Feb. 13, 1923. 1,445,230

E. C. MORGAN

MINING APPARATUS

Original Filed Aug. 28, 1915 2 sheets-sheet 1

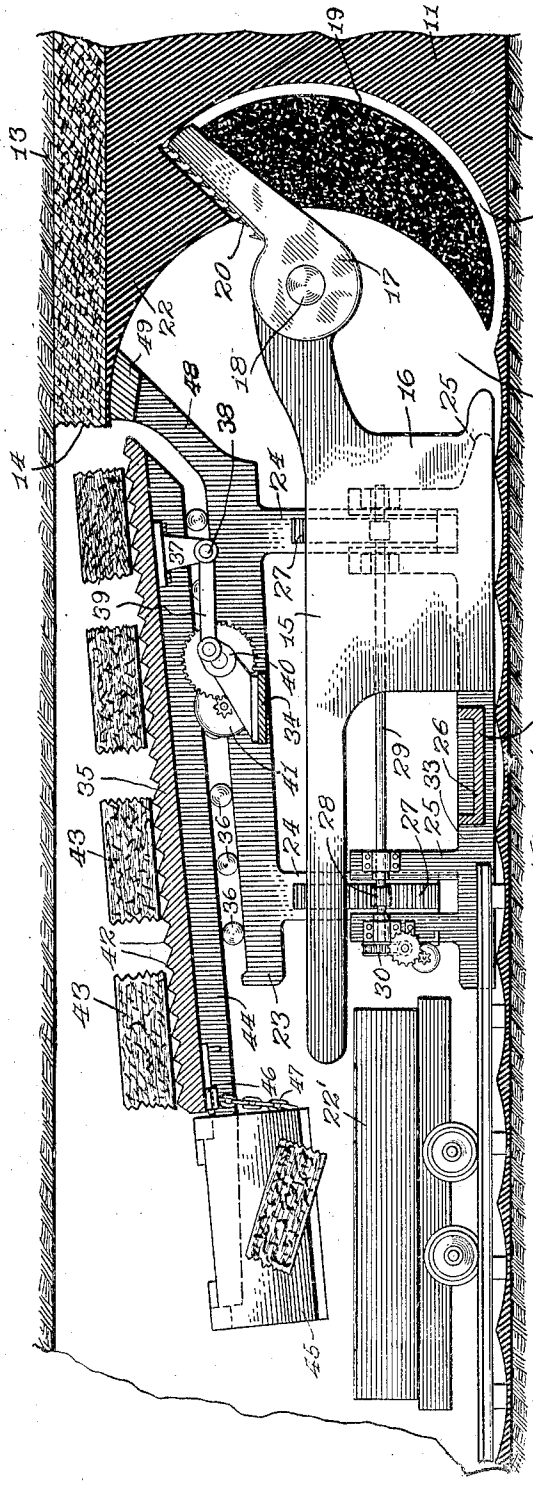


Fig. 1

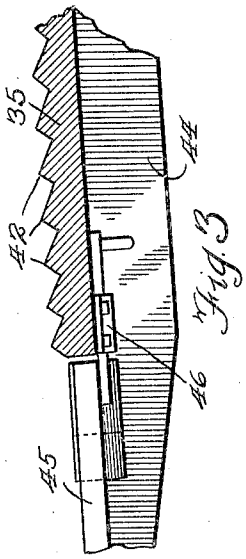


Fig. 3

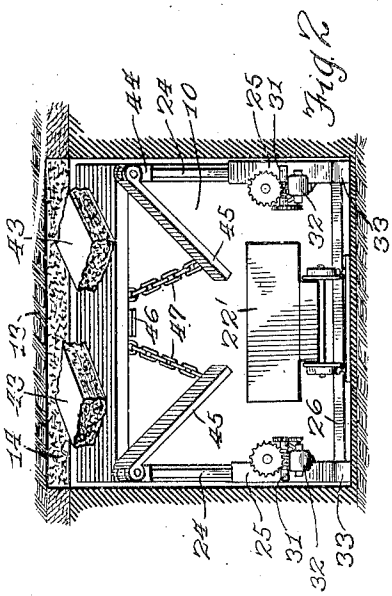


Fig. 2

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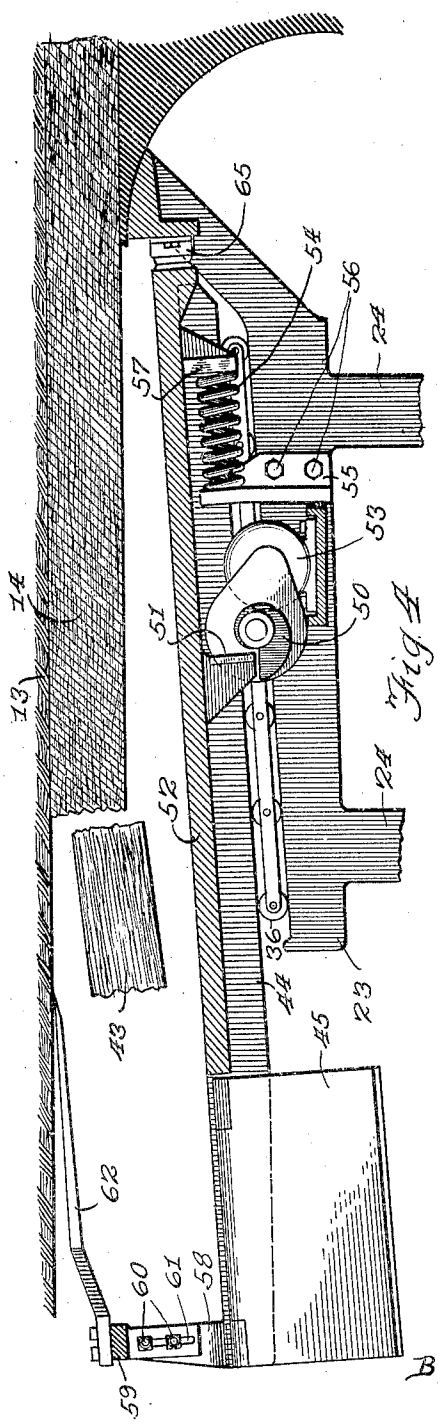


Fig 4

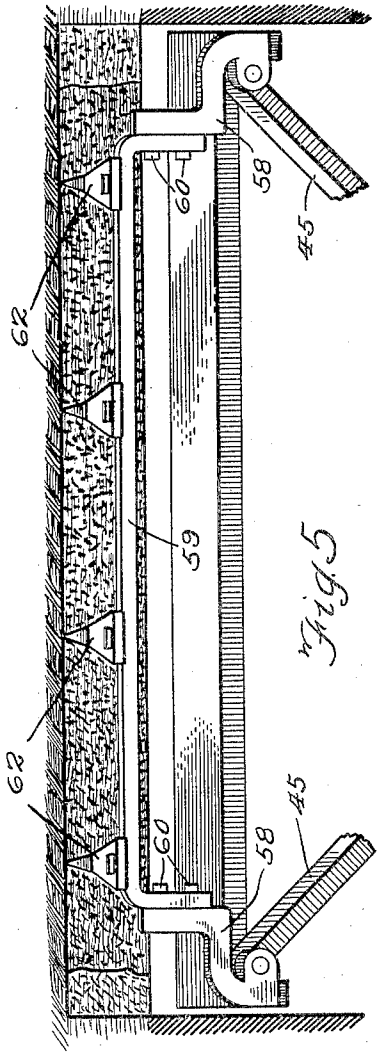


Fig 5

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UNITED STATES PATENT OFFICE.

