Feb. 19, 1929.

1,702,571

C. A. PRATT

MINING MACHINE

Original Filed Aug. 29, 1924 4 Sheets-Sheet 1

Fig. 1

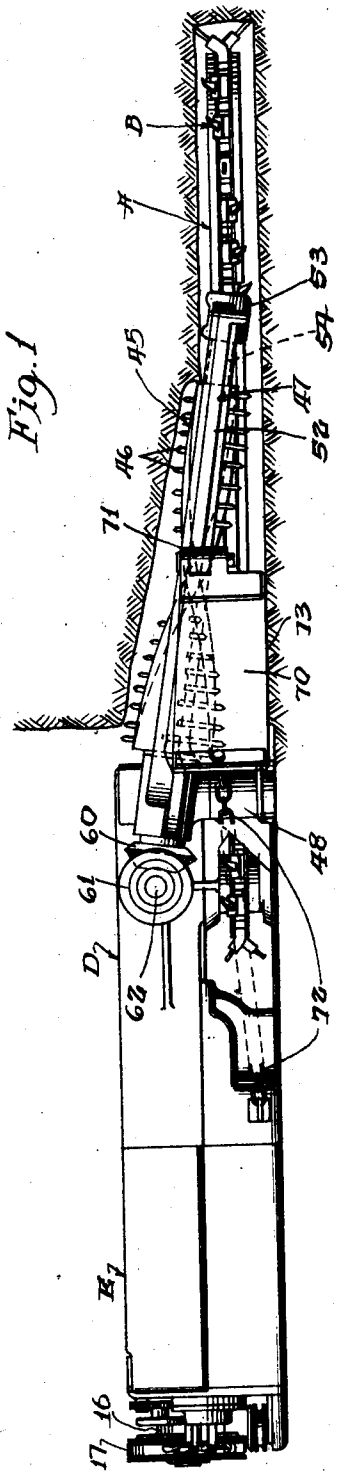
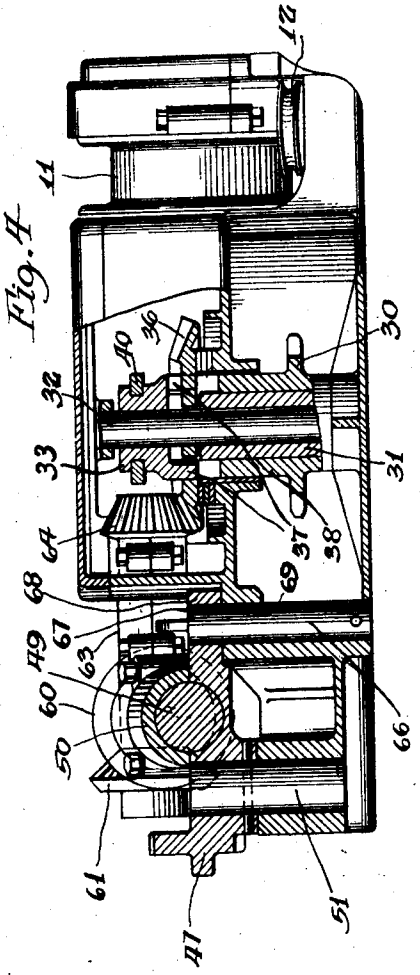


