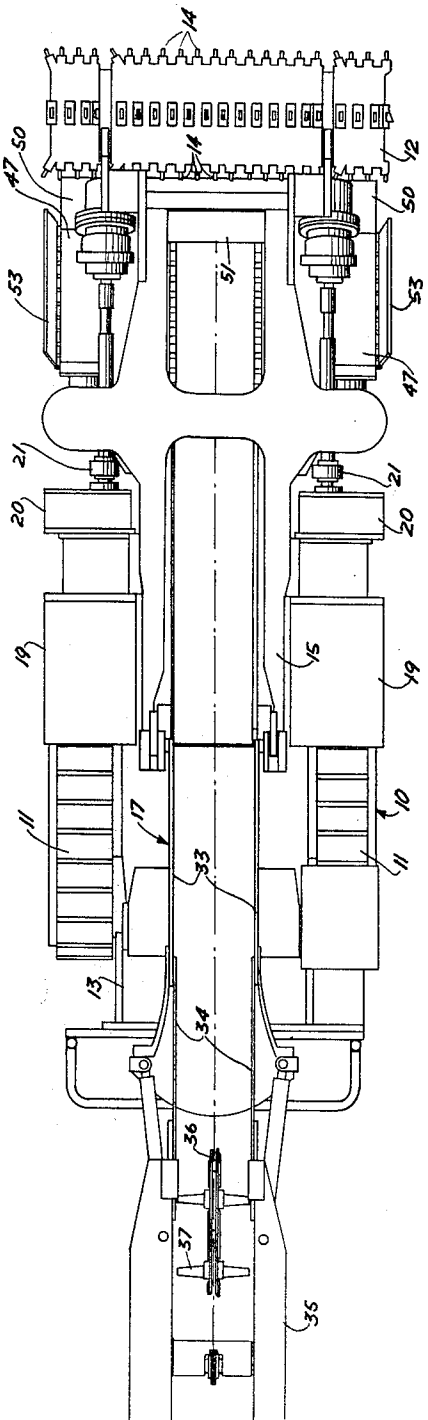
Feb. 16, 1965 R. C. LUNDQUIST 3,169,797

MATERIAL COLLECTING MEANS FOR CONTINUOUS MINING MACHINE

Filed Oct. 17, 1962 3 Sheets-Sheet 1

Fig. 1



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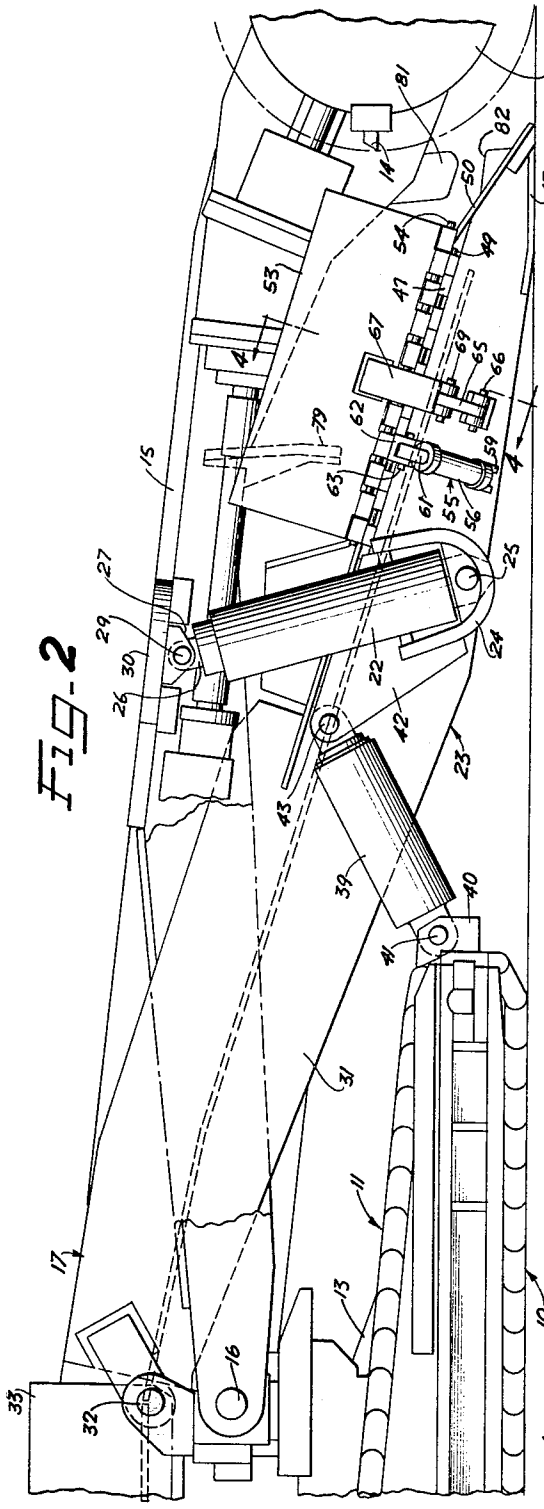


