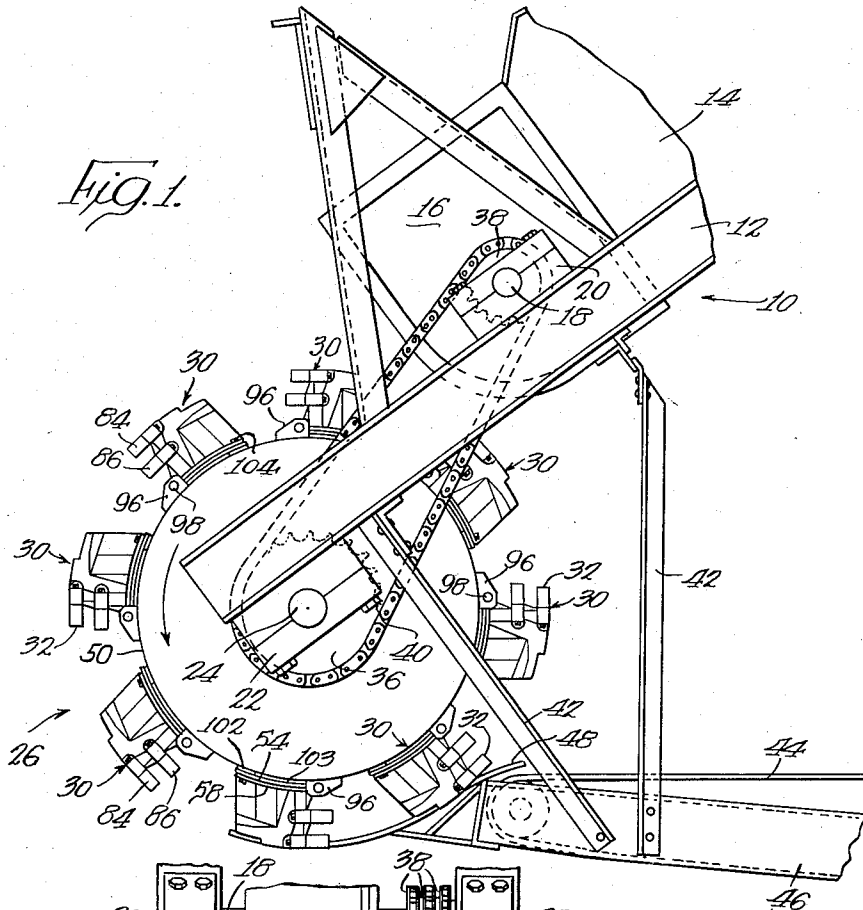
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2,909,855