Fig. 4



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MINING MACHINE

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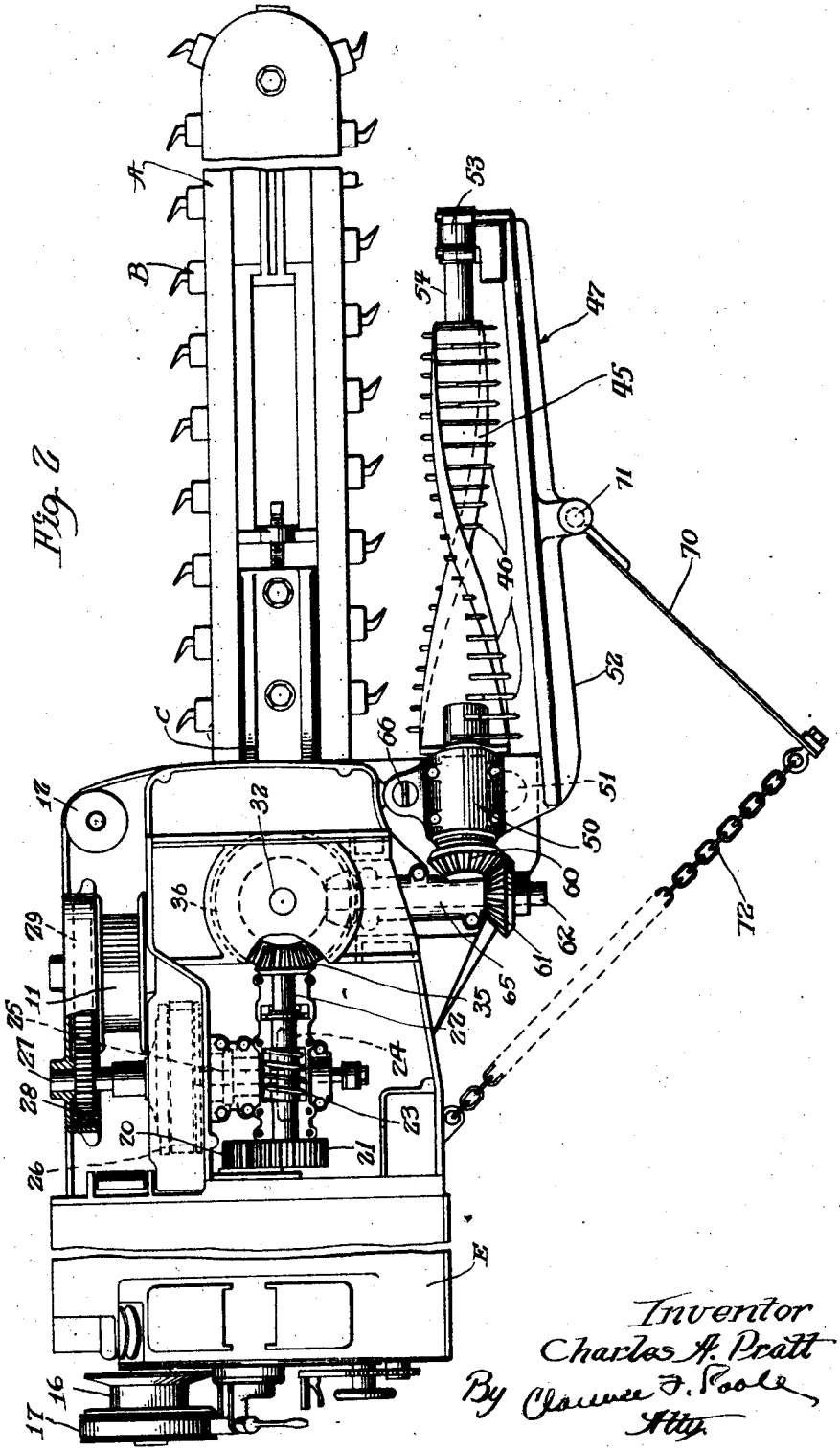