EDMUND C. MORGAN, OF CHICAGO, ILLINOIS.

MINING APPARATUS.

Application filed August 28, 1915, Serial No. 47,765. Renewed October 4, 1920. Serial No. 414,557.

To all whom it may concern:

Be it known that I, EDMUND C. MORGAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Mining Apparatus, of which the following is a specification.

This invention relates to mining machines, and has for its object to provide a device of this character which shall overcome difficulties experienced in handling material which may be found at the roof of mine chambers. The invention comprises the combination and arrangement of parts shown and described in the accompanying specification and drawings, and more particularly pointed out in the appending claims.

In the drawings—

Fig. 1 is a longitudinal vertical section through the center of a mine chamber or entry, showing a machine embodying the present invention in operative position in section in said chamber.

Fig. 2 is a transverse section of a mine chamber, showing the present invention in elevation in said chamber.

Fig. 3 is a fragmentary sectional view of a portion of this invention showing the latch used for holding the discharge doors in their upper position.

Fig. 4 is a fragmentary vertical longitudinal sectional view of a modified form of the invention.

Fig. 5 is a fragmentary transverse sectional view of a mine chamber, showing the rear portion of the form of the invention shown in Fig. 4.

Referring to Figs. 1 to 3 of the drawing, the numeral 10 designates a mine chamber or entry in which a machine embodying the present invention is represented as operating. This invention is especially intended to be used in connection with coal mining. In the regions where coal is found it occurs in a great many different conditions relative to other materials occurring in the earth. In the drawings a stratum of coal 11 is represented as occurring between two strata of rock 12 and 13, one below and the other above the layer of coal. Between the coal 11 and the rock 13 is shown a stratum of draw slate 14 resting on top of the coal. This arrangement of coal relative to the surrounding materials is of common occurrence, especially in the coal fields of the Pittsburgh region. While I do not limit myself to the use of my invention in connection with this particular arrangement of the coal relative to other materials, the invention is especially adapted for use where coal occurs under these conditions.

Shown diagrammatically at 15 in Fig. 1 of the drawing, is a mining machine having a frame portion 16 and a severing device 17. The mining machine here represented is of the general type shown in my co-pending applications, Serial Nos. 848,727, 864,221 and 39,986, filed July 3, 1914, Sept. 30, 1914 and July 15, 1915, respectively. Machines of this type are provided with a cutter or severing device represented at 17 in Fig. 1 of the drawing, which is carried on a horizontal pivot 18, and adapted to swing about this pivot in a vertical direction to sever a semi-cylindrical or crescent-shaped portion of the material to be mined from the end of the mine chamber. The first cut taken from a flat vertical surface will be substantially semi-cylindrical, but the succeeding cuts will be crescent-shaped in cross section as shown at 19 in the drawing. The severing device is provided with a cutter chain 20, which is carried by a U-shaped frame, and forms a kerf shown at 21 in the drawing. The material thus detached is carried backwardly by a conveyer mechanism not shown, and discharged at the rear portion of the mining machine into a car 22', or other transporting device, from whence it is removed from the mine chamber. Machines of this character are usually designed for cutting a chamber of a width considerably greater than the machine, the severing device in some machines being swung about another pivot in order to take cuts at each side in addition to the central cut. In other machines the entire frame and severing device are moved laterally in the chamber to position the machine for making different cuts to open the entire width of the chamber.

As will be seen from the drawing, after the coal 11 has been removed the stratum of slate 14 is left substantially unsupported; a great deal of trouble has been caused by this slate, becoming in whole or in part, severed from the roof of the mine and falling into the chamber. In certain forms of mining the coal and slate are brought down together, and this, of course, necessitates a subsequent separation of the two. In other

forms the attempt is to remove the coal first, and to care for the slate subsequently by various means, all of which has involved considerable labor, inconvenience and expense. Where a machine of the type shown is used, it will be seen from Fig. 1 of the drawing that each cut of the severing device leaves an overhanging portion of the coal, shown at 22 in Fig. 1 of the drawing, having an arched formation, and thus adapted to form a support for the portion of the roof extending over the severing device or operating portion of the machine. This permits of removal of the coal without its becoming mixed with the draw slate from the roof of the mine, but when the machine has been moved forward and a second cut taken, the support is removed from the portion of the roof back of the cutter, and the slate is then likely to fall from this portion of the roof. To take care of this falling slate, the present invention provides for a platform consisting of side rails 23 carried by uprights 24 positioned at each side of the mine chamber. The uprights 24 are slidably mounted in standards 25 held in position by a cross bar 26 extending from one side of the chamber to the other. Any suitable means may be provided for raising and lowering the uprights 24. In the drawing I have shown these uprights provided with racks 27, which are arranged to mesh with pinions 28 carried on the shaft 29, and driven by a worm wheel 30 which meshes with the worm 31, which is in turn driven by a motor 32. The adjusting mechanism for the uprights 24 is provided in duplicate, there being one set at each side of the mine chamber. The standards 25 on each side of the mine chamber are spaced apart longitudinally by bars 33, which extend from one of these standards to the other along the side of the mine chamber. The tracks 23 are spaced from one another transversely by a plate or beam 34, which extends across the mine chamber from one of these tracks to the other, and holds them in fixed relation relatively to one another.