EXCAVATING APPARATUS

Filed July 24, 1956

3 Sheets-Sheet 1



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EXCAVATING APPARATUS

Filed July 24, 1956

3 Sheets-Sheet 2

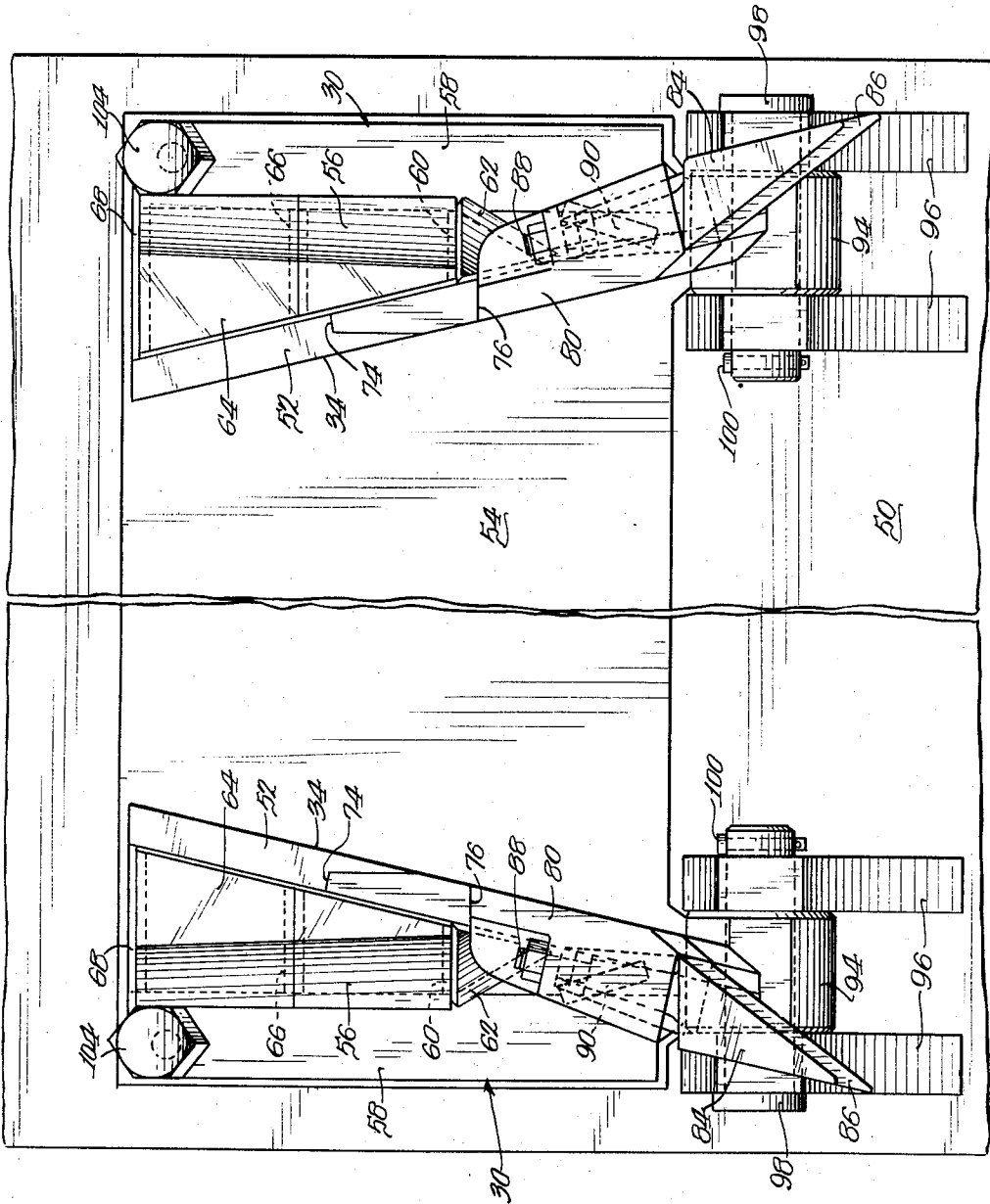


Fig. 3.

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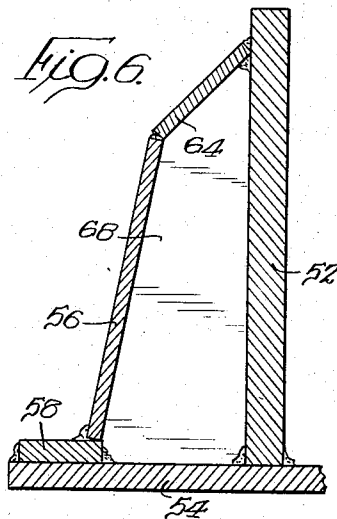
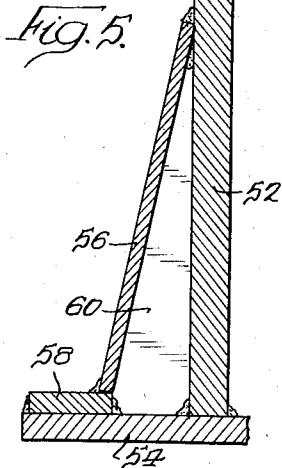
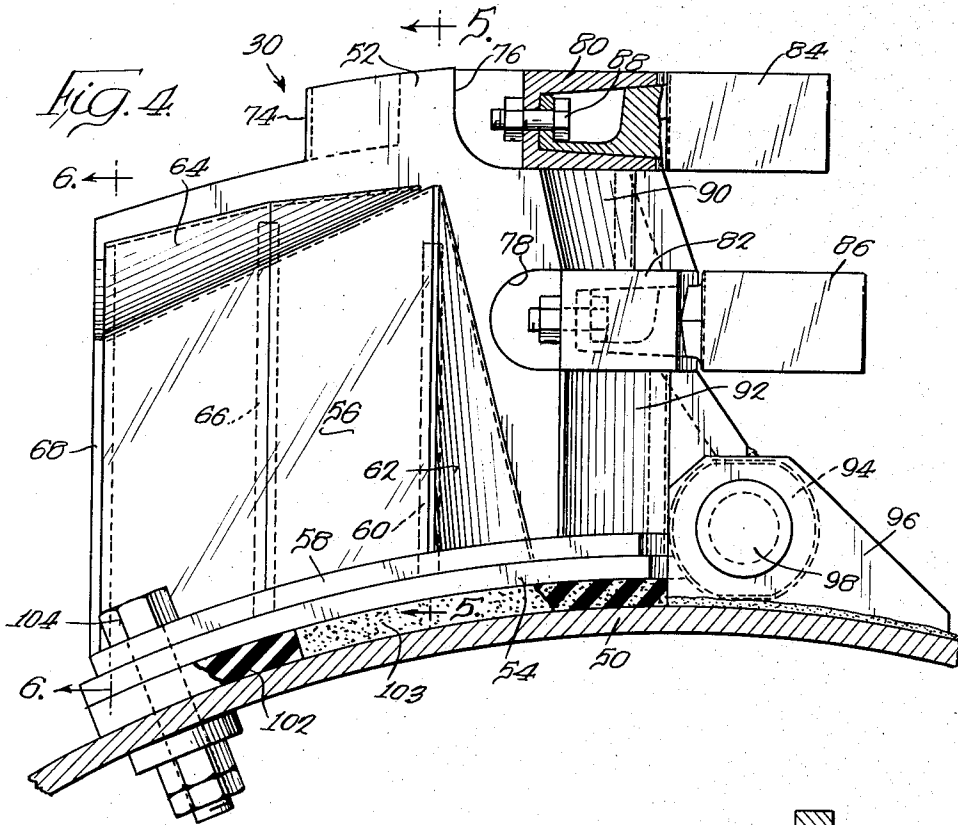
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EXCAVATING APPARATUS