Fig. 2

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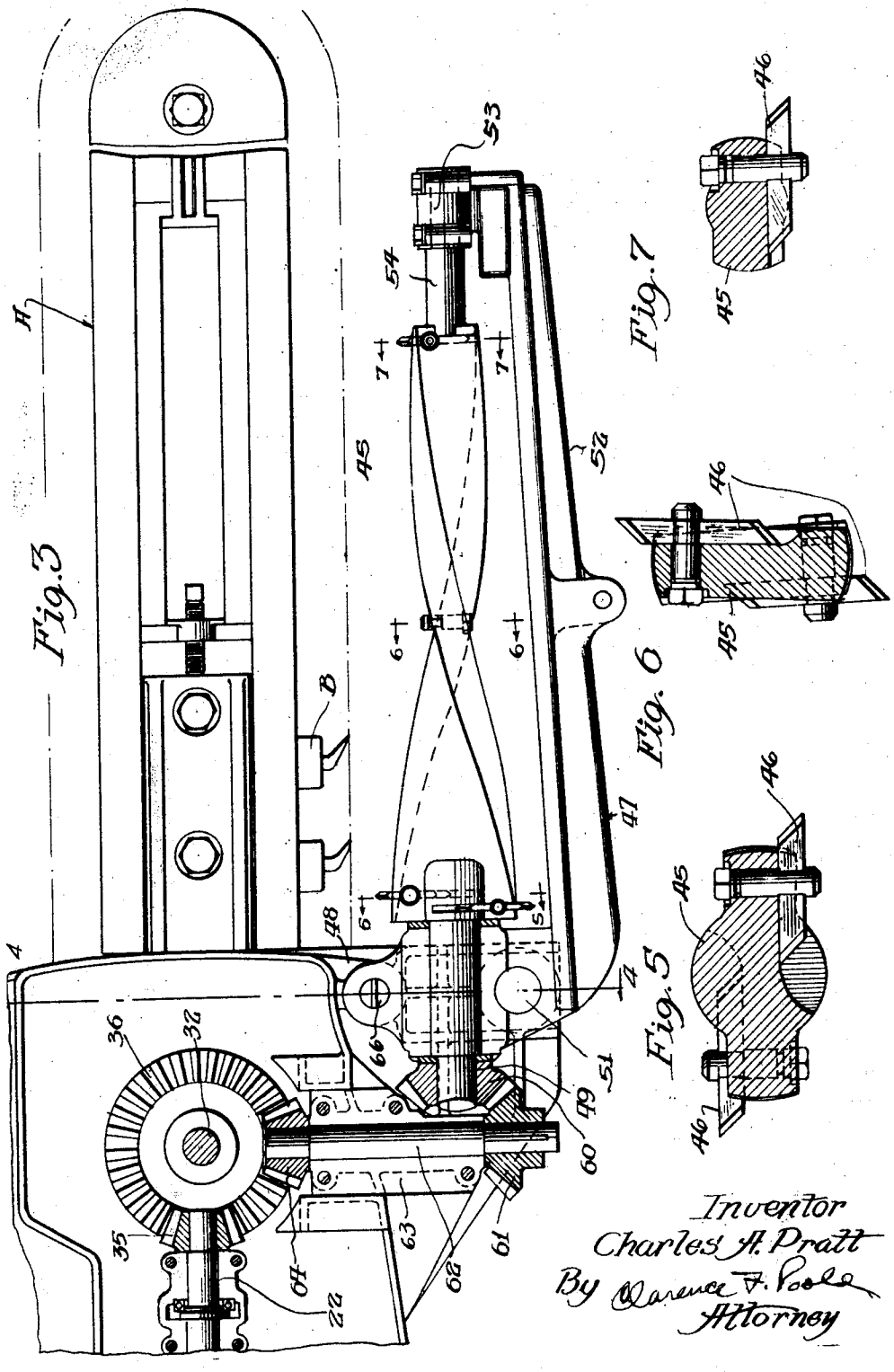
Feb. 19, 1929.

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MINING MACHINE

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MINING MACHINE

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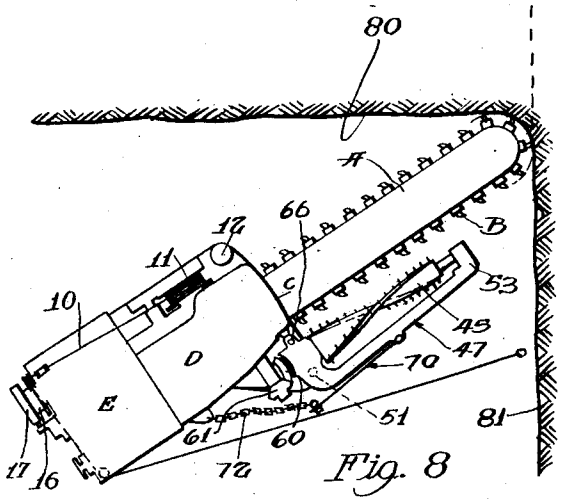