Fig. 2

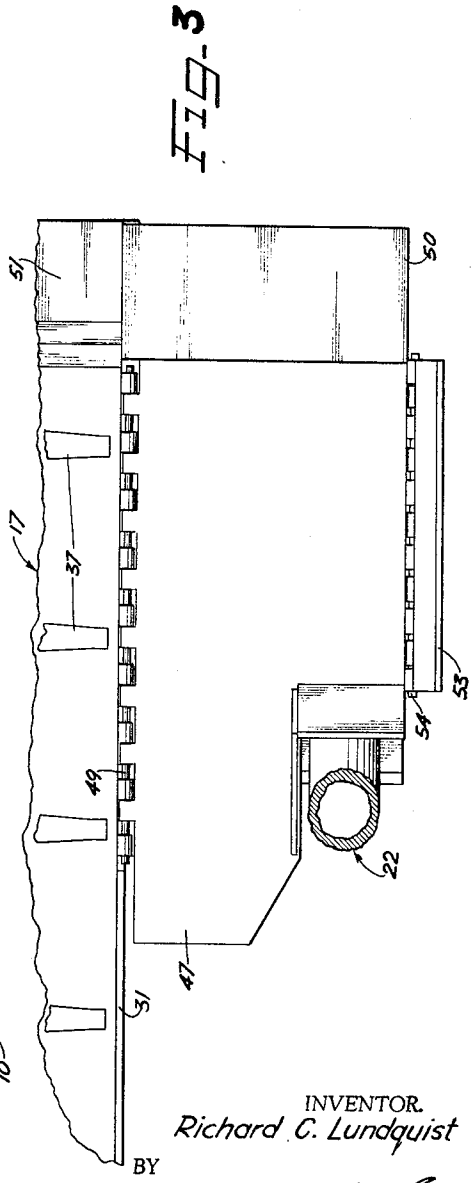


Fig. 3

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MATERIAL COLLECTING MEANS FOR CONTINUOUS MINING MACHINE

Filed Oct. 17, 1962 3 Sheets-Sheet 3

Fig. 4

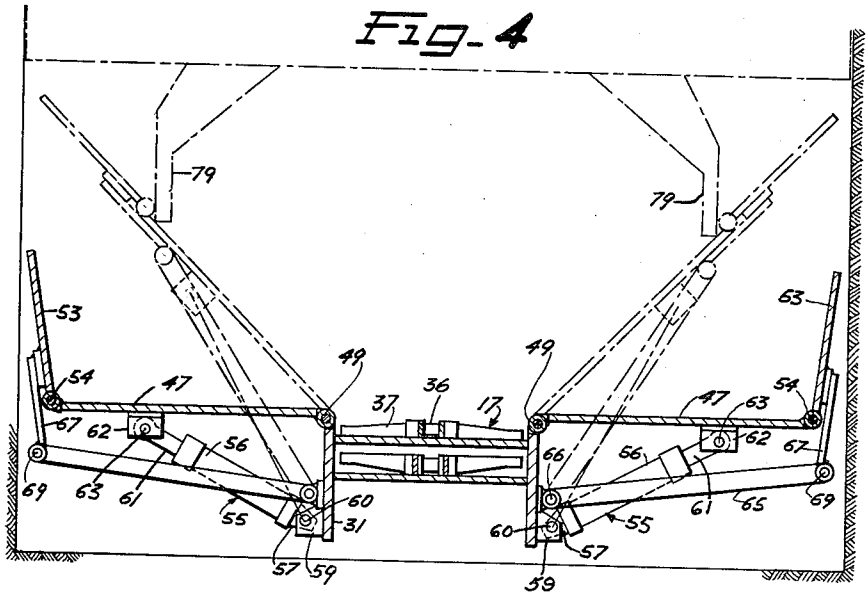
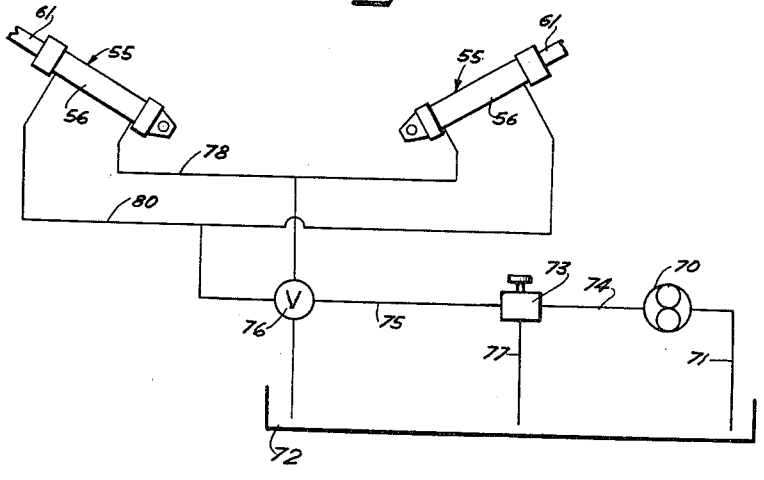


Fig. 5



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MATERIAL COLLECTING MEANS FOR CONTINUOUS MINING MACHINE

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Filed Oct. 17, 1962, Ser. No. 231,096
11 Claims. (Cl. 299—64)

This invention relates to improvements in continuous mining machines and more particularly relates to an improved means for collecting and transferring the mined material to the conveyor of the machine.

A principal object of the invention is to improve upon the continuous mining machines heretofore in use by providing a simplified and improved cuttings collecting device following the mining head during mining and forming a material collecting and transferring hopper of substantially uniform width in all vertical positions of the mining head, for transferring the mined material onto the conveyor of the machine.

A further object of the invention is to provide an improved means for collecting the material mined by ripper type mining heads and transferring the material to the conveyor of the machine in the form of aprons extending laterally from opposite sides of the conveyor of the machine and longitudinally pivoted thereto to be extended for substantially the width of the working place when the mining head is in position to be sumped into the working face along the ground and following the mining head during upward cutting movement thereof and extensible during the operation of following the mining head to present a material collecting area extending substantially to the ribs of the working place during the entire operation of mining a working place.

A still further object of the invention is to provide an improved form of continuous mining machine having a transversely pivoted boom extending in advance of the main frame of the machine over a material collecting conveyor, and having a transversely extending mining head supported at its forward end to mine by rotational movement of the mining head and upward feeding movement thereof effected by upward swinging movement of the boom, in which aprons longitudinally pivoted to opposite sides of the conveyor of the machine form a material collecting means transferring material to the conveyor of the machine and are moved vertically about their longitudinal pivotal axes upon vertical movement of the boom under the control of the boom, and have side boards extending along and pivotally connected to the outer ends thereof extending the aprons during upward pivotal movement thereof to maintain the material collecting areas of the aprons into positions at substantially the ribs of the working place during the entire scope of vertical feeding movement of the boom.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

