

May 18, 1926.

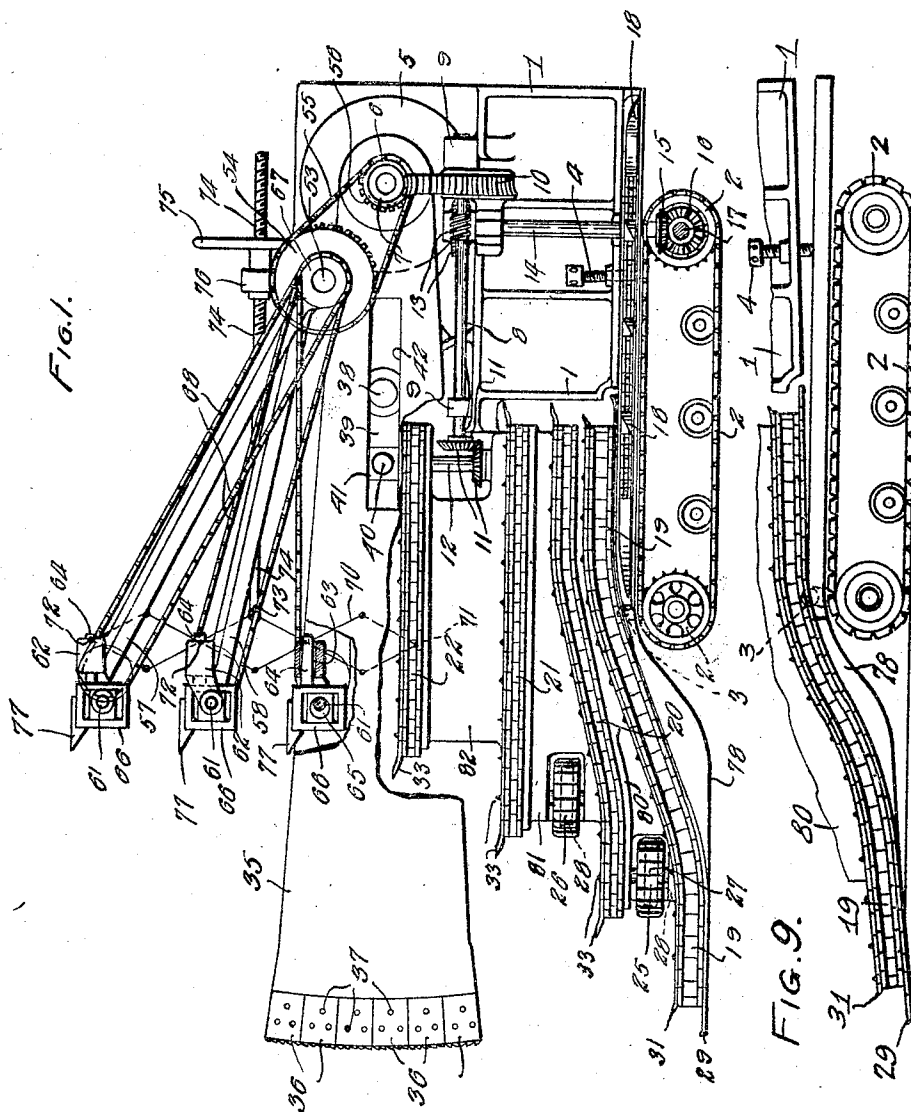
R. MacEACHEN

1,585,041

MINING MACHINE

Filed Dec. 14, 1923

4 Sheets-Sheet 1