Fig. 8

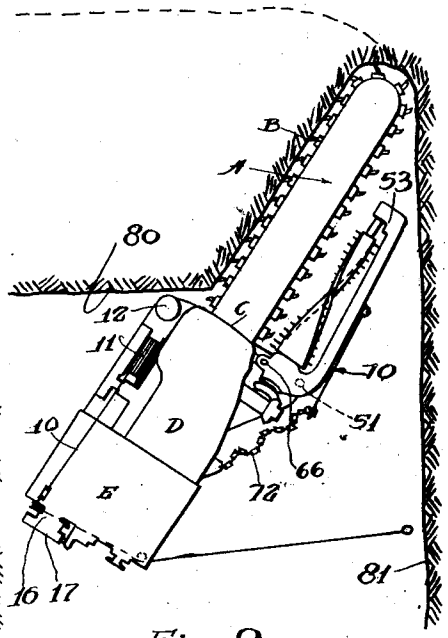


Fig. 9

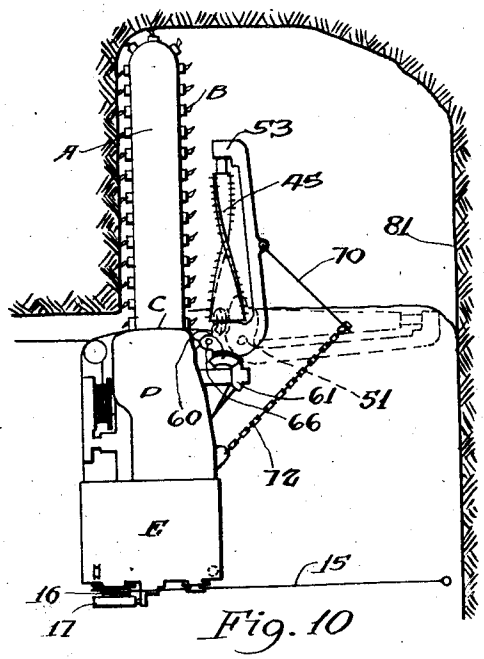


Fig. 10

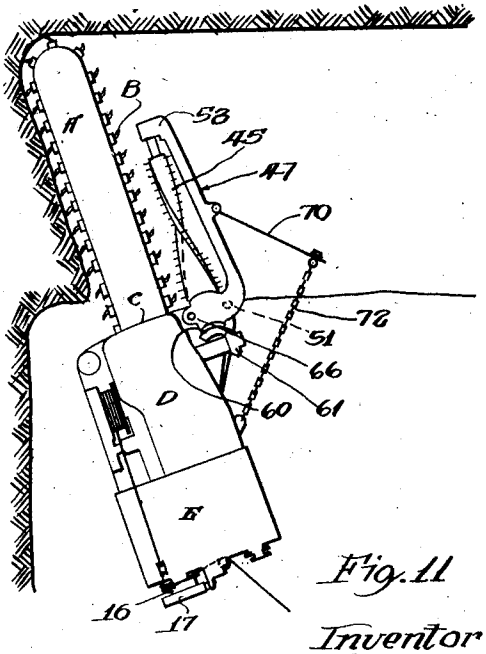


Fig. 11

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Patented Feb. 19, 1929. 1,702,571

UNITED STATES PATENT OFFICE.

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MINING MACHINE.

Application filed August 29, 1924, Serial No. 734,848. Renewed August 13, 1928.

This invention relates to improvements in mining machines, more particularly to kerf cutting mining machines having feeding and guiding devices for cutting a continuous kerf adjacent the mine floor. The principal object of this invention is to provide an improved machine of the class described capable of cutting a kerf relatively wider near its outer end than at its inner end whereby the material above the kerf when dislodged will have a tendency to roll out and away from the working face so as to facilitate the removal thereof. Further objects of this invention will appear from time to time as the description proceeds.

The invention may be best understood by reference to the accompanying drawings:

Figure 1 is a side view of a machine of the shortwall type embodying one form of my invention and showing the machine in cutting position adjacent the working face of the mine and also showing in vertical section the form of kerf cut thereby;

Figure 2 is a plan view of the machine shown in Figure 1 but drawn to a somewhat larger scale and having parts of the mining machine omitted;

Figure 3 is a plan view of the front end of the mining machine shown in Figure 2 but with parts omitted;

Figure 4 is a transverse section taken on line 4—4 of Figure 3;

Figures 5, 6 and 7 are sectional views taken respectively on lines 5—5, 6—6 and 7—7 of Figure 3;

Figures 8, 9 and 10 and 11 are diagrammatic views illustrating the manner in which the mining machine may be manipulated so as to form its initial sumping, transverse and withdrawing cut in the mine.

Referring now to the details shown in the drawings, my invention is shown as illustrated herein applied to a kerf cutting mining machine of the shortwall low vein type which has as its principal elements a cutter frame A provided with an endless cutter chain B supported at the front end of the machine frame C. This machine frame comprises a gear housing D at its front end and a motor housing E at its rear end. As shown herein the motor housing is attached at the rear end of the gear housing and forms therewith a plate or shoe upon which the machine is slidable upon the mine bottom during its cutting operation. The machine is controlled in the usual manner by means of flexible draft devices herein comprising a head rope 10 on a guide or winding drum 11 and trained over a guide or sheave 12 adjacent the front end of the frame and anchored at a distance from the machine so that the machine will be advanced in a lateral direction along the working face while the kerf is being cut. The rear end of the machine is retarded to control the position of the machine relative to the mine face in the usual manner. As shown herein retardation is accomplished by means of a tail rope 15 wound on a drum 16 and controlled by a friction band 17 in the usual manner.

