MINING ARRANGEMENT INCLUDING ANGULARLY DISPLACEABLE GUIDE MEANS FOR A MINING MACHINE

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ABSTRACT OF THE DISCLOSURE

Longitudinal guide means adapted to be placed adjacent a mine face for carrying a mining planer movable back and forth thereon in extractive engagement with the mine face, first and second articulating connection means (e.g., pivot points), adjustable length urging means (e.g., piston-cylinder means), and unitary base means (e.g., mining prop means) spaced from the guide means and connected by the first articulating connection means to the guide means and separately interconnected with the second articulating connection means, whereby as the urging means changes in length the guide means are articulated via the first articulating connection means and displaced angularly with respect to the mine face to change correspondingly the angle of engagement of such planer with the mine face.

The present invention relates to a mining arrangement including an angularly displaceable guide means for a mining machine, and more particularly to such an arrangement including base means, linearly adjustable urging means and guide means for a mining machine, such as a mining planer, with such urging means linkably connecting the base means and guide means and with the guide means and base means being articulately connected, whereby upon changing the linear amplitude of the urging means, the guide means may be displaced articulately with respect to the base means to change the angle of the guide means with respect to a mine face adjacent which the guide means is adapted to be longitudinally disposed.

It is known to tilt the guide rail on which a mining machine, such as a mining planer, for the extraction of coal from a mine face is mounted such that in turn the mining machine will be tilted with respect to the mine face being worked to change the attack of the mining machine with respect to such mine face. Various means have been used to control the angle of attack of the mining machine, especially the coal planer, as in the case where the coal planer is mounted on the side of a longitudinally extending mining conveyor adjacent the mine face. Mining conveyors are well known and arrangements in which the same are used for guiding a mining machine longitudinally therealong in extractive engagement with a mine face may be appreciated from U.S. Patent 2,702,697 to Lobb and U.S. Patent 2,832,908 to Roder. Often, the mining machine may be used in the form of a mining planer having a keel or swordplate extending transversely in a direction rearwardly of the mine face so that the keel underlies the conveyor and is guided not only by a guide track along the mine face side of the conveyor but also by the bottom portions of the side walls of the conveyor, as will be appreciated from U.S. Patent 2,795,407 to Bobersen and the aforementioned U.S. Patent 2,832,908.

By tilting the conveyor or other guide means for the mining machine, i.e., by rotating the conveyor or other guide means about an axis parallel to the mine face and extending in a relative horizontal direction, the mining machine, and especially the coal planer, is disposed to operate in turn at an angle to the mine face at a height which may be closer to the roof or closer to the level of the floor than the normal height thereof prior to the tilting displacement.

In order to accomplish the tilting control of the mining machine with respect to the mine face, an attempt was made to mount hydraulic cylinders on the side of the mining conveyor remote from the mine face and by means of such cylinders to raise and/or lower the mining conveyor and in turn the guide means, such as the guide rail, situated on the side of the conveyor in such a manner that the guide rail is tilted as desired. Such hydraulic cylinders additionally serve to make possible ready access to the lower strand of the drive chain for maintenance and servicing of the mining machine in the event of the mis-operation thereof. Generally, a drive chain is provided for the mining machine, especially in an arrangement in which such machine in the form of a coal planer is mounted slidably on guide means attached to the conveyor in order to conduct the planer back and forth in extractive engagement with the mine face. The ends of such chain, which may be termed an endless chain, are looped over appropriate drive drums or drive sprocket wheels at the ends of the mine face portion being worked. The strands of such chain are usually slidably received along the conveyor and often are provided in a housing on the side of the conveyor remote from the mine face, especially in the case where such conveyor is used in conjunction with a mining machine taking the form of a coal planer having a keel underlying the conveyor wherein the attachment of the planer to the drive chain takes place at the free end of the keel which reaches such remote side of the conveyor where the drive chain is situated. Therefore, by appropriate tilting of the conveyor, the lower strand of the drive chain becomes readily accessible to repair.

It is also known in the prior art to associate a further advancing cylinder with the advancing cylinder which is used to urge the mining conveyor and guide means progressively toward newly exposed layers of the mine face being worked, with such further advancing cylinder being situated at a different height from the main advancing cylinder, whereby by differential operation of these two advancing cylinders a tilting of the conveyor against which such cylinders bear and in turn a tilting of the guide means for the planer may be accomplished. Advancing cylinders of the type in question are shown in U.S. Patent 2,745,651 to Herrmann, and similar advancing means may be appreciated from U.S. Patents 2,691,514, 2,696,374 and 2,781,888 to Bobersen. Such advancing cylinder normally urges against the side wall of the conveyor remote from the main face or fixtures attached to such side wall, for instance, the housing for the drive chain or for utility conduits, cables or the like which are utilized in mining operations, for example, for the supplying of hydraulic, pneumatic or electrical power for the machinery used.

A particular construction in which the conveyor and in turn the guide means may be tilted with respect to the mine face by such pair of cylinders disposed at different relatively vertical heights is shown in copending U.S. application Ser. No. 307,244, filed Sept. 6, 1967. However, where attempts are made to control the conveyor and guide means of lighter weight members and with a minimum of reinforcing parts, the use of a pair of superimposed advancing cylinders of the foregoing type may lead disadvantageously to the rupture of the conveyor and guide means construction, especially along
the welded seams where the central plate of the mining conveyor is attached to the side walls thereof. It will be appreciated that in normal operation, the mining conveyor, for example, one of the double chain scraper types having an H-shaped cross-section, will be exposed to considerable bending forces, and depending upon the conditions of operation and the relative unevenness of the mine floor as well as the weight of the mining machine and extracted mineral exerted on the conveyor itself, such side walls may snap off from the central plate of the conveyor. This is especially true considering the efficient yet relatively non-reinforced construction of such a mining conveyor and the fact that at its thinnest cross-section, the same must be able to withstand not only such stresses produced by the pressures of the hydraulic cylinders and the forces produced by the passage of the mining machine along the conveyor, but also those forces additionally produced in the case where a rotary cutting machine is disposed for travel along the conveyor, alone or together with a mining planer, as, for example, in the case of combination systems used for extracting mineral of different types at or about the same time. Further, the conveyor parts include not only the specific weight of extracted mineral disposed on the conveyor but also the peak forces which are exerted thereon as the mineral in large lump form collapses onto the conveyor from the mine face and/or mine roof during the mining operation.

Nevertheless, it has been recognized that a better control of a mining machine, such as a coal planer, can be achieved by tilting the guide means, such as a guide rail disposed along the mine face side of a mining conveyor, than by adjusting the chisels or other cutting tools on the mining machine, e.g., coal planer itself. This is easily explained by the fact that the adjustment of the cutting tools or chisels on the mining machine, e.g., planer, itself does not change over the entire length of the long wall mine face being worked unless the cutting tools or chisels are readjusted constantly as the conditions require. Therefore, while the optimum position may be set for one planing action of the cutting tools on a mining planer, once such conditions change, as is typical over the length of the long wall mine face being worked, constant readjustment is necessary in order to achieve the maximum efficiency of working of the mineral. On the other hand, if the controlling of the angle of attack of the mining machine, e.g., mining planer, is carried out through the adjustment of the guide means, i.e., guide rail, the optimum setting of the planer can be determined empirically for each section of the mine face being worked, and the planer may be automatically controlled by tilting the guide means and in turn the planer as desired, through different angles of tilt along the length of the long wall mine face in dependence upon the changing conditions, utilizing separate control means along the conveyor and/or guide means to achieve such varied angles of tilt. In this manner, adjustments can be made to assure that the mining machine, especially a mining planer, neither cuts into the mine floor nor climbs above the level of the mine seam being worked, so that neatness and efficiency may be enjoyed in the mining operation and effective control of the angle of attack of the mining machine carried out regardless of the condition of the mine face so long as the adjustment means along the extent of the conveyor and/or guide means function individually to accommodate any such changes in conditions.

Of course, the faster the mining machine, and especially a mining planer, is conducted back and forth along the mine face, the greater will be the stresses transmitted to the planer and in turn the conveyor and/or guide means, and in the same way the heavier the mining machine is, for example, in the case of thick or extended vertical seams, the more important it is to control in an efficient manner the angle of attack of the planer for clean, efficient and complete extraction of mineral. Understandably, every time the conveyor is displaced during the mining operation so that the same is guided over a bank of coal left standing on the mine floor, for one reason or another, and every time the conveyor digs into the mine floor, difficulties arise which are not easily remedied. Of especial importance in this connection is perfect control where a conveyor is used which is provided on the mine face side thereof with a guide rail terminating at the mine face edge which is urged directly against the mine face, the mining planer being used being a so-called shearing or scouring mining planer which rides along the guide rail with its cutting tools or chisels extending outwardly beyond the guide rail. Such an arrangement permits the mineral to be cut to a depth represented by the increment by which the cutting tools on the mining planer extend outwardly beyond the knife-edge of the guide rail, whereby a constant thickness of mineral is extracted in a massive formation. In such a situation more precisely the control of the conveyor, despite unevenness in the mine floor, caused by the floor itself or even a bank of coal left standing thereon, and despite the speed of displacement of the planer along the conveyor and the weight of the planer, the more efficient will be the over-all mining operation using an arrangement of the aforementioned type. Naturally, the straighter the conveyor extends along the mine face and the more even the mine floor, the more efficient will be the extraction of mineral in terms of the constant cut which is to be made. Such constant cut is often desirable, for instance, in estimating the amount of mineral which is to be extracted in a given time or in a given operation, and the less straight the conveyor and the more uneven the mine floor, the less will be the degree of success of constant cut.

Another disadvantage of prior art guiding means for mining machines, such as coal planers, consists in the fact that the forces transmitted to the conveyor by control means and/or advancing means, and the like, which are exerted on the side of the conveyor remote from the mine face, are transmitted to the guide means, e.g., guide rail, over the width of the conveyor, including any lateral attachments thereon, whereby a very long lever arm length results in connection with the control of the tilt of the guide means and/or conveyor. The forces which eventually reach the guide rail or other guide means are relatively small due to this long lever arm length, and accordingly if, for example, the mining planer tends to lift the entire guide rail and in turn the conveyor on the side thereof adjacent the mine face, the counterforces exerted on the side of the conveyor remote from the mine face by reason of the advancing cylinder or other control systems disposed thereof, are generally insufficient to overcome the tendency to lift the mine face side of the conveyor and/or the guide rail which is caused by planer operation. This may occur, for instance, where the planer is met by strong counterforces in the mine face which are transmitted through the guide rail to the conveyor and thus cause an undesired lifting thereof from the normal position thereof.

Since presently used mining arrangements, including mining planers, are often combined with hydraulic prop means, attempts have been made to use a hydraulic prop as a reinforcement or backing cylinder. Specifically, the advancing cylinder urges the conveyor and/or guide means for the mining planer in a forward direction toward the mine face as newly exposed layers of mineral appear, such advancing cylinders being prevented from transverse rearward displacement by reason of the reinforcement being provided by such hydraulic prop rig or other backing. Popsals have also been made for improving the alternating displacement of the conveyor arrangement and the hydraulic prop system using appropriate automatic constructions for this purpose, whereby on the one hand the conveyor is urged
forward toward the mine face by the advancing cylinder of the hydraulic prop rig and hence the hydraulic prop rig is brought forward toward the conveyor in a walking manner so that the conveyor is ready to be moved forward the next step after the next passage of the mining planer, in the well known manner. Nevertheless, no construction has yet been provided which, in consideration of recent developments in the mineral extraction art, especially regarding long wall mining operations, permits a more direct control of the mining machine, especially the mining planer, in cooperation with a hydraulic prop rig and the conveyor or other guide means, whereby not only automatic advancing of the conveyor and prop rig toward the mine face will be achieved but also precise tilting of the conveyor or other guide means to achieve precise angles of attack of the mining machine with respect to the mine face in a similar automatic manner.

It is, therefore, an object of the present invention to overcome the foregoing drawbacks and to provide a mining arrangement including an angularly displaceable guide means for a mining machine.

It is another object of the present invention to provide such an arrangement including base means, linearly adjustable urging means and guide means for a mining machine, such as a mining planer, with such urging means linkingly connecting the base means and guide means and with the guide means and base means being articulatingly interconnected, whereby upon changing the linear amplitude of the urging means, the guide means may be displaced articulatingly with respect to the base means to change the angle of the guide means with respect to a mine face adjacent which the guide means is adapted to be longitudinally disposed.

It is a particularly important object of the present invention to utilize a hydraulic prop means in the operation and control of angle disposition of the mining machine, such as a mining planer, and to achieve reliable control through the guide means for the mining machine, even where relatively great forces are exerted upon the mining machine while in engagement with the mine face, and even where great forces are exerted on the guide means and/or conveyor, not only by the planer but also by reason of the unevenness in the mine floor and/or in the normal longitudinal configuration of the mine face.

It is an object of the present invention to provide such an arrangement in which advancing means are used to advance in increments or continuously the guide means and/or conveyor together with the mining planer and at the same time to permit by reason of the prop means position variations and the analogous variations of the guide means and/or conveyor and in turn of the mining machine, especially a mining planer, being used for the extraction of mineral from the mine face.

Other and further objects of the present invention will become apparent from a study of the within specification and accompanying drawings, in which

FIG. 1 is a schematic side illustration, partly in section, of a mining arrangement in accordance with one embodiment of the invention, illustrating the guide means, urging means and prop means linkingly interconnected for changing the angle of the guide means and the disposition of the planer with respect to the mine face;

FIG. 1a is a schematic side view, partially in section, of a portion of the prop means of FIG. 1, illustrating certain details of construction;

FIG. 2 is a schematic side illustration, partially in section, of a further embodiment in accordance with the invention, utilizing an auxiliary prop member rigidly connected to the mining conveyor such that the auxiliary prop member and conveyor and in turn the mining planer may be tilted in the desired manner for changing the angle of attack of the planer with respect to the mine face;

FIG. 3 is a schematic side illustration, partially in section, of a further embodiment in accordance with the invention in which an upright pit prop is fixedly interconnected with the guide means for the mining planer, such pit prop being connected by urging means with the prop means for tilting the pit prop and in turn the guide means and planer for the desired purpose.

FIG. 4 is a schematic side illustration, partially in section, of still another embodiment of the present invention similar to that of FIG. 3 but utilizing different constructional means for achieving the tilting of the pit prop, guide means and planer and for advancing the system in increments toward the mine face, or continuously toward the mine face;

FIG. 5 is a schematic side illustration, partially in section, of a further embodiment of the invention in which a foot member linkingly connected to the prop means is provided for achieving the tilting of the conveyor and guide means utilizing an urging means for this purpose, and in which further prop rig elements are provided in conjunction therewith for the incremental or continuous advancing of the prop means, conveyor, and guide means toward the mine face and

FIG. 6 is a schematic top illustration of the arrangement of FIG. 5, illustrating additional hydraulic prop rigs used in conjunction with the advance cylinder means and tilting means of the invention.

It has been found in accordance with the present invention that a mining arrangement may now be advantageously provided which comprises long wall guide means adapted to be extended along a mine floor adjacent a mine face for slidably receiving on the guide means a mining planer situated for movement back and forth along the mine face in extractive engagement therewith to remove mineral therefrom, as well as first articulating connection means, base means spaced from the longitudinal axis of the guide means and operatively connected via the first articulating connection means with the guide means, adjustable effective length urging means operable between a retracted position of minimum over-all effective length and an extended position of maximum over-all effective length, and second articulating connection means. The urging means are disposed to interconnect operatively along the over-all effective length thereof the base means and the guide means via the second articulating connection means, whereby upon operating the urging means to change the effective length thereof, the guide means are articulated via the first articulating connection means and displaced angularly with respect to such mine face and/or such mine floor to change correspondingly the angle of engagement of such mining planer with such mine face.

Preferably, the mining machine is extendible into supporting engagement with the mine roof and mine floor, while the urging means include a first urging part and a second urging part operatively interconnected for limited relative linear displacement with respect to each other to adjust the over-all effective length of the urging means. Also, the first articulating connection means include first pivot means and the second articulating connection means include second pivot means.

In accordance with a first embodiment of the present invention, the guide means include mining conveyor means which are pivotally connected thereto, the guide means being connected to the prop means, with the first urging part fixedly connected to the prop means and the second urging part pivotally connected by the second pivot means to the conveyor means. Furthermore, the prop means preferably includes seating means situated thereon movable axially with respect to the prop means, the prop means being directly pivotally connected by the first pivot means to the seating means, and such that the first urging part is directly rigidly connected to the seating means at a point thereon axially spaced from the first pivot means point of connection thereon. Such seating means and prop means preferably define together an up-right piston-cylinder arrangement, such that upon actuation of such piston-cylinder arrangement the seating means is displaced vertically with respect to the prop means in
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7 turn displacing the guide means in conjunction with the displacement of the guide means resulting from the operation of the urging means. Suitably, linear actuating means may be connected to the prop means to displace the prop means and in turn the guide means linearly toward and away from the mine face, such linear actuating means under typical operating conditions being utilized to urge constantly forward the guide means, i.e., in the direction of advance progressively toward the mine face.

In accordance with a second embodiment of the invention, the guide means includes a miner conveyor means and an auxiliary prop member rigidly interconnected at the side of the conveyor means remote from the mine face side thereof, the auxiliary prop means being pivotally connected by the first articulating connection means including said first pivot means to the prop means, with the first urging part being pivotally connected to the prop means and the second urging part being pivotally connected by said second pivot means to the auxiliary prop member. In this connection, preferably the auxiliary prop member is formed of three upright sub-members operatively interconnected for relative axial movement with respect to each other. Second prop means are pivotally connected to the upper and lower sub-members each being movable axially independently of the movement of the other in dependence upon the relative movement of the central sub-member with respect thereto. In this way, the upper and lower sub-members may be axially displaced into and out of engagement with the mine roof and mine floor at different axial positions of the central sub-member, such that upon relative axial displacement of the central sub-member with respect to the upper and lower sub-members, the conveyor means is displaced vertically in conjunction with the displacement thereof resulting from the operation of the urging means. The first articulating connection means include preferably an auxiliary urging means operable between a retracted position of minimum over-all effective length and an extended position of maximum over-all effective length pivotally connected at one end to the prop means and connected at the other end thereof via said first pivot means to the central sub-member.

In accordance with a third over-all embodiment of the invention, the guide means include a longitudinal guide means and a prop member pivotally interconnected to each other, and the first articulating connection means include a mining conveyor means pivotally connected to the prop means at one side thereof and pivotally connected at the other side thereof via the first pivot means to the pit prop. In this embodiment, the upper end portions of the prop means and pit prop are advantageously pivotally interconnected via the urging means and the second articulating connection means including said second pivot means.

In connection with a feature of this third over-all embodiment, the prop means and pit prop each are provided with a roof cap disposed on the upper end portion thereof and the roof caps are pivotally interconnected via the urging means and the second articulating connection means including said second pivot means. Advantageously, linear actuating means may be connected to the prop means to displace the prop means and the guide means toward and away from the mine face, and in accordance with typical mining operations, such linear actuating means may be used to continuously urge the guide means in the direction of advance, i.e., constantly toward the mine face.

In connection with a further feature of this third over-all embodiment, a supplementary prop is provided to form a prop frame with the prop means, and the first articulating connection means further includes a transverse piston-cylinder arrangement pivotally interconnecting the con-

veyor means and the prop frame, whereby upon actuation of the transverse piston-cylinder arrangement the conveyor means and guide means may be displaced linearly toward and away from the prop frame in conjunction with the angular displacement of the prop frame resulting from actuation of the urging means. Of course, the displacement toward and away from the prop means of the conveyor means and guide means will result in a corresponding displacement toward and away from the mine face being worked, and preferably the transverse piston-cylinder arrangement being used will not utilize typical mining operations be used to urge continuously the guide means toward the mine face, i.e., in the direction of advance of the system, as new layers of mineral are exposed.

In accordance with a fourth embodiment of the invention, the base means further includes a foot member linkably connected medially, i.e., intermediate its ends, to the lower portion of the prop means, and the guide means include track means and mining conveyor means rigidly interconnected, the track means being pivotally connected by the first articulating connection means, including said first pivot means, to the foot member. Said prop means is pivotally connected by the second articulating connection means, including said second pivot means, to the foot member and the second urging part is rigidly connected to the conveyor means. Preferably, urging spring means are provided operatively between the prop means and the foot member to urge downwardly and a foot member into supporting engagement with the mine floor, the conveyor means being transversely interposed between the track means and the urging means, and the foot member extending transversely under the conveyor means and being connected by said first pivot means to the track means on the side of the conveyor means remote from the side thereof to which the second urging part is rigidly connected. Preferably, also, a supplementary prop is provided to form a first prop frame with the prop means, said prop frame extending transversely with respect to the longitudinal axis of the guide means, and a corresponding second prop frame including a pair of pit props is also provided which is parallel to and connected operatively with the first prop frame by means of an interconnecting double-acting piston-cylinder transverse linear drive, whereby such frames may be alternately moved linearly relative to one another in a direction transverse the longitudinal axis of the guide means to displace the guide means toward and away from the mine face. The foot member, which is linkably connected at one portion thereof to the prop means and at another portion thereof to the track means. In this regard, in typical mining operations, the double-acting piston-cylinder transverse linear drive will continuously urge the first prop frame and in turn the guide means forwardly in the direction of advance, i.e., constantly toward the mine face being worked, as new layers of mineral are uncovered by the mining machine.

Referring to the drawings, FIG. 1 shows a guide means including a guide track 1 rigidly attached to a mining conveyor 2 of conventional design (see U.S. Patents 2,702,697, 2,823,308 and 2,943,727). Positioned upwardly directed leg 3, such bracket 4 being rigidly connected not only with conveyor 2 but also track 1 to reinforce these parts for joint displacement in any direction of movement thereof. Track 1 is disposed to permit a mining planer 1' (shown in phantom) of conventional design (see U.S. Patents 2,943,727 and 2,972,697) to pass the mining means 1' on a horizontal plane along in a manner avoiding substantial relative displacement therebetween except in the longitudinal direction of track 1. The mining planer 1' is conducted back and forth along the mine face (not shown) on track 1 via an endless drive chain (not shown) of the usual type, the ends of such drive chain being connected to a sprocket wheel drive means situated at the ends of the portion of the mine face being worked. Leg 3 is provided with a large ear 5 and a small ear 6 extending in a direc-
tion remote from the mine face. Base means, including seating means 9 and prop means 13 are disposed adjacent the guide means on the side thereof remote from the mine face, such base means being spaced from the longitudinal axis of the guide means. Seating means 9 may be displaced vertically (as shown in phantom) and is disposed on prop means 13 including the lower prop portion 14 and the upper prop portion 15. Roof cap 16 is disposed on upper prop portion 15 and prop portions 14 and 15 are operatively connected for relative linear displacement with respect to one another. Prop means 13 may take the form of a hydraulic or pneumatic prop or jack of conventional design which may be extended into engagement with the mine roof and mine floor and retracted from such engagement as desired. Roof cap 16 serves to support the mine roof against cave-in whereby to protect the workmen. First articulating connection means including first pivot 7 operatively interconnect the guide means at large ear 5 with the base means at seating means 9. On the other hand, an adjustable effective length urging means 10 is provided which is operable between a retracted position of minimum over-all effective length and an extended position of maximum over-all effective length, including a first urging part 11 fixedly attached to seating means 9 and a second urging part 12 pivotally connected via the second articulating connection means including second pivot 8 connected in turn via small ear 6 to the upper portion of leg 3, such urging means 10 being shown in the exploded arrangement of conventional design. Thus, urging means 10 operatively interconnects along the over-all effective length thereof the base means and the guide means via the second articulating connection means while the base means is separately operatively connected with the guide means via the first articulating connection means and urging means 10 to change the effective length thereof, the guide means and especially track 1 will be articulated via the first pivot 7 and displaced angularly with respect to prop means 13, the mine floor, and the mine face (not shown), to change correspondingly the angle of planer 1 with such mine face.

In this connection, linear actuating means 21 and/or linear actuating means 22, which may take the form of double-acting piston-cylinder arrangements, may be provided to urge the base means, including prop means 13 and seating means 9, and in turn the guide means linearly toward and away from the mine floor, thereby effecting typical mining operations, of course, the linear actuating means will constantly urge the base means and the guide means toward the mine face so that as new layers are extracted from the mine face the guide means may be advanced a further increment. Inasmuch as the track 1 is provided with an outwardly and downwardly extending knife-edge at the extreme left hand side of FIG. 1, the same may be urged by the linear actuating means into engagement with the portion of the mine face terminating at the mine floor so that such knife-edge may dig into the mine face and mine floor therefor to provide a more stable seating for the planer 1 so as it is conducted along track 1. Advantageously, by raising and lowering seating means 9 and by operating urging means 10, a more precise control not only with regard to the height of track 1 and conveyor 2 will be attained but also with regard to the angle of track 1 and the spatial disposition of the knife-edge at the outer end of track 1 with respect to the mine face. Thus, such knife-edge may dig into appropriate portions of the mine face and mine floor in a downward direction and/or in a forward direction and upon suitable actuation of seating means 9 and/or operation of urging means 10 such knife-edge may be raised from the mine floor and maintained at a given desired level thereabove. This is of advantage where the mine seam is uneven or undulates along its longitudinal extent, whereby the planer may be vertically positioned to extract mineral from the mine face at the desired height.

While a reinforcement prop may be positioned rearwardly of prop means 13 to provide the required leverage for linear actuating means 21 and/or linear actuating means 22, with one or both of such linear actuating means being used as desired, a further provision in accordance with the present invention is to utilize a supplemental prop 17 including a lower prop portion 18 and an upper prop portion 19 which are movable linearly relative to one another, roof cap 16 preferably extending rearwardly to overlie upper prop portion 19 and to be seated thereon in a manner similar to the seating of the forward portion of roof cap 16 on upper prop portion 15. In through a prop frame 20 is provided, including not only prop means 13 and roof cap 16 but also supplemental prop 17, such frame being displaceable as a unit in a direction transverse the mine face, with roof cap 16 being extendable into engagement with the mine roof (not shown) and retractable therefrom in order to permit the desired transverse advance. Normally, frame 20 will be utilized together with a companion frame (not shown) similar to the rig shown in FIG. 6 (see French Patent 1,199,170), such that the lower portions 14 and 18 of prop means 13 and supplemental prop 17, respectively, will be secured, for example by resilient metal straps, to the lower end of a piston rod of a double-acting piston enclosed within a double-acting cylinder of the type shown generally at 21. The cylinder in turn is connected by suitable means, for example, resilient metal straps, to the second frame (not shown) forming the remainder of the prop rig, whereupon when such second frame is placed in engagement with the mine floor and mine roof, frame 20 may be slightly relieved of the roof pressure sufficiently to permit advance of frame 20 with respect to the second frame in the direction of the mine face under a constant force exerted on the piston and piston rod of linear actuating means 21 which in turn is exerted through the metal straps to frame 20 at the lower portions 14 and 18 of prop means 13 and supplemental prop 17, respectively.

When the full forward amplitude of the linear actuating means 21 has been reached, frame 20 may be extended into holding engagement with the mine roof and mine floor, whereupon the second frame (not shown) may be urged forward via the cylinder connected thereto as the same traverses the piston rod in the well known manner. It will be appreciated by the artisan that linear actuating means 22 may be similarly interconnected by means such as resilient metal clips to the roof cap 16 of frame 20 and to the roof cap of the companion frame (not shown) to assist in the forward movement of the frames alternately in the manner described. For this purpose, the cylinder or piston, is attached to the roof cap of the companion frame. By operating linear actuating means 21 and 22 in conjunction, the two frames will be maintained in the desired upright relationship without tilting or deviation from their parallel transverse disposition. As aforesaid, preferably means 21 and 22 are maintained under constant force to urge continuously frame 20 and in turn track 1 toward a mine face and preferably in constant abutting engagement therewith.

In accordance with one particular feature of the embodiment shown in FIG. 1a, seating means 9 shown in FIG. 1, takes the form of a double-acting cylinder containing a hollow chamber in which is mounted a piston 14' outwardly disposed on the shaft of lower portion 14'. By suitable actuation in the well known manner, seating means 9 may be displaced axially to change its height with respect to piston 14' and in turn prop means 13. The change in the vertical height of seating means 9 will advantageously cause a change in the height of bracket 4 and in turn conveyor 2 and track 1, such displacement being utilized in conjunction with the angular or tilting displacement of track 1 caused by the operation of urging means 10.
In FIG. 2, an arrangement is shown in which a mining planer 23 of the conventional type (see U.S. Patent 2,795,407 and 2,823,908) containing a keel 25 is disposed for extractive engagement. Planer 23 is generally shaped such that the keel 25 passes along the mine floor 34. Planer 23 is shaped to accommodate thereat a portion of the guide means in the form of mining conveyor 27, similar to conveyor 2 of FIG. 1, which has rigidly attached to the side wall thereof remote from the mine face a backing plate or buffer plate 30 and outwardly thereof a hood 31 rigidly connected by spacer means 32 to backing plate 30 and in turn conveyor 27. Backing plate 30 may serve advantageously to prevent the overflow at the remote side of the conveyor of mineral deposited onto the conveyor during mining operation. Spacer means 32 divides the area between backing plate 30 and hood 31 into an upper channel 33 and a lower channel 29 for accommodating the upper and lower strands of an endless drive chain (not shown) used to drive the planer 23 back and forth along the mine face. Such drive chain is mounted at the ends of the conveyor over drive means, such as drive drums or sprocket wheels situated thereat, and the ends of the conveyor are connected to the lug 26 fixedly attached to the free end of keel 25. A slit 28 is provided between the bottom portion of hood 31 and the bottom portion of the adjacent side wall of conveyor 27 as well as the bottom portion of backing plate 30 to permit keel 25 to extend into lower channel 29 so that lug 26 may travel along channel 29 with the lower strand of the drive chain and thus conduct planer 23 in the desired longitudinal direction. The guide means includes in addition to conveyor 27, backing plate 30, spacing means 32 and hood 31, also the auxiliary prop member 37 rigidly attached via collar 36 to hood 31 and in turn through spacer means 32 and backing plate 30 to conveyor 27, whereby all of such parts provide a guide means which may be displaced as a unit. Auxiliary prop member 37 includes three upright sub-members operatively interconnected for relative axial movement with respect to one another. Specifically, central sub-member 38 is attached via collar 36 to hood 31 and thence through the aforementioned parts to conveyor 27. Central sub-member 38 is provided as a hollow member containing an intermediate wall 39 so as to define an upper cylinder 40 and a lower cylinder 42 into which are reciprocatingly received, respectively, the upper sub-part or piston 41 and the lower sub-part or piston 43. Thus, by suitable actuation pistons 41 and 43 may be displaced axially with respect to one another and with respect to central sub-member 38, whereby to extend auxiliary prop member 37 into engagement with the mine roof 35 and mine floor 34. By appropriate movement of pistons 41 and 42 relative to wall 39, central sub-member 38 may be relatively displaced with respect to such pistons 41 and 42 and axially displaced with respect to the mine floor and mine roof, whereby in turn to displace vertically collar 36 and the remaining parts connected thereto, including prop member 37. This vertical displacement including prop member 37 is similarly provided by the displacement of the sealing means 39 with respect to the prop means 13 as shown in FIG. 1.

Rearwardly of the guide means, including conveyor 27 and auxiliary prop member 37, is disposed the prop means 46 which takes the form of a similar construction to that of auxiliary prop member 37 including a collar 53, a central sub-member 47 containing an intermediate wall 48 to provide therewithin cylinders 49 and 51, as well as an upper sub-member or piston 50 and a lower sub-member or piston 52, whereby prop means 46 may be extended into engagement with the mine roof 35 and mine floor 34.

Auxiliary prop member 37 is pivotally interconnected by articulating connection means, including first pivot 44 and auxiliary urging means 57 having a first urging part or cylinder 58 and a second urging part or piston 59 and further pivot 55, to collar 53 and in turn prop means 46.

Furthermore, auxiliary prop member 37 is interconnected via second articulating connection means including second pivot 45 and the urging means 60 being the first urging part of cylinder 61 and the second urging part or piston 62 and further pivot 56, to collar 53 and in turn prop means 46. By such constructional arrangement, considering the piston 62 and cylinder 61 as the urging means of the invention, and considering pivot 44 as the first articulating connection means, upon extending the urging means 60 to change its angle of operation thereof, i.e., between second pivot 45 and further pivot 56, auxiliary prop member 37 and in turn the remainder of such guide means, including conveyor 27, may be tilted or displaced angularly in a desired direction such that conveyor 27 extends upwardly or downwardly as the case may be toward mine face 24. Because of the fact that planer 23 partially surrounds conveyor 27, the planer will also execute the desired displacement for changing its angle of operation with respect to mine face 24. It will be appreciated by the artisan that during any such displacement, the over-all effect length of auxiliary urging means 57, i.e., between first pivot 44 and further pivot 55, may remain the same, or if desired auxiliary urging means 57 may change in effective length to provide a more pronounced and especially a more precise control of the angle of tilt of auxiliary prop member 37 and in turn conveyor 27 and planer 23. Nevertheless, as the artisan will appreciate, urging means 57 may be considered the urging means of the invention, in which case urging means 60 will be considered the auxiliary urging means. In either case, the operation of the invention for precise control of the angular disposition of the guide means and in turn the planer will be attained. More importantly, the auxiliary urging means and even the urging means of the invention, i.e., piston cylinder arrangement 61-62 and 58-59, may be used conjunctively to urge constantly in a forward direction toward the mine face 24 the entire guide means and planer. Naturally, when urging the guide means constantly forward, auxiliary prop member 37 will be released from holding engagement with the mine roof 35 and mine floor 34 sufficiently to permit the advance to take place, and of course sufficiently to permit clearance between the ends of auxiliary prop member 37 and the adjacent surfaces of the mine roof 35 and mine floor 34. For this purpose, as the artisan will appreciate, the flat foot 43' and flat head 41' attached respectively to pistons 43 and 41, may be provided in an adjustable manner thereon so as to swivel sufficiently to permit the tilting or angular displacement of auxiliary prop member 37 to take place without becoming inextricably wedged against the mine roof and mine floor thereat. Typical swivel constructions are well known (see French Patent 1,070,316).

In FIG. 3, a further embodiment of the invention is shown in which the guide track means 64 includes a lower track 64a having a knife-edge extending outwardly and downwardly toward the mine face 24, an intermediate wall 64b containing the guide tubes 65 upon which the mining planer 63 of appropriate configuration is reciprocatingly received for slideable displacement longitudinally therealong, and rearwardly and downwardly extending chute plate 64c used for guiding extracted mineral into conveyor 76 and through which extends the upright pit prop 66 having the lower portion 67 and the upper portion 68 and roof cap 69. Pit prop 66 is extendable into and retractable from engagement with mine roof 35 and mine floor 34 in the well known manner, such pit prop preferably taking the form of a hydraulic or pneumatic pit prop of conventional design. The guide track means 64 and the pit prop 66 together form the guide means 65 of the invention. Such guide means 65 are interconnected via the first articulating connection means, including first pivot 70, conveyor 76 of conventional design, similar to conveyors 27 and 2 of FIGS. 2 and 1, respectively, and further pivot 75, to base means 71, in--
including a prop means having a lower prop portion 72 and an upper prop portion 73 movable axially with respect to one another in the well known manner so that base means 71 may be extended into and retracted from engagement with the mine roof 35 and the mine floor 34. Upper prop portion 73 is provided with a suitable roof cap 74. The urging means 77 of the invention takes the form of a cylinder 78 and piston 79 which connects via the second articulating connection means, including second pivot 81, the roof cap 69 and in turn prop 66 and guide track means 64, with base means 71 via roof cap 74 and further pivot 80 of the urging means 77, prop 66 further pivoting about first pivot 70. Indeed, while in this embodiment the further pivot 75 may be replaced by a fixed rigid connection or while first pivot 70 may be replaced by such as a fixed rigid connection (in which case further pivot 75 would remain and would be designated the first pivot), the desired angular displacement may take place just as well with the first articulating connection means shown wherein conveyor 76 is considered a part of such articulating means. Were pivot 70 to be replaced by a fixed rigid connection, then conveyor 76 would be considered a part of the guide means subject to angular displacement, as the artisan will appreciate. Indeed, although conveyor 76 is shown in elevated disposition, the same may be attached to the respective parts to permit the same to rest upon mine floor 34 or alternatively suitable prop constructions such as shown in FIG. 2, may be employed whereby to permit adjustment in the height of conveyor 76 above the mine floor 34. In this connection, in a manner similar to the previous embodiments discussed, a linear actuating means 82 in the form of a cylinder 83 and cooperating piston 84 may be provided to dispose the base means or prop means 71 and in turn the guide means, including prop 66 and guide track means 64, in a direction transverse mine face 24. Under typical mining operations, the linear actuating means 82 will urge continuously the base means 71 and the guide means, including prop 66 and guide track means 64, forward in the direction of advance, i.e., progressively toward the mine face as new layers of mineral are exposed. In order to provide reinforcement support for the linear actuating means 82, a further supplementary backing 85 is provided. Base means 71 may be provided, including lower prop portion 86, upper prop portion 87 and roof cap 88. Understandably, while backing prop 85 will be in full extended engagement with the mine roof and mine floor to provide the desired support, the prop means 71 and prop 66 in slightly retracted disposition at their roof caps are continuously urged in forward direction by the linear actuating means 82. Since prop 66 will tilt in order to execute the desired angular displacement of the guide track means 64 and in turn planer 63, roof cap 69 is preferably constructed so as to swivel on the head of upper prop portion 85 so as to maintain the alignment of the means against the mine roof when tilting of prop 66 is undertaken. In FIG. 4, an embodiment is shown which is similar to that of FIG. 3, and corresponding parts are assigned corresponding reference numerals. This embodiment differs mainly from that shown in FIG. 3, by the direct connection of the upper portion 68’ of prop 66 with the upper prop portion 73’ of base means or prop means 71’ via the urging means 77’ of the invention, including cylinder 78’ and piston 79’, and by the use therefor of the linear actuating means 82’, including the cylinder 83 and the cooperating piston 84’. The piston 84’ is pivotally connected by further pivot 75’ directly at the side of the conveyor 76’ remote from the mine face 24. Here, linear actuating means 82’ may be considered a transverse linear piston-cylinder arrangement forming a part of the first articulating connection means of the invention. In this embodiment, the roof caps 74’ and 88’ of base means or prop means 71’ and backing prop 85’, respectively, are interconnected by a pivot 89 while the corresponding lower prop portions 72’ and 86’ of prop means 71’ and backing prop 85’, respectively, are interconnected by strap 90, preferably of resilient metal. In this manner, a prop frame 91 is provided which contains prop means 71’ and backing prop 85’ interconnected at their roof caps by pivot 89 and at their lower ends by strap 90. Accordingly, upon the constant forward urge of piston 84’ in the manner of the constant urge of piston 79’, the guide means including prop 66’ and guide track means 64’ are advanced in the desired manner toward mine face 24 as planer 63’ moves back and forth longitudinally to expose new layers of mineral. Advantageously, the constant forward urge of piston 84’ and piston 78’ will take place in a controlled manner regardless of whether prop 66’ is vertically erect or displaced tiltingly toward and away from mine face 24. Preferably cylinder 83’ is fixedly connected to lower prop portion 72’, although it is not, the principles of interconnection of the parts is still preserved due to the fact that the base means in this embodiment of the invention will comprise mining prop frame 91 rather than merely prop means 71’. The rigid attachment of cylinder 83’ to lower prop portion 72’ is most desirable in order to prevent undesirable deviation of the parts under the heavy stresses experienced thereby during mining operations and due to the fact that a more compact and stable system is provided which will permit a more precise control of the angular displacement of the guide means in question with respect to the base means. Of course, in this embodiment as well the conveyor 76’ generally is situated in resting engagement with the mine floor 34 or may be connected to the prop 66’ or the prop 71’ for vertical displacement in the manner of the prop constructional arrangement of FIGS. 1a and 2. In FIGS. 5 and 6 another embodiment of the invention is shown and is unique in that it provides for independent movement of the conveyor adjacent the mine face and thus the amount of working space in the area between the mine face and conveyor is reduced as well as the amount of exposed and unsupported mine roof. The guide means herein include the guide track 92 far to the location on the conveyor, and conveyor 93, similar to conveyors 2, 27, 76 and 76’ of FIGS. 1 to 4, respectively, and reinforcing bracket 94, whereby track 92 and conveyor 93 are rigidly interconnected. Track 92 and conveyor 93 are actually in the form of articulatedly interconnected longitudinal sections 92’ and 93’, as the case may be, to accommodate unevenness in the mine floor and angular deviation during advance in the conventional manner. The base means include the prop means 105 containing the lower prop portion 106 and the upper prop portion 107 as well as the roof cap 108, and the arched foot member 97 including the rear end 99 and the forward end 98 and the medial arch portion 95. Foot member 97 is linkably connected at medial arch portion 95 to prop means 105 via the coil springs 109 disposed about the periphery of the lower prop portion 106 and upwardly abutting the skirt 110 on lower prop portion 106. In this manner, the portion of the extended or retracted position of prop means 105, foot member 97 will be urged into supporting engagement with the mine floor (not shown). At the forward end 98 of foot member 97, the base means is pivotally connected by the first articulating connection means including first pivot 96 with the guide means, such that the prop 84’ is pivotally engaged by the conveyor 93. On the side wall of conveyor 93b, i.e., the side remote from the mine face side of the conveyor, a connecting ele-
ment 103 is provided which rigidly connects conveyor 93 with a portion of urging means 100. Urging means 100 includes the cylinder 101 and the piston 102, piston 102 being connected with the base means at foot member 97 via the second articulating connection means second pivot 104. In this manner, upon operating urging means 100, the guide means including conveyor 93 and track 92 will be angularly displaced with respect to the mine face and the base means by pivoting about first pivot 96. The angle at which the planer (not shown) engages the mine face will in turn be changed whereby the advancement of the present invention will be achieved. In order to provide for proper reinforcement and suitable continuous advance of the base means and guide means toward the mine face, prop means 105 is provided in the form of a prop frame 117 with supplemental prop or backing prop 111 containing lower prop portion 112 and upper prop portion 113 carrying the roof cap 114 thereon. Roof props 108 and 114 are interconnected by pivot 116, and lower prop portion 112 of backing prop 111 is interconnected via strap 115, preferably formed of resilient metal, with prop means 105 at foot member rear end 99. Since foot member 97 is linkingly connected with prop means 105, foot member 97 is considered a part of prop frame 117. Of course, in this embodiment the forward end 98 of foot member 97 extends under the conveyor 93 and thus maintains the conveyor at a position elevated from the mine floor, and the first pivot 96 is situated on the side of the conveyor adjacent the mine face rather than otherwise, as was the case in the previously discussed embodiments. However, with respect to the longitudinal axis of the guide means and especially the track 92, sufficient longitudinal spacing with respect to the base means is present for the required tilting operation to be achieved. In order to continuously urge in the forward direction toward the mine face the guide means and the base means, frame 117 is constructed in a manner similar to that described with respect to the embodiment of FIG. 1, with a further frame 127 having a pair of pit props 128 and 129 (see FIG. 6) and a connecting strap 126 similar to strap 115 as well as a roof cap arrangement (not shown) similar to that of caps 108 and 114. While prop means 105 is connected via strap 122, preferably of resilient metal, with one end of piston rod 120, backing prop 111 is connected therewith via resilient strap 123. On the other hand, the prop frame 127, including props 128 and 129, is connected via strap 126 and resilient straps 124 and 125 to the cylinder 119, making up the linear actuating means 118. Linear actuating means 118 may be considered a double-acting piston-cylinder transverse linear drive and a similar drive may be provided at 121 (see FIG. 5) between the roof caps of the appropriate frames 117 and 127, such arrangement not being shown in detail yet as the artisan will appreciate, the interconnection will be similar to that of straps 122 to 124. Naturally, the operation of linear drives 118 and 121 will have to be carried out more or less in unison so that the respective props and roof caps and in turn the frames in question will be displaced together. In accordance with typical mining operations, frame 117 will be retracted from engagement with the mine roof to permit continuous urging via drives 118 and 121 thereof and in turn track 92 toward the mine face, frame 127 being in engagement with the mine roof and mine floor to provide the required support. When the full forward distance of the linear drives 118 and 121 has been reached, a reverse actuation is undertaken but this time frame 117 is displaced into engagement with the mine roof, frame 127 being in engagement therewith to permit forward movement of such frame 127. Attendant the parallel frame arrangement just described, further prop rigs 130 may be provided for supporting the mine roof in the area of the mining operation and permitting incremental advance of such prop rigs in an automatic manner. These rigs may take the form of suitable arrangements shown in U.S. Patent 3,192,722, issued July 6, 1965, and the aforesaid French Patent 1,199,170. Such rigs include prop frame 131 having props 132 and 133 interconnected by strap 134, and prop frame 135 including props 136 and 137 interconnected by strap 138, the two frames being operatively interconnected via the linear actuating means of double-acting piston-cylinder transverse linear drive 139 as used in the form of a cylinder 140 and piston 141 to which are appropriately attached the straps 142 and 143 in the case of frame 131 and straps 144 and 145 in the case of frame 135.

It will be appreciated that in each case the guide means, e.g., mining conveyor, is preferably provided in individual conveyor sections articulated interconnected with one another to permit not only deviation from the longitudinal direction in an undulating manner, but also deviation from the relative horizontal direction where the mine floor is uneven. Naturally, a plurality of spaced apart base means of the invention will be utilized at different points along the guide means to effect automatically yet individually along the length of the guide means arrangement the desired tilting of the guide means and the desired forward advance thereof continuously by newly exposed layers of the mine face. In the same way, while piston-cylinder arrangements of the conventional type have been shown as useful for the urging means, prop means, etc., these parts may be replaced by other suitable means, such as pawl and ratchet assemblies, preferably with constant spring urging to achieve the continuous advance in the case of the linear actuating means discussed, or perforated overlapping bar connections which permit relative changes in the over-all effective length thereof, and the like.

Indeed, in order to achieve the continuous advance, the prop elements connected with the advancing apparatus are preferably set at less than maximum extended position so as to allow such advance without intermittent prop retracting operations. The embodiments in which the guide means include a guide track having a knife-edge are advantageously precisely controlled in accordance with the invention since such knife-edge may be urged forwardly at the desired height and at the desired angle with respect to the mine face, and thereby the precise control of the invention will permit, especially in the case where the planer extends past the knife-edge a given distance, the extraction of mineral in estimated quantities and at predetermined levels. According thereto, efficient mining operations may be undertaken with a minimum of time and effort and with a maximum recovery of those mineral portions desired in terms of the particular stratum or vein of mineral being worked.

Specifically, lifting and/or pushing piston-cylinder arrangement may be used to achieve the angular adjustment of the guide means and in turn the mining machine, such as a coal planer, with the prop means or the like attached to the guide means being set at less than maximum pressure whereby the same may be urged forwardly with the guide means, and this is true regardless of the particular angle of tilt at which the prop means connected with the guide means may be situated. The constant urgency of the guide mean and any props connected therewith with the precise control of the angle of disposition of the guide means and in turn the mining machine with respect to the mine floor is the most effective arrangement for extracting mineral from the mine face, with suitable automatic changes taking place along the mine face being worked at the particular spaced apart prop means arrangement provided. The prop means disposed immediately next to the conveyor face allows the required sufficient forces of the urge means to be transmitted directly thereto without the over-all guide means construction being subjected to undesired excessive forces which might otherwise cause rupture of the construction.

The particular feature of the invention, indigenous to the embodiments of FIGS. 1 and 2, advantageously permit the guide means to be displaced vertically as well as
3,357,742

angularly. In this connection, no special means, such as hydraulic cylinder means, need be mounted on the conveyor means of the invention, but instead the vertical mobility is made possible by the hydraulic system employed on the particular prop itself (see FIGS. 1a and 2).

Of course, it is of importance that the prop means associated with the guide means be capable of withstanding those forces transmitted to it and for this reason the same is placed in engagement with the mine floor and mine roof, yet at a lower setting force than otherwise whereupon the same may be slid forwardly in this condition. Nevertheless, in the case of the embodiments of FIGS. 2, 3 and 4, the prop associated with the guide means may be rigidly affixed to the guide rail in question so that the entire prop will tilt with the guide rail, or by the constructions of the embodiments of FIGS. 1 and 5, the guide rail will pivot while the prop associated therewith remains upright between the mine roof and mine floor.

By reason of the use of a pair of parallel mining frames in accordance with another feature of the present invention, a walking hydraulic prop rig may be provided which may be urged forwardly steadily where the prop frame of the rig connected to the guide means is placed under a slightly less setting force than the remaining prop frame of the conventional front prop of the frame being displaced to the guide rail, conveyor or the like, perhaps through intermediate members, an overall advance is achievable in increments along the longitudinal extent of the mine face, and alternate advance of the other frame of the rig may take place when the full forward amplitude of the linear drive has been reached.

Understandably, a prop rig of the foregoing type for controlling the forward advance of the guide means need only be present at spaced apart intervals along the guide means, and intermediate thereto one or more conventional prop rigs may be provided to achieve the required roof support as may be seen in connection with the embodiment of FIGS. 5 and 6. It will be appreciated by the artisan that the embodiment of FIG. 1 may be similarly provided with intermediate rigs of the normal type and the condition of FIGS. 2, 3 and 4 may be modified to permit normal advancing prop frame rigs to be interposed between the prop means of the invention. Nevertheless, the particular prop or frame that is meant to slide forward under constant pressure should be maintained in its desired vertical or inclined position so that the corresponding control of the angle of the mining machine within the range thereof will not change. Of course, such position will vary perhaps along the extent of the mine face but at each area of the guide means, the particular angle will be preserved during the advance until the particular mineral seam conditions change thereby to warrant a change in such angle.

The embodiment of FIG. 1 efficiently permits the angular displacement to occur despite the long lever arm distance between the knife-edge of the guide track and the remote side of the conveyor due to the reinforcement provided by the bracket underlying the conveyor. Thus, no undue stress will be urged upon the conveyor parts which might otherwise rupture the same.

By the embodiments of FIGS. 3 and 4, the conveyor is interposed between a pair of props and these may be modified in accordance with the embodiments of FIGS. 1a and 2 to be changed in height despite the fact that one of the props is rigidly affixed to one of the guide rails.

In the case of the embodiments of FIGS. 2, 3 or 4, it will be realized that the particular vertical or inclined position of the props should be maintained the same even during the continuous advance of the arrangement toward the mine face, and this is carried out where the separate cylinders may function for the advance such that the cylinders urge the arrangement forward at the same linear rate. With regard to these embodiments, suitable pivotal linkages are provided to aid in permitting such advance despite unevenness in the mine floor and despite slight variance of the desired angle of tilt which may be caused by uneven linear advance of the pair of advancing cylinders utilized.

In connection with the embodiment of FIG. 4, it will be appreciated that the prop means associated with the conveyor may be advanced as a separate unit due to the particular arrangement of urging piston-cylinder constructions, or the conveyor may comprise a prop frame usable with another prop frame in the form of a prop rig of the type discussed in connection with the embodiment of FIGS. 5 and 6.

With regard to the embodiment of FIG. 5, despite the fact that the guide track and conveyor would normally present a long lever arm to be angularly displaced, due to the presence of the foot underlying the conveyor and the pivot connection at the side of the conveyor adjacent the mine face, suitable articulation may occur without excessive stresses being transmitted to the conveyor and thereby such conveyor is protected from rupture which might otherwise occur. Indeed, the prop means or prop frame in the embodiment of FIG. 5 to which the footing is attached, although placed under slightly engaging support with the mine roof to permit forward advance, is still sufficiently in contact with the mine roof and mine floor to ensure downward urgent of the footing against the mine floor via the coil spring, the entire track is thus maintained in sufficient contact with the mine floor at the mine face by the construction utilized, even though but one prop means is particularly associated therewith because the footing used is linkably connected with the prop means intermediate the footing ends such that the footing ends rest upon the mine floor in a stable manner. Accordingly, the torque necessary to achieve the tilling can be accommodated in this construction with but one prop cylinder arrangement, while in the previously described embodiments additional cylinder arrangements are necessary.

It will be appreciated that the instant specification and drawings are set forth by way of illustration and not limitation, and that various modifications and changes may be made without departing from the spirit and scope of the present invention which is to be limited only by the scope of the appended claims.

What is claimed is:

1. Mining arrangement which comprises longitudinal guide means adapted to be extended along a mine floor adjacent a mine face for slidably receiving on said guide means a mining planer for movement back and forth along said mine face in extractive engagement therewith to mine mineral therefrom, first articulating connection means, unitary base means spaced from the longitudinal axis of said guide means and operatively connected via said first articulating connection means with said guide means, adjustable effective length urging means operable between a retracted position of minimum overall effective length and an extended position of maximum overall effective length, and second articulating connection means, said urging means operatively interconnecting along the over-all effective length thereof said base means and said guide means via said second articulating connection means, whereby urging means to change the effective length thereof said guide means are articulated via said first articulating connection means and displaced angularly with respect to such mine face to change corresponding the angle of engagement of such mining planer with such mine face.

2. Arrangement according to claim 1 wherein said base means includes mining prop means extending outward from the mining planer with respect to the mining planer, said engaging engagement with the mine roof and mine floor, wherein said urging means includes a first urging part and a second urging part operatively interconnected for limited relative linear displacement with respect to each other to adjust the over-all effective length of said urging means, and wherein said first articulating connection
means include first pivot means and said second articulating connection means include second pivot means.

3. Arrangement according to claim 2 wherein said guide means include mining conveyor means, said conveyor means being pivotally connected by said first pivot means to said prop means, and wherein said first urging part is fixedly connected to said prop means and said second urging part is pivotally connected by said second pivot means to said conveyor means.

4. Arrangement according to claim 3 wherein said prop means includes seating means thereon movably axially with respect to said prop means, and wherein said conveyor means is directly pivotally connected by said first pivot means to said seating means, and said first urging part is directly rigidly connected to said seating means at a point thereon axially spaced from the first pivot means point of connection thereof.

5. Arrangement according to claim 4 wherein said seating means and said prop means together define an upright double-acting piston-cylinder arrangement such that upon actuation said seating means is displaced vertically with respect to said prop means in turn displacing said guide means over a distance effective with the displacement thereof resulting from the operation of said urging means, and wherein linear actuating means are connected to said prop means to displace said prop means and in turn said guide means linearly toward and away from the mine face.

6. Arrangement according to claim 2 wherein said guide means include mining conveyor means and an auxiliary prop member rigidly interconnected at the side of said conveyor means remote from the mine face side thereof, said auxiliary prop member being pivotally connected by said first articulating connection means including said first pivot means to said prop means, and wherein said first urging part is pivotally connected to said prop means and said second urging part is pivotally connected by said second pivot means to said auxiliary prop member.

7. Arrangement according to claim 6 wherein said auxiliary prop member is formed of three upright sub-members operatively interconnected for relative axial movement with respect to one another, including a central sub-member to which said first and second pivot means are attached and to which said conveyor means are rigidly attached, an upper sub-member and a lower sub-member, said upper and lower sub-members each being movably axially independently of the movement of the other with respect to the central sub-member, whereby said upper and lower sub-members may be axially displaced into and out of engagement with the mine roof and mine floor at different axial positions of said central sub-member, such that upon relative axial displacement of said central sub-member with respect to said upper and lower sub-members said conveyor means is displaced vertically in conjunction with the displacement thereof resulting from the operation of said urging means.

8. Arrangement according to claim 7 wherein said first articulating connection means include an auxiliary urging means operable between a retracted position of minimum over-all effective length and an extended position of maximum over-all effective length pivotally connected at one end to said prop means and connected at the other end thereof via said first pivot means to said central sub-member.

9. Arrangement according to claim 2 wherein said guide means include mining conveyor track and an upright pit prop fixedly interconnected to each other, wherein said first articulating connection means include a mining conveyor means pivotally connected to said prop means at one side thereof and pivotally connected at the other side thereof via said first pivot means to said pit prop, and wherein the upper end portions of said prop means and pit prop are pivotally interconnected via said urging means and said second articulating connection means including said second pivot means.

10. Arrangement according to claim 9 wherein prop means and pit prop each have a roof cap disposed on the upper end portion thereof and said roof caps are pivotally interconnected via said urging means and said second articulating connection means including said second pivot means, and wherein linear actuating means are connected to said prop means to displace said prop means and in turn said guide means linearly toward and away from the mine face.

11. Arrangement according to claim 9 wherein a supplemental prop is provided to form a prop frame with said prop means, and wherein said first articulating connection means further includes a transverse piston-cylinder arrangement pivotally interconnected said conveyor means and said prop frame, whereby upon actuation of said transverse piston-cylinder arrangement said conveyor means and said guide means may be displaced linearly toward and away from said prop frame in conjunction with the angular displacement of said guide means upon actuation of said urging means.

12. Arrangement according to claim 2 wherein said base means further includes a foot member linkably connected medially to the lower end portion of said prop means, wherein said guide means include track means and mining conveyor means rigidly interconnected, said track means being pivotally interconnected by said first articulating connection means including said first pivot means to said foot member, and wherein said first urging part is pivotally connected by said second articulating connection means including said second pivot means to said foot member and said second urging part is rigidly connected to said conveyor means.

13. Arrangement according to claim 12 wherein urging spring means are provided operatively between said prop means and foot member to urge downwardly said foot member into supporting engagement with the mine floor, said conveyor means being transversely interposed between said track means and said urging means, and said foot member extending transversely under said conveyor means and being connected by said first pivot means to said track means on the side of said conveyor means remote from the side thereof to which said second urging part is rigidly connected.

14. Arrangement according to claim 13 wherein a supplementary prop is provided to form a first prop frame with said prop means, said prop frame extending transversely with respect to the longitudinal axis of said guide means, and a corresponding second prop frame including a pair of pit props is also provided which is parallel to and connected operatively with said first prop frame by means of an interconnecting double-acting piston-cylinder transverse linear drive, whereby said frames may be alternately moved linearly relative to one another in a direction transverse the longitudinal axis of said guide means to displace said guide means toward and away from the mine face via said foot member linkably connected at one portion thereof to said prop means and at another portion thereof to said track means.

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