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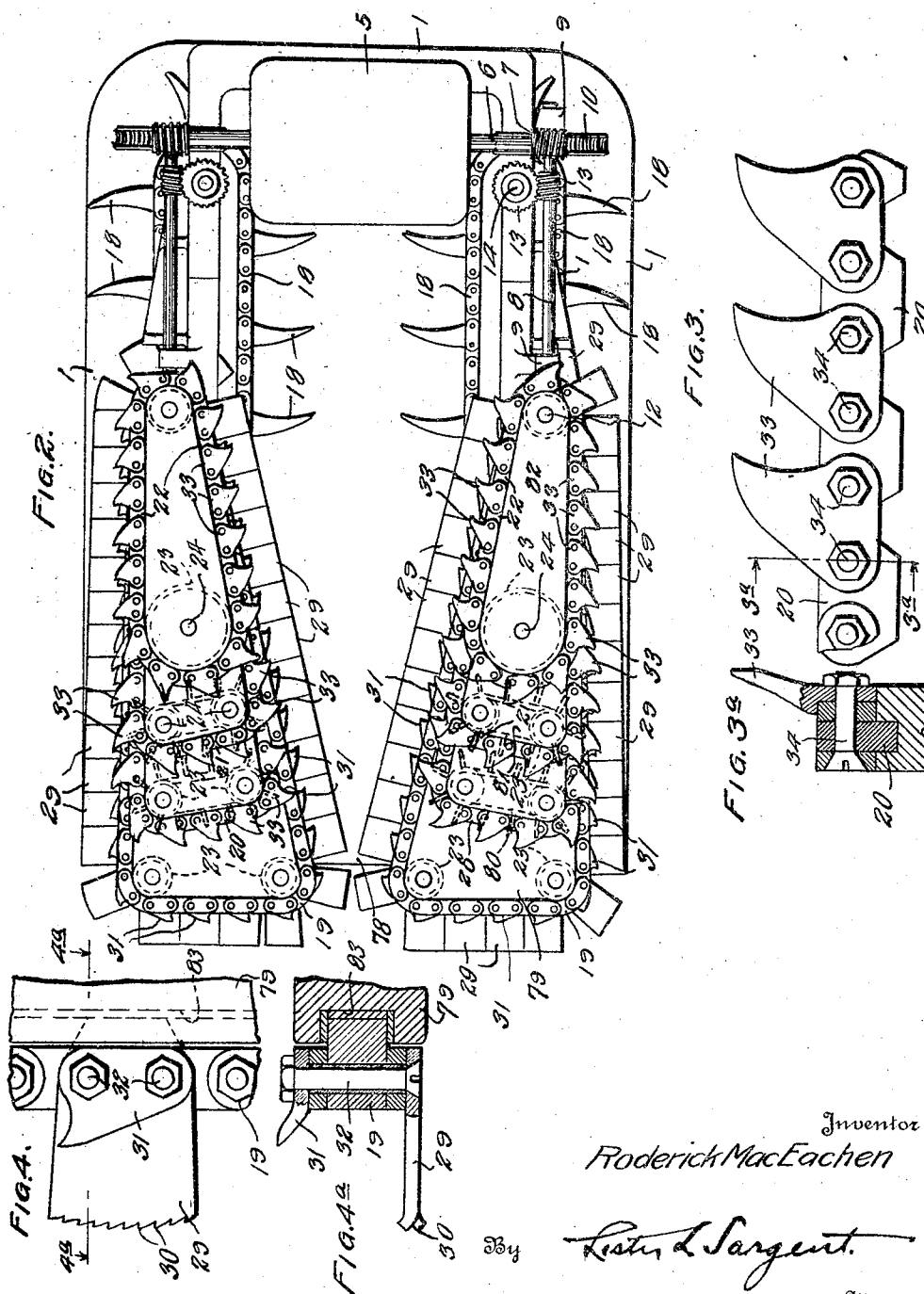
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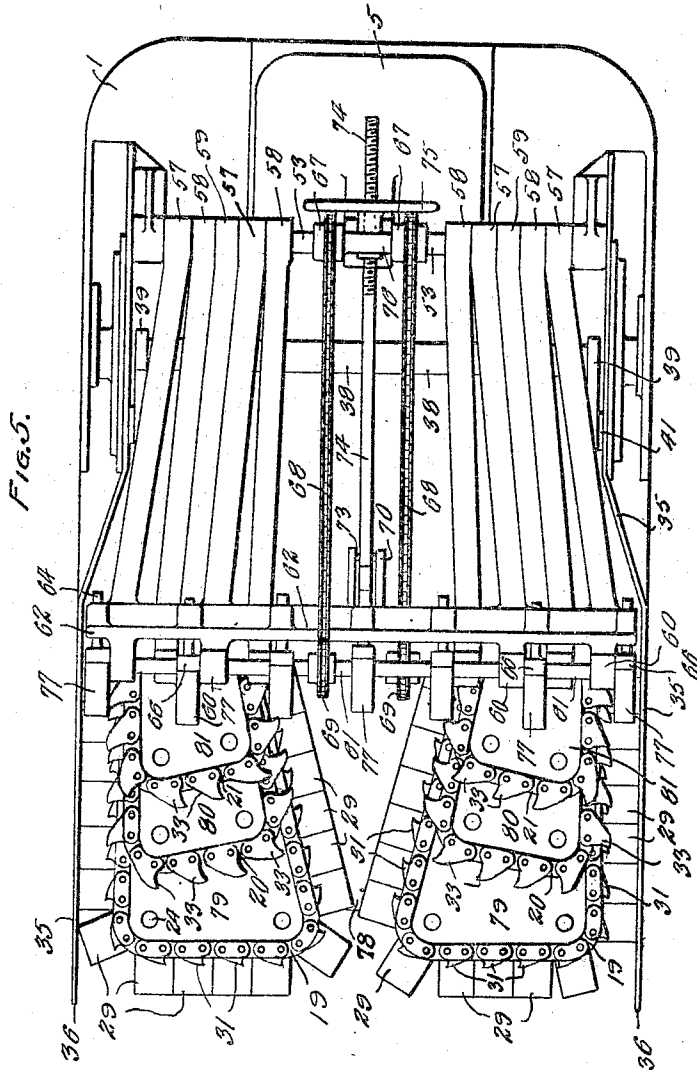