The main operating mechanism of the machine comprises a motor pinion 20 engaging a gear 21 on a longitudinal shaft 22 in the gear housing D. Driving connections are provided for the winding drum 11 upon which the feed rope 10 is wound, as for instance a worm 23 carried on shaft 22 engaging a worm gear 24 on a transverse shaft 25. This transverse shaft 25 is connected with a planetary variable speed device 26 which in turn is connected through a shaft 27 and gears 28 and 29 to the winding drum 11. Details of the variable speed device 26 need not be described as it forms no part of the present invention, it being understood that any suitable variable speed device may be substituted therefor if desired. The cutter chain B is movable on the cutter bar A in the usual manner and is driven by means of a chain sprocket 30 loosely mounted on a sleeve 31 (see Figure 4). This sleeve is in turn mounted on an upright shaft 32. Driving connection between the intermediate shaft 22 and the chain sprocket 30 is afforded through a bevel pinion 35 engaging a bevel gear 36 loosely mounted on the shaft 32. A vertically movable clutch mechanism 33 is mounted on the shaft 32 above the beveled gear 36 but has depending clutch jaws 37, 37 extending downwardly through said gear and movable into and out of driving engagement with the hub 38 of sprocket 30. The clutch member 36 is shifted in a shifting device 40 of the usual construction.

The parts hereinbefore described are substantially the same as those heretofore used in mining machines of the ordinary construction, but it will be understood that my invention in its broadest aspects is not limited to use with this specific form of shortwall machine.

Referring now more particularly to the features constituting the embodiment of my invention illustrated herein, it will be observed that I provide a cutting element 45 arranged in cooperative relationship with respect to the main cutting arm A so as to cut a kerf that is wider at its outer end than at its inner end. In the preferred form shown this cutting element is of the rotary type tapered toward its front end and has a plurality of cutter bits 46, 46 thereon. This rotary cutter bar is supported at both ends in a supporting arm 47 pivotally mounted on a bracket 48 projecting laterally from the following or receding side of the gear housing D. The bearing support at the rear end of the cutter bar comprises a shaft 49 forming a part of the cutter bar and having bearing in a sleeve 50 forming a part of the supporting arm 47. The arm has pivotal support on the bracket 48 comprising a vertical pin 51 carried by the bracket 48 and extending through said arm at a point outside of the cutter bar shaft 49, as clearly shown in Figure 4. Thence the supporting arm curves forwardly about the receding or following side of the cutter bar 45 to form a section 52 extending to the front end of the cutter bar where it is provided with an offset journal bearing 53 in which is rotatably mounted a bearing shaft 54 forming the front end of the cutter bar 45. It will be observed in Figure 1 that the front or journal bearing 53 is in substantial horizontal alignment with the main cutter bar A which during the cutting operation precedes the rotary cutter bar 45 and its supporting arm 47 so as to form a space wherein the bearing member 53 may enter.

Driving connection between the rotary cutter bar 45 and the operating mechanism of the mining machine comprises a bevel pinion 60 carried on the inner end of the cutter bar shaft 49 and engaging at the outer periphery thereof a bevel pinion 61 on the shaft 62. Said shaft is journalled in bearings 63, rigid with the main frame, and carries a bevel pinion 64 thereon at its inner end, engaging the bevel gear 36 associated with the chain driving mechanism, as heretofore described. Under operating conditions it is preferable to permit the auxiliary rotary cutter bar to swing laterally away from the main cutter bar A which is accomplished by the pivotal connection of the supporting arm 47 and the pivot pin 51. As will be seen from Figure 10 the pivotal movement of the arm causes the bevel gear 60 on the cutter bar to swing inwardly and away from its companion bevel gear 61 so as to be disengaged therefrom. The supporting arm is locked in its forward or cutting position by suitable means such as a locking pin 66 adapted to extend through a hole 67 formed in a lug 68 and registering with a hole 69 formed in the main supporting bracket 48. This construction is clearly shown in Figure 4.

In conjunction with the supporting arm 47 which when in operating position extends into the kerf behind the main cutter arm A, I provide means for clearing the cuttings from the kerf which means herein comprises a scraper 70 arranged in upright position and pivoted at 71 to the forwardly extending section 52 of the supporting arm 47. This scraper is preferably connected to the main body of the machine by means of a flexible connection such as a chain 72 arranged in its extended position so as to hold said scraper in a rearwardly and outwardly inclined position, as clearly shown in Figure 2. The lower edge 73 of the scraper is arranged to substantially engage the bottom of the kerf so when the machine is cutting the kerf the slack or cuttings left in the kerf will be engaged by the scraper and be cleared from the kerf. By reason of the pivotal connection of the scraper to the supporting arm 47 it may be folded inwardly toward the supporting arm whenever necessary during the cutting operation.