FIGURE 1 is a top plan view of a continuous mining machine constructed in accordance with the principles of the invention;

FIGURE 2 is an enlarged partial fragmentary view in side elevation of the forward end portion of the machine, showing the boom supporting the mining head in position to be sumped into a working face;

FIGURE 3 is a fragmentary plan view of one side of the machine, showing a material collecting apron and side board in the position shown in FIGURES 1 and 2;

FIGURE 4 is a transverse sectional view taken substantially along line 4—4 of FIGURE 2; and

FIGURE 5 is a diagrammatic view showing an illustrative form of fluid system controlling vertical swinging movement of the material carrying aprons of the machine.

In FIGURES 1 and 2 of the drawings, I have shown a continuous mining machine 10 mounted on laterally spaced continuous traction tread devices 11. The traction tread devices 11 serve to transport the machine from working place to working place and to sump a rotary mining head 12, extending transversely of a main frame 13 of the machine into the working face of a mine. The mining head 12 is a drum type of mining head having cutter bits 14 projecting from the periphery thereof and is fed vertically along the working face from the floor to the roof of the mine by a boom 15 supporting the mining head at its forward end, and transversely pivoted to the main frame 13 of the machine on transverse pivot pins 16.

The continuous mining machine 10 is commonly called a ripper type of mining machine and operates on principles similar to those shown and described in my application Serial No. 67,267, filed November 4, 1960, now forfeited.

As shown in FIGURES 1 and 2, the boom arm 15 is transversely pivoted to the main frame of the machine along opposite sides of a conveyor 17 and extends over the top of said conveyor in advance of the forward end thereof and supports the rotary mining head 12 at its forward end for rotation about an axis extending transversely of the main frame of the machine.

Motors 19 extend along opposite sides of the boom 15 and have speed reducer housings 20 at the forward ends thereof, forming continuations of the motor housings. The speed reducer housings 20 contain conventional speed reduction gearing (not shown) therein.

The speed reduction gearing contained in the housing 20 forms a means for driving flexible and universal drive connections 21, driving the mining head 12 through bevel geared drive connections (not shown) in a manner similar to that shown and described in my application Serial No. 67,267, and no part of the present invention so not herein shown or described further.

The boom 15 and mining head 12 are elevated by hydraulic jacks 22 extending along opposite sides of an inclined elevating frame structure 23 of the conveyor 17. As shown in FIGURE 2, a stirrup 24 extends laterally from each side of the inclined frame structure 23, intermediate the ends thereof, and has the jack 22 pivotally connected thereto on a transverse pivot pin 25. The opposite end of the hydraulic jack 22 is shown as being in the form of a piston rod 26, pivotally connected between connector ears 27 on a transverse pivot pin 29. The connector ears 27 depend from an upper plate portion 30 of the boom 15.

The inclined elevating frame structure 23 of the conveyor, includes parallel spaced side plates 31 transversely pivoted at their rear ends to the main frame 13 on transverse pivot pins 32 shown in FIGURE 2 as being disposed above the pivot pins 16 and in general vertical alignment therewith. The side plates 31 slidably extend within side plates 33 of the conveyor 17, extending along the main frame 13 in parallel relation with respect to each other. The side plates 33 terminate into flexible side walls 34, connecting the side plates 33 to a rear laterally swingable discharge trough section 35 of the conveyor, positionable to discharge the mined material into shuttle cars and the like.

The material moving structure of the conveyor 17 is generally shown in FIGURE 1 as being of the conventional single strand laterally flexible endless chain and flight type including a center strand chain 36 having flights 37, 37 spaced therealong and extending laterally from opposite sides thereof.

Hydraulic jacks 39 extend forwardly of the forward end of the main frame 13 and are pivoted at one of their

ends to said main frame, between ears 40 extending forwardly of the main frame 13, on pivot pins 41. The jacks 39 are pivoted at their opposite ends between connector brackets 42, spaced outwardly of the side plates 31 of the frame structure 23, on pivot pins 43. The jacks 39 are provided to elevate the inclined elevating frame structure 23 above the ground when it is desired to tram the machine from working place to working place and to accommodate a ground engaging shoe 45 extending transversely of the inclined frame structure 23 along the bottoms of the side plates 31 and laterally beyond said side plates to slidably engage the ground during the operation of mining.