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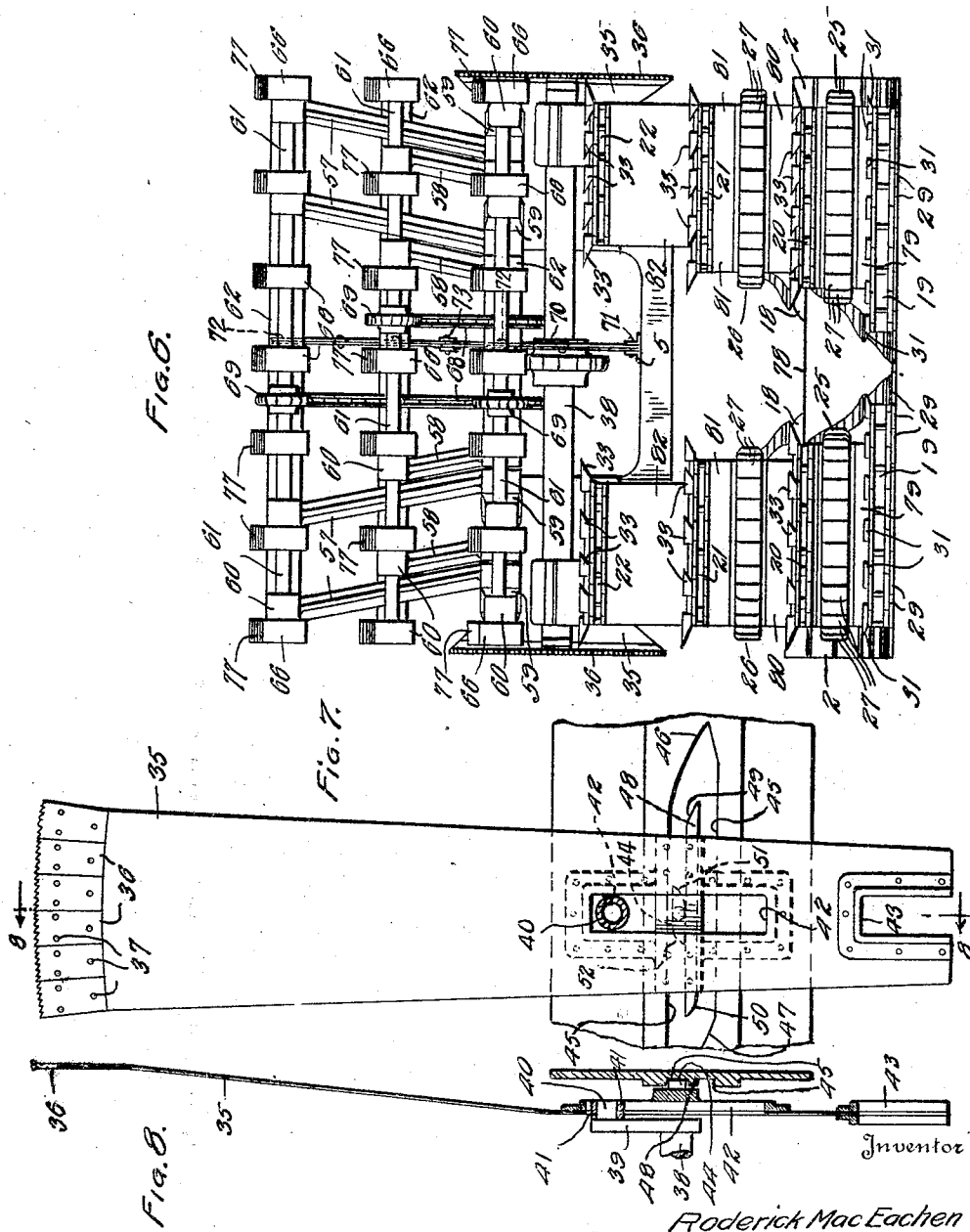
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MINING MACHINE

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UNITED STATES PATENT OFFICE.

RODERICK MacEACHEN, OF WASHINGTON, DISTRICT OF COLUMBIA.

MINING MACHINE.

Application filed December 14, 1923. Serial No. 680,760.

The object of my invention is to provide a mining machine capable of excavating a whole seam of coal by a threefold process, namely, by undermining, shearing, and blocking the coal, thus eliminating the arduous and hazardous operations of drilling and blasting now common to the mining process. Furthermore it is an object of my invention to provide a mining machine which in addition to excavating coal also carries the coal which it has loosened from the natural vein upon a suitable conveyor to the rear of the machine from whence it is loaded into cars.

I attain these and other objects of my invention by the mechanism illustrated in the accompanying drawings, in which:—

Figure 1 is a side elevation of my invention with part of one of the arms 35 broken away;

Fig. 2 is a plan view of the machine with the upper cutting bit structure and the vertical oscillating cutter arms removed;

Fig. 3 is an enlarged detail view of the chain used as the second, third and fourth cutting chains hereinafter described;

Fig. 3^a is a detailed sectional view on line 3^a—3^a of Fig. 3;

Fig. 4 is an enlarged detail view of the lower cutting chain and bottom saw blade carried by said chain;

Fig. 4^a is a section on line 4^a—4^a of Fig. 4;

Fig. 5 is a top plan view of the entire machine;

Fig. 6 is a front elevation of the machine viewed from its operating end;

Fig. 7 is a detail elevational view of vertically oscillating cutter arm 35 and the means for eccentrically controlling its action;

Fig. 8 is an edge view of same partly in section and

Fig. 9 is a detail side elevation of the lower portion of the machine illustrating the function of screw 4 in elevating frame 1.

Like character of reference designate like parts in each of the several views.

Referring to the accompanying drawings, I provide a main frame 1 mounted on a suitable caterpillar truck 2 to which it is pivotally attached at 3. I provide suitable means such as screw 4 for tilting the machine by elevating the rear portion of the frame 1 on the caterpillar truck 2. Mounted in the rear of the machine I provide a suitable motor 5 which has the motor shaft 6 carrying

worm 7 which drives worm gears 10 which are splined on the horizontal shaft 8 arranged at right angles to the motor shaft and longitudinally of the frame of the machine. Shafts 8 which are mounted in bearings 9 drive vertical shafts 12 through suitable trains of gears 11.

The caterpillar truck 2 carries gears 16 on its rear axle 17, which gears are driven by gears 15 on vertical shafts 14 which are driven by a train of worm gears 13 from horizontal shafts 8, as shown in Fig. 1.

I provide a suitable conveyor 18 mounted on truck 2, into which coal is delivered from a series of combined cutting and conveyor chains. These cutter and conveyor chains consist of a lower cutter chain 19, a second cutting chain 20, third chain 21 and fourth cutting chain 22, of which any suitable number may be provided, preferably as shown in Fig. 1, the chains being arranged in stepped relation as regards their forward operating portion. As shown in Fig. 2, I provide suitable idler shafts 24 carrying sprockets 23 on which the respective cutting chains above described are mounted. Intermediate the forward ends of chains 19 and 20 I provide conveyors 25; and intermediate chains 20 and 21 I provide conveyors 26. These conveyors are provided with outstanding or radial blades 27. Conveyors 25 and 26, which preferably are of the chain type, are mounted on sprockets 28 carried by vertical shafts 24 which also carry sprockets 23 and are driven by the cutting chains 20 and 21, as shown in Figs. 1 and 2.

Referring to Figs. 1, 4 and 4^a, I provide bottom saw blades 29 having cutting teeth 30 disposed preferably as shown in Fig. 4^a. I also provide upper cutter blades 31. Saw blades 29 and upper cutter blades 31 are bolted on the bottom and top, respectively, of bottom cutting chain 19 by suitable bolts 32 which also connect the links of the chain to each other, as shown in Fig. 4^a. The cutting chain 19 travels in a suitable peripheral groove or channel 83 in the stepped portion 79 of the main frame 1 of the apparatus. Upper cutting chains 20, 21 and 22 are provided with suitable cutter blades 33 suitably bolted to the chains as by bolts 34, as shown in Fig. 3^a.

Referring to Fig. 1, I provide a plurality of like vertically oscillating shearing arms 35 which carry a series of saw cutting blades 36 suitably affixed as by bolts 37 to

the outer arcuate end of arm 35. Blades 36 are preferably of a like size and interchangeable with blades 29 of the bottom cutting chain. As shown in Fig. 8, shearing arm 35 is operated by crank 39 which carries a stub shaft 40 removably mounted in the bushing 41 of the shearing arm, as illustrated. Crank 39 is mounted on and operated by shaft 38. Shearing arm 35 is provided with a rectangular opening 42 to adjustably receive the bushing 41 in which the stub shaft 40 of the crank arm is mounted for reciprocating the shearing arm. I further provide a slot 43 in the shank of the shearing arm 35, as shown in Fig. 7.

Mounted on the face of the shearing arm 35 I provide a cam lug 44 travelling in the cam groove 45 in the frame of the machine. As shown in Fig. 7, cam groove 45 has its upper end 46 offset to the rear of the machine, while its lower end 47 is offset to the front of the machine. The central cam guide member 48 is provided with a rearwardly offset upper cam end 49 and with a forwardly offset cam end 50. Cam 44 has a forwardly offset upper cam end 51 and a rearwardly offset lower cam end 52, the cam ends being arranged the reverse of those of the groove 45 and the central cam guide member 48, whereby to retract the cutter arm as it is elevated by the crank 39 for a new stroke, and to shift it forward as it starts downward on a new stroke, thus permitting it to engage the coal in descending.

Referring to Figs. 1, 5 and 6, I provide a transverse horizontal shaft 53 carrying the sprockets 54 operated by chains 55 which in turn are operated by the small sprockets 56 on motor shaft 6. I provide a suitable plural number of reciprocating arms or shaft 57, 58 and 59 for operating the cutters or picks 77 which are arranged on the upper part of the machine. I provide transverse shafts 61 journaled in the bearings 60 which are carried by the arms 57, 58 and 59, as shown in Fig. 6. I provide journal boxes 62 on the forward free ends of arms 57, 58 and 59, these journal boxes, as indicated in Fig. 1, being provided with longitudinal bores 63, in which are reciprocally mounted the stub shafts 64. Shafts 61 carry eccentric sleeves 65 operably mounted in the pick-carrying casting 66 which also functions as an eccentric strap.

As shown in Fig. 1, I provide a lazy tong support 70 for the several journal boxes 62, this lazy tong support being operably mounted at 71 on frame 1 and operably attached at 72 to the several journal boxes. I further provide a horizontally threaded shaft 74 operably connected at joint 73 with the lazy tongs 70, the threaded end of shaft 74 being operated by means of a suitable hand wheel 75 mounted in the bearing 76,

whereby the operative height of the cutting picks 77 may be readily adjusted by turning hand wheel 75. Frame 1 is provided with suitable stepped portions 79, 80, 81 and 82, as shown in Figs. 1 and 5, intervening between the respective stepped cutting chains 19, 20, 21 and 22.

I provide a suitable bottom guide plate or floor 78 arranged under cutting chain 19 and forming a floor for the conveying operation of said chain.

The system of operation employed in this new and improved mining machine is based upon the principle of mining formerly applied by the discretionary action of the human intellect in the skilled work of mining by hand.

The coal is first loosened from its natural basis, clay or stone, by the operation of the saw blades on the lower side of the bottom cutting chain which is driven horizontally by power. This operation effects an undercut, preferably about one inch high and six inches deep. The bits or blades on the upper side of the carrier teeth perform the first blocking operation, namely, that of splitting away a narrow section of coal (about three inches high and six inches deep) overhanging the cut made by the bottom saw blades. These blocking bits are carried by each of the several cutting chains which travel horizontally, turning toward each other at the outer end of the apparatus, that is, toward the middle, and then traveling backward so as to carry the coal so loosened to a suitable conveyor, such as illustrated in my co-pending application, Serial 656,183, filed August 7, 1923. Into the several pairs of chains arranged in stepped relation are likewise fitted blocking blades or bits which are so spaced as to split off the desired section of coal that has been calculated both as to height and depth by the positioning of the chains.

As indicated in Figs. 1 and 5, chains 19, 20, 21 and 22 are both laterally and vertically flexible, the links being pivotally connected to each other for lateral and vertical movement.

Above the said chains are arranged adjustable shafts on which are mounted a definite number of reciprocating cutting teeth or picks which operate by cams mounted on same shaft driven by power suitably applied. These picks, by a multitude of blows, struck along the lines of the coal-grain, sever sections of coal overhanging spaces that have been excavated by the operation of the abovementioned carrier chains. These shafts are built in frames, respectively, which are fitted with hinged supports, which are adjustable to a higher or lower position by the operation of a screw, or other device, attached to a suitable position on the machine.

To facilitate the operation of chains and picks in loosening the coal from its natural bed, the coal is cleaved or sheared on both sides by the operation of two vertically swinging arms fitted with saw-like sections on their forward, or swinging end. These two shaft-like saws are elevated and lowered by the operation of suitable cranks driven by power suitably applied. In the process of lowering the teeth of these shaft-like saws engage the coal, cutting therein a narrow passage or ridge which releases a calculated section at both sides, and facilitates the operation of the chains and picks. The shafts of said swinging saws are fitted with sliding bearings in which the driving cranks operate. They are also provided with slides and bobbin which contribute a cam-movement to them while they are in operation, in such manner that in the upward movement the saw teeth are withdrawn slightly backward so as to permit them to rise without engaging the coal. In conjunction with this cam-movement there are also fitted in the rear end of said shafts sliding bearings which permit them to take the forward and recessional movement.

