

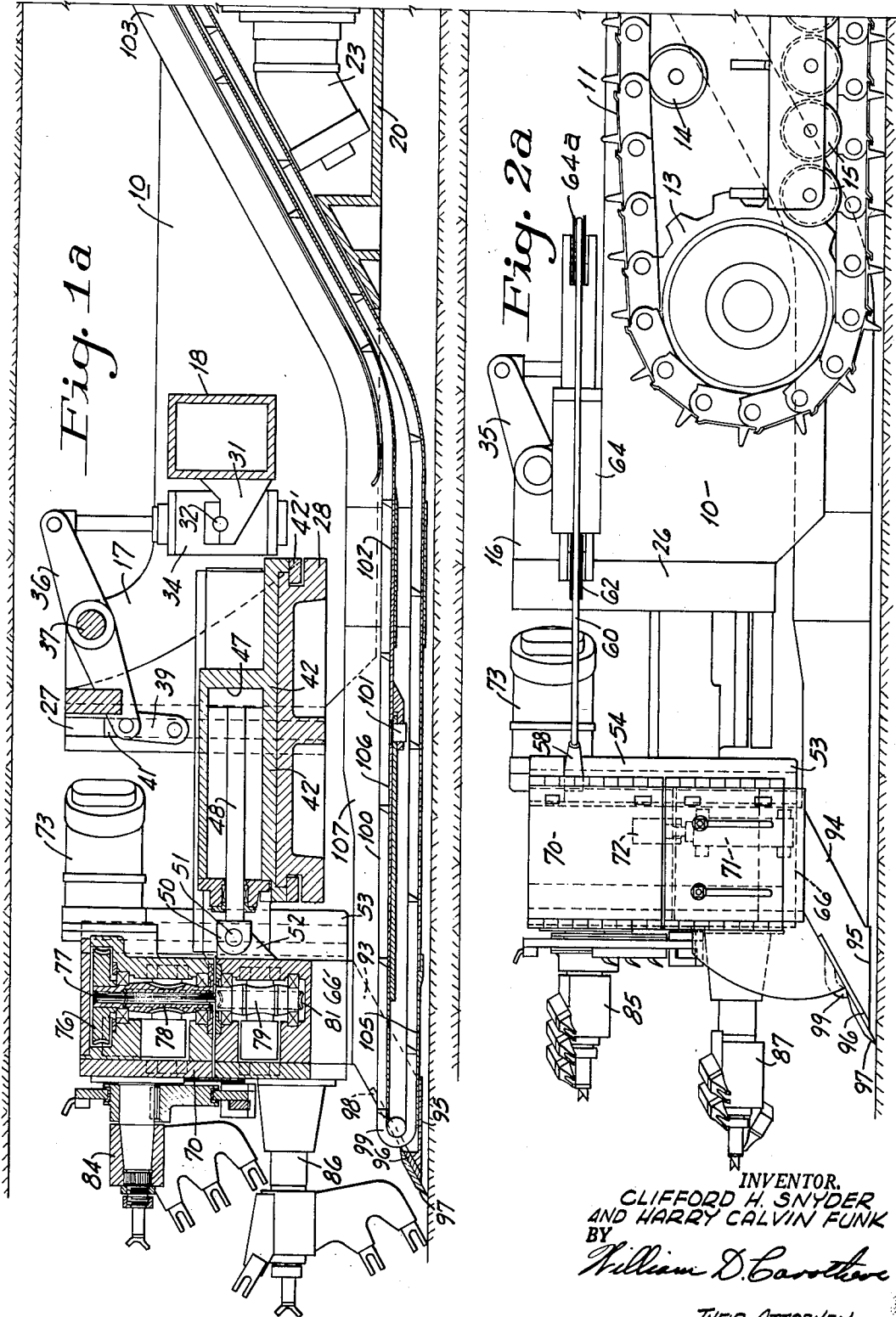
April 3, 1956

C. H. SNYDER ET AL
INTERMITTENT MINING MACHINE WITH TURNTABLE
MOUNTED ROTARY CHIPPING HEADS

2,740,618

Filed Sept. 8, 1949