Referring now in particular to the extensible material collecting and transferring hopper of the invention, collecting and transferring the material mined by the mining head 12 onto the conveyor 17, an apron 47 extends along the upper end portion of each side plate 31, for a portion of the length thereof. Each apron interleaves the upper end portion of an associated side plate and is pivotally connected thereto as by a hinge pin 49 extending generally parallel to the side plate 31. Each apron 47 has an inclined shovel-like plate 50 forming a continuation of the forward end thereof. Each shovel-like plate 50 is inclined downwardly toward the ground at a steeper angle than the angle of the apron 47 and engages the ground at its forward end when the apron is in the position shown in FIGURE 2. The shovel-like plates 50 overlap the outer end portions of an inclined shovel-like plate 51, extending across the front of the conveyor and connected to the shoe 45 at its lower end.

The inclined shovel-like plates 50, 50 and 51, provide a wide front shovel edge to be forced under the pile of loose coal mined, when the mining head 12 is in position to be sumped along the ground and is sumped into the mine face to initiate a vertical mining operation from the floor to the roof of the mine.

Each apron 47 is interleaved at its outer side by a side board 53 pivotally connected to said apron by a pivot pin 54, extending parallel to the pivot pin 49.

The aprons 47, 47 are raised and lowered together by hydraulic jacks 55, 55. As shown in FIGURE 4, each hydraulic jack 55 includes a cylinder 56 having an ear 57 extending from the head end thereof between parallel spaced brackets 59 extending laterally of the side plate 31 and pivotally connected thereto as by a pivot pin 60.

A piston rod 61 extensible from the cylinder 56 extends between connector brackets 62 depending from the underside of the apron 47 and is pivotally connected thereto as by a pivot pin 63.

The side boards 53 are moved from the upwardly extended positions shown in FIGURES 1, 2, 3 and 4 to the outwardly extended positions shown by broken lines in FIGURE 4 by links 65 connected to the outer sides of the side walls 31, on pivot pins 66. The outer ends of the links 65 are pivotally connected to rigid arms 67 welded or otherwise secured to the undersurfaces of the side boards 53 and extending downwardly therefrom, when the side boards are in their upwardly extended positions shown in FIGURE 4. Pivot pins 69 pivotally connect the links 65 to the arms 67.

Thus, as the aprons 47 are pivoted upwardly about the axes of the hinge pins 49, the side boards 53 will be pivoted about the hinge pins 54 to maintain said side boards in extended relation with respect to the aprons 47 during upward movement of said aprons to provide cuttings collecting and transferring surfaces extending substantially to the ribs of the working face during the entire mining operation, to thereby provide a generally uniform cuttings collecting and material transferring area, for transferring the material mined by the mining head 12 onto the conveyor 17.

An illustrative form of fluid pressure diagram showing a part of the fluid pressure system of the machine and the fluid pressure connections to the hydraulic jacks 55, is shown in FIGURE 5. As shown in this figure a pump 70 has an intake line 71 leading from a fluid storage tank 72. The output of the pump 70 is connected with a variable pressure relief valve 73 through a pressure line 74. The variable pressure relief valve 73 governs the pressure in a pressure line 75 leading from said relief valve and connected with a four way valve 76. A return line 77 leads from the relief valve 73 to the tank 72.