Filed July 24, 1956

3 Sheets-Sheet 3



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2,909,855

## EXCAVATING APPARATUS

Frank F. Kolbe, Winnetka, Ill., assignor to The United Electric Coal Companies, Chicago, Ill., a corporation of Delaware

Application July 24, 1956, Serial No. 599,804

5 Claims. (Cl. 37-189)

The present invention relates to improvements in excavating apparatus, and particularly, to improvements in excavating apparatus of the character disclosed in my copending applications, Serial No. 281,950, filed April 12, 1952, now Patent No. 2,757,463, granted August 7, 1956, and Serial No. 308,817, filed September 10, 1952, now Patent No. 2,757,462, granted August 7, 1956.

In excavating apparatus of the character referred to, an excavating wheel including two spaced parallel rows of cutting blades is rotated and simultaneously moved horizontally sideward into a bank of earth material to effect excavation. Each blade has a generally radially extending leading edge disposed adjacent the outboard side of the wheel and an inner side surface inclined from the leading edge of the blade toward the other row. As the wheel is rotated and moved sidewardly in the manner defined, the leading edges of the blades in the leading row cut material from the bank and the inclined surfaces thereof move the excavated material into the space between the rows. The inclined surfaces of the blades in the other row and the face of the bank being excavated retain the excavated material in the space between the rows, and the said inclined surfaces of the blades in both rows force the excavated material in the direction of wheel rotation to deliver the material onto a discharge conveyor extending rearwardly from the wheel.

It is the object of the present invention to improve upon apparatus of the character described, especially the excavating wheel and its components.

To this end, one object of the invention is the provision of an improved excavating wheel comprising a rigid unitary drum detachably mounting the two rows of excavating blades.

Another object of the invention is to provide an improved excavating blade for apparatus of the character defined comprising a composite welded assembly of a plurality of steel plates, the plates defining a rigid wedge-shaped blade of improved strength and longevity of service. Also, it is an object of the invention to incorporate detachable excavating teeth in the said composite blade.

An additional object of the invention is to provide an improved mounting for excavating blades in apparatus of the aforesaid character comprising means pivotally mounting the blade on the excavating wheel adjacent the leading edge of the blade, and shock absorber means between the blade and the wheel adjacent the trailing edge of the blade, the pivotal mounting and the said shock absorber means accommodating movement of the blade when the blade encounters rocks and the like and absorbing the impact load on the blade to prevent shearing of the blade off the wheel.

A further object of the invention is the provision in apparatus of the character described of a novel blade set assembly, comprising, in its complete form, a pair of spaced blades, one for each row, and a common base for the two blades, the base to be pivotally mounted on

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a rigid drum in the manner above described and including shock absorber means as defined.

Other and more specific objects and advantages of the invention will become apparent in the following detailed description of a preferred embodiment of the invention.

Now, in order to acquaint those skilled in the art with the manner of making and using the excavating apparatus of the invention, I shall describe, in connection with the accompanying drawings, a preferred embodiment of the invention and a preferred manner of making and using the same.

In the drawings:

Figure 1 is a fragmentary side elevation of excavating apparatus of the type to which the present invention relates, the apparatus as shown including the excavating wheel, blades, blade sets and mounting means of the invention;

Figure 2 is a front elevation of the apparatus shown in Figure 1;

Figure 3 is a plan view of the novel blade set of the invention, the view showing my improved blade and mounting means;

Figure 4 is a side elevation of the blade set shown in Figure 3;

Figure 5 is a vertical cross-sectional view of my improved blade, the view being taken substantially on line 5-5 of Figure 4; and

Figure 6 is another vertical cross-sectional view of my improved blade, the view being taken substantially on line 6-6 of Figure 4.

Referring now to the drawings, and particularly to Figures 1 and 2, the apparatus to which the invention relates is shown as including a frame or digging ladder 10 carrying a rotatable digging or excavating wheel 26 at the outer end thereof. As is shown, the ladder 10 is adapted to be pivotally supported on a vehicle for horizontal and vertical swinging movement and for transportation from place to place, the vehicle including means supporting the ladder and carrying power drive means for imparting the necessary movements to all movable parts of the apparatus.