5 Sneets-Sheet 1



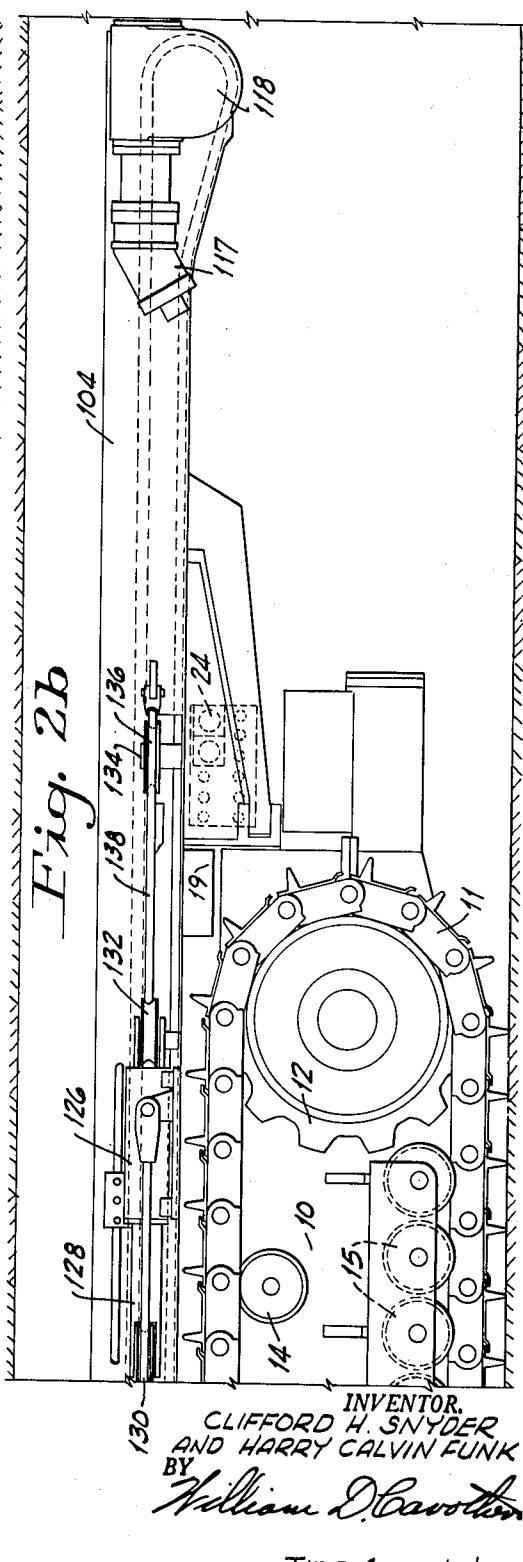
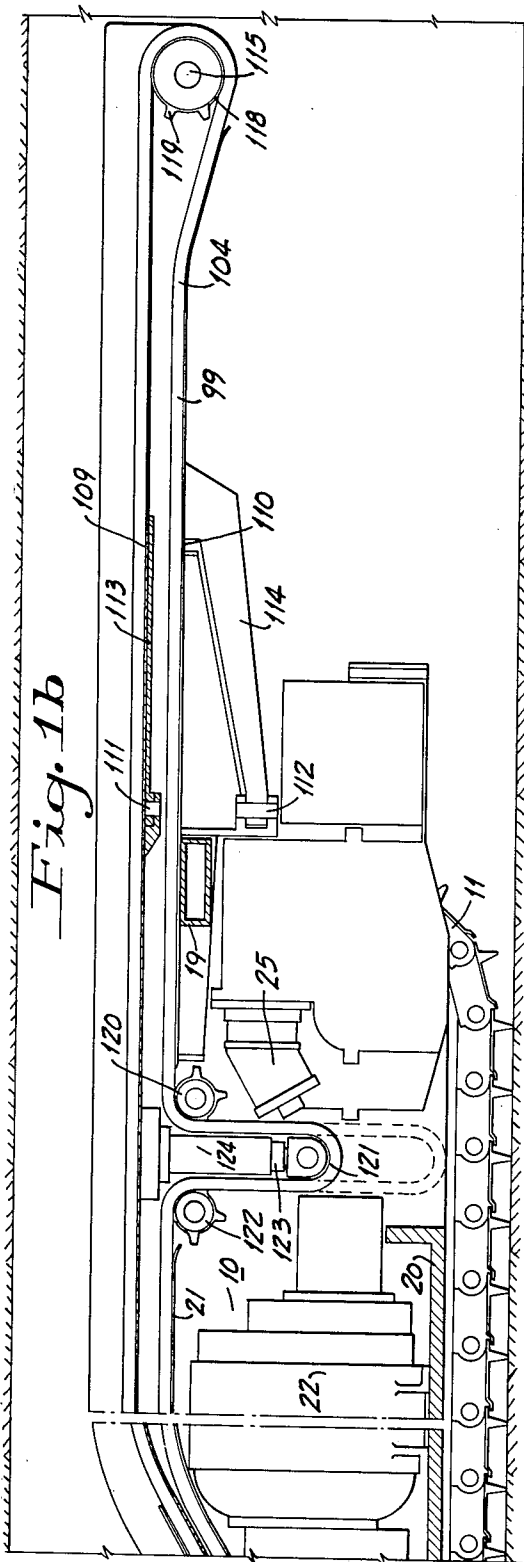
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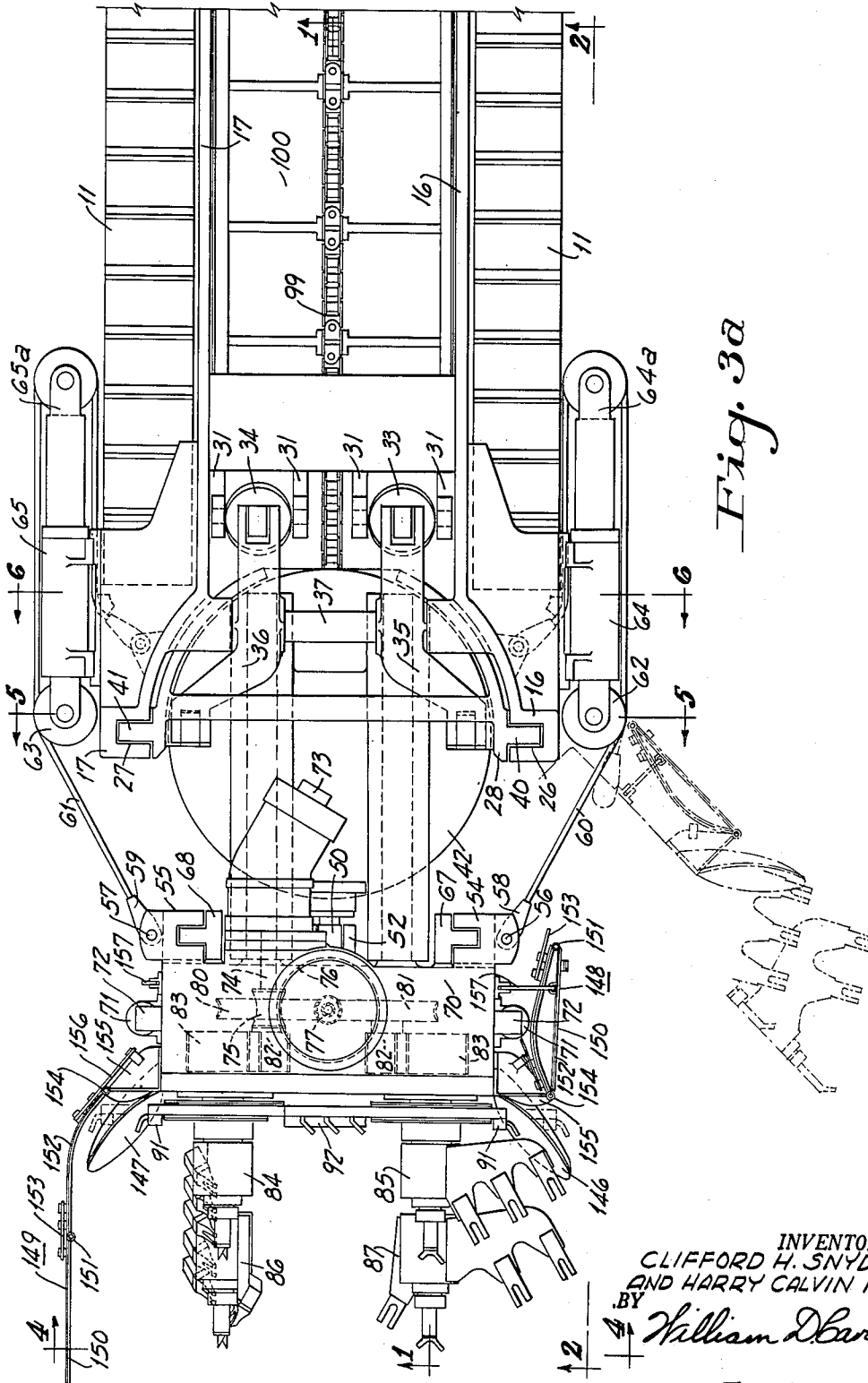