The tracks 23 are higher at their forward end, as shown in Fig. 1, than at the rear end, and a table 35 is mounted for reciprocation along the tracks 23, and is supported thereon by a series of rollers 36. Secured to the lower side of the table 36 is a downwardly extending lug or projection 37, which has pivotally secured thereto at 38, a pitman rod 39, which is driven by a crank 40, arranged to be rotated by a motor 41 mounted on the cross plate 34. It will be apparent that the operation of the motor 41 will transmit a reciprocatory motion to the table 35. The upper surface of the table 35 is provided with a series of transverse ridges 42 which, as shown in the figure, are given an inclination to the rear or lower portion, of the table. Blocks of material, such as shown at 43, when detached from the roof of the mine will fall upon the table 35, and will gradually be moved to the rear or lower portion of the table as the table is reciprocated by the motor 41, in a way which will be apparent from the figure. Extending longitudinally of the table, at each side thereof, and arranged to support the same, is a pair of beams 44, and these beams have pivoted thereto, at the rear or lower end, the downwardly swinging doors 45. A latch 46 is provided for holding the doors in their upper position, and a pair of chains 47 limit the downward movement of these doors to give them an inwardly sloping position when lowered, as shown in Fig. 2. The material which falls upon the table 35 gradually works backwardly and downwardly to a position on top of the doors 45, and there is collected until the latch 46 is withdrawn and the doors permitted to drop. The material will then be discharged into the car 22′, being guided to a position over the car by the slope of the doors in their lowered position. Secured to the forward end of each of the rails 23 is a forwardly and upwardly directed extension 48. These extensions carry a cross bar 49 at their upper end. The extensions 48 are of the proper length to bring the cross bar 49 into contact with the roof of the mine at a position substantially at the end of the last cut made by the severing device 17 when the machine is positioned for starting a new cut. In this way the cross bar 49 cooperates with the arched extension 22 of the material being mined, to support the roof of the mine directly over the operating position. The bar is forcibly pressed into contact with the roof by the rack and pinion device for adjusting the position of the uprights 24.

From the foregoing description it is thought that the operation of the device will be easily understood. When the machine is properly positioned in the chamber for making a cut, the uprights 24 are suitably adjusted by means of the motors 32 with their connecting gearing, to bring the cross bar 49 firmly into contact with the roof of the mine at a point where it will just clear the severing device when it reaches the upper end of the next cut. The severing device is then operated, and the coal which is severed is carried back and discharged onto the car 22′. During this operation the table 35 is in position to intercept any material that may become detached from the roof of the mine, and usually practically all of the draw slate found between the coal and the upper stratum of rock will fall down by its own weight onto this table, where it will be worked backwardly by the reciprocatory movement of the table, and be collected on the doors 45. When a sufficient amount has

been gathered an empty car will be placed beneath the doors, and they will be allowed to discharge the slate. After the coal has been removed, the mining machine and the supplemental device for handling the draw slate will both be moved forwardly by any suitable mechanism into position to repeat the operation.

In some mines it may happen that the draw slate will not become readily detached by its own weight after the coal has been removed, but will adhere to the upper surface of the mine chamber for some time, where it forms a constant menace. Where this is the case, it is desirable to provide a positive means for detaching the slate from the roof of the mine. In Figs. 4 and 5 I have shown such construction. In the form of the device shown in these figures, rails 23 and their supporting uprights 24 have the same construction as in the form of the device previously described. Instead of the pitman rod arrangement shown in Fig. 1, the cam 50 is provided, which co-operates with downwardly projecting lug 51 secured to the table 52. The cam is rotated in a counter clockwise direction as shown in Fig. 4 by a motor 53, and it will be apparent that each rotation of the cam will move the lug 51, together with the table 52, in a direction toward the rear or lower end of the table. Heavy coil springs are secured to the track members 23 at each side of the device, by means of angular lugs 55 and bolts 56. The opposite ends of the springs 54 are fastened to downwardly projecting lugs 57 secured to the lower side of the table 52. When the table 52 is forced rearwardly by the cam 50, the springs 54 will be compressed, but as soon as the table is released from the cam these springs will expand with a sudden movement, and give the table a rapid motion in a forward direction. A buffer 65 of any suitable construction is provided for limiting the movement of the table in a forward direction. Since the table moves rearwardly with a relatively slow motion, the friction between the surface of the table and any material resting thereon will be sufficient to carry the material rearwardly with the table, but when the table is suddenly forced forwardly by the expansion of the springs 54, the movement will be so rapid that the inertia of the material on the table will overcome the friction between this material and the table top, and the material will remain in its position, and not move forwardly with the table. In this way the material is gradually fed to the rear or lower end of the table onto the doors 45, where it is disposed of in the manner previously described.

Secured to the rear end of the beams 44 which support the table 52, is a pair of brackets 58, which project upwardly and are offset inwardly from the end of the beams. A cross bar 59 is secured to these brackets, and extends transversely of the mine chamber near the roof thereof. This bar is vertically adjustable by means of bolts 60 and slots 61, and has secured to its upper surface a series of forwardly extending pick bars 62. These bars are directed slightly upwardly so that their ends will lie at a level with the upper surface of the stratum of draw slate 14. It will be apparent from the construction described that at each forward movement of the table 52 produced by the springs 54, the pick bars 62 will be driven rapidly forwardly, and will strike a blow upon any slate that may not have fallen upon the table 52, but is still adhering to the roof of the mine. In this way all of the draw slate that is not detached by its own weight is positively removed by the pick bar 62.

While I have shown what I now believe to be the best embodiment of my invention, it will be clear to those skilled in the art, that the invention may be embodied in many other forms, and I do not, therefore, wish to confine myself to any particular form.

What I claim as my invention and wish to secure by Letters Patent is:

1. In mining apparatus, the combination with a supporting frame, of mechanism mounted thereon for dislodging material from a mine vein, and supplemental mechanism mounted on said frame adjacent the roof of the mine chamber remote from said dislodging mechanism and out of reach thereof in position to receive material only from the roof above the range of operation of said dislodging mechanism and transfer such detached material longitudinally of said frame along paths of travel adjacent such roof back to a position for loading into a mine car independently of the operation of said dislodging mechanism.

2. In mining apparatus, the combination with a supporting frame, of severing mechanism carried thereby, conveyor mechanism, and means for supporting said conveyor mechanism adjacent the roof of the mine chamber out of the range of operation of said severing mechanism and therefore incapable of receiving the material dislodged by said severing mechanism but in position to catch material detached from the roof above the range of operation of said severing mechanism and transferring such material rectilinearly along a path adjacent such roof toward the rear end of said frame.

3. The combination of a mining machine comprising a supporting frame and severing mechanism, conveying mechanism for catching material detached from the roof above the range of operation of said severing mechanism and transferring such material over the top of said mining machine in a space adjacent the roof toward loading position, and means for supporting said con-

veying mechanism in position to receive only such roof material and out of position for receiving material from said severing mechanism.

4. In combination, a mining machine comprising mechanism for severing and removing the material to be mined, and a supplemental device adapted to be positioned above said mining machine in a mine chamber for intercepting material that may become detached from the roof of said chamber, said supplemental device comprising a reciprocating conveyer for conveying material so intercepted to a position removed from said mining machine.