The digging wheel 26 may be mounted for rotation in various manners on the ladder 10, and is provided with outboard drive means which may be disposed at either or both sides of the wheel. By way of example, in the structure disclosed herein, the digging ladder 10 includes a pair of spaced parallel beams 12 supporting a drive motor 14 and a speed reducer 16. The speed reducer 16 includes a drive shaft 18 rotatably supported at its ends by bearings 20 mounted on the beams 12. At the outer end thereof, each beam 12 is provided with a bearing block 22 rotatably supporting a digging wheel shaft 24 in spaced parallel relation to the shaft 18. The digging wheel 26 is mounted on the shaft 24 for rotation therewith and includes two spaced rows of cutting blades or cutters 30 each including a leading edge 32 disposed at the outboard side of the respective row of blades and an inwardly facing surface 34 inclined from the leading edge of the respective blade toward the other row of blades. At one side thereof, wheel 26 is spaced from the adjacent beam 12 to accommodate the mounting of a plurality of sprockets 36 on the shaft 24. A like number of sprockets 38 are mounted on the drive shaft 18 in alignment with the sprockets 36, and chains 40 are reeved over aligned pairs of the sprockets 36 and 38 to provide a drive connection or power transmission between the motor 14 and the excavating wheel. While a chain drive at one side of the wheel is shown herein as satisfactory, it will be appreciated that other drive means of a known nature may be provided at either or both sides of the wheel.

The digging ladder 10 includes a plurality of struts 42

extending downwardly therefrom to support a conveyor belt 44 and its associated frame 46. The conveyor 44 is conventional in form with the upper run thereof comprising the material carrying surface. The conveyor is of a width substantially equal to the distance between the two rows of cutting blades 30 and is supported with its end disposed immediately to the rear of the blades to receive material cut thereby.

In the embodiment illustrated, the cutting blades 30 are adapted to effect a downward cutting action on a bank of material, the wheel 26 being rotatable in a counterclockwise direction. With the excavating wheel rotated in this direction, a guide plate 48 is suitably secured, as by welding, to the forward portions of the conveyor frame 46 and extends into the space between the two rows of cutting blades at the lower portions thereof. The guide plate 48 is positioned adjacent the periphery of the digging wheel and is arcuately curved in a path generally conforming to the periphery of the cutting blades. The plate 48 terminates at its rearward end adjacent the upper run of the conveyor belt 44 to direct material cut and moved by the blades from the space between the two rows of blades onto the belt. The belt 44 is driven by suitable means (not shown) to convey the excavated material to a point of discharge.

In operation, the excavating wheel 26 is rotated in the manner described and the digging ladder 10 and the apparatus carried thereby are supported to be moved horizontally and vertically. The apparatus is moved into position so that the peripheral edges of the cutting blades are disposed adjacent the face of a bank of material to be excavated. As the excavating wheel is rotated, the ladder 10 is swung in one direction in a horizontal arc to move the cutting blades 30 in the leading row sidewardly into engagement with the bank of material to commence a cut. The leading edges 32 of the cutting blades 30 in the leading row cut into the bank to remove material therefrom, the blades 30 being so disposed with respect to one another and the rate of advancement of the wheel into the bank being such that the material is cut up into relatively small pieces which are forced, by the inclined surfaces 34 of the blades 30, into the space between the two rows of blades. The inclined surfaces of the blades 30 in the other or trailing row prevent the passage of cut material from the space between the two rows in a direction transverse to the rows. The wall of the bank being excavated forms an end wall which, with the two rows of blades, defines a chamber receiving the material cut from the bank by the blades of the leading row. Gravity, centrifugal force, the peripheral speed of the cutting blades 30 and the impelling action of the inclined surfaces 34 of the blades force the material within the said chamber downwardly and toward the rearward portions of the excavating wheel. The cut material is thus forced by the inclined surfaces of the blades onto and over the guide plate 48 and thence onto the upper run or carrying surface of the conveyor belt 44, which conveys the excavated material to a convenient point of discharge.

The above described action continues until the ladder 10 has been moved to one limit of its horizontal swinging movement, or the cutting blades in the leading row become disengaged from the surface of the bank of material being excavated. At such time, the ladder 10 and the excavating wheel are advanced inwardly into the bank so that the cutting blades 30 in the other row are moved into position to effect a cut. The ladder 10 and excavating wheel 26 are then swung horizontally in the opposite direction so that the blades in the said other row will perform the cutting operation above described and the blades in the first-named row will assist in the material impelling and moving function previously described. In continued operation of the apparatus, the digging ladder 10 and the excavating wheel 26 are oscillated in a horizontal plane

with respect to the bank of material being excavated, with the wheel being advanced toward the bank at the end of each swinging stroke. The ladder 10 may also be lowered or raised to position the wheel for horizontal oscillation at different levels, to accommodate excavation over a wide area of the face of the bank.