Fig. 3a

INVENTOR,
CLIFFORD H. SNYDER
AND HARRY CALVIN FUNK

BY *William D. Barthele*

THEIR ATTORNEY

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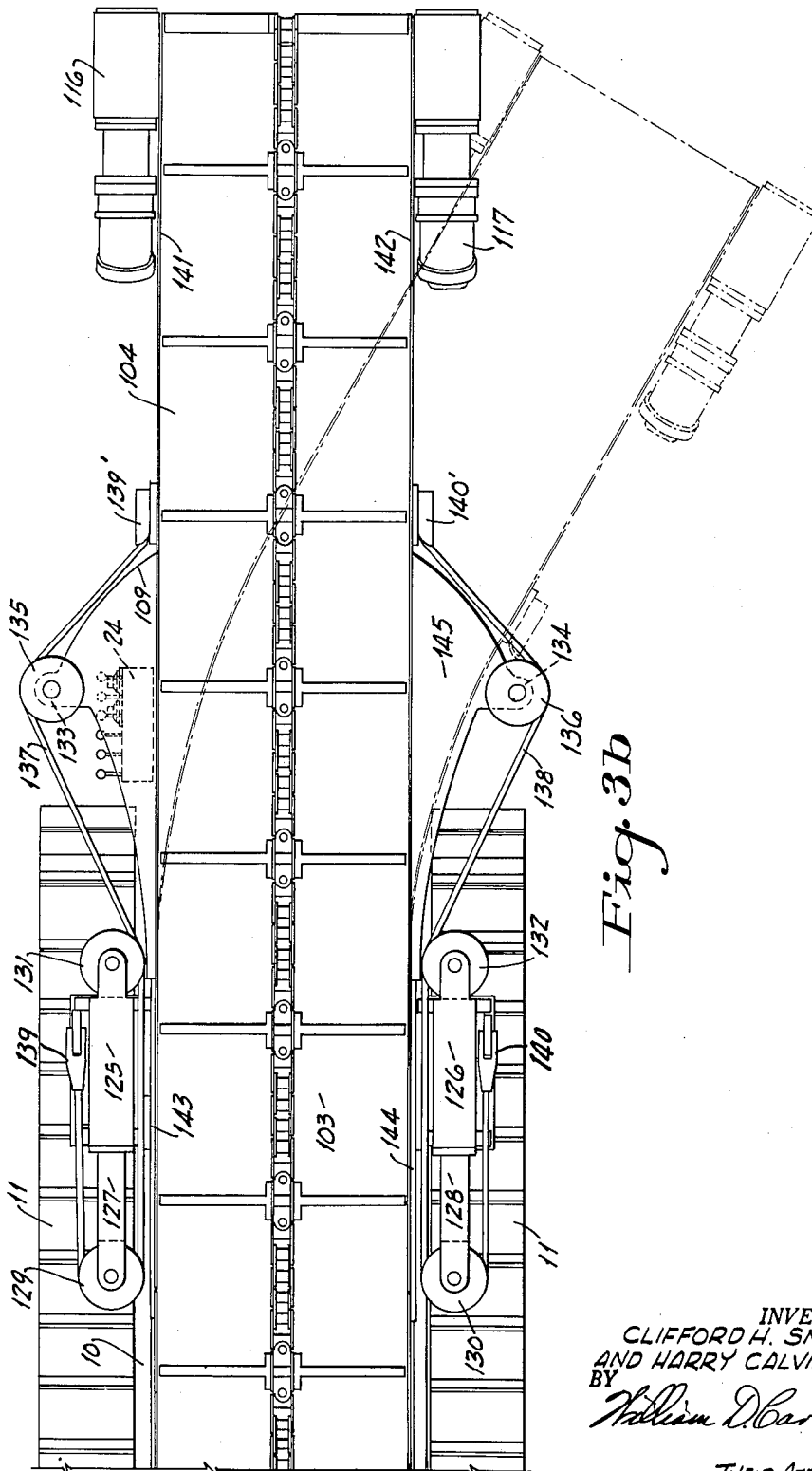


Fig. 3b

INVENTOR.
CLIFFORD H. SNYDER
AND HARRY CALVIN FUNK
BY

William D. Carothers

THEIR ATTORNEY.