5. A mining machine comprising a frame, and a device carried at one end of said frame for severing material to be mined, in combination with supplemental mechanism positioned above said machine, and comprising a table for intercepting material that may become detached from the roof of the mine, and a support arranged to engage the roof of the mine adjacent the end of the machine which carries said severing device.

6. The combination with a mining machine comprising a main frame, of mechanism at one end thereof for making an arcuate cut in the material to be mined to the roof of the mine chamber, and a supplemental frame mounted on said main frame and extending into position for supporting the roof near the upper end of the arcuate cut produced by said cutting mechanism.

7. In combination, a mining machine provided with means for severing material to form an entry or mine chamber, and a supplemental device positioned above said mining machine for intercepting material that may become detached from the roof of said chamber, said supplemental device including an inclined table, means for reciprocating said table to cause the material to move downwardly thereon, and a discharge opening at the end of said table.

8. The combination with a mining machine having a supporting frame and severing mechanism on the forward end thereof, of roof material conveying mechanism, and means for supporting said conveying mechanism on top of said mining machine adjacent the roof of the mine chamber in position to receive material detached from the roof out of the range of operation of said severing mechanism and out of position to receive material from the latter, and carry such roof material thereby preventing the same from falling onto said mining machine and for transferring such detached material along a path above said mining machine to a position behind the latter to load such roof material into a mine car entirely independently of the loading into a mine car of material dislodged by said severing mechanism.

9. The combination with a mining machine comprising a supporting frame, of a supplemental device positioned above said mining machine adjacent the roof of the mine chamber in position to receive and carry material detached from the roof and prevent the same from falling on said mining machine, and means for vertically adjusting said supplemental device in accordance with the height of the said roof.

10. The combination with a mining machine for dislodging material to form adequate space for advance of said mining machine, and supplemental mechanism supported by said mining machine above the same to partition the space occupied by the dislodging mechanism from the space below the roof, and to receive and carry only material dislodged from the roof and to prevent such material from falling on said mining machine or becoming mixed with material dislodged by said mining machine.

11. In mining apparatus, the combination with a machine for mining coal from an upright mine wall of a coal vein, and supplemental mechanism adapted to be positioned above said mining machine to extend substantially from one side of the mine chamber to the other and forwardly to a position adjacent the upper range of operation of said mining machine but independently of the latter to form a transverse partition between the mining machine and the roof of the mine chamber to receive and carry only foreign material detached from the roof and prevent such material from being mixed with the coal mined from a coal vein.

12. In combination, a mining machine for removing material to be mined, thus forming an entry or mine chamber, and a supplemental device having a platform extending across said chamber above said mining machine, a table supported on said platform, means for reciprocating said table to cause material thereon to move along said table, and a dumping device at one end of said table for receiving material therefrom to be discharged at the will of the operator.

13. In combination, a mining machine, a platform, means for adjustably supporting said platform above said mining machine, a device secured at one end of said platform for supporting material at the roof of a mine, and conveyer mechanism carried by said platform for intercepting material that may become detached from the roof of said mine and transporting said material to a position removed from said mining machine.

14. In combination, a mining machine, a platform, means for supporting said platform above said mining machine and spaced from the roof of a mine, a device secured to one end of said platform for supporting a portion of such roof, and means for raising said platform to adjust said platform

vertically and to force said supporting device into contact with the mine roof.

15. In combination, a mining machine having a severing device at one end thereof, a platform, means for supporting said platform above said mining machine and spaced from the roof of a mine, a roof support carried by said platform at the end thereof adjacent said severing device, and means for vertically adjusting said platform to bring said support into contact with the mine roof.

16. In combination, a mining machine having a severing device positioned at one end thereof, a platform, means for supporting said platfrom above said mining machine, a mine roof support carried by said platform at the end thereof adjacent said severing device, conveyer mechanism carried by said platform and arranged to intercept material that may become detached from the mine roof, and means at one end of said conveyer mechanism for receiving material therefrom and for discharging said material periodically at the will of the operator.

17. The combination of a mining machine comprising a supporting frame, a supplemental device carried by said supporting frame above the same to form a transverse partition to intercept material that may become detached from the roof of the mine, means for operating said supplemental device to effect movement of the material thereon over the top of said mining machine frame toward loading position, and means for detaching material from the mine roof onto said transverse partition.

18. In combination, a mining machine, a supplemental device positioned above said mining machine for intercepting material that may become detached from the roof of a mine, means located at one end of said supplemental device for preventing detachment of material from said mine roof, and means positioned away from said end for detaching material from said roof.

19. In combination, a mining machine, a reciprocating platform positioned above said mining machine for intercepting material that may become detached from the roof of a mine, and a pick carried by said platform for detaching material from the roof of said mine.

20. In mining apparatus, the combination with a supporting frame, of a supplemental vibratory frame mounted on top of said supporting frame adjacent the roof of a mine chamber in position for intercepting material that may become detached from such roof and prevent such material from falling on said supporting frame, and means connected to said supplemental frame for detaching material from the mine roof onto said supplemental frame.

21. In combination, a mining machine having a severing device positioned at one end thereof, a platform positioned above said mining machine and having a support adapted to contact with the roof of the mine adjacent the end of said machine provided with said severing device, conveying mechanism carried by said platform, and means for detaching material from the roof of said mine to cause it to fall onto said conveying mechanism.

22. In combination, a mining machine, a platform, means for adjustably supporting said platform above said mining machine, a reciprocating table carried on said platform, means for moving said table slowly in one direction, and resilient means for moving said table rapidly in the opposite direction.

23. In combination, a mining machine, a platform, means for adjustably supporting said platform above said mining machine, a reciprocating table carried by said platform and arranged to intercept material detached from the roof of a mine, means for moving said table in one direction, resilient means for rapidly moving said table in the opposite direction, and a device carried by said table adapted to strike a blow on the material at the roof of the mine when said table is moved by said resilient means to cause material to become disengaged from the roof of said mine.

24. In a mining apparatus, the combination with a supporting frame, of a platform, means for supporting said platform above said supporting frame adjacent the roof of a mine chamber in position to form a transverse partition for intercepting material that may become detached from the roof and prevent such material from falling onto said supporting frame, and means for operating said partition platform to effect the movement of material thereon longitudinally of the supporting frame and above the same to a position for loading into mine cars.

25. In mining apparatus, the combination with a mining machine comprising a frame and cutting mechanism connected thereto, of a platform, means for supporting said platform on said frame adjacent the roof of a mine chamber for intercepting material that may become detached from said mine roof above the range of operation of said cutting mechanism, and mechanism for reciprocating said platform to transport such intercepted material to a position from which it may be removed from said mine chamber.