While express reference has been made hereinbefore to the operation of the device in such manner that the cutting blades effect a downward cut, it will be appreciated that the blades may be operated in the opposite direction so as to effect an upward cut, as has been described in my copending application Serial No. 281,950, filed April 12, 1952, now Patent No. 2,757,463.

Referring more particularly to Figures 3 to 6, the present invention provides an improved excavating wheel for apparatus of the character above described, an improved blade for the wheel, an improved mounting for the blade, and a novel blade set including the improved blade and blade mounting.

The excavating wheel of the invention is shown in Figures 2 to 4 as comprising a rotatable cylindrical drum 50 mounted on the shaft 24, the drum being of sturdy construction and internally reinforced, if desired, to withstand the severe abuse to which the wheel is subjected in use. Adjacent each end thereof, the drum 50 carries a circumferential row of cutting blades 30, the blades being detachably mounted on the peripheral surface of the drum in circumferentially spaced relation in each of the two rows. Thus, the two rows of blades are mounted on a common rigid support in spaced parallel planes for conjoint rotation in said planes. Preferably, the blades in the two rows are of the same number and are paired transversely of the planes of rotation of the rows, corresponding blades in the two rows being aligned with one another longitudinally of the drum 50.

Each of the blades 30 is preferably constructed of a plurality of steel plates welded together in a sturdy rigid assembly, constituting an improvement upon the unitary cast blade disclosed in Patent No. 2,731,742, issued January 24, 1956, to Gustaf A. Johansson, which patent is assigned to the assignee of the present application. The principal element of the blade of the invention is a main plate 52 which projects generally radially outward from the drum 50 and is disposed at an inclination to the plane of rotation of the blade to define at the inner surface thereof the previously described inclined material impelling surface 34 of the blade. The lower edge of the plate 52 is curved and welded to a correspondingly curved rectangular base plate 54, the curvature of which corresponds to the drum surface. As will become apparent, the base plate 54 is to be attached to the drum 50 with one of its axes parallel to the planes of rotation of the two rows of blades, the main plate 52 extending generally vertically from the base plate and being inclined with respect to said one of the axes of the base plate. At its outer side, the main plate 52 of the blade is reinforced by auxiliary plate means 56, suitably comprised of two plate pieces, which is smaller than the main plate 52 and disposed with its rearward edge aligned generally with the rearward edge of the plate 52 and with its forward and upper edges spaced respectively from the leading and peripheral edges of the blade. At its lower edge, the plate 56 is welded to a base strip 58 which in turn is welded to the base plate 54 adjacent and parallel to the outer edge thereof. The lower edge of the plate 56 is spaced from the lower edge of the main plate 52, the distance between the two edges increasing from the forward edge of the plate 56 to the rearward or trailing edge thereof.

The plate 56 is inclined upwardly from its lower edge toward the main plate 52 and at the upper limit of its forward edge engages against and is welded to the main plate 52 in downwardly spaced relation from the outer edge of the main plate 52. A first reinforcing strut 60, of a triangular form corresponding to the space between

the plates 52 and 56 at the forward end of the plate 56, is welded within that space to rigidify the structure. A first or frontal closure plate 62 of triangular form is welded at one edge thereof to the forward edge of the plate 56, along a second edge to the outer side of the plate 52 and at its base edge to the base plate 54 to close the forwardly open end of the space between the plates 52 and 56. As thus mounted, the closure plate 62 extends upwardly from the base plate 54 at an inclination to the base, main and auxiliary plates to define an inclined wedge surface at the forward end of the auxiliary plate 56. A second generally triangular closure plate 64, suitably formed like the plate 56 of two plate pieces, is inclined upwardly from the upper edge of the plate 56 to the plate 52, the closure plate 64 being welded along one edge to the upper edge of the plate 56 and along a second edge to the outer side of the plate 52 to close the upwardly open space between the two plates resulting from the inclination of the plate 52 to the plane of rotation of the blade. Two additional reinforcing struts 66 and 68 are welded in place within the space defined by the plates 52, 54, 56 and 64. The struts 66 and 68 are of generally triangular form and extend at right angles to the plate 56, the two struts preferably being located at approximately the midpoint and the rearward or trailing edge of the plate 56, respectively. In particular, the reinforcing strut 68 is welded to the plates 52, 54 and 56 at the trailing edges thereof to constitute an end closure plate for the blade. The plates 56, 62, 64 and 68 thus cooperate with the main plate 52 to rigidify the plate 52 and to define a generally wedge-shaped excavating blade.

The peripheral edge of the main plate 52 is stepped, as indicated at 74, and the inner side surface of the stepped portion is inclined to the plane of the plate to be aligned generally with the plane of rotation of the blade to accommodate clearing of stones and adhering earth materials from the blade.