This mining machine is mounted upon specially prepared caterpillar drives suitably driven by the power provided. The drives are separately geared so as to permit the diversified shifting required for the operation of the machine. A device has also been provided whereby this machine can be set accurately to take any rise or dip that may occur in the bottom, or base of the coal, upon which it performs its function. To this end the upper portion of the machine is pivoted horizontally, at a suitable point, preferably at the front axle, upon the caterpillar-drive-truck. At another suitable point, preferably toward the rear of the machine, are positioned set screws, hand or power driven, which elevate or lower rear of machine so as to enable it to cut accurately along the lower edge of the coal seam, namely along the lower surface of the coal, at its juncture with the underlying strata.

What I claim is:—

1. In a mining machine, the combination of a series of endless chains arranged in stepped relation, the bottom chain projecting farthest forward, said bottom chain carrying horizontally projecting saw blades, and each of the chains carrying horizontally projecting cutting bits attached to the upper portions of the respective chains.

2. In a mining machine, the combination of a series of endless chains arranged in stepped relation, the bottom chain projecting farthest forward, said bottom chain carrying horizontally projecting saw blades, each of the chains carrying horizontally projecting cutting bits attached to the upper portions of the respective chains, a plural-

ity of horizontally arranged cutting picks, and power controlled means for actuating said picks.

3. In a mining machine, the combination of a series of endless chains arranged in stepped relation, the bottom chain projecting farthest forward, said bottom chain carrying horizontally projecting cutting bits attached to the upper portions of the respective chains, a plurality of horizontally arranged cutting picks, power controlled means for actuating said picks, and manually controlled means for adjusting said picks to varying heights.

4. In a mining machine, the combination of a series of endless chains arranged in stepped relation, the bottom chain projecting farthest forward, said bottom chain carrying horizontally projecting saw blades, each of the chains carrying horizontally projecting cutting bits attached to the upper portions of the respective chains, and intermediately disposed endless chains, said chains having regularly projecting blades to convey the coal.

5. In a mining machine, the combination of a series of horizontally disposed cutting picks, means for reciprocating said picks, the aforesaid picks being arranged in spaced rows, lazy tong mechanism to which the rows of spaced picks are attached and whereby the height of the rows of picks relative to each other and to the frame on which they are mounted may be adjusted.

6. In a mining machine, the combination of vertically disposed saw arms the operating ends of said arms consisting of a series of saw-blade sections detachably secured to the saw arms, whereby to permit of convenient replacement of broken blades.

7. In a mining machine, the combination of vertically disposed saw arms carrying saw-blade sections on their operating ends, means for reciprocating said blades, and means for vertically oscillating said blades.

8. In a mining machine, the combination of a series of pairs of endless chains arranged in stepped relation, horizontally projecting saw blades carried by the bottom pair of chains, bits carried by the other chains and also by the bottom chains, vertically disposed oscillatable saw arms, said saw arms having a series of saw blades detachably secured to their operating ends, said saw blades being interchangeable with the saw blades mounted on the aforesaid pair of bottom chains, and power means for operating on the aforesaid apparatus.

9. In a mining machine, a cutting arm carrying saw blades on its operating end, a crank operatively attached to the arm for driving same upward and downward, and a sliding bearing bolted on the arm connected to said crank.

10. In a mining machine, the combination

of a series of pairs of endless chains carrying cutting bits and saw blades, said chains being arranged in a stepped relation to each other, a series of rows of horizontally cutting picks arranged above the chains, means for reciprocating said cutting picks, a main frame carrying all of the aforesaid apparatus, vertically oscillating shearing arms, a caterpillar truck on which the main frame is mounted, the frame being hingedly attached to the caterpillar truck, and means for elevating or lowering the other end of the main frame to secure the desired adjustment of the operative end of the apparatus best suited for the particular locations where it is used.

11. In a mining machine, the combination of a series of pairs of endless chains carrying cutting bits and saw blades, said chains being arranged in a stepped relation to each other, a series of rows of horizontal cutting picks arranged above the chains, means for reciprocating said cutting picks, a main frame carrying all of the aforesaid apparatus, vertically oscillating arms, a caterpillar truck on which the main frame is mounted, the frame being hingedly attached to the caterpillar truck, means for elevating and lowering the other end of the frame to secure the desired adjustment of the operating end of the apparatus best suited for the particular locations where it is to be used, and a conveyor arranged to receive material delivered by the aforesaid chains and cutting picks and to convey same to another conveyor.

12. In a mining machine, the combination of a pair of endless chains carrying cutting bits and saw blades, horizontally operating picks arranged above the chains, means for reciprocating said picks, a main frame on which the aforesaid apparatus is mounted, a caterpillar truck on which the main frame is hingedly mounted near one end thereof, and means for elevating or lowering the other end of the main frame.

13. In a mining machine, the combination of an endless chain carrying cutting bits and horizontal saw blades, picks arranged above the chain, means for reciprocably operating said picks, a main frame on which the aforesaid apparatus is mounted, a caterpillar truck on which the main frame is hingedly attached near one end thereof, and means for elevating or lowering the other end of the main frame relative to the caterpillar truck.

14. In a mining machine, the combination of a series of pairs of endless chains carrying cutting bits and saw blades, said chains being arranged in a stepped relation to each other, horizontally disposed cutting picks arranged above the chains, means for reciprocating said cutting picks, a main frame carrying all of the aforesaid apparatus, a

caterpillar truck on which the main frame is hingedly attached near one end thereof, and means for elevating or lowering the other end of the main frame to secure the desired adjustment of the operating end of the picks and chains.

15. In a mining machine, the combination of a plurality of pairs of endless chains, a frame on which pairs of chains are mounted in stepped relation, said chains including cutting and conveying elements, and a caterpillar truck on which the aforesaid apparatus is mounted and including a caterpillar drive to force it into the coal.

16. In a mining machine, the combination of several pairs of endless chains carrying coal cutting or sawing elements, a series of rows of horizontally disposed cutting picks arranged above and rearwardly of the operating end of the chains, and a caterpillar drive carrying the aforesaid apparatus and adapted to force it into the coal.

17. In a mining machine, the combination of several pairs of endless chains carrying coal cutting or sawing elements, a series of rows of horizontally disposed cutting picks arranged above and rearwardly of the operating end of the chains, a caterpillar drive carrying the aforesaid apparatus and adapted to force it into the coal to be mined, and vertically oscillating saw arms carried by and operatively connected with the aforesaid apparatus.

18. In a mining machine, the combination of a series of cutting chains, horizontally disposed cutting picks disposed above the chains and operating in a position rearwardly of the chains, a plurality of oscillating saw arms arranged to cut vertically on either side of the picks, and a caterpillar drive carrying the aforesaid apparatus and arranged to shift the entire apparatus to its operative position and to press the operative end of the machine against the face of the coal while in operation.

19. In a mining machine, the combination of a series of pairs of chains, said chains carrying coal cutting elements, reciprocably operated picks arranged above and rearwardly of the operating ends of the aforesaid chains, vertically operating saw arms arranged on either side of the series of picks and cutting chains, a main frame carrying all of the aforesaid apparatus, a caterpillar truck to one end of which the aforesaid apparatus is hingedly mounted, means for elevating and lowering the main frame relative to the caterpillar truck, the above described chains carrying coal cutting elements having their links pivotally connected to each other for lateral and vertical flexibility.

20. In a mining machine, the combination of a series of pairs of chains, said chains carrying coal cutting elements, reciprocably operated picks arranged above and rear-

wardly of the operating ends of the aforesaid chains, vertically operating saw arms arranged on either side of the series of picks and cutting chains, a main frame carrying
5 all of the aforesaid apparatus, a caterpillar truck to one end of which the aforesaid apparatus is hingedly mounted, means for elevating and lowering the main frame relative to the caterpillar truck, the above described chains carrying coal cutting elements 10 and having their links pivotally connected to each other.

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