The use and operation of the machine above described is illustrated in Figures 8, 9, 10 and 11. It will be understood that the machine is transported from one working face to another in the usual manner on a mining machine truck. The diagrams show how the machine may be operated in the usual cutting operations without interference from the rotary cutter arm 45 and its supporting arm 47. In Figure 8 the machine is shown in its initial sumping position with the main cutter arm A in engagement at the corner of the room formed by the working face 80 and the right hand wall or rib 81. The draft ropes are used in any ordinary and well known manner to sump the machine, as shown in Figures 8 and 9, from which it will be observed that the rotary cutter bar 45 follows the main cutter bar A, which forms a space wherein the front bearing 53 of said cutter bar may enter to follow the main cutter bar in its sumping cut.

In Figure 10 the machine is shown as it is cutting across the working face, with the rotary cutter bar 45 and its supporting means extended in normal parallel relationship with the main cutter bar A and with the scraper 70 in extended position to clear the cuttings from the kerf. Under some conditions it may be desirable to swing the rotary cutter bar out of the kerf while this cross cut is being made. This may readily be accomplished by removing the locking pin 66 and swinging the supporting arm pivotally about its pivot

pin 51 as clearly shown in dotted lines in Figure 10. When this is done the mitre gears 60 and 61 are automatically disengaged and thus disconnect the driving connection of the rotary cutter bar and the motor. Figure 11 shows the manner in which the machine may be withdrawn along the left hand wall without interference from the rotary cutter bar. During these cutting operations it will be seen that the scraper 70 is in position to clear the cuttings from the kerf.

Among the advantages of the machine constructed in accordance with my invention is the provision of means for cutting a kerf opening outwardly toward the working face so that the material when shot down or dislodged in the usual manner will have a tendency to roll outwardly. It has been demonstrated that with a kerf of this type the coal is found to be dislodged with greater ease and requires less than the usual charge of blasting powder, so that a substantial saving is made in the amount of lump coal obtained. Among other advantages of my invention is the provision of an axiliary cutter bar arranged on the following side of the main cutter bar so that there is no possibility that the material forming the overhanging part of the kerf can be dislodged and fall upon the main cutter arm so as to interfere with the operation of the machine. It will be observed further that the rotary cutter arm is arranged to cut substantially the entire amount of material within the vertical limits of the kerf, and the material is readily removed by means of the scraper device described. The arrangement whereby the auxiliary cutter bar has bearing supports at both ends is particularly desirable in machines of this character, owing to the enormous lateral pressures which such a cutter bar must withstand.

I claim as my invention:

1. In a mining machine, a frame slidable upon the floor of a mine and provided with flexible feeding and guiding means, a kerf cutting element projecting from one end thereof, and a second kerf cutting element disposed to one side of said first named cutting element and arranged in inclined position with respect thereto.

2. In a mining machine, a frame slidable upon the floor of a mine and provided with flexible feeding and guiding means, a kerf cutting element projecting from one end thereof, and a second kerf cutting element disposed to one side of said first named cutting element and arranged in inclined position with respect thereto, said second cutting element being pivotally mounted on said frame to swing laterally relative to said first cutting element.

3. In a mining machine, a frame slidable upon the floor of a mine and provided with flexible feeding and guiding means, a kerf cutting element projecting from one end thereof, and a second kerf cutting element comprising a rotating cutter bar disposed to one side of said first named cutting element and arranged in inclined position with respect thereto.

4. In a mining machine, a frame slidable upon the floor of a mine and provided with flexible feeding and guiding means, a kerf cutting element projecting from one end thereof, a second kerf cutting element comprising a rotating cutter bar disposed to one side of said first named cutting element and arranged in inclined position with respect thereto, and supporting means for the front end of said rotating cutter bar including a bearing disposed in substantially the same horizontal plane as said cutter arm.

5. In a mining machine, a frame slidable upon the floor of a mine and provided with flexible feeding and guiding means, a kerf cutting element projecting from one end thereof, a second kerf cutting element comprising a rotating cutter bar disposed to one side of said first named cutting element and arranged in inclined position with respect thereto, and supporting means for the front end of said rotating cutter bar including a bearing disposed in substantially the same horizontal plane as said cutter arm, said supporting means being pivotally mounted on said frame to swing said cutter bar into and out of cooperating cutting position relative to said kerf cutting element.

6. In a mining machine, a frame slidable upon the floor of a mine, a motor on said frame, draft means operatively connected with said motor for feeding and guiding said frame, a plurality of cutting elements driven by said motor and inclined toward each other in a vertical plane and normally arranged in projecting position in front of the machine frame, one of said cutting elements being pivotally connected to said frame to swing laterally with respect to the other cutting element.