The four way valve 76 is connected with the head ends of the cylinders 56 by pressure lines 78. The four way valve 76 is operable to raise and lower the aprons 47 by manual operation of the valve. The valve 76 also may continuously supply fluid under pressure to the head ends of the cylinders 56 and bias the aprons 47 into upwardly extended relation with respect to the conveyor 17 into the positions shown by dot dash lines in FIGURE 4. The relief valve 73 is set to govern the pressure in the cylinders 56 and to accommodate downward movement of the aprons 47 upon engagement of the top surfaces of said aprons with stop legs 79 depending from opposite sides of the boom 15 when the operator may neglect to turn the valve 76 to supply fluid under pressure to the piston rod ends of the cylinders 56, to lower the aprons 47, or where it may be desired to have the aprons automatically follow the boom and mining head. Pressure lines 80 lead from the valve 76 to the piston rod ends of the cylinders 56, to retract aprons 47 by operation of the valve 76.

During the operation of sumping the mining head 12 into the working face when positioned to cut along the ground, there will be a space between the bottoms of the stop legs 79 and the aprons 47. As, however, the mining head is sumped into the working face and upward feeding movement thereof is started, the valve 76 may be turned to supply fluid under pressure to the head ends of the cylinders 55 and move the aprons 47 upwardly about the hinge pins 49 into engagement with the stop legs 79. The hand may then be taken from the controls of the valve 76 and the aprons 47 may move upwardly with the boom 15 following the stop legs 79 to their extended positions shown in FIGURE 4, limited by the strokes of the hydraulic jacks 55. If required, the boom may then move away from the aprons 47 to feed the mining head 12 upwardly to the roof of the mine.

Upon downward movement of the boom 15 the stop legs 79, 79 engaging the aprons 47, 47 will move said aprons downwardly about the axes of the hinge pins 49 against the hydraulic bias of the cylinders 56 controlled by the relief valve 73.

During the operation of sumping the mining head 12 into the working face, the aprons 47 and sideboards 53 may be retained in the upright positions shown in FIGURE 4. As the mining head is sumped into the working face to the required depth and the hydraulic jacks 22 are put into operation to feed the boom 15 and mining head 12 upwardly towards the roof of the mine, the valve 76 may be turned by the operator of the machine to admit fluid under pressure to the head ends of the cylinders 56 and move the aprons 47 upwardly to follow the boom 15 and to effect opening of the sideboards 53 as the aprons 47 move upwardly. The relief valve 73 may be set to supply just enough pressure to cause the aprons to follow the stop legs 79. The operator of the machine may thus remove his hand from the control lever for the valve 76 and the aprons 47 will be swung upwardly under control of the stop legs 79 until they reach their limit of upward travel.

Upon lowering movement of the boom, the stops 79 engaging the aprons 47 will pivot said aprons downwardly against the hydraulic bias in the cylinders 56, until the stops 79 reach the lower ends of their travel. Where desired the valve 76 may then be operated to admit fluid under pressure to the piston rod ends of the cylinders 56 and lower the aprons 47 to the positions shown in FIGURE 4.

The boom arm 15 also has a stop 81 depending from its forward end portion just rearwardly of the mining head

12. This stop is engageable with a stop 82 on the shovel-like plate 51, to limit downward movement of the mining head 12 and to prevent the mining head from cutting into the shovel-like plates 50 and 51.

It may be seen from FIGURE 2 that when the mining head 12 is cutting along the ground the stop 81 is spaced above the abutment 82. This spacing is provided to enable the mining head 12 to be adjusted to cut below the floor line, when desired.

The aprons 47 and side boards 53 thus form an extensible hopper of a substantially uniform width in all positions of the aprons with respect to the conveyor 17, for collecting and transferring the material mined onto said conveyor.

It should here be noted that while the aprons 47 and side boards 53 usually follow the mining head during the mining operation, that said aprons and side boards need not follow the mining head, but may remain in their lowermost positions shown in FIGURE 4 and allow the mined material to be deposited thereon, and then may be periodically raised to cause the material deposited thereon to flow onto the conveyor.

While I have herein shown and described one form in which my invention may be embodied, it may readily be understood that various variations and modifications in the invention may be attained without departing from the spirit and scope of the novel concepts thereof as defined by the claims appended hereto.