In the forward or leading edge portion of the main plate 52, a pair of recesses or cutouts 76 and 78 are formed, one at the corner of the leading and peripheral edges of the blade and the other radially inwardly thereof. Each recess is adapted for the reception therein of a tooth socket 80 and 82, respectively, the two sockets being continuously welded at their edges to the plate 52. Each socket in turn detachably mounts an excavating tooth 84 and 86, respectively. Each tooth comprises a tooth portion and a polygonal shank, the tooth socket complementing and receiving the shank. In the shank thereof, each tooth has a recess in one side wall and a hole in the end wall thereof. A bolt 88 is received within the recess and extended through the hole in the end wall of the tooth and through a corresponding hole in an end wall portion of the socket, a nut being threaded to the extending portion of the bolt detachably to secure the tooth in the socket. As shown, the leading edge of the main plate 52 is generally upright and extends generally radially of the drum 50, with the exception that the leading edge is stepped. The recesses or cutouts 76 and 78 for the tooth sockets are provided to opposite sides of the step, so that the lower or radially inward excavating tooth 86 projects forwardly of the outer tooth 84 in the direction of blade movement whereby the two teeth do not simultaneously cut into the bank of material to be excavated as the blade is moved into excavating position. Accordingly, the stress imposed upon the blade at the commencement of each excavating stroke is reduced to limits readily resisted and supported by the composite blade structure described. Also, the leading edge of the main plate 52 is inclined at the radially inward portion thereof and at the portion thereof between the two teeth. As thus mounted, the teeth 84 and 86 extend forwardly from the leading edge of the blade, and it is the teeth that principally perform the excavating or material cutting function.

To rigidify the teeth and their sockets, a reinforcing bar 90 is welded in place between the sockets 80 and 82, and a similar reinforcing bar 92 is welded in place between the socket 82 and the base plate 54 of the blade, the bars being disposed to the outboard side of and being welded to the plate 52 to unite the teeth to the plate.

At the lower or inner extremity of the leading edge thereof, the composite blade includes a mounting bearing 94 welded to the main and base plates 52 and 54 of the blade. The axis of the bearing extends perpendicular to the plane of rotation of the blade and the bearing itself projects radially inward or downwardly below the base plate 54.

To accommodate detachable mounting of the blades 30 thereon, the drum 50 is provided at each blade location with a pair of spaced parallel supports 96 welded to the peripheral surface of the drum adjacent the respective end thereof parallel to the plane of rotation of the respective row of blades. The bearing 94 of the blade is movably received between the supports 96 with the leading edge of the blade extending generally radially of the drum. The leading edge of the blade is disposed adjacent the end of the drum and the reinforcing and closure plates 56, 62 and 64 face toward the end of the drum. The blade is pivotally mounted at its leading edge on the supports 96 by means of a pivot pin or axle 98 passed through the supports and the bearing 94, the axle 98 suitably having a head at one end and being secured in place by means of a bolt or pin 100 passed through the opposite end thereof.

As thus pivotally mounted, the forward end of the base plate 54 of the blade is elevated above the drum surface. At the rearward portion of the blade, a bumper 102 is provided between the blade and the drum 50 to maintain the spacing of the base plate from the drum and to constitute a shock absorber for the blade. The bumper 102 may comprise known forms of shock absorbers, such as one or more compression springs, a hydraulic unit, or the like. However, I prefer to employ, simply, a block or sheet of rubber confined between the base plate of the blade and the peripheral surface of the drum. The rubber bumper may be coextensive with the base plate, or provided only at the rearward or trailing edge portions thereof, as may be desired. To maintain the trailing edge portions of the blade in operative position on the drum, a retainer 104 in the form of a bolt extends, preferably radially, through the base strip 58 and base plate 54 of the blade, through the resilient bumper 102 and through the wall of the drum, thus to retain the trailing edge of the blade against excessive movement outwardly of the drum. Preferably, the retainer 104 is utilized to prestress the bumper 102, so that the bumper maintains the blade at the outer limit of movement accommodated by the retainer and resists inward movement of the blade under normal excavating conditions.

By way of example, in a preferred embodiment of the excavating wheel of the invention, the drum 50 is 12 feet in diameter and approximately 5 feet long. Each blade is about 3 feet long measured at the base plate, approximately 26 inches high, and the main plate 52 thereof is 2 inches thick. The teeth on the blade are approximately 9 inches long, 5 inches high and about 5 inches thick at the base thereof. The pivot pin 98 suitably comprises a 3½ inch diameter pin and the retainer 104 is a 1¾ inch bolt. In such structure, a preferred resilient bumper 102 comprises a piece of rubber approximately 2 inches thick confined between the blade base plate and the drum, the rubber being slightly compressed upon tightening of the retainer bolt 104. I prefer to utilize eight blades in each of the two rows at equal circumferential spacings, corresponding blades in the two rows preferably being aligned with one another longitudinally of the drum.

To facilitate assembly of the blades on the drum in the

manner described, the blades are preferably provided in sets each including two blades, one for each row. As shown, each set comprises the base plate 54 which is of a length equal substantially to the length of the drum and a blade mounted adjacent each end of the base plate, the two blades being opposed to one another and each including the bearing 94 at the leading edge thereof. The two bearings 94 are pivotally mounted in two sets of the brackets 96, which are aligned longitudinally of the drum, thus pivotally to mount the base plate and the two blades as a unit on the drum. In the preferred structure above described, the base plate 54 is preferably 1¼ inches thick, approximately 31 inches wide, and about 4¾ feet long. In this structure, a rubber mat 1 foot x 5 feet x 2 inches is fitted under the trailing edge of the base plate to constitute the resilient bumper 102, and the remainder of the space between the base plate and the drum is filled in with sponge rubber, as indicated at 103, to prevent the entry of dirt in the said space. As thus mounted, the blades in each set are spaced apart approximately 4½ feet at the forward edges of the excavating teeth, approximately 3¾ feet at the leading edges of the plates 52, and approximately 2¼ feet at the trailing edges of the blades. The main plate 52 of each blade, which comprises the essential member thereof, thus is inclined at approximately a 15 degree angle to the plane of rotation of the respective row of blades.

In use, when the excavating wheel is rotated and one row of blades is advanced sidewardly into the bank of material to be excavated, the blades, being of welded rigid construction, cut readily into the bank. The cutting or excavating teeth effect entry of the blades into the bank and remove material therefrom in a relatively finely divided state. The wedge-shaped form of the blade also facilitates entry of the excavating teeth into the bank and mitigates against an excessive rate of sideward advancement of the blades due to the engagement of the outboard auxiliary plate 56 with the bank in the plane of rotation. Should one blade engage a large rock or like obstruction, the impact load on the blade is transmitted thereby over the full area of the base plate 54, thus to reduce the unit force. Simultaneously, the pivotal mounting and the resilient bumper permit the blade set to yield or give to a certain extent and the bumper absorbs the shock, thus to prevent the blade from shearing off the drum. Should the excavating teeth on the blade be damaged upon encountering rocks or the like, or should the teeth wear out after a period of use, the detachable mounting of the same accommodates ready replacement. Likewise, should a blade set be damaged or worn out, the same may readily be replaced due to the detachable hinged mounting thereof on the drum.

The smooth, radially extending, inclined inner surfaces of the main plates 52 of the blades in the leading row force the material into the space between the rows and in the direction of drum rotation, and the corresponding surfaces of the blades in the other row prevent lateral discharge of excavated material and assist in moving the material in the direction of drum rotation. The face of the bank of material being excavated prevents discharge of excavated material in that direction, whereby the rows of blades force the material onto and over the guide plate 48 and onto the discharge conveyor 44. The peripheral surface of the drum between the two rows of blades also assists in moving the material.

In view of the foregoing, it is to be appreciated that the present invention affords, in apparatus of the character defined, an improved excavating wheel, an improved excavating blade, an improved mounting for the blade, and an improved blade set.

While I have shown and described what I regard to be a preferred embodiment of my invention, it is to be appreciated that various changes, rearrangements and modifications may be made therein without departing from

the scope of the invention, as defined by the appended claims.

I claim:

1. In an excavating apparatus, a rotatable drum, two rows of blades extending circumferentially around said drum, said rows being spaced apart and disposed, respectively, adjacent the opposite ends of said drum, each row including a plurality of circumferentially spaced blades, each of said blades including a leading edge extending outwardly from said drum and disposed adjacent the respective end of said drum, each of said blades including an inwardly facing surface inclined from the leading edge of the blade toward the other row of blades, the blades in the two rows being of the same number and being paired generally transversely of the planes of rotation of said rows, a common base plate for each pair of blades, said base plate being hingedly connected to said drum adjacent the leading edges of the blades on an axis generally transverse to the planes of rotation of said rows, and a bumper between said base plate and said drum adjacent the trailing edges of the blades, said hinged connection and said bumper absorbing shocks imparted to the blades upon encountering rocks and the like during excavation.

2. In an excavating apparatus, a rotatable drum, two rows of excavating blades extending circumferentially around said drum, said rows being disposed in spaced parallel relation and adjacent the opposite ends of said drum, each row including a plurality of circumferentially spaced blades, each of said blades including a generally radial leading edge extending outwardly from said drum and disposed adjacent the respective end of said drum, each of said blades including a generally radial inwardly facing surface inclined from the leading edge of the blade toward the other row of blades, the blades in the two rows being of the same number and being disposed in aligned pairs transversely of the planes of rotation of said rows, a common base plate for each pair of blades, each of said base plates being hingedly connected to said drum at the leading edges of the blades thereon on an axis parallel to the axis of rotation of said drum, a sheet of rubber confined between each base plate and the surface of said drum adjacent the trailing edge of the respective base plate, and a retainer extending between each base plate and said drum adjacent the trailing edge of the base plate to prevent movement of the blades outwardly of the drum surface beyond a predetermined extent.

3. In an excavating apparatus, an excavating blade comprising a base plate, a main plate extending substantially vertically upward from said base plate, said main plate including a generally vertically extending leading edge disposed adjacent one end and one edge of said base plate, said main plate being inclined transversely of said base plate and extending inwardly of the base plate from said leading edge to the trailing edge thereof, said main plate being fixed to said base plate at the lower edge thereof, an auxiliary side plate of a size smaller than said main plate extending upwardly at an inclination from said base plate toward said main plate, said auxiliary plate at the lower edge thereof paralleling said one end of said base plate and being fixed thereto in spaced relation to the lower edge of said main plate, said auxiliary plate at its upper edge adjacent the leading edge thereof engaging and being fixed to the side of said main plate, a plurality of generally triangular reinforcing struts extending upward from said base plate transversely of said auxiliary plate and said main plate and being fixed at the respective edges thereof to said base, main and auxiliary plates, at least one of said struts extending between the trailing edges of said main and auxiliary plates to close the trailing end of the space between said plates, a generally triangular front closure plate extending upwardly from said base plate at an inclination to said base, main and auxiliary plates at the leading edge of said auxiliary plate, said front closure plate engaging and being fixed

at the respective edges thereof to said base, main and auxiliary plates to close the leading end of the space between said main and auxiliary plates and to define an inclined wedge surface between said plates rearwardly of the leading edge of said main plate, and a generally triangular upper closure plate extending at an upward inclination from the upper edge of said auxiliary plate to the side of said main plate and being secured at its respective edges to said plates to close the upper end of the space between said main and auxiliary plates, said plates defining a wedge-shaped blade including a main excavating plate having a generally upright leading edge and a generally vertical inner side wall inclined transversely of the base plate.

4. In an excavating apparatus, an excavating blade comprising a base plate, a main plate extending generally vertically upward from said base plate, said main plate including a generally upright leading edge disposed adjacent one end and one edge of said base plate, said main plate being inclined transversely of said base plate and extending inwardly of the base plate from said leading edge to the trailing edge thereof, said main plate being fixed to said base plate at the lower edge thereof, an auxiliary side plate of a size smaller than said main plate extending upwardly at an inclination from said base plate toward said main plate, said auxiliary plate at the lower edge thereof paralleling said one end of said base plate and being fixed thereto in spaced relation to the lower edge of said main plate, said auxiliary plate at its upper edge adjacent the leading edge thereof engaging and being fixed to the side of said main plate, generally triangular closure plates closing the leading, upper and trailing ends of the space between said main and auxiliary plates and cooperating therewith to define a wedge-shaped blade, said main plate forwardly of said auxiliary and closure plates having a plurality of vertically spaced recesses in the leading edge thereof, a tooth socket fixed in each of said recesses and each defining a forwardly open socket, and an excavating tooth detachably mounted in each of said sockets, said teeth projecting forwardly from said leading edge of said main plate and comprising the cutting instrumentalities of the blade.

5. In an excavating apparatus, a blade set comprising an elongate base plate, a pair of excavating blades secured to one surface of said base plate adjacent the opposite ends thereof; said blades each comprising a main

plate fixed to said base plate and extending generally vertically upward therefrom at an inclination to the base plate axes, said main plate including a generally upright leading edge disposed adjacent the respective end and one longitudinal edge of said base plate, said main plate defining a generally vertical inner side surface inclined from said leading edge thereof toward the other blade, an auxiliary side plate of a size smaller than said main plate disposed to the outer side of said main plate and extending upwardly at an inclination from said base plate toward said main plate, the trailing edges of said main and auxiliary plates being aligned generally with the opposite longitudinal edge of said base plate, said auxiliary plate at the lower edge thereof paralleling the adjacent end of said base plate and being fixed to said base plate in spaced relation to the lower edge of said main plate, said auxiliary plate at its upper edge adjacent the leading edge thereof engaging and being fixed to the side of said main plate, generally triangular closure plates closing the leading, upper and trailing open ends of the space between said main and auxiliary plates and cooperating therewith to define a wedge-shaped blade, and a plurality of excavating teeth mounted on said main plate and extending forwardly from the leading edge thereof in vertically spaced relation to one another and said base plate; a pair of bearings secured to said base plate at said one longitudinal edge thereof adjacent the leading edges of said blades and defining a pivot axis to accommodate pivotal mounting of the blade set adjacent said one longitudinal edge of said base plate, and a rubber bumper mounted on the opposite surface and extending along said opposite longitudinal edge of said base plate.

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