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5 Sheets-Sheet 5

Fig. 4

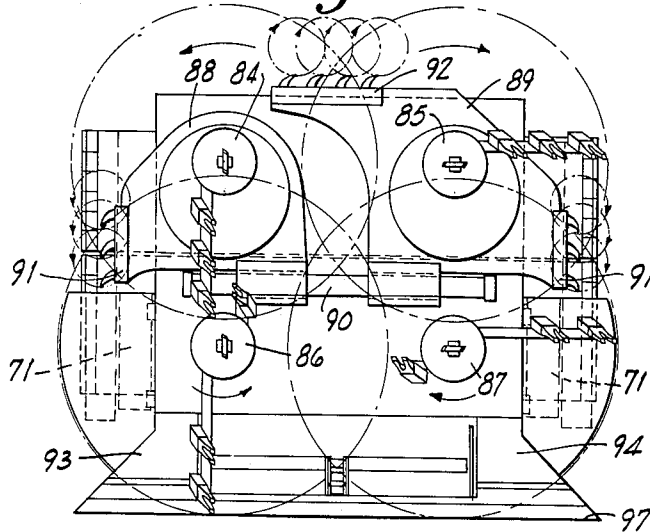


Fig. 5

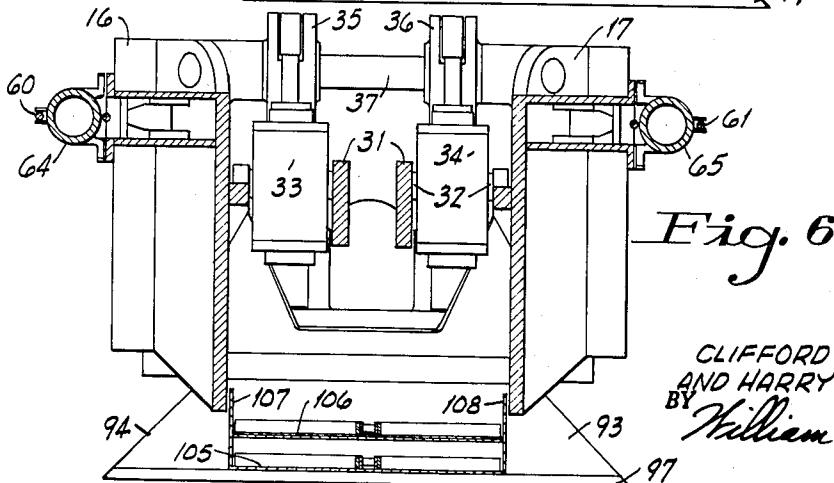
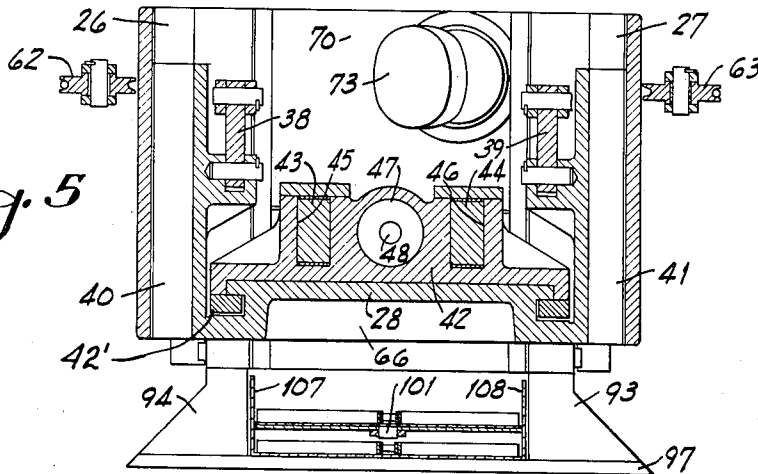


Fig. 6

INVENTOR
CLIFFORD H. SNYDER
AND HARRY CALVIN FUNK
BY *William D. Carothers*

THEIR ATTORNEY.

1

2,740,618

INTERMITTENT MINING MACHINE WITH TURN-TABLE MOUNTED ROTARY CHIPPING HEADS

Clifford H. Snyder, Dormont, Pa., and Harry Calvin Funk, Salem, Ohio, assignors, by mesne assignments, to The Colmol Company, New Lexington, Ohio, a corporation of Ohio

Application September 8, 1949, Serial No. 114,555

12 Claims. (Cl. 262—9)

This invention relates generally to mining and more particularly to new and improved methods and apparatus for the mining of coal and in its more specific aspect this invention contemplates intermittent progressive mining of coal.

Several mining machines have been developed to cut and remove the coal without the aid of the well known type of cutting bar machine that is employed in general practice to undercut the coal face which is subsequently drilled and blasted loose for loading and conveying to the surface.

Some newly developed intermittently operating machines employ a cutting bar for undercutting the coal in a portion of the coal face which is subsequently broken down by vibratory picks operated by hammers and the coal falls on a conveyor for removal. This character of machine operates in alternate cycles of undercutting a predetermined portion of the coal face and then presenting the vibratory picks which remove the coal immediately above the undercut and gradually chip it to the top of the seam until the coal is removed in that section of the face. The machine is then shifted to adjacent sections of the coal face until the coal in the whole of the face in the room or entry is removed to a predetermined depth. The size of the coal removed by the picks of this type of a machine is an indeterminate factor depending upon the cleavage structure of the coal and the ordinary problems of undercutting are always present due to the use of the undercutting bar. Aside from the necessity of removing the bug dust it is difficult to control the coal as it breaks loose and it spills on the floor and may require other loading means or a cleanup crew. The undercutter requires a great amount of horsepower for the work accomplished.

Another type of intermittent mining machine employs a battery of cutting bars having their chains disposed in parallel vertical planes spaced a few inches apart. This battery of cutting bars or head is moved in a vertical plane and is fed into a section of the coal face adjacent the bottom thereof. When the cutting bars have penetrated to their full working depth they are raised to cut the coal thereabove until the teeth on the cutting bars remove all of the coal up to the top of the seam in the selected section of the coal face. The picks or teeth on these cutting bars approach and enter the coal from the bottom of the head and return along the top carrying loose coal to a conveyor which removes it from the face. With this machine it is also difficult to catch all of the coal when it breaks free and the cutting bar action grinds the coal into fines producing a considerable amount of bug dust. This type of machine also requires a great amount of horsepower in relation to the work accomplished.

This invention overcomes the numerous difficulties accompanying the foregoing methods and intermittent machines and provides method and apparatus which greatly increases the production of coal without such a high percentage of fines and bug dust and comparatively mate-

2

rially less horsepower is required to dig and remove the same amount of coal in the same period of time. The coal is removed by rotary chipping overlapping concentric kerfs and the cusps therebetween and leaving a clean floor.

