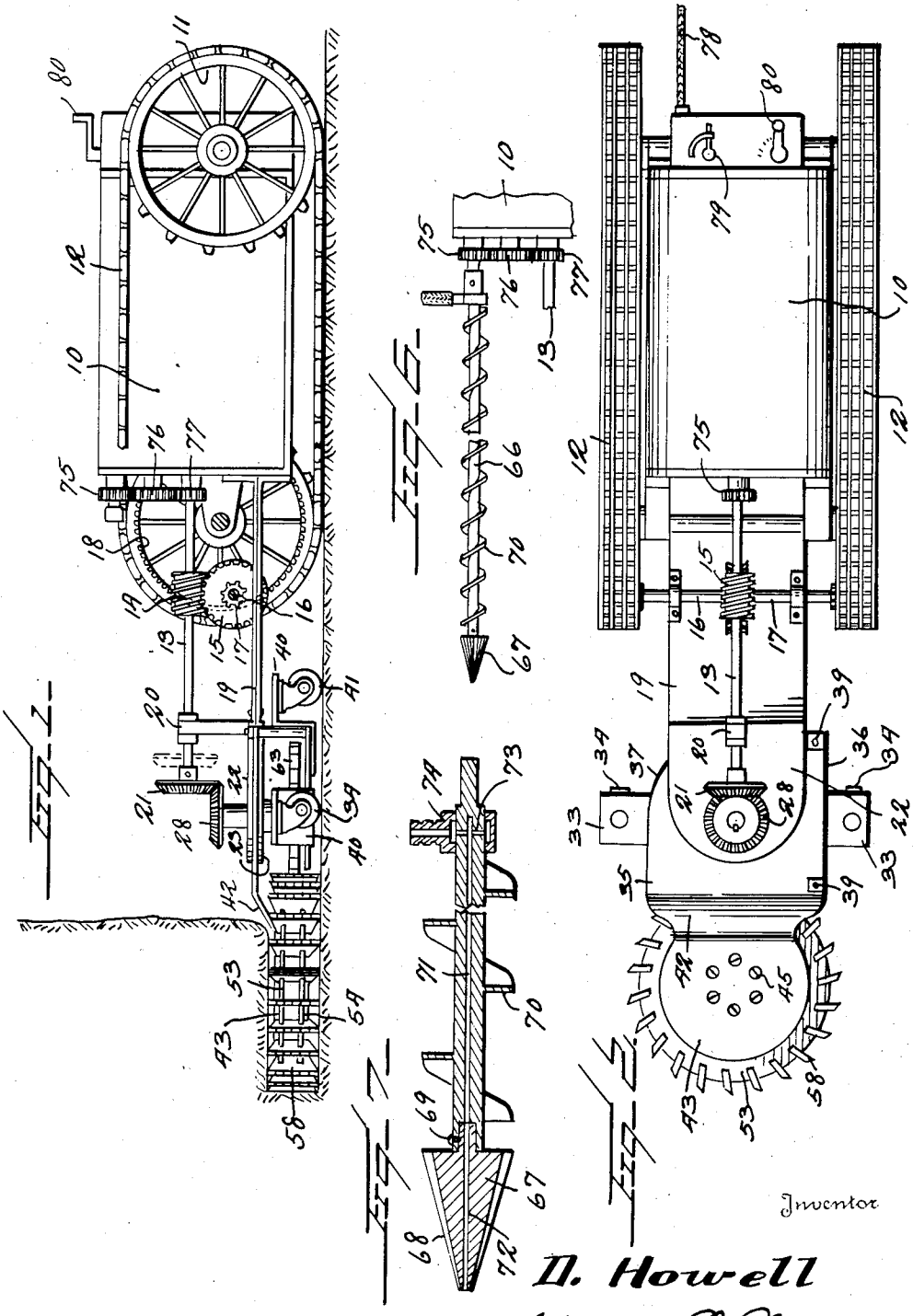
Dec. 18, 1934. D. HOWELL 1,984,832

COAL MINING MACHINE

Filed July 27, 1933 3 Sheets-Sheet 1