26. In mining apparatus, an inclined platform of a width to extend substantially from side to side of a mine chamber, means for supporting said platform spaced below the roof of a chamber for intercepting ma-

terial that may become detached therefrom, and means carried by said platform at one end thereof for contacting with said roof to prevent detachment of material at that end thereof.

27. In mining apparatus, a platform, means for supporting said platform in a mine chamber above the floor and adjacent the roof thereof for intercepting material that may become detached from said roof, and a reciprocating table inclined downwardly toward loading position and carried by said platform for conveying the material so intercepted toward such loading position where it may be transported from said chamber.

28. In mining apparatus, the combination with a supporting frame, of a platform carried above said supporting frame and extending transversely and longitudinally thereof, an inclined table carried by said platform adjacent the roof of the mine chamber and in position to form a partition between such roof and the space occupied by said supporting frame and said platform, and means for operating said table to transfer toward loading position material dislodged from the roof, by imparting a relatively slow movement to said table in one direction for carrying the dislodged roof material toward loading position, and imparting a relatively rapid movement to said table in the opposite direction to move said table forwardly under said material.

29. In mining apparatus, a platform means for supporting said platform in a mine chamber, an inclined table carried by said platform for intercepting material that may become detached from the roof of said chamber, means for imparting a relatively slow movement to said table in a direction toward the lower end thereof, resilient means for imparting a relatively rapid movement of said table in the opposite direction, and a device carried by said table, adapted to strike a blow on the material at the roof of said mine when said table is moved by said resilient means, for detaching said material from said mine roof.

30. In mining apparatus, the combination with a supporting frame, of a reciprocating table, a platform mounted on top of said supporting frame for supporting said table above said supporting frame to intercept material detached from the roof of the mine chamber and prevent such material from falling onto said supporting frame, a cam for imparting a relatively slow movement to said table in one direction for moving material carried by said table in said direction, and resilient means for rapidly returning said table to its original position when released by said cam and thereby cause said table to move forwardly by slipping under said material.

31. In mining apparatus, a platform, means for adjustably supporting said platform in a mine chamber, an extension carried at one end of said platform and adapted to be forced into contact with the roof of said chamber by said adjustable supporting means, an inclined track carried by said platform, a table supported on said track, means for imparting a relatively slow movement to said table in a direction away from said extension, resilient means for imparting a relatively rapid movement of said table towards said extension, a buffer for stopping said table at the end of the movement thereof towards said extension, and picks carried by said table and arranged to be moved into contact with material at the roof of said chamber by the rapid movement of said table for detaching the material from said roof to cause it to fall on said table.

32. The combination of a mining machine comprising mechanism for severing material by making a cut therein of a shape to provide an overhanging extension at the upper portion of said cut, and means mounted on said mining machine in position to bear against said overhanging portion and support the same rigidly by reason of rigid connection with said mining machine.

33. The combination of a mining machine comprising severing mechanisms for making a cut in the material to be mined of a shape to leave an overhanging extension of said material at the upper portion of said cut adapted to assist in supporting the roof of the mine above said severing device, and means carried on top of said mining machine to form a partition between the same and the roof of the mine chamber adjacent said roof and to intercept material that may become detached from the roof at a position removed from that portion of said roof supported by said extension.

34. The combination of a mining machine having a severing device arranged to make a cut in material to be mined, of a shape to leave an overhanging arched portion for supporting the portion of the mine roof where the mining operation is taking place, and means independent of said severing device and mounted on top of said mining machine adjacent the roof of the mine chamber in position to intercept material that may become detached from the roof at those portions back of said arched portions.

35. The combination of a mining machine having severing mechanism for cutting material in an upright mine wall to a shape leaving an overhanging arched portion for supporting the roof of the mine directly above the range of cutting operation, a roof jack on said mining machine in position to assist said arched portion in supporting the roof adjacent the range of cutting operation, and means also mounted on said mining ma-

chine but back of said roof jack for receiving material that may become detached from the roof back of said roof jack.

36. The combination of a mining machine having severing mechanism for cutting material from a mine wall leaving an overhanging arched portion of said material for assisting in supporting the portion of the mine roof directly above the range of cutting operation, and mechanism mounted on said mining machine adjacent the roof of the mine chamber and inclined downwardly toward the rear of said mine chamber for intercepting material detached from those portions of the roof back of the said arched portion.

37. The combination with a mining machine comprising mechanism to form an arcuate cut in the material to be mined and to leave an overhanging arch of said material near the upper portion of the mine chamber for supporting the roof thereof above the operating position, a supplemental device, a conveyor mounted on said supplemental device for intercepting material detached from the roof back of said overhanging arch, mechanism for detaching material from the mine roof and cause it to fall on said conveyer and a supplemental support between the cutting position and the detaching position for engaging one end of said overhanging arch and assist the latter in sustaining the roof above cutting position during the cutting operation.

38. The combination of a mining machine comprising a supporting frame and a severing device at one end thereof arranged to make an arcuate cut in the material to be mined, thus leaving an overhanging arched portion of material, a supplemental device mounted on said frame in position to engage the roof immediately back of said arched portion to assist the latter to support the roof of the mine chamber above the range of operation of said severing device, and means also mounted on said supporting frame adjacent the roof and immediately back of said supplemental device in position for receiving material detached from the roof back of said supplemental device.

39. In combination, a mining machine comprising a frame having a severing device at one end thereof arranged to make an arcuate cut in the material to be mined thus leaving an overhanging arched portion of said material adapted to support the roof of the mine chamber above said severing device, supplemental mechanism positioned above said mining machine frame and having an extension arranged to contact with the roof of said chamber adjacent the outer edge of said arch-shaped portion, and having a reciprocating conveyer for intercepting material that may become detached from other portions of the roof of said chamber, and means for positively detaching material from said roof that does not become detached by the force of gravity.

40. In combination, a mining machine comprising a frame, and a severing device carried by one end of said frame arranged to make an arcuate cut in the material to be mined thus forming an overhanging arched portion of said material adapted to support the roof of a mine chamber above said severing device, supplemental mechanism arranged to be positioned in said mine above said mining machine frame and adapted to extend laterally from side to side of the mine chamber, said supplemental mechanism having a reciprocating table carried thereon in position to intercept material that may become detached from the roof of said chamber and adapted to transfer said material to a position where it may be conveyed out of said chamber, a support carried by said supplemental mechanism, and means for adjusting said supplemental mechanism to move said reciprocating table toward and away from the roof of said chamber and to force said support into contact with said chamber roof at a point adjacent the outer extremity of said overhanging portion of said material.

41. In mining apparatus, the combination with a mining machine comprising a frame, of a shaking table mounted on the top of said mining machine frame in position to receive dislodged material from the roof of a mine chamber, and means for operating said shaking table to transfer the material received thereby to the rear end of said mining machine.

42. In mining apparatus, the combination with a mining machine comprising a frame, of a supplemental frame mounted on top of said mining machine frame, means for adjusting the elevation of said supplemental frame, a shaking table mounted on top of said supplemental frame in position near the roof of a mine chamber to receive dislodged material from such roof, and means for operating said shaking table to transfer the material received thereby into position for loading into a mine car.

43. In mining apparatus, the combination with a mining machine comprising cutting mechanism and a supporting frame, of a vibratory supplemental device mounted on top of said frame for intercepting material dislodged from the roof of a mine chamber in which said mining machine is operated, and means for vibrating said supplemental device to effect delivery of material thereon into position for loading into a mine car.

44. In mining apparatus, the combination with a mining machine comprising a supporting frame, of a vibratory supplemental frame mounted in an inclined position on

top of said first-named frame for receiving dislodged material from the roof of a mine chamber in which said mining machine is operated, and mechanism for vibrating said supplemental frame to effect delivery of material thereon off the rear end of said mining machine.

45. In mining apparatus, the combination with a mining machine, of mechanism mounted on top of said mining machine in position for receiving material from the roof of said mine chamber above the range of operation of said mining machine, means for operating said receiving mechanism to transfer material thereon toward loading position, and supplemental mechanism for delaying the dropping of material at loading position until after the exchange of mine cars.

46. In mining apparatus, the combination with a mining machine comprising a frame, of a reciprocating device on said frame in position to intercept material that may become detached from the roof of a mine chamber in which said mining machine is operated, means for reciprocating said device to effect the transfer of material thereon toward loading position, and mechanism for collecting material near the delivery end of said reciprocating device to delay movement of said material into a mine car until said collecting means is released.

47. The combination with a mining machine comprising mechanism for cutting an upright crescent-shaped core of material from an upright mine wall leaving an overhanging semi-arch-shaped body of material at the roof of the mine chamber, said mining machine comprising also a supporting frame, means mounted on said supporting frame in position for engaging such semi-arch-shaped body of material to assist in supporting the roof above the range of the cutting operation, and mechanism mounted on said supporting frame back of and adjacent said supporting means for receiving material from the roof back of said supporting means and transferring such roof material toward loading position back of the mining machine.

48. In mining apparatus, the combination with a supporting frame, of a reciprocable table mounted on top of said frame to form a partition between said frame and the roof of a mine chamber in position to intercept material from the said roof and carry such material, means for supporting said reciprocable table on said frame in a position downwardly inclined toward the rear of said supporting frame, and means for reciprocating said table to cause the material carried thereby to be transferred off the rear end of said table.

49. In mining apparatus, the combination with a supporting frame, of a serrated table mounted on the top of said frame and extending from the forward portion thereof longitudinally to the rear end thereof, said table being adapted to extend across a mine chamber to form a partition between said frame and the roof of the mine chamber in position to intercept material from the roof and carry such material, and means for vibrating said serrated table to effect the transfer of roof material carried thereby off the rear end of said table.

50. In mining apparatus, the combination with supporting framework, of a table having a serrated upper surface and mounted above said framework in position to extend approximately over the entire length of said framework to intercept material from the roof of a mine chamber and carry such material, and means for vibrating said table to cause such material thereon to travel along said table.

51. In mining apparatus, the combination with supporting framework, of a reciprocating table carried above said framework adjacent the roof of a mine chamber and extending longitudinally along said framework toward the rear end thereof, means for reciprocating said table, and means on said table to cause material to be moved along the same in a predetermined direction when reciprocated.

52. In mining apparatus, the combination with supporting framework, of a table mounted for reciprocation above said framework adjacent the roof of the mine chamber, said table having an upper surface facing the roof and inclined downwardly toward the rear of said framework, means on said surface for engaging material thereon when said table is moved in one direction and for sliding under said material when moved in the opposite direction, and means for reciprocating said table.

53. In mining apparatus, the combination with supporting framework, of a reciprocating table mounted above said framework spaced above the mine floor and in position adjacent the mine roof to form a transverse partition between such framework and said roof to receive dislodged material from said roof and carry said material, and means for unloading such material from said table by moving said table slowly in one direction to carry the material thereon toward loading position and for moving said table quickly in the opposite direction to slide the table under said material without carrying it along.

54. In mining apparatus, the combination with supporting framework, of a reciprocating table mounted on said framework to occupy a position above the same with its upper surface facing the mine roof and with its upper surface adapted to receive and carry material dislodged from said roof, mech-

anism comprising an involute cam for moving said table in one direction slowly, and a spring for quickly returning said table to initial position when released by said cam.

55. In mining apparatus, the combination with supporting framework, of a platform mounted in said framework, a roof support connected to said platform, means for adjusting the elevation of said platform and said roof support, a reciprocating table mounted on said platform, and means for reciprocating said table to cause material received thereon from the roof of a mine chamber to travel along said table in a predetermined direction.

56. In mining apparatus, the combination with a supporting frame, of a roof support mounted thereon, means for adjusting the elevation of said roof support, a table carried by said roof support, said table being back of said roof support and in position to receive dislodged material from the roof, and means for reciprocating said table to effect transfer of such dislodged material thereon toward loading position.

57. In mining apparatus, the combination with a supporting frame, of a reciprocating table mounted thereon near the roof of a mine chamber in position to receive dislodged material therefrom, a pick mounted on said table to reciprocate therewith and extending lengthwise of the mine chamber, and means for reciprocating said table and said pick to effect the dislodgment of material from the roof of a mine chamber onto said table.

58. In mining apparatus, the combination with supporting framework, of an inclined reciprocating table mounted on said framework, a pick carried by said table and movable therewith along the roof of a mine chamber to dislodge material therefrom onto said table, and means for reciprocating said table to effect the operation of said pick and the delivery of material from said table.

59. In mining apparatus, the combination with a main frame, of a supplemental frame mounted to reciprocate thereon in position to receive material dislodged from the roof of a mine chamber, a plurality of picks mounted on said supplemental frame in position to scrape along the roof of the mine and pry off material below its lines of movement, and means for reciprocating said supplemental frame to effect the operation of said picks.

60. In mining apparatus, the combination with a supporting frame, of a conveyer mounted on top of said supporting frame and spaced a substantial distance above the floor of a mine chamber and located adjacent the roof of such mine chamber in position to receive material directly from such roof when such material is dislodged, and transfer such roof material toward loading position, and mining mechanism mounted to operate in a plane approximately parallel to the plane of the roof and spaced upwardly therefrom.

61. In mining apparatus, the combination with a main frame, of a supplemental frame mounted above said main frame to reciprocate longitudinally thereof and in position near the roof of a mine chamber to receive dislodged material therefrom, a pick mounted on said supplemental frame to extend lengthwise of the mine wall to dislodge material in its path of movement onto said supplemental frame, and means for reciprocating said supplemental frame to effect the operation of said pick longitudinally of the mine wall.

62. In mining apparatus, the combination with a main frame, of a supplemental frame mounted above said main frame and having a table to receive material dislodged from the roof of the mine, a mining tool connected to said supplemental frame in position to dislodge material from the mine roof by moving in a plane spaced above the forward mine roof, and means for reciprocating said table both to operate said pick and to shake the dislodged material to position for loading into mine cars.

63. In mining apparatus, the combination with a supporting frame, of a reciprocable table mounted on top of said frame at a substantial distance above the floor of the mine chamber and adjacent the roof thereof to extend longitudinally of said frame along the mine chamber to intercept material dislodged from the roof above said supporting frame, a pick connected to said table and movable therewith along the roof above the rear portion of said supporting frame, and means for reciprocating said table to shake material thereon to loading position at the rear end of said supporting frame and to simultaneously operate said pick to dislodge material from the mine roof above said supporting frame.

64. In mining apparatus, the combination with main supporting framework, of a collecting device mounted on top of said frame in a position spaced substantially above the floor of the mine chamber and extending longitudinally of said framework to receive material dislodged from the roof above said framework, means for reciprocating said collecting device to cause the material received thereon from the roof to be moved toward loading position back of the rear end of said supporting framework, and roller bearings between said collecting device and said supporting framework to facilitate such reciprocation.

65. In mining apparatus, the combination with supporting framework, of a supplemental frame, a spring between said frames, means for compressing and suddenly re-

leasing said spring to reciprocate said supplemental frame, and a pick connected to said supplemenaal frame to have a range of operation spaced from the face of a mine wall to dislodge a layer of material from such mine wall between such face and such range of operation.

66. In mining apparatus, the combination with a main frame, of a supplemental frame having a rearwardly inclining table near the roof of a mine chamber in position to intercept material therefrom, a spring between said frames, cam mechanism for compressing said spring and suddenly releasing the same to effect longitudinal reciprocation of said table, a plurality of picks connected to the rear end of said table in position to dislodge a layer of material from said roof onto said table, a roof support at the forward end of said main frame, and means for adjusting the elevation of said roof support together with said supplemental frame.

67. In mining apparatus, the combination with a main frame, of a supplemental frame having a table for receiving material from the roof of a mine chamber, dislodging mechanism connected to said supplemental frame and extending along said roof, means for reciprocating said supplemental frame together with said table and said dislodging mechanism, and means for adjusting the elevation of said supplemental frame together with said dislodging mechanism.

68. In mining apparatus, the combination with a supporting frame, of a conveyor mounted thereon, and mechanism comprising swinging doors adapted to occupy positions at the delivery end of said conveyor in immediate continuation of the latter to act as a collecting device when in such positions to receive material from said conveyor by sliding movement on to the surfaces of said doors adjacent said conveyor.

69. In mining apparatus, the combination with a supporting frame, of a conveyor mounted thereon, and swinging doors mounted at the delivery end of said conveyor and adapted to be swung to upward positions immediately adjacent the rear end of said conveyor where the upper surfaces of such doors may act as a collecting device in approximate continuation of the upper delivery end of said conveyor, said doors being also adapted to act as a delivery chute into a mine car when swung downwardly to open positions with the previously upper surfaces of said doors facing each other.

70. In mining apparatus, the combination with a mining machine supporting frame, of a roof rigid throughout and having a comparatively large area so as to extend over said frame longitudinally and laterally and means for supporting said roof on top of said frame in a position spaced substantially above the floor of the mine chamber immediately below the roof of the mine chamber to intercept material detached from such roof above said supporting frame and carry such material to prevent it from falling from either side of said roof and to prevent it from mixing with material not detached from such roof.

71. In mining apparatus, the combination of a mining machine supporting frame, and a roof mounted on top of said mining machine frame in a position spaced substantially above the floor of the mine chamber and facing the ceiling of a mine chamber, to intercept material detached from such ceiling, said roof being inclined downwardly toward the rear of said mining machine frame for the passage of such detached material.

72. In mining apparatus, the combination with a mining machine supporting frame, of cutting mechanism for forming an entry or mine chamber to permit free passage of said mining machine frame, a roof mounted on top of said mining machine frame and extending across the same to form a transverse partition and longitudinal chute in such mine chamber between the mining machine frame and the ceiling of the mine chamber in position to receive material detached from such ceiling above the mining machine frame and prevent such material from falling off the lateral edges of said roof.

73. In mining apparatus, the combination of a supporting frame and conveyer mechanism mounted on top of said supporting frame spaced substantially above the floor of the mine chamber in position to receive material detached from the ceiling of the mine chamber above said supporting frame, said conveyer mechanism extending longitudinally of said supporting frame and being inclined downwardly from the front portion thereof to the rear end thereof, and means for operating said conveyer mechanism to transfer such detached material toward the rear end of said supporting frame.

74. In mining apparatus, the combination with a supporting frame, of a roof jack mounted on the forward end of said frame for supporting a portion of the roof of the mine chamber, and mechanism mounted above said supporting frame and extending rearwardly from said roof jack in a position spaced substantially above the floor of the mine chamber and located adjacent the roof of said mine chamber to receive material detached from such roof above said supporting frame and back of said roof jack.

75. In mining apparatus, the combination with a mining machine frame, of a table rigid throughout and having an area large as compared with the plan area of said frame, and means for supporting said table on top of said mining machine frame to extend longitudinally and transversely thereof in a position spaced substantially above

the floor of the mine chamber and facing the roof of the mine chamber to receive and carry only material detached from such roof above such intercepting table.

76. In mining apparatus, the combination with a supporting frame, of a roof support mounted thereon, means for adjusting the elevation of said roof support, and a table mounted above said supporting frame back of said roof support in position to receive material dislodged from the roof above said supporting frame.

77. In mining apparatus, the combination with a supporting frame, of a table mounted above said supporting frame near the roof of a mine chamber in position to receive dislodged material therefrom, a pick, and means for operating said pick to effect the dislodgment of material from the roof of the mine chamber onto said table.

78. In mining apparatus, the combination with supporting framework, of a pick mounted for operation along the roof of a mine chamber above said framework, and a platform mounted above said framework in position to receive material dislodged from the roof of the mine chamber, such platform being spaced substantially above the floor of the mine chamber and facing the roof of the mine chamber to form a partition between said framework and said roof and extending longitudinally and transversely over the top of said framework.

79. In mining apparatus, the combination with a main frame, of a supplemental frame mounted on said main frame for adjustment in elevation, a roof support connected to said supplemental frame for movement therewith, means for adjusting the elevation of said supplemental frame to adjust the elevation of said roof support, and a table mounted on said supplemental frame to extend over the top of said frames adjacent the roof of the mine chamber in position to receive material detached from the roof above said frames.

80. In mining apparatus, the combination with a main frame, of a supplemental frame, roof supporting mechanism connected to said supplemental frame, means comprising worm gearing for moving said supplemental frame upwardly to force said roof supporting means into position and anchor said supporting frame, and mechanism mounted above said frames in position adjacent the roof of the mine chamber back of said roof supporting means to receive material detached from such roof above said frames.

81. In mining apparatus, the combination with a main supporting frame, of a supplemental frame provided with a plurality of vertical racks, driving mechanism engaging said racks for adjusting the elevation of said supplemental frame, roof supporting means mounted on said supplemental frame at the forward end thereof and near the forward end of said main supporting frame, and mechanism mounted above said frames in position to span the same and extend rearwardly from said roof supporting means to collect material detached from the roof of the mine chamber above said frames.

82. In mining apparatus, the combination with a supporting frame, of a supplemental frame comprising a table inclined downwardly toward the rear of said supporting frame and mounted above such supporting frame substantially above the floor of the mine chamber and adjacent the roof thereof, and a discharge opening at the lower rear end of said table.

83. In mining apparatus, the combination with a supporting frame, of mechanism mounted above said supporting frame at a substantial distance above the floor of the mine chamber and adjacent the roof thereof in position to receive material detached from the roof above said supporting frame, and dumping mechanism at one end of said receiving mechanism for collecting material from the latter and discharging the same at the will of the operator.

84. In mining apparatus, the combination with supporting framework, of mechanism mounted on top of said framework to span the same and extend longitudinally thereof in position to receive material detached from the mine roof above said supporting frame, and means at one end of said receiving mechanism for collecting material from the latter and for discharging such material periodically at the will of the operator.

85. In mining apparatus, the combination with supporting framework, of mechanism mounted on top of the same adjacent the roof of a mine chamber in position to receive only material detached from the roof above said supporting framework, and a discharge device at the rear end of said receiving mechanism for directing material from the latter to a mine car independently of the space within said framework below said receiving mechanism.

86. In mining apparatus, the combination with supporting framework, of mechanism mounted on top of the same in position to receive material detached from the roof of a mine chamber, and chute-members mounted at the rear end of said receiving mechanism to direct dislodged roof material into a mine car back of said supporting frame.

87. In mining apparatus, the combination with a mining machine comprising a supporting frame, of mechanism comprising a table downwardly inclined toward the rear of said mining machine and spanning the width of said supporting frame and extending longitudinally thereof along the top of said supporting frame in position adjacent the roof of the mine chamber to receive ma-

terial detached from such roof above said supporting frame. and a pair of chute-members mounted at the rear end of said table to direct dislodged roof material into a mine car back of said mining machine.

88. In mining apparatus, the combination with a mining machine comprising a supporting frame, of mechanism mounted on top of said supporting frame in position to receive material detached from the roof of the mine chamber above said supporting frame, a discharge chute mounted at the rear end of said receiving mechanism, and means for holding said discharge mechanism in position to form a continuation of said receiving mechanism and permit collection thereon of dislodged roof material during the exchange of mine cars.

89. In mining apparatus, the combination with supporting framework, of mechanism mounted on said framework in position to receive material detached from the roof of the mine chamber above said supporting framework, and a discharge device comprising swinging chute members carried by the rear end of said receiving mechanism.

90. In mining apparatus, the combination with a supporting frame, of a conveyer mounted thereon, and a discharge device carried directly by the rear end of said conveyer itself, said discharge device comprising chute members connected directly to the rear end of said conveyer.

91. In mining apparatus, the combination with a supporting frame, of a conveyer mounted thereon, a discharge device comprising a pair of chute members, and means for pivotally supporting said chute members to swing on longitudinal axes at the rear end of said conveyer to position said chute members immediately adjacent the rear end of said conveyer.

92. In mining apparatus, the combination with supporting framework, and mechanism comprising spaced-apart uprights and a connecting member in position to engage the roof of a mine chamber adjacent the range of mining operation at a coal vein below the plane of such roof, to positively and non-yieldingly anchor such framework in adjusted position while supporting the roof above the coal vein adjacent such space.

93. In mining apparatus, the combination with a supporting frame, of roof supporting mechanism comprising a plurality of spaced-apart upright supports mounted on said frame and a connecting member in position to engage the roof of a mine chamber approximately in the place of the upper surface of a mine vein, to support the strata of material of said mine vein during mining operations, and means for actuating said upright supports to force said connecting member against the roof to support the latter during mining operations.

94. In mining apparatus, the combination with a supporting frame, of roof jack mechanism comprising four upright legs connected to said frame and a head in position to engage the roof of a mine chamber to support the same during mining operations on a coal vein below the plane of such roof, and elevating mechanism connected between said frame and said upright legs to elevate said head against the roof to support the latter during mining operation.

95. In mining apparatus, the combination with a supporting frame, of roof supporting mechanism mounted on said frame to extend forwardly relative thereto in position to engage the roof of a mine chamber adjacent the space where mining operations are being carried on at a coal vein below the plane of such roof, said roof supporting mechanism comprising upright members and a horizontal connecting member supported by said upright members in position to engage the roof to support the same, and means for actuating the upright members to force said horizontal connecting member into roof supporting position.

96. In mining apparatus, the combination with supporting framework, of roof supporting mechanism at the forward portion of said framework, and pick mechanism mounted on the rear portion of said framework in position to dislodge material from the roof of the mine chamber back of said roof supporting mechanism.

97. In mining apparatus, the combination with a supporting frame, of a conveyor mounted thereon, means for delivering material to said conveyor, and discharge mechanism immediately adjacent the rear end of said conveyor and comprising chute members pivotally mounted to swing on spaced-apart axes substantially parallel to the path of travel of the material along said conveyor, said chute members being adapted to be swung toward each other on such axes to form a chute for directing the material discharged from said conveyor to a position centrally located relatively to the longitudinal length of the said supporting frame.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 26th day of August, A. D. 1915.

EDMUND C. MORGAN.

Witnesses:

THOS. COLSON,

A. J. CRANE.