7. In a mining machine, a frame slidable upon the floor of a mine, a motor on said frame, draft means operatively connected with said motor for feeding and guiding said frame, a plurality of cutting elements driven by said motor and inclined toward each other in a vertical plane and normally arranged in projecting position in front of the machine frame, one of said cutting elements being pivotally connected to said frame to swing laterally with respect to the other cutting element, said last named cutting element having means automatically disconnectable from the motor by pivotal movement thereof.

8. In a mining machine, a frame slidable upon the floor of a mine, a motor on said frame, draft means operatively connected with said motor for feeding and guiding said frame, a plurality of cutting elements driven

by said motor and inclined toward each other in a vertical plane and normally arranged in projecting position in front of the machine frame, one of said cutting elements being pivotally connected to said frame to swing laterally with respect to the other cutting element, and locking means for maintaining said movable element in cutting position.

9. In a mining machine, a frame slidable on a mine bottom, a cutter arm extending from one end thereof and provided with a cutter chain, a motor on said frame operatively connected with said cutter chain, feeding and guiding devices for said frame connected with said motor, a rotating cutter bar extending in inclined position from said frame and arranged in a plane parallel with but spaced laterally from the plane of said cutter arm, and a support for both ends of said cutter bar pivotally connected at one side of said frame.

10. In a mining machine, a frame slidable on a mine bottom, a cutter arm extending from one end thereof and provided with a cutter chain, a motor on said frame operatively connected with said cutter chain, feeding and guiding devices for said frame connected with said motor, and a rotating cutter bar extending in inclined position from said frame and arranged in a plane parallel with but spaced laterally from the plane of said cutter arm, said rotating cutter bar being tapered toward its forward end and having its cutting lower margin extending substantially to the horizontal plane of the upper cutting margin of said cutter chain.

11. In a mining machine, a frame slidable on a mine bottom, means for sumping and moving the same transversely, a chain cutter carrying element projecting forwardly of said frame, an upright sprocket in said frame for driving said chain, a motor on said frame operatively connected with said sprocket, a second cutter element projecting forwardly of said frame, but at one side of said first named cutter bar, and a horizontally disposed shaft operatively connected with said vertical shaft and forming a driving connection for said second named cutting element.

12. In a mining machine having a frame slidable on a mine bottom, a motor on said frame, means connected with said motor for feeding and guiding said machine during its cutting operation, a cutting element extending forwardly of said frame, and a second cutting element extending forwardly of said frame and inclined at an angle to said first cutting element, and gearing operatively connecting said last named cutter element with said motor, said gearing being below the upper surface of said motor.

13. In a mining machine, a frame slidable on a mine bottom having means for sumping and moving the same transversely of the working face of a mine, a cutter arm projecting from one end of said frame and provided with a cutter chain, a motor on said frame operatively connected with said cutter chain and with said sumping and feeding means, a second cutter element projecting from the forward end of said frame and arranged at an angle inclined with respect to said cutter arm, the rear end of said second cutting element being arranged below the upper surface of said motor and having operative connection with the latter by gearing also disposed below the upper surface of said motor.

14. In mining machine, a frame slidable upon the floor of a mine and provided with flexible feeding and guiding means, a kerf cutting element projecting from one end thereof, a support pivotally connected with said frame and disposed to one side of said cutting element, and a deflector connected adjacent its forward end to said support, the free rear end of said deflector being arranged at an angle to said kerf cutting element to clear the cuttings from the kerf.

15. In a mining machine, a frame slidable upon the floor of a mine and provided with flexible feeding and guiding means, a kerf cutting element projecting from one end thereof, a support extending from said frame and disposed to one side of said cutting element, a deflector pivotally mounted on said support, and a flexible connection between said frame and said deflector, said deflector being adapted to be arranged at an angle to said cutting element when the flexible connection is in extended position.

16. In a mining machine, a frame slidable on a mine bottom, a cutting element extending horizontally from one end of said frame, a cutting element rotatable on its longitudinal axis extending in an inclined position from said frame and arranged in a plane parallel with but spaced laterally from the plane of said first named cutting element, bearing means for the front end of said second cutting element in substantial horizontal alignment with said first named cutting element, and a motor on said frame operatively connected to drive said cutting elements.

17. In a mining machine, a frame slidable on a mine bottom, a cutting element extending from one end of said frame, a second cutting element extending in an inclined position from said frame and arranged in a plane parallel with but spaced laterally from the plane of said first named cutting element, and a motor on said frame operatively connected to simultaneously drive said cutting elements.

18. In a mining machine, a frame slidable on a mine bottom, a cutting element extending from one end of said frame, a second cutting element extending in an inclined position from said frame and arranged in a plane parallel with but spaced laterally from the plane of said first named cutting element, and a motor on said frame opera-

tively connected to simultaneously drive said cutting elements from a common bevel gear rotatable on a vertical axis in front of said motor.

