Feb. 28, 1956 E. B. STEELE 2,736,546

MINING APPARATUS WITH CLEAN-UP DEVICE

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Fig. 1.

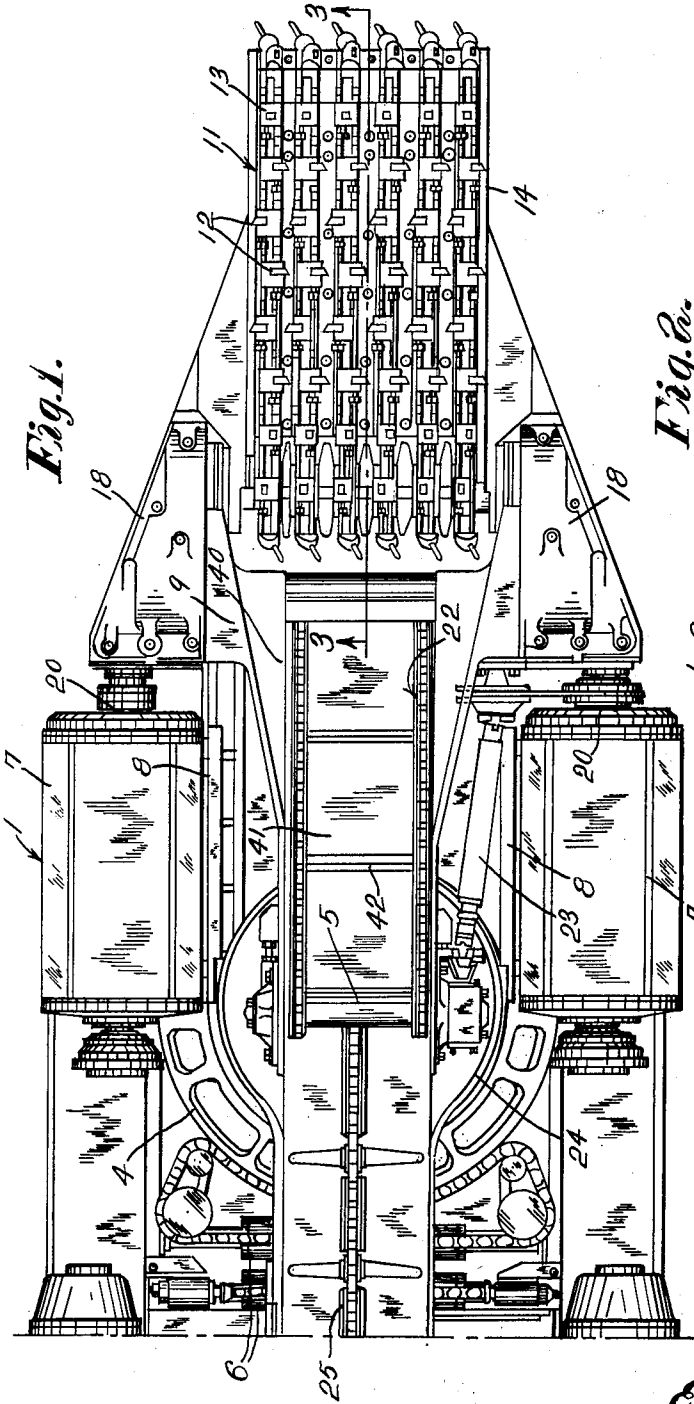
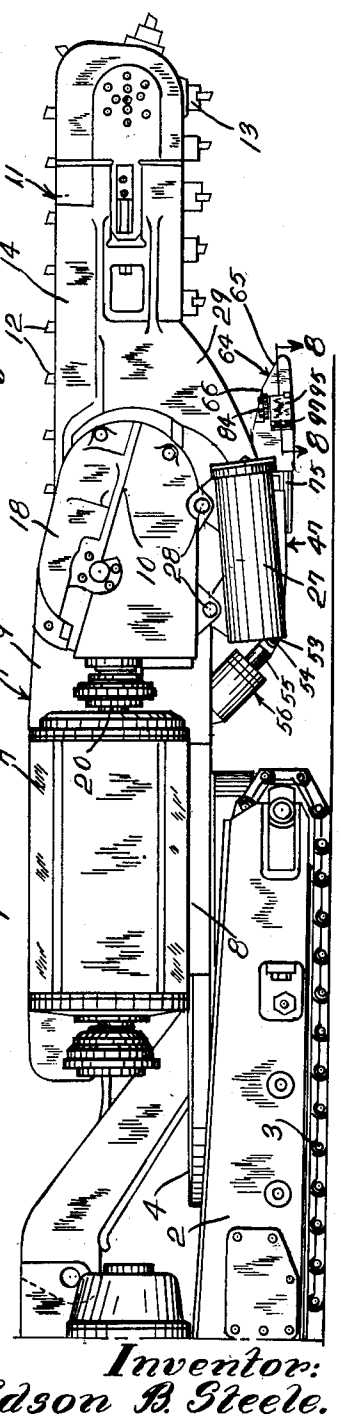


Fig. 2.



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MINING APPARATUS WITH CLEAN-UP DEVICE

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Fig. 3.

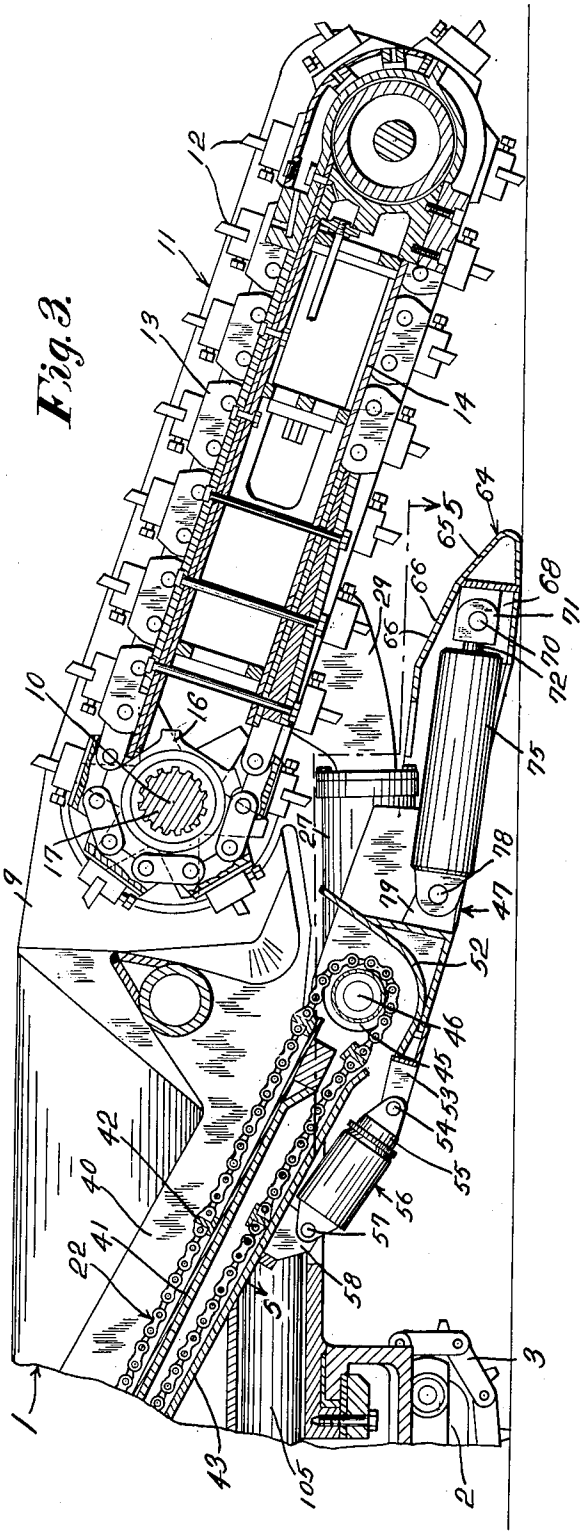
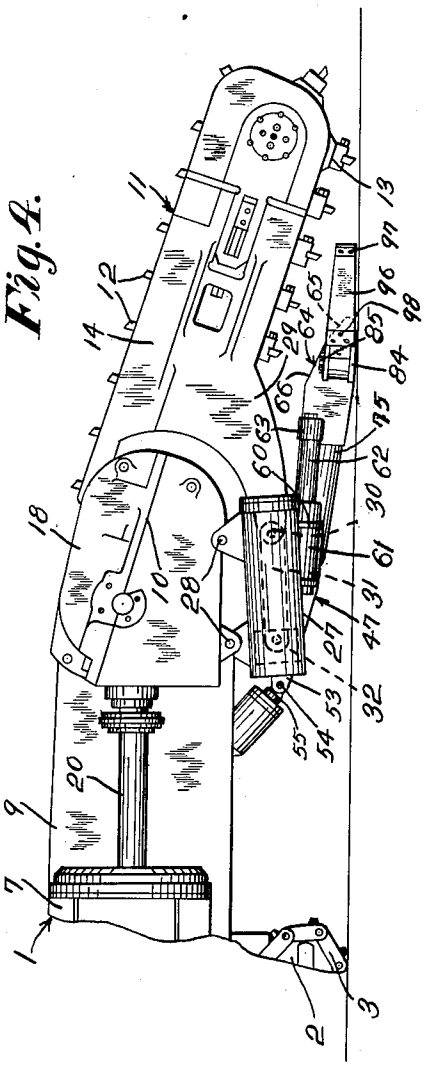


Fig. 4.



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MINING APPARATUS WITH CLEAN-UP DEVICE

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Fig. 5.

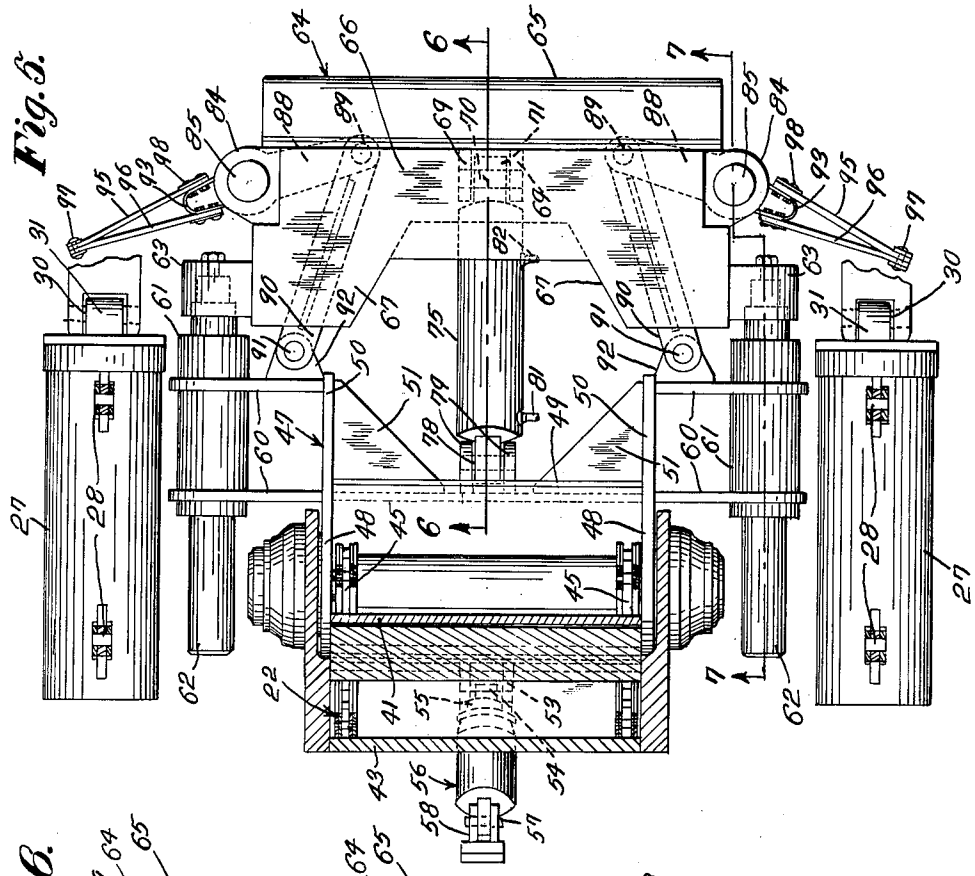


Fig. 6.

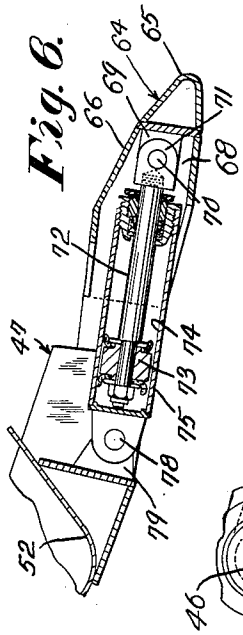


Fig. 7.

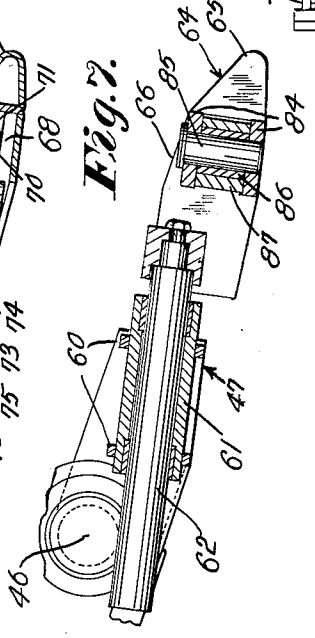
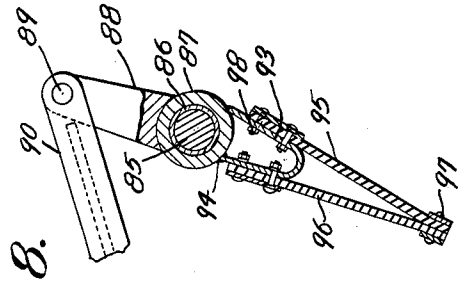


Fig. 8.



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MINING APPARATUS WITH CLEAN-UP DEVICE

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Fig. 9.

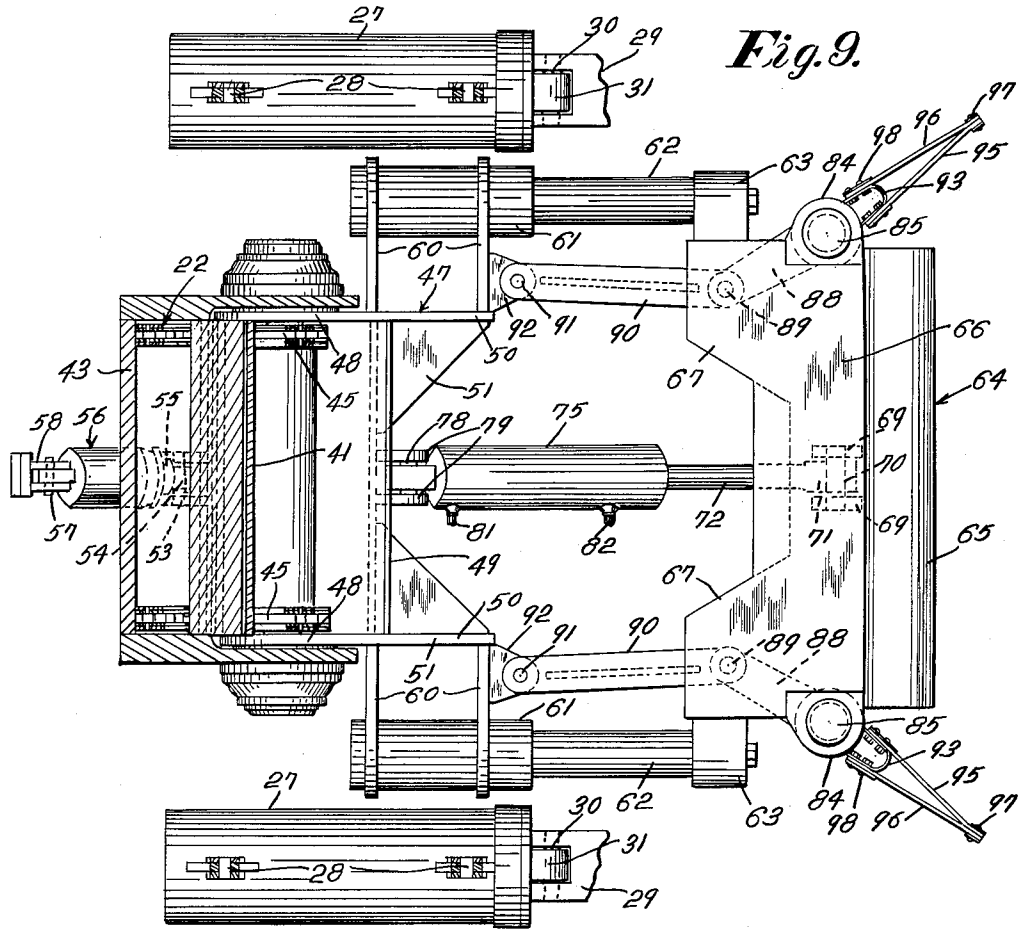
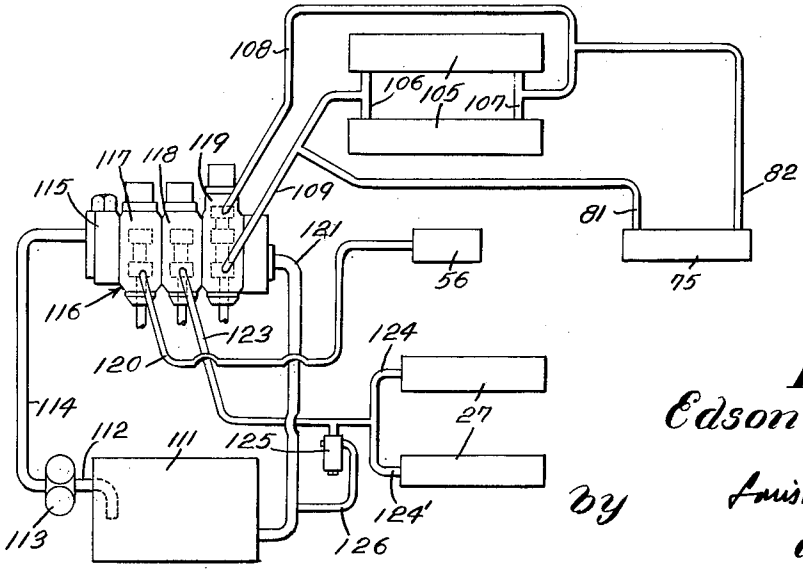


Fig. 10.



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United States Patent Office 2,736,546 Patented Feb. 28, 1956

2,736,546

MINING APPARATUS WITH CLEAN-UP DEVICE

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Application July 2, 1949, Serial No. 102,786

7 Claims. (Cl. 262—29)

My invention relates to mining apparatus, and more particularly to mining apparatus of the so-called "Continuous Miner" type.

"Continuous Miners" are apparatus for mining coal or other mineral from seams or veins in a relatively continuous process, effecting a disintegration of the seam or vein and the removal of the coal or other mineral detached from the seam or vein and delivering it to a desired transport system, all without intervening handling by manpower.

In a form of "Continuous Miner" which has recently come upon the market there is incorporated a tractor-supported base upon which a turntable is mounted for rotation upon a vertical axis. This turntable has on it means for disintegrating a mineral vein, means for receiving the material detached from the mineral vein and carrying it backward, and means for delivering the material so carried backward, to a transport system, such as one or more shuttle cars, a shaker conveyor or the like. The disintegrating mechanism includes, in the apparatus mentioned, a frame which is reciprocable radially of the turntable along different angularly related generally horizontal paths and a disintegrating apparatus per se which is mounted on said frame for swinging movement about a horizontal axis perpendicular to the path of reciprocation. This disintegrating apparatus includes a plurality of series of orbitally moving disintegrating elements traveling in similar elongated orbits and so spaced as to tear loose the mineral which they attack over a substantial width—on the order, but without limitation thereto, of two to three feet. The disintegrating apparatus is swingable upwardly at its forward end about the horizontal axis mentioned, and may be driven by power provided by motor means so supported as to be rotated upon rotation of the turntable, and so connected with the disintegrating apparatus that the sumping and withdrawing movements of the latter and the vertical swinging movements of the latter will not interrupt the drive of the disintegrating elements. The disintegrating apparatus is provided with hydraulic feeding and retracting cylinders and with hydraulic upswing cylinders, and a cycle of operation applied to a single vertical band of coal or other mineral includes, desirably, a sumping, entering attack on the coal or other mineral, a vertical upswinging movement during which usually the largest part of the coal in a particular band is torn loose from the face, and finally a retracting movement during which a roof generally parallel to the mine floor is formed. The coal or other mineral is torn from the face and disintegrated, and most of it is carried by the disintegrating elements rearwardly along the top of the disintegrating mechanism and delivered to a front receiving conveyor which conveys it back to a hopper in the well known form of apparatus mentioned, from which hopper the material is delivered to a desired discharge point by a rear conveyor. Successive vertical bands are removed across a face until the full width has been covered, and then another layer, so to speak, is progressively

mined out by the disintegration of its constituent vertical bands.

These machines as so far constructed have been found to have a need, for work in many mines, for cleanup devices because bug dust and some lumps, instead of being discharged to the delivery point of the machine, reach the mine floor in substantial quantity. The same need may of course exist in the case of other minerals. Some disintegrated mineral may escape at the partially open side of the upright bands while these are undergoing disintegration; some is detached with such force that it is thrown or bounces out of the front receiving conveyor, and some escapes downwardly through the spaces between the disintegrating elements as these are sweeping through the generally upwardly directed arcuate portions of their travel at the forward end of the disintegrating apparatus. In any event, enough coal (for example)—mostly fines—escapes to the mine floor to present a number of problems or complications which make the cleaning up of the bottom both desirable and worthwhile. While the fine material on the floor is more expensive to clean than the average material that goes over the miner conveyors, it is of real value, and unless it is loaded and taken out of the mine it represents a definite loss.

Such material increases fire and dust explosion hazards, and it is difficult and expensive to attempt by rock dusting to prevent these dangers.

A layer of loose material on the floor interferes with the setting of props, as the coal has to be shoveled aside so the props can be firmly supported on the floor. And the coal displaced in setting props may, since it is likely to be shoveled in front of the operator, not only add to the discomfort of the operator, but actually make things more unsafe for him in the event quick movement may be necessary.

From the standpoint of actual operation of the miner, if the bug dust be not removed, there will be more frequent need for adjustment of the lower limit of the disintegrating apparatus, as the level of the bottom of the miner will change with the thickness of the unremoved layer of coal. There will be a less stable foundation for the machine as it attacks the face; and, especially in low seams, it may be impracticable to use machines which could otherwise have been employed.

For all these, and perhaps other, reasons, it is highly desirable that provision be made to clean up the loose coal or other material from the mine bottom and effect its delivery with the other and main portion of the disintegrated product.

An object of the present invention is to provide an improved mining apparatus. Another object of the invention is to provide an improved mining apparatus including improved means for effecting the cleaning up from the mine floor of any material detached from a coal or other mineral seam or vein and which may escape to the mine floor. A further object of my invention is to provide an improved mechanism for moving loose material on the mine bottom into the range of operation of an apparatus which will pick it up from the floor and deliver it to a desired point. Still another object of my invention is to provide an improved floor cleaning arrangement including a loose-material pushing apparatus operatively connected with a moving part of a mining apparatus for actuation by the latter, and so connected with the latter as not only to move the material of which it changes the position on the mine floor, into the reach of the vein-attacking apparatus, but also so connected as to be kept out of possible interference with the vein-attacking apparatus as the vein-attacking apparatus is moved into a lower and retracted position. A further object of the invention is to provide an improved adjust-

able material moving apparatus. Yet a further object of the invention is to provide an improved disintegrating and floor cleaning arrangement for a mining apparatus including a disintegrating apparatus including moving disintegrating elements, a structure for moving loose material on the mine bottom within the reach of the disintegrating elements, and an improved arrangement for coordinating the relative movements of the parts. Other objects and advantages of the invention will hereinafter more fully appear.

In the accompanying drawings, in which one illustrative embodiment of the invention is shown for purposes of illustration:

Figs. 1 and 2 are respectively plan and side elevational views of the forward ends of a "Continuous Miner" in which the illustrative embodiment of the invention is incorporated.

Fig. 3 is an enlarged longitudinal vertical section in the plane of the line 3—3 of Fig. 1.

Fig. 4 is a view similar to the front half of Fig. 2, but with the parts illustrated shown in sumped position.

Fig. 5 is an approximately horizontal section in the planes of the section line 5—5 of Fig. 3, the view being an enlarged scale.

Fig. 6 is a detail sectional view in the plane of the line 6—6 of Fig. 5.

Fig. 7 is a detail sectional view on the plane of the line 7—7 of Fig. 5.

Fig. 8 is a fragmentary view, partially in section, and on an enlarged scale, the sectional portion on the plane of the line 8—8 of Fig. 2.

Fig. 9 is a view generally similar to Fig. 5, showing parts in a different position.

Fig. 10 is a diagrammatic view showing a hydraulic system.

Referring to the drawings, and first to Figs. 1, 2 and 3, thereof, it will be observed that I have shown at **1** a mining apparatus of the so-called "Continuous Miner" type. This includes a base **2** adapted to be transported by power driven tractor tread devices **3** and carrying a turntable **4** which may be rotated on a vertical axis **5** by a horizontally rotative force-applying means **6**. The turntable **4** carries a pair of motors **7**, **7** in stationary relation to it, and has guideways **8**, **8** in which there is reciprocable, radially of the turntable, a frame **9**, which pivotally supports, for swinging movement in vertical planes about a transverse axis **10**, a disintegrating mechanism **11** which includes a plurality of disintegrating elements **12**, herein shown as supported by circulating chains **13** guided in closed orbits on a built-up bar structure **14** (see Fig. 3). The chains **13** are driven by sprockets **16** carried by a splined shaft **17** which is driven by gearing (not shown) housed in gear boxes **18** supported by the sliding frame **9**; power being delivered to the gearing in these gear boxes by telescopic shafts **20** driven by the motors **7**. The disintegrating apparatus discharges to a front conveyor **22** of the flight type, and this conveyor is driven from one of the motors **7** through extensible transmission mechanism **23**. The front conveyor **22** discharges into a hopper **24** from which a suitable delivery conveyor **25**, of which only the forward portion is shown, delivers the material to a desired point rearwardly of the apparatus.

The disintegrating apparatus **11** is adapted to be swung vertically by power supplied by a pair of upswing cylinder and piston mechanisms **27** secured, as at **28**, to the bottom of the reciprocable frame **9**; and the frame **14** has at its opposite sides depending, rearwardly extending arms **29** pivotally connected at their inner ends, as at **30**, to pitmen **31** pivotally connected to pistons **32** reciprocable in the cylinders **27** and adapted to be moved forwardly in the cylinders by hydraulic fluid supplied under suitable control, and to be returned upon venting of the fluid by the weight of the disintegrating apparatus.

As so far described, the apparatus is essentially the same as that disclosed in the John R. Sibley application

Serial No. 102,996, filed July 5, 1949, which is a continuation-in-part of the John R. Sibley application Serial No. 47,422, filed September 2, 1948, now abandoned, both applications being owned by the assignee of the present invention. It is believed unnecessary to describe or illustrate the structure thus briefly adverted to and described, in any more detail, but if further description is desired, it may be had by reference to the patent which will be granted upon the said Sibley application.

The reciprocable structure **9** includes a material receiving trough structure **40** at whose bottom there is arranged a forwardly sloping deck plate **41** over which the flights **42** of the front conveyor **22** move rearwardly; the return run of this conveyor passes over a lower deck plate **43**. The trough structure supports a transversely extending idler roller **45** for the flight conveyor **22** and, pivotally supported for swinging about a horizontal axis in the same straight line with the axis of the idler roller **45**, which axis is indicated at **46**, is a frame **47** including a pair of rearwardly extending ear elements **48**, a transverse plate element **49**, forwardly extending side plate elements **50**, and reinforcing plates **51**.

The frame **47** also carries a troughlike element **52** which curves around the forward end of the flight conveyor **22** and which prevents forward escape of the material which may drop from the rear end of the disintegrating apparatus directly downward. The frame **47** has at its extreme rearward end ear elements **53** to which there is pivotally connected at **54** the front end of the piston element **55** of a cylinder and piston device **56** whose opposite end is suitably pivotally connected at **57** to depending plate portions **58** carried by the bottom deck plate **43**. The cylinder and piston mechanism **56** may be supplied with fluid under pressure at its rearward end for the purpose of tilting or swinging the frame **47** about the axis **46** and raising the forward end of the frame and the parts which are supported by the latter forwardly of the pivot **46**.

The frame **47** has oppositely laterally directed bracket elements **60** which receive within their outer ends guide members **61** in which guide rods **62**, herein shown as cylindrical guide rods, are reciprocable in a direction generally longitudinally of the frame **47**. These guides and guide rods are located to the outside of the forward end of the front conveyor **22** and inwardly of the cylinder and piston mechanisms **27** which effect upswing of the disintegrating apparatus **11**. At their forward ends the guide rods **62** support heavy ears **63** which are secured to the side portions of a shovel or pusher element **64**. This element **64** is a built-up structure, as shown, and includes a front nose portion **65**, a more flatly inclined top plate **66** disposed rearwardly of the nose portion **65**, and a pair of laterally spaced, generally horizontal portions **67** which extend back past the ears **63**. The element **64** has a chamber or open space **68** within it, within which there is mounted a pair of pivot supporting lugs or ears **69** to which there is pivotally connected, as at **70**, a member **71** supported at the front end of a piston rod **72**. This piston rod is provided with a piston **73** reciprocable in a bore **74** of a cylinder member **75** which projects forwardly into the shovel member in a retracted position of the latter and is pivotally connected at **78** on projecting ears **79** carried by the frame **47**. Fluid may be supplied through suitable conduits **81** and **82** to the opposite sides of the piston **73** to effect, in case of supply to the conduit **81**, advance of the element **64**, and in the case of the supply to the conduit **82** and venting of the conduit **81** retraction of the shovel. The element **64** carries ear portions **84** projecting from its opposite sides, and these have pivot pins **85** extending between them and surrounded by bushings **86** on which the herein cylindrical sleeve portions **87** of pivoted arms **88** are turnable. The arms **88** extend towards each other and are connected, as at **89**, with link elements **90** whose opposite ends are pivotally connected, as at **91**, to ears **92** supported, as shown, by the forward ones of the

bracket elements 60. At the other sides of the sleeve portions 87 are arms 93 welded, as at 94, to the sleeve portion 87 and which are made so as to possess a certain resilience. Pusher arms 95 which include opposite plate portions 96 are secured together at their outer ends, as at 97, and at their inner ends are bolted, as at 98, to the arms 93. The pusher arms 95 possess a certain amount of give in the event that they strike an element difficult to move.

The mode of operation of this apparatus will be readily understood. It will be noted that the element 64 may be lifted off of the mine floor by supplying fluid to the cylinder and piston device 56, or allowed to rest under its own weight on the mine floor when fluid is vented from the cylinder and piston device 56. Upon supply of fluid to the connection 81, the element 64 will be advanced relative to the frame 47 and it will be noted that the frame 47 is itself advanced and retracted respectively during the sumping and withdrawing operations of the disintegrating apparatus; and during the sumping movement of the disintegrating apparatus the element 64 will push forward the material in front of it along the mine bottom and move this material towards the zone of operation of the forwardly moving lower run of the disintegrating chains 13 of the disintegrating apparatus 11. In order that the material on the mine bottom may be brought still closer to the lower run of the disintegrating apparatus, and in order that a wider zone may be swept upon the mine bottom, the shovel mechanism or pusher mechanism described has been provided. Fig. 5 shows this in retracted position relative to the frame 47, and Fig. 9 shows it in advanced position. Upon the supply of fluid to the connection 81, the piston 73 will be moved forwardly in the cylinder 75 and it will advance the frame by which the pusher element 64 is supported. As this frame is advanced, the pivotal supports for the arms 88 will also be advanced, and as the inner ends of these arms are connected by the links 90 to the relatively stationary frame 47, the free ends of the arms will be swung from the position shown in Fig. 5 and moved into the positions shown in Figs. 4 and 9, their outer ends sweeping through lines which are the resultant of the rectilinear advance of the pivots and the swinging movement of the arms. This crowds the material outwardly of the ends of the shovel or pusher element 64 inwards towards the path of movement of this member, and accordingly the material on the mine bottom or floor for a substantial width is pushed forwardly where it will be swept by the disintegrating elements 12 forwardly towards the face and then upwardly onto the disintegrating mechanism, and rearwardly along the latter.

In Fig. 10 there is shown in simple form a hydraulic system adapted for the control of the mechanism which functions during the cleanup of the mine floor. The sumping and withdrawing cylinders for effecting sumping and retraction of the disintegrating apparatus 11 are shown at 105 in the diagram, and one of them is also shown in part in Fig. 3. These are double acting cylinders, since they both advance and retract the disintegrating mechanism, and they are connected together at their opposite ends by cross connections 106 and 107. A conduit 108 serves to supply fluid to the front ends of the cylinders 105, and a conduit 109 to supply fluid to the rearward ends of the cylinders 105. As it is desired to move the material on the mine bottom forwardly into the paths of travel of the disintegrating mechanism before the sumping operation is started, I have provided an arrangement whereby the shovel is advanced when fluid is supplied to the cylinders 105 to effect advance of the disintegrating mechanism (and in fact before such advance takes place), and whereby the shovel is retracted when fluid is supplied to the sumping and withdrawing cylinders 105 to effect the withdrawing operation. Accordingly, the conduit 81 is connected to the conduit 109, and the conduit 82 to the conduit 108; and since the forces necessary to move the shovel will be less than those necessary to effect sumping and withdrawing movements of the disintegrating apparatus, the shovel 64 will be advanced at the start—prior to the start, ordinarily—of sumping of the disintegrating mechanism, and will push the loose material on the mine floor ahead of it into reach of the disintegrating elements before the sumping movement commences.

Continuing further with the description of the hydraulic system, it will be noted that a tank 111 supplies fluid through a suction connection 112 to a suitably driven hydraulic pump 113 which discharges through a conduit 114 into the pressure relief valve section 115 of a plural unit valve box 116. This valve box includes: a valve unit 117 for controlling the cylinder and piston mechanism 56 which raises the cleanup mechanism for transport; a valve unit 118, which controls the supply and venting of fluid to the upswing cylinders 27; and a valve unit 119, which controls the supply and venting of fluid to the conduits 108 and 109 and associated conduits 82 and 81. The valve unit 117 controls the flow of fluid through the conduit 120 to the lift cylinder 56, and its venting from that cylinder back to a return line 121. The valve unit 118 controls the flow of fluid through a conduit 123 and the branch conduits 124 and 124' leading to the rear ends of the upswing cylinders 27. An appropriately loaded relief valve 125 is openable to connect the conduit 123 with a return conduit 126 opening into the main return conduit 121 when the disintegrating mechanism is subjected to excessive downward forces when the fluid supply to it is cut off by the valve unit 118. It will be appreciated that in the neutral or off positions of each of the valve units 117, 118 and 119 there is a free flow, due to the construction of these units, from the conduit 114 to the conduit 121, which free flow is interrupted when any of the valve units is effecting the supply of fluid to the hydraulic mechanism which it controls. The relief valve in the relief valve section 115 controls the pressure of the fluid supplied to the sumping and withdrawing cylinders 105 and to the lift cylinders 56, as well as the pressure supplied to the upswing cylinders 27, the latter, however, being provided with additional protection through the presence of the relief valve 125.

A very brief further description may be given. Assuming that the disintegrating mechanism is properly positioned for sumping cut and that the fluid is vented from the cylinder and piston device 56 so that the pusher element or shovel 64 is resting on the mine floor, it will be appreciated that upon the supply of fluid to the conduit 109 under control of the unit 119, fluid will flow through the conduit 81 to the cylinder 75 and cause the pusher element to move the material on the mine bottom forwardly so that it may be picked up by the return runs of the disintegrating chains and delivered to the hopper 24. During the forward movement of the piston 73 the sweeper arms 95 will be swung towards each other and forwardly as the pusher plate 64 moves ahead. As soon as the forward movement of this pusher structure has been completed, the pressure in the rear ends of the sumping cylinders 105 will be effective to cause a sumping movement of the disintegrating apparatus, and it will be understood that the chains 13 have been circulating as the pusher 64 was moved forward, and so picked up the material brought into its reach, off of the mine bottom. When sumping has been completed the valve device 119 will be operated to shut off the supply of fluid to the conduit 109 and to the pusher operating cylinder 75. Fluid will then be supplied under control of the valve device 118 to effect upswing of the disintegrating apparatus. When this upswing has proceeded to the desired height the valve unit 118 will be manipulated to shut off the fluid supply to the cylinder 27 and trap fluid in them; and the valve unit 119 will then be manipulated to effect a delivery of fluid to the conduit 108 and through it to the conduit 82. The

cleanup arrangement **64**, etc. will therefore be immediately retracted, and then fluid admitted to the conduit **108** will act in the cylinders **105** and effect retraction of the disintegrating apparatus. At the conclusion of this retractive movement the valve unit **119** may be manipulated to cut off fluid supply. When the fluid is vented from the cylinders **27** and the turntable has been turned to reposition the disintegrtaing apparatus for a new attack, the disintegrating apparatus will be lowered to bring its tip down to the mine bottom, and it will clean up the material at the base of the band it is about to attack.