The present invention contemplates process and apparatus for simultaneously cutting, preferably by chipping to remove the coal to a predetermined depth and loading it from a series of sections across the face until the whole of the face has been mined and then progressing for the next series of cuts.

The cutting means is preferably provided with a plurality of rotary chipping heads having widely spaced teeth progressively receding axially and connected by rearwardly sharpened surfaces. These chipping heads are mounted in quadrangular relation with the heads at the same elevation operating in opposite directions to convey the coal laterally to between the heads where it is loaded onto a conveyor for removal from the face.

The quadrangle arrangement of the chipping heads permits them to function as a unit that may be swiveled on a vertical axis on the front of the machine and the whole of the unit is fed forwardly to cut successive sections of coal as the unit is swung from one side of the mine to the other. When the several sections across the coal face have been removed and the cutting unit retracted, the machine is advanced toward the freshly opened face and stopped permitting the cutting unit to remove another series of successive sections across the coal face before the machine is again advanced.

The upper chipping heads are movable vertically relative to the lower chipping heads to increase the size of the chipping unit in accordance with the height of the seam of coal but when the upper chipping heads are fully lowered, the cutting dimension of the unit may be made to produce vertical and horizontal clearance for the machine. Thus, if the cutting unit is maintained in alignment with the machine it may be operated as a continuous mining machine by movement of the cutting unit and the whole machine in successive steps or by producing the feed through propulsion of the machine alone.

In order to intermittently feed only the cutting unit into the coal and maintain the fore part of the conveyor on this unit, regardless of its position, it is preferable to employ a conveyor that is capable of articulating laterally as well as extending and retracting with the cutting unit without interrupting its operation. This is an important object of this invention and is accomplished by providing conveyor links capable of swiveling together with a variable takeup intermediate the ends of the return run of the conveyor. This improvement also permits the conveyor at the ends of the machine to articulate laterally for loading the coal and conveying it to receivers at opposite sides of the mine or for swinging the tail to an entry when the machine is cutting a room disposed at an angle thereto.

Other objects and advantages appear in the following description and claims.

The accompanying drawings show, for the purpose of exemplification, but without limiting the invention or claims thereto, certain practical embodiments of the invention wherein:

Figs. 1a and 1b together constitute a sectional view of the mining machine comprising this invention, taken on the line 1—1 of Fig. 3;

Figs. 2a and 2b together constitute a side elevation of the machine embodying the invention;

Figs. 3a and 3b together constitute a plan view of the structure shown in the foregoing views;

Fig. 4 is a view in front elevation of the cutting unit of the machine;

Fig. 5 is a view of a transverse section taken on the line 5—5 of Fig. 3; and

Fig. 6 is a view of a transverse section taken on the line 6—6 of Fig. 3.

Referring to Figs. 1 to 3b of the drawings, the mining machine is made up of a vehicular body 10 supported on a pair of endless tracks 11 propelled by the sprockets 12 at the rear of the body and carried by the idlers 13 at the front. Intermediate the sprocket and idler the upper flights of the tracks 11 are supported by the idler rolls 14 journaled on the body 10 and the lower flights of the tracks are engaged by the track rollers 15 which are also carried by the body 10 and support the same directly through the endless tracks 11 to provide substantially continuous bearing for the full length of the endless tracks.

The body 10 of the mining machine is constructed with heavy side frame members 16 and 17 connected by the front and rear cross frame or box shaped bridge members 18 and 19 and connected at the bottom by the floor member 20 and at the top by the deck 21.

As shown in Figs. 1a and 1b the motor 22, which is preferably a variable speed direct current motor, is arranged to drive the hydraulic pump 23. The pump 23 is connected through appropriate controls, the manipulating levers of which are best located at the rear and to one side of the body, as indicated by the box 24 in Figs. 2b and 3b, but are not shown in detail. The hydraulic pump 23 is designed to supply all the power necessary to propel and guide the machine, raise, lower and rotate the cutting heads at the front of the machine and operate and swing the conveyor.

The hydraulic traction motors 25 are located on each side of the body adjacent their respective sprockets 12 and are independently controlled to provide complete maneuverability in steering and moving the machine forward and reverse.

The side frames 16 and 17 extend forwardly of the front bridge member 18 and are provided with inwardly facing ways 26 and 27 as shown in Figs. 1a, 3a and 5 for receiving the slides 40 and 41 of the vertically movable circular base or platform 28. The bridge member 18 has two sets of spaced projecting brackets 31 with aligned openings to receive the gudgeons 32 extending from the double-acting hydraulic cylinders 33 and 34 having their pistons connected to one end of their respective rocker arms 35 and 36 pivotally supported on the shaft 37 carried by the frames 16 and 17. These rocker arms are connected by the links 38 and 39 to the slides 40 and 41 of the circular casting or platform 28 to raise and lower the same in the ways 26 and 27. The circular casting 28 has the turn table 42 revolvably mounted thereon and held in place by the spelt ring 42'. The turn table 42 supports the whole of the mining head assembly for arcuate movement on the front of the machine frame. The horizontally disposed arms 43 and 44 are slidable in ways 45 and 46 formed on the turn table. Intermediate of the ways 45 and 46 on the turn table is a double-acting hydraulic cylinder 47 having the piston 48 extending forwardly to the eye 50 which is held by the pin 51 mounted in the spaced ears 52. The ears 52 and the front ends of the arms 43 and 44 are attached to the transverse plate 53 carrying the vertical ways 54 and 55 on the ends thereof.

The casting 53 is provided with the vertical posts 56 and 57 on which is pivoted the eyes 58 and 59 on the ends of the cables 60 and 61 that extend from the casting 53 and are trained over their respective pulleys 62 and 63 journaled on the front ends of the cylinders 64 and 65 pivotally supported on opposite sides of the frame members 16 and 17. The pistons 64a and 65a project from the rear of the cylinders 64 and 65 and their outer ends carry pulleys over which the cables 60 and 61 pass and return toward their respective cylinders and their ends are secured to the frame. Each of the cylinders 64 and 65 is double-acting and is controlled so that the one piston is extended simultaneous with the retraction of the other

piston. In this manner the casting 53 may be swung with the turn table 42 through an arc of approximately ninety degrees regardless of the forward or aft position or movement of the casting or the up and down movement of the circular casting 28.

The casting 53 is formed integral with the lower gear box 66 and the spaced vertical ways 54 and 55 receive the guides 67 and 68 attached to the upper gear box 70 and travel therewith. The lower gear box 66 is raised or lowered with the base casting 28 and the upper gear box will move therewith but is separable from the lower gear box by the jacks 71 mounted on the sides of the lower gear box with their pistons engaged in the lugs 72 on the upper gear box.

A hydraulic motor 73 is driven through appropriate controls from the pump 23 and is attached to the back of the upper gear box 70. The motor 73 drives the shaft 74 and the pinion 75 on the end thereof drives the gear 76, the bore of the hub of which is splined to receive the complementary splined vertical shaft 77 as shown in Fig. 3a. In Fig. 1a the shaft 77 is shown to have two worm pinions; the pinion 78 for the upper gear box and the pinion 79 for the lower gear box. Each of these pinions is engaged by a pair of worms 80 and 81, respectively. These worms are attached to horizontal shafts having the spur pinions 82 that mesh with the gears 83 on the four quadrangular head shafts 84, 85, 86 and 87, the top shafts being separable from the bottom shafts. Thus, the hydraulic motor 73 drives each of the four head shafts through this gear train reduction and the upper gear box may be raised by the cylinders 71 relative to the lower gear box without interrupting this drive through the splined shaft 77.

Each of the head shafts carries a chipping head that is provided with a double-toothed central pilot bit and a series of angularly extending, radially disposed and rearwardly receding spaced bits, each having a double tooth and removable for replacement. The lower heads preferably extend beyond the upper heads and the first bit of the radial series is positioned on the opposite side of the shaft to provide some counterbalance to the head. The outer bits of the bottom chipping heads extend a little farther forward than the corresponding bits of the upper heads as shown in Fig. 1a. Only four shafts and chipping heads are provided in this quadrangular arrangement but additional shafts and chipping heads may be added in horizontal or vertical tiers which are preferably added to maintain the quadrangular arrangement of chipping heads.

In back of the upper chipping heads each shaft 84 and 85 has an eccentric disc secured thereto. These eccentric discs are duplicates and are mounted on the upper shafts 84 and 85 and rotate therewith or in opposite directions to one another and have circular tracks to receive the split plates 88 and 89 which gyrate in opposite directions and are maintained in one hundred and eighty degrees phase relation with each other. These plates have aligned sockets to receive the connecting slide bar 90 which prevents the plates from rotating but allows them to gyrate in opposite directions in their separate orbits determined by the eccentrics on which they are mounted. Each plate has a series of three side teeth 91 and the plate 89 has a second or top series of teeth 92.

As these plates gyrate when their shafts are rotated, the top and side sets of teeth travel in the small circular paths as indicated by the dotted circles in Fig. 4 and the several teeth cut the cusps formed between the kerfs cut by adjacent cutting heads. This gyratory cutting action places very little load on the rotary shafts yet it readily removes the cusps of coal and they represent a very important object of this invention. By changing the size of the eccentric the amount of the cusp that is removed may be determined.

The lower gear box 66 has spaced downwardly and forwardly projecting arms 93 and 94 joined at their bottom edges by the horizontal plate member 95 forming a pocket.

5

The inclined front edges of the arms 93 and 94 have the blade plate member 96 secured thereto. The inclined blade plate 96 carries the sharpened blade 97 along the lower edge which extends below the horizontal plate 95 and beyond the ends of the gear box 66.

The pocket 98 formed by the spaced arms 93 and 94 and the plate members attached thereto are arranged to receive and have secured thereto the front end of the drag chain conveyor 99. The trough of the conveyor is made up in four sections. The front section 100 is secured in the pocket 98 and has a pivotal connection located below the center of the circular casting 28, as indicated at 101, with the second conveyor section 102. The conveyor section 102 telescopes within the third conveyor section 103 that passes rearwardly and upwardly to the top of the machine. The fourth conveyor section 104 is a swinging tail section that has substantially a ninety degree movement or forty-five degrees from each side of the center position. Each section of the conveyor is provided with a bottom trough surface 105 for the return flight of the drag chain 99 and the top trough surface 106 for supporting the drag chain in its load flight. The side walls 107 and 108 of the conveyor trough extend materially above the top trough surface 106 to prevent the coal from spilling as it is carried rearwardly from the chipping heads. The pivoting of the conveyor at the pin 101 permits the front section 100 to swing horizontally with the chipping head and the telescoping of the second section 102 within the third section 103 permits the first two conveyor sections to move out and back with the chipping head assembly. The conveyor hinges at the top of the frame of the mesh when the chipping unit is raised and lowered relative to the body of the machine. Each of the conveyor surfaces 106 and 105 that support the load and return flights of the several conveyor sections is overlapped in the direction of travel to prevent the chain or its cross flights from catching thereon.

As shown in Figs. 1b, 2b and 3b, the load and return flight surfaces of the conveyor fan out and provide the circular arcuate edges 109 and 110, the center of which is located in the pivotal pins 111 and 112 fixed relative to the body of the machine on which are journaled the arms 113 and 114 which support the fourth conveyor section 104 for swinging in an arc. The upper and lower conveyor surfaces 106 and 105 of the fourth conveyor section have complementary arcuate edges that underlie and overlie the respective arcuate edges 109 and 110. The tail swinging fourth conveyor section 104 has the shaft 115 journaled therein and driven at each end by the hydraulic motors 116 and 117. A large sleeve 118 surrounds the shaft for guiding the chain 99 therearound as the latter is driven from the shaft by the sprocket 119.

Intermediate the ends of the body the return flight of the chain 99 passes over the idler sprocket 120 and down around the idler roller 121 then back up over the idler sprocket 122 as it continues to the front part of the machine. The idler roll 121 is rotatably supported on the end of the piston 123 that extends from the double-acting cylinder 124. This piston is retained against turning and is biased to force the conveyor chain 99 downwardly to the depth indicated in dotted lines. When the chipping heads or the tail conveyor swing, the effective length of the conveyor chain 99 is increased. Again, when the cutting head assembly is moved forward on its ways, more length is required in the conveyor chain. The force in swinging the tail conveyor, the chipping heads or moving the assembly forward to extend the chipping heads is sufficient to counteract the pressure biased piston 123 and retract the same as shown in Fig. 1b. On the other hand, when the conveyor tail and the chipping heads are straightened and retracted, the pressure biased piston 123 takes up the return flight of the conveyor chain by fully extending the chain to the position indicated in dotted lines.

6

The tail conveyor section 104 is swung in a manner similar to that of the chipping heads. As shown in Fig. 3b, the cylinders 125 and 126 are mounted on each side of the third conveyor section 103 and have their pistons operating toward the front of the machine.

The outer ends of the pistons 127 and 128 have journaled thereon the pulley 129, 130 and the back ends of the cylinders likewise rotatably carry the pulleys 131 and 132. The arcuate conveyor surface of the intermediate section 103 has the laterally projecting ears 133 and 134 at the ends of the arcuate edge 109. These ears rotatably support the pulleys 135 and 136. The three pulleys on each side of the machines are arranged to carry the cables 137 and 138. The front ends of these cables are attached to the frame supporting the cylinders as indicated at 139 and 140. These cables extend forwardly passing around the pulleys on their respective pistons then back between the cylinders and the conveyor to the pulleys on the back of the cylinders and thence over the pulleys 135 and 136 to the sides of the swinging conveyor section 104 where they are secured to the brackets 139 and 140. The hydraulic cylinders 125 and 126 are operated by similar controls and in a manner similar to that of the swing cylinders 64 and 65, which extend the piston 127 at the same time and rate that the piston 128 is contracted to swing the conveyor section 104 on the pivots 111 and 112.

The sides 141 and 142 of the conveyor are fixed relative to the swinging section 104 but are only attached to the intermediate conveyor section 103 adjacent the center of the stiffening plates 143 and 144. Thus, the sides of the conveyor sweep over the arcuately shaped top conveying surface plate 145. The cross flights of the drag conveyor chain will engage the short radius wall of the flexed conveyor sides and thus guide the chain and direct the coal to the swinging conveyor.

The lower gear box 66 is provided with outwardly projecting flexible ears 146 and 147, the perimeters of which closely follow the outer marginal kerfs of the lower chipping heads to gather up any stray pieces of coal that are not swept laterally to the conveyor by the chipping heads. These ears are hinged mounted so that they will fold toward the chipping heads when the latter are retracted.

In operating this mining machine the quadrangularly arranged chipping heads are presented to the coal face. The circular casting 28 is raised or lowered by the cylinders 33 and 34 so that the lower tier of chipping heads will cut to the bottom of the coal seam. The upper row of chipping heads is then positioned relative to the lower row so that they will cut to the top of the coal seam to be mined. The chipping head assembly is then preferably swung to the right by contracting cylinder 64 and expanding cylinder 65. All the chipping heads are rotated and the whole of the chipping head assembly is then fed forwardly on the ways 43 and 46 by the hydraulic feed cylinder 47, the piston 48 of which is moved outwardly at the selected speed suitable for chipping the coal. The continuous forward feed of the rotating chipping heads thus remove the entire coal seam as they move forward and the gyrating side bits 91 and top bits 92 remove the cusps between the kerfs. When the feed piston 48 has reached the limit of its stroke it is quickly retracted and the turn table is swung to the left to take a second bite into the coal face. The consecutive bites taken by laterally swinging the chipping heads across the coal face preferably overlap one another substantially the same degree as the overlap of the vertical tiers of the chipping head assembly.

In taking adjacent overlapped bites across the face from one side of the tunnel to the trailing or open side of the chipping head assembly it is exposed and must be baffled to prevent the coal from being deposited over the floor. Such a foldable baffle is shown at 148 and 149, the former being folded in as the heads are in the

process of taking their cuts from right to left and the latter 149 is extended to catch the coal and keep it within sweeping reach of the chipping heads. These baffles extend the full height of the head assembly as shown in Figs. 1a, 2a and 3a and are provided with a tip section 150 pivotally connected by a piano type hinge 151 to the arcuate section 152. This hinge 151 is locked open by the sliding brace bolts 153 on the back of the baffles. The arcuate baffle section 152 is hinged 154 to the spaced ribs 155. These hinge joints 154 are locked open by the sliding bolts 156. When folded back these baffles are latched in place by the hooks 157.

After the first cut is made into the coal face, the baffle on the trailing or open side of the chipping heads is unfolded and locked open until the chipping assembly has reached its full lateral swing. The endless tracks 11 then move the machine forward to bring the retracted chipping heads closer to the face to permit them to be again fed into the coal seam in consecutive bites as the chipping head assembly is intermittently swung from one side of the room to the other. The intermittent action of bringing the machine forward after each lateral swing of the chipping heads and the intermittent action in taking lateral progressive bites into the coal and to the limit of the extension of the piston 43 leaves a tunnel, the sides of which are merely a series of steps. Such steps provide room for workmen to stand when machinery is passing and they also provide protection for posts that are set to timber the roof.

By moving the machine down the center of the tunnel and swinging the chipping heads to the full limit of the arcuate travel of the turn table, the dimension of the tunnel cut is materially wider than the machine. In fact, two shuttle units may sit side by side in back of this machine and the tail of the conveyor may switch from side to side to fill these shuttle units in alternate succession.

While, for clarity of explanation, certain preferred embodiments of this invention have been shown and described, it is to be understood that this invention is capable of many modifications, and changes in the construction and arrangement may be made therein and certain parts may be employed without conjoint use of other parts and without departing from the spirit and scope of this invention.

We claim:

1. A rotary chipping means for use on an articulating mounting of an intermittent mining machine, which comprises a reciprocal plate, upper and lower gear boxes mounted on said plate and connected for vertical movement relative to each other, a pair of rotary shafts extending from each gear box and positioned in quadrangular relation to each other, a gear train in each box for rotating said shafts in opposite directions, splined shaft driving means connecting the gear trains of said gear boxes, motor means carried by one gear box for driving said gear trains, and chipping heads mounted on said shafts to chip a section of the coal face when said plate is reciprocated.

2. The structure of claim 1 characterized in that said rotary chipping heads cut kerfs in overlapped relation to one another, bits mounted on plates to be gyrated by selected rotary shafts for cutting the cusps between the overlapped kerfs and slide means carried by said plates to guide the movement of said bits.

3. The structure of claim 2 which also includes power expansion means for separating said gear boxes from one another to a selected degree while maintaining the overlapped relation of the chipping heads.

4. A rotary chipping means for use on an articulated mounting of an intermittently progressive mining machine, comprising a series of horizontally disposed quadrangularly arranged rotary shafts operating in timed relation with one another, a chipping head mounted on each shaft and constructed to cut overlapping concentric kerfs, an

eccentric on each of a selected plurality of said shafts, a plate mounted on each eccentric, slide means connecting adjacent plates to synchronize them in gyrating movement as said shafts rotate, and bits on said plates mounted to chip the cusps formed between the kerfs cut by the overlapping chipping heads.

5. A machine for mining and removing coal comprising a mobile body, powered gearbox means supporting and operating a plurality of forwardly projecting rotary chipping heads in upper and lower rows, the cutting circles of adjacent chipping heads overlapping each other to cut the full depth of the seam in forming a single opening in the coal, spaced vertical ways mounted on the front end of said mobile body, a platform guided for vertical movement by said ways, motor means to raise and lower said platform, a motor actuated turntable mounted to swing in a horizontal plane on said platform, and reciprocating motor means mounted on said turntable to support and reciprocate the powered gearbox radially in a horizontal plane to feed the rotary chipping heads into the coal to cut the full depth of the seam and produce a progressive series of single openings that extend from one side of the tunnel to the other to advance the same.

6. A machine for mining and removing coal comprising a mobile body, powered gearbox means supporting and operating a plurality of forwardly projecting rotary chipping heads, the cutting circles of adjacent chipping heads overlapping each other to cut a single opening in the coal, a motor actuated turntable mounted to swing in a horizontal plane on the front of the mobile body, reciprocating motor means mounted on said turntable to support and reciprocate the powered gearbox radially in a horizontal plane to feed the rotary chipping heads into the coal to produce a progressive series of single openings that extend from one side of the tunnel to the other to advance the same, and said powered gearbox means comprises lower and upper box members with interconnected power to drive the rotary chipping heads on each box member, and motor means to vary the proximity of one box member to the other to control the size of the single opening that the chipping heads make in the coal.

7. A machine for mining and removing coal comprising a mobile body having vertical guide means on its forward end, a motor actuated platform movable vertically on said guide means, a motor actuated turntable mounted on said platform, a gearbox, reciprocating motor means mounted on said turntable to support said gear box for horizontal reciprocation, a plurality of forwardly projecting rotary chipping heads on the front of said gearbox, a second gearbox mounted on and above the first gearbox for powered vertical movement relative to the first gearbox and having a plurality of forwardly projecting rotary chipping heads, the cutting circles of adjacent cutting heads overlapping each other to simultaneously cut single openings in the coal as the lower gearbox is reciprocated radially and progressively from the turntable in a horizontal plane and at different elevations of said platform.

8. A machine for mining and removing coal comprising a mobile body, powered gearbox means supporting and operating a plurality of forwardly projecting rotary chipping heads, the cutting circles of adjacent chipping heads overlapping each other to cut a single opening in the coal, a floor scraping blade depending from said powered gearbox means, a motor actuated turntable mounted to swing in a horizontal plane on the front of the mobile body, and reciprocating motor means mounted on said turntable to support and reciprocate the powered gearbox means and floor scraping blade radially in a horizontal plane to feed the rotary chipping heads into the coal to produce a progressive series of single openings that extend from one side of the tunnel to the other to advance the same.

9. The structure of claim 8 which also includes vertical guide means on the forward end of said body, a motor actuated platform movable vertically while retained

9

in a horizontal plane by said guide means and supporting said turntable to raise and lower the powered gearbox means with the rotary chipping heads and the scraping blade to different elevations relative to said body.

10. A machine for mining and removing coal comprising a mobile body, a motor actuated turntable mounted to swing on the front of said body, a powered gearbox means, coal cutting means extending from said gearbox means, a floor scraping blade having a pocket and depending from said gearbox means to co-operate with said coal cutting means to deliver coal to said pocket, a conveyor carried by said body and having its forward end in said pocket to receive the coal and carry it rearwardly of the machine, a powered reciprocating means mounted on said turntable and supporting said gearbox means, scraping blade and the forward end of said conveyor for feeding the same outwardly from said turntable to produce a consecutive progressive series of small openings from one side of the tunnel to the other to advance the same, and conveyor take-up means to compensate for the reciprocation of the gearbox means.

11. The structure of claim 10 which also includes vertical guide means on the forward end of said body, a motor actuated platform movable vertically while retained in the same plane by said guide means and sup-

10

porting said turntable to raise and lower the same to different elevations relative to said body.

12. The structure of claim 10 which also includes a retractable baffle means on each side of said gearbox means to trail on the open side of the coal cutting means when swinging from one side of the tunnel to the other.

References Cited in the file of this patent

UNITED STATES PATENTS

235,563	Parlour	Dec. 14, 1880
454,895	Wyman	June 30, 1891
1,508,634	Wilson	Sept. 16, 1924
1,770,934	Levin	July 22, 1930
1,953,327	Morgan	Apr. 3, 1934
2,166,569	Mitchell	July 18, 1939
2,269,781	Osgood	Jan. 13, 1942
2,320,653	Ramsay	June 1, 1943
2,546,899	McCarthy	Mar. 27, 1951
2,634,963	Barrett	Apr. 14, 1953

OTHER REFERENCES

Coal Age Publication, May 23, 1926, pg. 667. (Copy in Div. 47.)