19. In a mining machine, a frame slidable on a mine bottom, a cutting element extending from one end of said frame, a second cutting element extending in an inclined position from said frame and arranged in a plane parallel with but spaced laterally from the plane of said first named cutting element, and a motor on said frame operatively connected to selectively drive either said first named cutting element or said second named cutting element.

20. The combination in a mining machine, a frame slidable on a mine bottom, means for sumping and moving said machine comprising feed driving mechanism including a variable reduction gearing, a chain carrying element projecting forwardly of said frame, a second rotating cutting element projecting forwardly of said frame but at one side of said first named element and inclined with respect thereto, a motor on said frame operatively connected with said cutting elements, said operative connection comprising an upright shaft on said frame forward of said motor and said feed driving mechanism, a sprocket on said shaft for driving said chain on said chain carrying element, a bevel gear on said shaft above said sprocket and adapted to be operatively connected with said sprocket and said motor, an intermediate shaft parallel to and having connection with said motor shaft by a gear on its rearward end, its forward end having connection with said bevel gear by a bevel pinion, and a horizontally disposed shaft operatively connected with said bevel gear and forming a driving connecton for said second named cutting element.

21. The combination in a mining machine, a frame slidable on a mine bottom, means for sumping and moving said machine comprising feed driving mechanism including a variable reduction gearing, a chain carrying element projecting forwardly of said frame, a second rotating cutting element projecting forwardly of said frame but at one side of said first named element and inclined with respect thereto, a motor on said frame operatively connected with said cutting elements, said operative connection comprising an upright shaft on said frame forward of said motor and said feed driving mechanism, a sprocket on said shaft for driving said chain in said chain carrying element, a bevel gear on said shaft above said sprocket and adapted to be operatively connected with said sprocket and said motor, an intermediate shaft parallel to and having connection with said motor shaft by a gear on its rearward end, its forward end having connection with said bevel gear, and a horizontally disposed shaft extending in a plane perpendicular with said intermediate shaft, a bevel pinion on the inner extremity of said shaft connected with said first named bevel gear, and a bevel pinion on its outer end having connection with another bevel pinion to operatively connect said second named cutting element with said motor.

22. The combination in a mining machine, a frame slidable on a mine bottom, means for sumping and moving said machine comprising feed driving mechanism including a variable reduction gearing, a chain carrying element projecting forwardly of said frame, a second rotating cutting element projecting forwardly of said frame but at one side of said first named element and inclined with respect thereto, a motor on said frame operatively connected with said cutting elements, said operative connection comprising an upright shaft on said frame forward of said motor and said feed driving mechanism, a sprocket on said shaft for driving said chain in said chain carrying element, a bevel gear on said shaft above said sprocket and adapted to be operatively connected with said sprocket and said motor, an intermediate shaft parallel to and having connection with said motor shaft by a gear on its rearward end, its forward end having connection with said bevel gear, and a horizontally disposed shaft extending in a plane perpendicular with said intermediate shaft, a bevel pinion on the inner extremity of said shaft connected with said first named bevel gear, and a bevel pinion on its outer end having connection with another bevel pinion to operatively connect said second named cutting element with said motor, said horizontal shaft and said gearing extending below the upper surface of said motor.

23. The combination in a mining machine, a frame slidable on a mine bottom, means for sumping and moving said machine comprising feed driving mechanism including a variable reduction gearing, a chain carrying element projecting forwardly of said frame, a second rotating cutting element projecting forwardly of said frame but at one side of said first named element and inclined with respect thereto, supporting means for said rotating cutting element, said supporting means including a bearing for the front of said rotating cutter bar disposed in substantially the same horizontal plane as said cutter arm and pivotally mounted on said frame to swing said cutter bar into and out of cooperating cutting position relative to said kerf cutting element, a motor on said frame operatively connected with said cutting elements, said operative connection comprising an upright shaft on said frame forward of said motor and said feed driving mechanism, a sprocket on said shaft for driving said chain in said chain carrying element, a bevel gear on said shaft above said sprocket and

adapted to be operatively connected with said sprocket and said motor, an intermediate shaft parallel to and having connection with said motor shaft by a gear on its rearward end, its forward end having connection with said bevel gear by a bevel pinion, and a horizontally disposed shaft operatively connected with said bevel gear and forming a driving connection for said second named cutting element.

Signed at Chicago, in the county of Cook and State of Illinois, this 20th day of August, 1924.

CHARLES A. PRATT.