I claim as my invention:

1. In a continuous mining machine,
a main frame,
a boom transversely pivoted to said main frame and extending in advance thereof,
a rotary mining head supported on said boom for rotation about an axis extending transversely of said main frame,
means for vertically moving said boom with respect to said main frame and feeding said mining head vertically along a mine face,
a conveyor extending along said main frame and having an inclined elevating forward end portion extending in advance of said main frame in a downwardly inclined direction into engagement with the ground,
inclined aprons extending along opposite sides of said conveyor and laterally therefrom and mounted on said conveyor for angular movement with respect thereto about axes extending longitudinally of said conveyor and parallel to the plane of travel thereof and engaged by said boom when said boom is in a lowermost position,
and fluid pressure operated means pivotally connected between said conveyor and aprons, pivotally moving said aprons upwardly to follow said boom and form an inclined hopper terminating at said conveyor.

2. A continuous mining machine in accordance with claim 1 wherein side boards are pivotally connected to and extend along the outer sides of said aprons and cooperate with said aprons to form a movable hopper of uniform width for transferring the mined material to said conveyor, and wherein linkage connections are provided between opposite sides of said conveyor and said side boards to extend said side boards outwardly with respect to said aprons upon upward pivotal movement of said aprons.

3. In a continuous mining machine,
a main frame,
a boom transversely pivoted to said main frame and extending in advance thereof,
a rotary mining head supported by said boom for rotation about an axis extending transversely of said main frame,
means for vertically moving said boom with respect to said main frame and feeding said mining head vertically along a mine face,

a conveyor extending along said main frame and having an inclined elevating trough portion extending in advance of said main frame downwardly into position to engage the ground, the inclined elevating trough portion of said conveyor having a steeply inclined shovel plate extending across the forward end thereof to a position adjacent the ground,
material retaining aprons extending along opposite sides of said elevating trough portion and pivotally connected thereto for movement about axes extending longitudinally of said trough portion,
hydraulic jack means connected between said trough portion and said aprons for pivoting said aprons upwardly,
and engaging connections between said boom and said aprons accommodating said aprons to follow said boom upon angular upward movement thereof upon the admission of fluid under pressure to said hydraulic jack means to pivot said aprons upwardly, and moving said aprons downwardly upon downward movement of said boom upon the release of pressure in said hydraulic jack means.

4. In a continuous mining machine,
a main frame,
a boom transversely pivoted to said main frame and extending in advance thereof,
a rotary mining head supported by said boom for rotation about an axis extending transversely of said main frame,
means for vertically moving said boom with respect to said main frame and feeding said mining head vertically along a mine face,
a conveyor extending along said main frame and having an inclined elevating trough portion extending in advance of said main frame downwardly into position to engage the ground, and having parallel spaced side walls extending therealong having an inclined shovel-like plate extending across said side walls in advance thereof in position to engage the ground,
material collecting and transferring aprons extending along the upper end portions of said side walls and laterally therefrom,
means pivotally connecting said aprons to said side walls for upward movement about axes extending longitudinally of said walls,
hydraulic jack means pivotally connected between said side walls and aprons for raising and lowering said aprons about their axes of connection to said side walls,
side boards extending along the outer sides of said aprons and pivotally connected thereto for movement about axes extending parallel to the axes of connection of said aprons to said side walls,
and linkage connections between said side walls and said side boards, pivoting said aprons outwardly upon angular upward movement of said aprons to extend said aprons laterally to maintain a uniform cuttings collecting surface upon upward feeding movement of said mining head.

5. A continuous mining machine in accordance with claim 4 wherein a hydraulic circuit is provided to said jacks including a control valve and a relief valve to bias said aprons into angular upward extended relation with respect to said conveyor, and wherein an engaging connection is provided between said boom and said aprons to pivot said aprons downwardly upon downward travel of said boom and mining head and to accommodate said aprons to travel upwardly with said boom.

6. A continuous mining machine in accordance with claim 5 wherein the engaging connection comprises a pair of stop legs depending from said boom and having controlling engagement with said aprons.