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COAL MINING MACHINE

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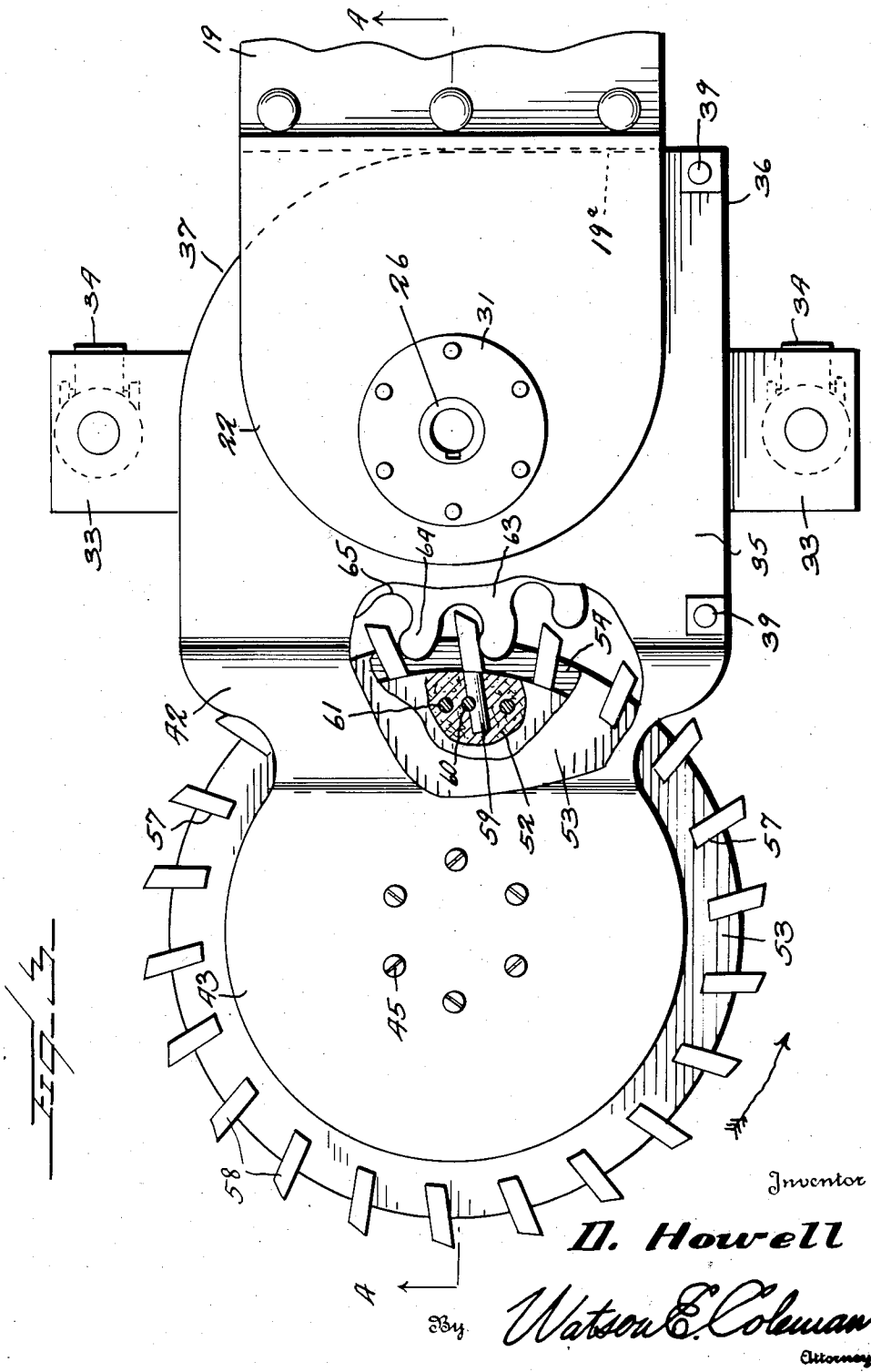


Fig. 4

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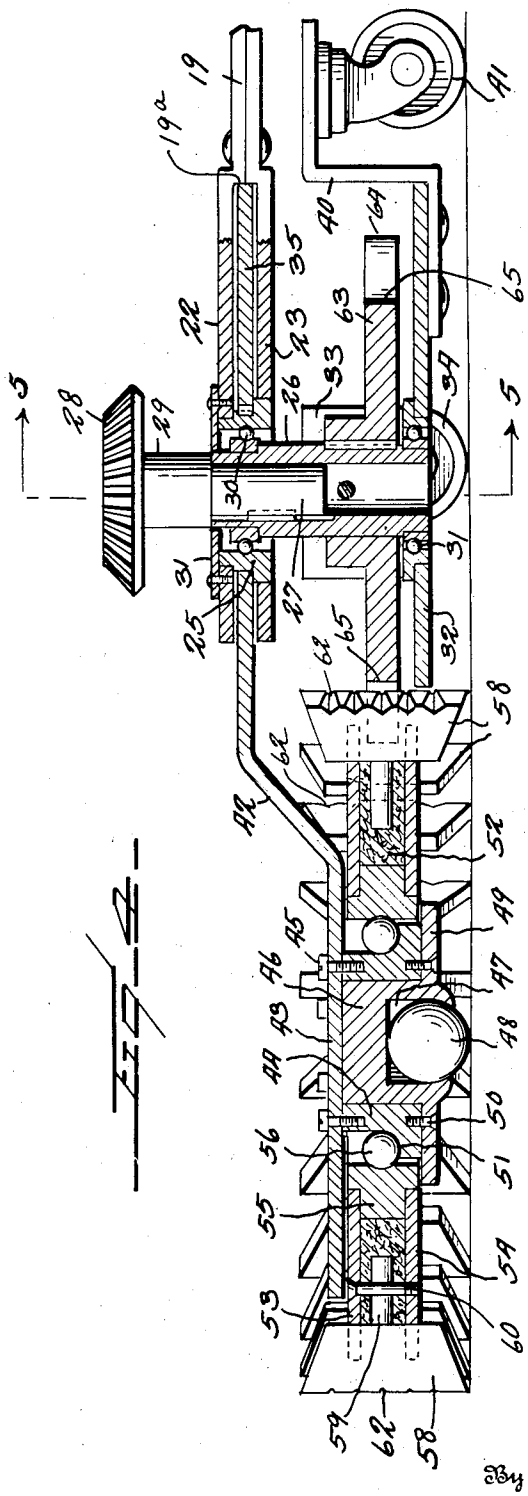
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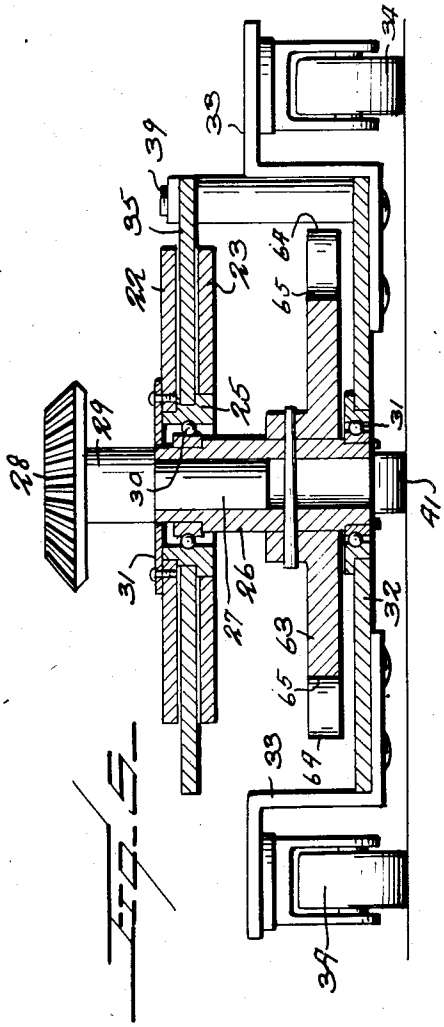
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COAL MINING MACHINE

Filed July 27, 1933 3 Sheets-Sheet 3





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Patented Dec. 18, 1934 1,984,832

UNITED STATES PATENT OFFICE

1,984,832

COAL MINING MACHINE

David Howell, Huntsville, Pa., assignor of one-fourth to Samuel Francis, Edwardsville, Pa., one-fourth to Richard Powell, Fortyfort, Pa., and one-fourth to Lee Welker, Wilkes-Barre, Pa.

Application July 27, 1933, Serial No. 682,497

5 Claims. (Cl. 262—28)

This invention relates to machines for cutting coal and particularly to mechanism for undercutting the coal from a vein whereby the coal afterwards may be blasted down.

One of the objects of the present invention is to provide a mining machine of this character which makes a relatively thin cut through the coal, thus avoiding waste of coal which is so constructed that it will operate at a relatively high speed, which is light and, therefore, readily portable and which may be operated by either air or electricity, both forms of motive power being found in coal mines.

A further object is to provide a mechanism of this character in which the cutting wheel is provided with detachable cutting teeth so constructed as to cut a kerf wider than the thickness of the cutting wheel, the cutters being detachable from the cutting wheel so that they may be renewed whenever desired or necessary and another object in this connection is to provide means for driving the cutting wheel including a peculiarly shaped gear wheel having teeth so shaped as to engage against the faces of the cutting teeth on the cutting wheel inward of their cutting edges.

A still further object is to provide a construction of this character in which the frame supporting the cutting wheel may be turned with relation to the tractor upon which the frame of the cutting wheel is mounted so as to permit the cutting wheel to be driven transversely across the breast of the coal to any desired extent.

A further object is to provide means whereby a drill may be mounted upon the tractor, this drill being so arranged that it and the tractor may be disposed at an angle for drilling blast holes in the breast of coal above the under mined portion and in this connection provide means whereby the dust from the drill may be carried rearward and the dust forced out of the teeth of the drill.

Another object is to provide as a supporting and driving means for the cutter a tractor of the crawler type which may be very light and readily handled within the limited space of a mine.

Other objects will appear in the course of the following description.

My invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a side elevation of the complete machine;

Figure 2 is a top plan view thereof;

Figure 3 is a top plan view of the undermining cutter, the supporting frame being partly broken away and the cutting wheel being also broken away to show certain details;

Figure 4 is a section on the line 4—4 of Figure 3;

Figure 5 is a section on the line 5—5 of Figure 4;

Figure 6 is a fragmentary elevation of the forward portion of the tractor showing a drill engaged therewith for drilling blast holes;

Figure 7 is a longitudinal sectional view of the drill.

Referring to these drawings, 10 designates generally a tractor of the crawler type and having any suitable means of propulsion. The tractor has the usual sprocket wheels 11 over which pass the parallel sprocket or crawler chains 12. I have not shown the particular means for operating these wheels 11 and controlling the movement of the tractor as this forms no part of my invention.

While as before stated, the particular means for driving the tractor may be of various characters, I have illustrated for this purpose a driving shaft 13 driven from any suitable motor carried within the tractor, as for instance, an electric motor, this shaft 13 carrying upon it a worm 14 which engages a worm wheel 15 carried by a shaft 16 carrying thereon the pinion 17 which engages with an internal gear 18 on each forward sprocket wheel.

Extending forward from the forward end of the tractor body is a push bar 19 which supports a bracket 20. This bracket carries the bearing for the shaft 13 and mounted upon the end of this shaft 13 is a beveled gear wheel 21 which is engaged with the shaft 13 by a set screw or any other suitable means whereby the gear wheel may be shifted rearward upon the shaft or be disposed in operative engagement with the driving gear wheel for the cutter.

As illustrated, the push bar 19 is formed of two plates which forward of the bracket 20 are spaced from each other as at 22 and 23 in Figures 4 and 5. Both of these plates are formed with an opening 24 and disposed within this opening is a bearing ring 25. Disposed within this opening is a vertical tubular shaft 26 and keyed on the upper end of this tubular shaft 26 is the shank 27 or stub shaft of beveled gear wheel 28 which engages the gear 21. The tubular shaft section 26 carries upon it a bearing ring 29 and disposed between this ring and the ring 25 are the ball bearings 30. A cover plate 31 extends over the opening in the plate 22 and closely surrounds the stub shaft 29. The lower end of the tubular shaft 26 is supported in ball bearings 31 and a plate 32, this plate on each side being provided with the angular brackets 33 carrying caster wheels 34 mounted to turn freely on vertical axes on the brackets 33.

Disposed between the separated plates 22 and 23 of the frame is a plate 35 which has a straight edge 36 along one side and a curved edge 37 extending from one end of the straight edge to the diagonally opposite corner of the plate. This plate 35 is, therefore, rotatable with relation to the plates 22 and 23 and around the bearing 25. This plate 35 is connected to the plate 32 by means of

the vertical posts 38 disposed at the ends of the straight portion 36 in the plate. Bolts 39 pass through these posts. Attached to the rear of the plate 32 is an angular bracket 40 as shown in Figure 4 which carries the caster wheel 41 which is free to rotate around a vertical axis after the manner of casters.

The plate 35 as shown in Figure 4 is extended forward and then extends downward as at 42 and then extends horizontally at 43, this portion 43 being disk-like and joined to portion 42 by a relatively narrow neck. Mounted beneath this disk-like portion 43 is an annulus held in engagement with the disk-like portion 43 by means of the screws 45 or other suitable means to this end. Disposed within the center of the ring 44 is a socket member 46 having therein a socket 47 which carries within it the supporting ball 48, this ball being free to rotate in any direction within the socket 47 and acting as a support for the hub constructed of the members 44 and 46, this socket member 46 being provided with a flange 49 extending beneath the annulus 44 and being held thereto by screws 50. The annulus 44 is formed upon its outer face with a ball race-way 51.

Surrounding the annulus 44 is the cutting wheel. This consists of a medially disposed core 52 which may be made of compressed fibre or any other suitable light but relatively strong material faced on each side by the metal plates 53 and 54. Also disposed between the plates 53 and 54 and forming a facing for the interior edge face of the core 52 is a metal ring 55 constituting a ball bearing for the balls 56 which are disposed within the race-way 51. The plates 53 and 54 project out beyond the core 52 and these plates are formed with inclined slots 57 as shown in Figure 3, these slots being tangential to a circle whose center is the center of rotation of the cutter. The cutting teeth 58 are formed as shown in Figure 4 with a shank 59, the core 52 being bored at intervals radially to receive the shanks, the shanks being held in place by the screws 60. Intermediate the screw pins 60 are screw pins 61 which also pass through the plates 53 and 54 and hold these plates against the core. The pins 60 perform a like function and also pass through recesses in the shanks 59 and detachably hold these shanks in place. Each cutter 58 is wider at its outer cutting edge 62 than at its inner edge, the inner edge having a length approximately equal to the distance between the outer faces of the plates 49 and 43. The inner margin of each cutter is disposed within the slots 57 in the plates 53 and 54 and thus it will be seen that each cutter is rigidly held in place and at a tangent to a circle concentric to the axial center of the cutting wheel. Each cutter has a beveled edge face 62 as before referred to, the edge being beveled away from the direction of rotation of the cutter, this direction being indicated in Figure 3 by the arrow.

For the purpose of rotating this cutting wheel, I mount upon the tubular shaft 26 the gear wheel 63 which is shown as being pinned to the shaft 26, though I do not wish to be limited to this. This wheel 63, as shown in Figure 3, is formed with a plurality of tangentially extending teeth 64, these teeth having a curved face and the valleys 65 between the teeth being relatively deep and tangentially extending. These teeth as shown in Figure 3 engage against the rear faces of the cutting teeth 58 but the valleys 65 are of such depth that these cutting teeth 58 are not contacted by the edge face of the driving wheel 63 at any time.

It will be seen that with this construction as the tractor is driven forwardly toward the breast of the coal, and assuming that the cutter is placed in the position shown in Figure 2, the cutter will move over the floor of the mine and cut into the vein very close to the floor and the cutter may be inserted into the vein to a depth equal to nearly the diameter of the cutter. This cutting wheel has a diameter of approximately three feet, though, of course, I do not wish to be limited to these dimensions and the cutting wheel will be rotated at a speed of fifteen hundred R. P. M. As the tractor is advanced, therefore, the cutting wheel will cut into the coal in the manner shown in Figure 1 and then, as will be later stated, the frame of the cutting wheel may be rotated around its pivotal center, which is the shaft 26, or rather the push bar 19 with its supporting frame, may be rotated relative to the cutter and into angular relation thereto so as to permit the tractor to be disposed parallel to the breast of the coal and the machine may be then operated to undermine the coal to a depth of three feet or more along its entire breast.

If desired and for the purpose of drilling blast holes in the breast of the coal, I design to mount upon the tractor a blast hole drill having a shank 66, the extremity of this shank carries upon it the drill head 67 which is preferably tapering and provided with the teeth 68. These teeth will preferably be curved from the tip to the base of this bit. I have shown the bit 67 as being mounted within the shank 66 by means of a set screw 69, though I do not wish to be limited to this. The shank 66 is preferably provided with a worm 70 and the interior of the shank is formed with a longitudinally extending channel or bore 71 and the bit 67 with a like channel 72. The rear end of the bore 71 opens into cross bores 73 so that air may be forced into the bore 71 from a swiveled connection 74 in turn adapted to be connected to an air pipe or to a fan in case the mine is not equipped with air pipes. The air passing through the bores 71 and 72 flows rearward through the bore made by the bit and keeps the bit teeth clean and the conveyor roll 70 carries this fine dust out of the bore and thus prevents any choking of the drill. These blast bores are usually driven in an upwardly slanting direction from the breast of the coal and to this end the forward end of the tractor may be disposed on upwardly inclined boards or other tracks so that when the tractor is forced forward, it will move forward and upward and thus drive the drill in an upward and forward direction into the breast of the coal.

I have illustrated the drill shank 66 as being driven by means of a pinion 75 carried by the drill shank in turn driven by an intermediate gear 76 upon the pinion 77 of the drive shaft 13 but I do not wish to be limited to this.

I have illustrated a cable 78 as conveying power to the motor of the tractor and controller handles 79 and 80 for controlling the motor.

One of the principal advantages of my construction resides in the fact that the cut made is very thin, approximately a cut of about two inches in height so that there is extremely little waste and, as a matter of fact, this mechanism in actual test has shown that there will be with this machine less than 25% of loss whereas with soft coal and with machines now in use or where miners are mining the soft coal by hand, there is a loss at the breast of from 40 to 50% and with hard coal there is even a higher percentage

of loss. With this construction, even very thin veins of coal may be mined at a profit because the coal may be under cut and then by blasting in the coal immediately above the vein of coal, the coal may be brought down in masses. If the rock below the coal be soft, my machine may be used to cut this rock beneath the vein of coal and thus no waste will occur. A two H. P. motor has been found to be amply sufficient to drive this cutter at a speed such that it will cut at the rate of forty feet per minute. The total weight of the cutter with the tractor motor and allied parts will be about three hundred and twenty-five pounds and the total length from the rear end of the tractor to the forwardmost portion of the cutter is approximately six and one-half feet. Therefore, it will be seen that with a light weight tractor of this character, the tractor may be easily shifted within the mine to bring it in proper operative position to cause the tractor to be driven parallel with the breast of the coal while the cutter is undercutting along the length of the breast. The tractor is of such light weight that it may readily be lifted by jacks and shifted so that the axis of the shaft 13 is at right angles to the supporting bar 42.

By causing the gear wheel 63 to engage the teeth 58, an important advantage is secured, because if a tooth 58 breaks, it may be readily replaced whereas if a toothed wheel were used on the cutter, the teeth of this wheel being engaged by the teeth 64 then if a tooth of the cutter wheel were broken the whole cutter wheel would have to be replaced. Thus, the teeth 58 perform a double function acting as gear teeth and also as cutting teeth. As a matter of fact, the breakage of the tooth 58 will not interfere with the proper driving of the cutter and the cutter will continue to operate unless two adjacent teeth are broken, in which case it is a relatively easy matter to substitute a new tooth for the old tooth.

It will be seen from Figure 3 that the bar 44 can make a one-fourth turn around the pivotal axis of the shaft 26 but that it is limited to this quarter turn by the transversely extending shoulder 19*a* shown in Figure 3. Thus the supporting bar 42 may extend straight outward from the push bar 19, as shown in Figure 2, or be disposed in right angular relation thereto in one direction. It is also noted that the depth of cut of the cutting wheel is nearly the full diameter of the wheel. It will be obvious that the diameter of the wheel might be varied so as to secure a still deeper cut.

Many changes might be made in the details of construction and arrangement of parts without departing from the spirit of the invention as defined in the appended claims.

Having described my invention, what is claimed is:—

1. In a coal mining machine, a cutter comprising an annular core, plates disposed on opposite side faces of the core and having inwardly extending slits, cutters insertible into said slits and having shanks insertible into the core, and means for holding said shanks detachably engaged with the core.

2. In a coal mining machine, a wheeled supporting frame, a central hub on the frame, means for supporting the hub on the floor of the mine and a cutting wheel surrounding said hub and including an annular core, plates disposed on opposite sides of the core and detachably engaged therewith, the plates projecting beyond the core and having inwardly extending slots and cutters disposed in said slots and extending vertically beyond the plates on each side thereof, each cutter having a shank extending into the core, means extending through the plates and through the core and detachably engaging said shank, and anti-friction bearings disposed between the hub and said core.

3. In a coal mining machine, a wheeled supporting frame, a depending hub carried on the frame, means for supporting the hub on the floor of a mine, a bearing ring surrounding the hub and fixed to the frame and to the hub, a cutting wheel including an annular core surrounding said bearing ring, ball bearings disposed between the annular core and the bearing ring, plates disposed on opposite sides of the core and detachably engaged therewith, the plates projecting beyond the core, cutters mounted on the periphery of the core and extending beyond the plates, the core terminating short of the plates, a vertical shaft carried by the frame, and a wheel carried by the vertical shaft and operatively engaging the cutting wheel between the teeth thereof and between said plates.

4. In a coal mining machine, a rotatably mounted horizontally disposed cutting wheel, a supporting frame therefor, the periphery of the wheel having removable substantially radial cutters, plates disposed on each side of the cutting wheel and forming part thereof and extending on each side of the shanks of the cutters, and means for driving the cutting wheel including a power rotated horizontally disposed wheel carried by the frame having peripheral teeth, the teeth being curved outward and toward the direction of rotation of the power wheel and of the cutter wheel and engaging on the rear faces of the teeth and between the plates of the cutter wheel.

5. A coal mining machine including a tractor having a motor, a motor driven shaft and tractor wheels driven by the motor, push bars extending outward from the tractor, a driving shaft extending outward above the push bars, the push bars having an upper bifurcated element and a lower bifurcated element, caster wheels supporting the lower element, a vertical shaft mounted for rotation in the upper and lower elements of the push bars, means for driving said shaft from the driving shaft of the tractor, a cutter supporting member mounted within the bifurcated upper push bar element for free rotation around the axis of the vertical shaft, the cutter supporting member being downwardly deflected adjacent one end, means for limiting the rotation of said cutter supporting member, a cutting wheel mounted upon the cutter supporting member and having radially projecting cutters, means at the center of said cutting wheel and supporting the cutting wheel upon the floor, and a toothed wheel carried by the vertical shaft and having teeth engaging against the rear faces of the cutters to thereby rotate the cutting wheel.

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