It will be observed that the cleanup arrangement described is simple, that it is coordinated in its movements with the movements of the disintegrating device, that it cleans up a relatively wide path, and that it cooperates with the disintegrating mechanism in such a manner as to cause the latter to effect the actual pickup of the loose material from the mine bottom.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim is:

1. In combination, a base, pivots carried by said base, guides carried by said base, a pusher element supported by said guides, cylinder and piston mechanism for advancing and retracting said pusher element relative to said guides, material-gathering arms pivotally supported on said pusher element, and links extending between said arms and said pivots carried by said base and connected to said arms and to said pivots for effecting swinging of said arms upon advance and retraction of said pusher element.

2. In combination, a base, a tiltable support carried by said base, guides carried by said tiltable support, a pusher element supported by said guides, and cylinder and piston mechanism for advancing and retracting said pusher element relative to said guides, material-gathering arms pivotally supported on said pusher element, and links extending between said arms and said tiltable support for effecting swinging of said arms upon advance and retraction of said pusher element.

3. In combination, a base, a tiltable support carried by said base, guides carried by said tiltable support, a pusher element supported by said guides, and cylinder and piston mechanism for advancing and retracting said pusher element relative to said guides, material-gathering arms pivotally supported on said pusher element, and links extending between said arms and said tiltable support for effecting swinging of said arms upon advance and retraction of said pusher element, said links pivotally connected to said arms at points at the sides of their respective pivots away from the material-engaging ends of the arms.

4. In combination, a base, a frame supported on said base for reciprocation relative to the latter, said frame having longitudinally extending guideways at its opposite sides, a pusher element, guide rods secured to said pusher element at its opposite sides and guided by said guideways, advancing and retracting means acting on said pusher element at a point midway between the sides thereof, pivots on said pusher element at its opposite sides, swingable arms mounted on said pivots and having portions extending in opposite directions from their respective pivots, and link means connecting like portions of said arms with said frame.

5. In combination, a base, a frame on said base mounted for reciprocation relative thereto, a disintegrating apparatus supported on said frame for movement relative thereto in upright planes and for movement with said frame to effect sumping and withdrawing, a material-pushing device extending across the front end of the frame and reciprocably supported by said base for forward and rearward movement relative to said frame in the planes of swing of said disintegrating apparatus, and means for effecting advance and retraction of said device relative to said frame and of said disintegrating apparatus relative to said base including cylinder and piston mechanism for effecting advance and retraction of said device, and other cylinder and piston mechanism for effecting advance and retraction of said disintegrating apparatus and means for supplying operating fluid to said cylinder and piston mechanisms including fluid supply connections a portion of which is common to the supply of fluid to both cylinder and piston mechanisms and a control valve common to both of said cylinder and piston mechanisms.

6. In combination, a base, a frame mounted for advance and retraction with respect to said base, disintegrating apparatus supported by said frame, material pushing means supported by said frame for forward and rearward movement relative to the latter and to said disintegrating apparatus, and means (*a*) for advancing said pushing means relative to said frame and to said disintegrating apparatus and for thereafter advancing said disintegrating apparatus and said pushing device concurrently at like rates and (*b*) for retracting said pushing means relative to said frame and to said disintegrating apparatus and for thereafter retracting said disintegrating apparatus and said pushing device concurrently at like rates including cylinder and piston mechanism associated with said pushing means for advancing and retracting it relative to said disintegrating mechanism and cylinder and piston mechanism associated with said frame for advancing and retracting it relative to said base, said first mentioned cylinder and piston mechanism having a greater ratio of power to load as it performs its working strokes than the second as the latter performs its working strokes, when both are supplied with fluid at the same pressure, and means for subjecting both of said cylinder and piston mechanisms concurrently to pressure fluid at the same source pressure.

7. In combination, a base, a frame mounted for advance and retraction with respect to said base, disintegrating apparatus supported by said frame, material pushing means supported by said frame for forward and rearward movement relative to the latter and to said disintegrating apparatus, and means (*a*) for advancing said pushing means relative to said frame and to said disintegrating apparatus and for advancing said disintegrating apparatus and said pushing device concurrently at like rates and (*b*) for retracting said pushing means relative to said frame and to said disintegrating apparatus and for thereafter retracting said disintegrating apparatus and said pushing device concurrently at like rates including cylinder and piston mechanism associated with said pushing means for advancing and retracting it relative to said disintegrating apparatus and cylinder and piston mechanism associated with said frame for advancing and retracting it relative to said base, and means for subjecting both of said cylinder and piston mechanisms concurrently to pressure fluid, said first mentioned cylinder and piston mechanism having a greater ratio of power to load as it performs its working strokes than the second as the latter performs its working strokes, when both are so supplied with fluid.

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2,269,781	Osgood	Jan. 13, 1942
2,334,323	Gilbert	Nov. 16, 1943
2,561,529	Mongan et al.	July 24, 1951