7. In a continuous mining machine,
a main frame,
a boom transversely pivoted to said main frame and extending in advance thereof,

a rotary mining head supported by said boom for rotation about an axis extending transversely of said main frame,

means for vertically moving said boom with respect to said main frame and feeding said mining head vertically along a mine face,

a conveyor extending along said main frame and having an inclined elevating trough portion extending in advance of said main frame downwardly into position to engage the ground, and having parallel side walls having a plow plate extending across the forward ends thereof and in advance thereof for collecting the material mined by said mining head and transferring the material onto said conveyor including inclined aprons extending along said side walls and pivotally connected thereto for movement about axes extending longitudinally thereof generally parallel to the plane of said conveyor,

hydraulic jack means pivotally connected between said side walls and aprons for pivoting said aprons upwardly to follow said boom upon upward movement thereof,

side board extends along the outer sides of said aprons and longitudinally pivoted thereto,

control arms extending downwardly of the outer sides of said side boards, said side boards with said aprons forming a vertically movable hopper transferring the mined material to said conveyor,

and control links connected between said control arms and side walls and maintaining said side boards in generally upright positions when said conveyor is in engagement with the ground and moving said side boards angularly outwardly with respect to said aprons upon upward pivotal movement of said aprons.

8. A continuous mining machine in accordance with claim 7, wherein said boom has stop legs depending therefrom and having controlling engagement with said aprons for moving the said aprons outwardly upon downward movement of said boom and accommodating upward movement of said aprons upon upward movement of said boom to feed said mining head vertically along a mine seam.

9. A continuous mining machine in accordance with claim 8 wherein a fluid pressure circuit is provided to supply fluid under pressure to said jack means and bias said aprons to follow said boom upon upward movement thereof and wherein a relief valve loaded to maintain said aprons into engagement with said stops is provided in said circuit.

10. In a conveyor having an inclined elevating forward end portion having parallel spaced side walls extending therealong and an endless chain and flight conveyor movable along said side walls in the space therebetween,

a hopper for said inclined elevating forward end portion of said conveyor for transferring the mined material onto said conveyor comprising

aprons extending along opposite sides of said inclined elevating forward end portion of said conveyor and longitudinally pivoted to said side walls,

hydraulic jack means connected between said side walls and aprons for raising and lowering said aprons about their axes of connection to said conveyor,

side boards extending along the outer sides of said aprons and pivotally connected thereto for movement about axes extending parallel to the axes of pivotal movement of said aprons,

and linkage connections between said side walls of said conveyor and said side boards pivoting said side boards outwardly upon angular upward movement of said aprons to maintain the width of said hopper substantially uniform in all vertical positions of said aprons with respect to said conveyor.

11. In a continuous mining machine,

a main frame,

a boom transversely pivoted to said main frame and extending in advance thereof,

a rotary mining head supported on said boom for rotation about an axis extending transversely of said main frame,

means for vertically moving said boom with respect to said main frame and feeding said mining head vertically along a mine face,

a conveyor extending along said main frame and having an inclined elevating forward end portion extending in advance of said main frame and inclined downwardly from said main frame toward the ground,

said inclined forward end portion having a shovel-like plate extending across the forward end thereof to the ground,

inclined aprons extending along and outwardly of opposite sides of said inclined elevating portion of said conveyor and pivotally connected thereto for movement about axes extending longitudinally of said conveyor,

means for pivoting said aprons upwardly about said axes to form a vertically movable hopper to collect and transfer material onto said conveyor,

said aprons each having a forward shovel-like extension overlapping said shovel-like plate and forming lateral continuations thereof when said aprons are in their lowermost positions of adjustment,

side boards extending along said aprons and longitudinally pivoted to the outer sides thereof and extending upwardly therefrom when said mining head is positioned along the ground,

and links pivotally connected between the undersides of said side boards and opposite sides of said inclined elevating portion of said conveyor to effect movement of said side boards outwardly toward the ribs of a working place upon angular upward movement of said aprons toward each other.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,169,797 February 16, 1965

Richard C. Lundquist

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 7, line 23, for "board extends" read -- boards extending --.

Signed and sealed this 17th day of August 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents