ROOF SUPPORTING ARRANGEMENT INCLUDING CANTILEVERED ROOF BAR CARRYING EXTENSIBLE ROOF SUPPORTING CAP AND CUTTER MEANS

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ABSTRACT OF THE DISCLOSURE

Roof supporting arrangement for a mine roof adjacent a mine face including an extensible pit prop carrying a cantilevered longitudinal roof bar, a preliminary roof cap and cutting means mounted slidably on top of the bar and extensible partially beyond the free end thereof yet in supporting engagement therewith, outwardly inclined drive means of changeable longitudinal length, e.g., a piston-cylinder means, pivotally connected between said bar and roof cap and cutting means, and a blade on the cap and cutting means outer end having an edge directed toward the interface between the adjacent mine face and the roof, thereby upon drive means displacement to extend said cap and cutting means preliminary mine roof support will be provided and said blade will cut away overhanging roof coal at the mine face ahead of such arrangement.

The present invention relates to a roof supporting arrangement or roof propping unit including at least one continuously extensible or constantly urged pit prop or mining prop, or the like, a roof bar adapted to extend substantially crosswise to the longwall working face of the mine or, the like, and a preliminary roof supporting cap longitudinally displacedly mounted in cantilever fashion on the roof bar and carrying cutting means thereon situated to attack in the longitudinal direction of the bar and cap overhanging coal in the mine face at the mine roof.

Roof supporting arrangements or roof propping units are known generally, such as that disclosed in German Utility Model 1,907,015, in which a preliminary roof supporting cap is joined articulately to the front end or free end of the roof bar of a propping unit and is pivoted upwardly against the roof by means of a pressure cylinder after a section of the overhanging roof coal has been removed to expose the roof area thereat to a sufficiently large extent to accommodate the load contact therewith of the full length of the preliminary roof supporting cap. Thus, this known construction is only purposeful where the overhanging coal in the mine face at the roof has been removed sufficiently to expose a large enough roof area for the preliminary roof supporting cap to engage the same in an unhindered manner whereby to support preliminarily such roof area against undesired cave-in. It will be noted further that the use of these roof propping units is greatly limited by the mining conditions since the roof surface must be cut particularly clean, with no adhering mineral, such as overhanging coal, in the area in question. This is true since otherwise the upwardly pivoting preliminary roof supporting cap would be held away from the roof surface by the remaining roof coal or other adhering mineral and thus prevent adequate seating required for bearing the load of the roof via the preliminary roof supporting cap.

The reason for using preliminary roof supporting caps, of course, is to provide preliminary support of the roof during longwall mining operations in the area defined by the width of the planer alley along which the appropriate mining machine is conducted to extract mineral as well as the guide means therefor including perhaps a mining conveyor situated parallel to the mine face being worked. As new layers of mineral, such as coal, are extracted, the prop units supporting the roof must be advanced an additional increment yet the normal roof bars as a practical matter cannot extend sufficiently toward the mine face during the entire phase of operations and, therefore, preliminary roof supporting caps are used in conjunction therewith. The preliminary roof supporting caps will maintain the roof load until the mining machine and its guide means, including the mining conveyor if present, have advanced a sufficient increment toward the new layers of mine face to be worked to permit the main roof supporting units to be advanced in turn. Roof supporting arrangements or roof propping units are well known (see, for example, U.S. Patents 3,169,277, 3,174,289, 3,186,179, 3,192,727, 3,237,903 and 3,241,323), and these are modified by including a preliminary roof supporting cap at the free end of the roof bar adjacent the mine face.

It is an object of the present invention to provide a roof supporting arrangement or roof propping unit including at least one continuously extensible or constantly urged pit prop or mining prop, or the like, a roof bar adapted to extend substantially crosswise to the longwall working face of the mine or, the like, and a preliminary roof supporting cap longitudinally displaceably mounted in cantilever fashion on the roof bar and carrying cutting means thereon situated to attack in the longitudinal direction of the bar and cap overhanging coal in the mine face at the mine roof.

It is another object of the present invention to provide a roof supporting arrangement including at least one extensible prop carrying a roof bar thereon and a preliminary roof supporting cap which contains cutting means at its outer or free end facing the mine face to be worked, such that a cutting edge of the cutting means is disposed in the plane of the interface between the mine roof and mine face so as to cut any overhanging mineral, such as coal, precisely and cleanly away from the mine roof surface to permit the preliminary roof supporting cap to be extended forwardly and upwardly into load bearing roof supporting contact thereat in an unhindered manner.

It is still another object of the present invention to provide an arrangement of the type described having drive means, such as piston-cylinder means, interconnected operatively the roof bar and preliminary cap to permit retraction and extension longitudinally of the cap with respect to the bar so that the cutting means on the free end of the cap may engage operatively the interface between the mine roof and mine face thereon and clear the way for the simultaneous extension of the cap or roof supporting engagement.

It is still another object of the present invention to
achieve the foregoing using a longitudinal drive means operatively connected between the roof bar and roof cap in an upwardly inclined manner from a lower level pivot connection with the roof bar to an upper level pivotal connection with the roof cap so as to attain urging support by the drive means of the cap against the roof in addition to urging engagement of the cutting blade with overhanging material at the interface.

It is still another object of the present invention to provide an arrangement of the foregoing type in which the preliminary cap is mounted on the roof bar in cantilever fashion so that the cap will be supported on the bar in any position of displacement therebetween in the longitudinal direction of the roof bar.

It is a further object of the present invention to provide an arrangement of the foregoing type utilizing a channel member or inverted U-shaped member as the cap to permit slidable mounting thereof on the top surface of the roof bar so that the constructional arrangement may be achieved without modification of conventional roof bars now in existence.

It is still a further object of the present invention to provide an arrangement of the type described in which the cap is merely slidable mounted on the bar and held in supporting engagement by the upward force of the prop transverse to the roof bar to the cap, with the cap being held in position by the resultant clamping engagement thereof between the bar, on the one hand, and the mine roof thereabove, on the other hand.

It is still a further object of the present invention to provide an arrangement of the foregoing type in which the prop is maintained under sufficient force to achieve the clamping engagement of the cap between the bar and the roof while also permitting the cap under the urge of the drive means to be displaced rearwardly and forwardly in the longitudinal direction of the bar without undue friction and concomitantly without sacrificing the support of the roof thereat, whereby the cutting blade may clear a path at the roof for the cap and in turn the cap may be extended toward the mine face.

It is still a further object of the present invention to attain the foregoing with a minimum of danger to the mine workmen from roof cave-in using a practical interrelation of parts, with a minimum of modification of existing devices, in a simple manner.

It is a still further object of the present invention to provide a construction of the foregoing type which is durable in use and inexpensive to manufacture and maintain.

It is still a further object of the present invention to provide an arrangement of the foregoing type in which a preliminary roof supporting cap may be mounted in slidable relation therewith in cantilever fashion carrying a cutting edge extending in the plane of the interface between the mine roof and mine face, with further support of the cap especially in extended position being supplied by the upwardly inclined drive means.

It is still another object of the present invention to provide an arrangement of the foregoing type in which the drive means is disposed in spaced relation to the roof bar and roof cap rather than housed within the roof bar and/or roof cap to permit ready access for installation and/or repair without modifying the construction of conventional roof bars now being used.

It is still another object of the present invention to provide the longitudinal drive means in upwardly inclined manner to achieve the best utilization of power for the purposes of displacement of the cutting edge and support of the cap in the performance of the present invention.

It is a still further object of the present invention to provide an arrangement of the foregoing type having the dual purpose of stripping the roof area in the longitudinal direction of the roof bar and of supporting preliminarily the stripped roof by the cap as soon as possible after stripping.

It is an additional object of the present invention to provide a roof bar and cap and cutting means construction operatively connected via a drive means, as described, which permits the extension of the bar beneath the cap and cutter means upon advance of the prop arrangement to achieve a relative retraction of the cap and cutter means with respect to the bar in order to return the arrangement of parts to the initial position for undertaking the next extension of the cap and cutter means for accomplishing the purposes of the invention.

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

The figure shown illustrates schematically a side elevation of one embodiment of the invention including an upright prop, a roof bar on which is slidably mounted a preliminary roof supporting cap, and a piston-cylinder means operatively interconnecting the bar and cap for relative longitudinal displacement therebetween, wherein the forward or free end of the cap is provided with cutting means including a cutting blade having its edge disposed in the plane of the interface between the mine roof and mine face.

It has been found in accordance with the present invention that a roof supporting arrangement or roof prop- ping unit may now be provided which avoids the above-mentioned disadvantages by using a preliminary roof supporting cap mounted on the roof bar of a prop unit for longitudinal extension and retraction substantially along the axis of the roof bar using a longitudinal drive means, such as a piston-cylinder arrangement which is tilted slightly upwardly from the roof bar to the free end of the roof cap and which is disposed closely beneath the roof bar, in conjunction with cutting means including a cutting tool at the forward or free end of the preliminary roof supporting cap having a cutting edge which slides along the surface of the roof to cut away any mineral such as coal adhering to the roof during longwall mining operations. Advantageously, the drive means is joined articulately at its end adjacent the mine face to the preliminary roof supporting cap and joined articulately at its end remote from the mine face to the roof bar in a manner achieving the upwardly inclined disposition thereof in a direction toward the free end of the cap. The drive means serve the dual purposes of alternately extending and retracting the cap in the longitudinal direction of the roof bar on the prop to cause the cutting blade edge to shave away overhanging mineral in the vicinity of the roof there ahead, on the one hand, and of supporting preliminarily the stripped roof via the cap in extended position, on the other hand. It will be realized that the arrangement will be advanced in increments by appropriate advancing means of the conventional type whereupon the roof bar will be guided forwardly toward the mine face to cause the retraction of the cap thereon in order to carry out the next cutting and preliminary support advance of the cap. The drive means is arranged, as the artisan will appreciate, to achieve the relative displacement in longitudinal direction of the cap and bar with respect to one another during extension and retraction phases.

The preliminary roof supporting cap is preferably in the form of a steel channel or inverted U-shaped member having its open side directly downwardly over the top surface of the roof bar in covering relation there-with in such a manner that the depending sides of the channel or U-shaped member are disposed beneath lateral displacement of the bar and cap with respect to one another while permitting controlled guidance in longitudinal direction of the bar and cap with respect to one another.

While the cutting means including the blade may be disposed on the free end of the cap directly, it is preferable to provide a headpiece on the free end of the cap.
in which the cutting means, such as a cutting tool in the form of a wedge, may be accommodated. In accordance with a particular feature of the present invention, a roof supporting arrangement for a mine roof adjacent a mine face is contemplated which comprises prop means including at least one extensible pit prop carrying a cantilevered longitudinal roof bar, a preliminary roof cap and cutting means mounted slidably on said roof bar and having an outer end portion extensible in longitudinal direction partially outwardly beyond said bar yet in supporting engagement therewith, energizable slightly upwardly inclined longitudinal drive means of changeable over-all effective length connected pivotally at the corresponding lower longitudinal end thereof to said roof bar and at the corresponding upper longitudinal end thereof to said roof cap and cutting means, and a cutting blade mounted on the outer end portion of said cap and cutting means with the edge of said blade adapted to be directed toward the interface between such mine roof and mine face, whereby upon energizing said drive means to change the effective length thereof by increasing such length said cap and cutter means connected thereto are extended thereby partially outwardly beyond said bar to provide preliminary roof support thereat and in turn said blade is urged along said interface to cut away attendant mineral from the mine face longitudinally along the mine roof.

Referring to the drawing, a roof supporting arrangement or roof proping unit 10 is shown which includes the extensible prop 11 which may be a pit prop or mining prop, such as a hydraulic prop or jack of conventional design, having the cylinder member 12 and the piston member 13 operatively arranged in telescop ing relation to permit the outward or upward extension of the piston member 13 as well as the inward or downward retraction thereof with respect to cylinder member 12. In this manner the roof bar 14 supportingly mounted thereon by conventional means may be raised or lowered from supporting engagement with the mine roof 32. Roof bar 14 may be connected, for example, via a pivot 15 with an auxiliary roof bar 16 disposed rearwardly there of to the area of support of the mine roof.

The aforesaid description is conventional and is often provided as part of a prop frame containing one or more additional props interconnected for simultaneous movement, or a pair of such props or frames is connected for alternate advance. The aforementioned parts in the drawings are conventional and are covered, for instance, in the various U.S. patents enumerated hereinabove.

The extensible prop 11 under proper energizing force, for example, using hydraulic fluid, is anchored between the mine floor 31 and mine roof 32 via the roof cap 14. During advance of the arrangement, a slight decrease in pressure on prop 11 may be provided to permit the prop and roof bar 14 and other elements connected therewith, such as the auxiliary bar 16, to be advanced in a direction toward the working face or mine face 33 with a minimum of friction between the top surface 17 of roof bar 14 and the roof thereof yet without sacrificing any support of the roof during this time.

Generally, the roof bar 14 in conventional constructions extends in longitudinal direction and has a flat or even, i.e., linearly straight, top surface 17, and may or may not have a similarly flat or even contour in transverse direction. Usually, the top surface 17 will be disposed in a horizontal plane to achieve maximum supporting engagement with the mine roof. The roof bar 14 is provided with a forward, preferably upwardly tapering, cantilevered portion 18 extending to the upper face of the mine roof 33 in order to provide as far as possible preliminary support of the mine roof in that width of the mineway situated between the prop 11 and the working face 33. It will be realized that during longwall mining operations, a mining machine such as a planer (not shown) of conventional design is conducted along the mine face to extract mineral therefrom. Usually this is accomplished in a linear direction transverse the longitudinal direction of the roof bar 14, if not at right angles thereto at least in crosswise direction, so as to provide sufficient working space for the mining equipment and for the removal of mineral being extracted.

A guide means for the mining machine is usually disposed rearwardly thereof in relation to the mine face 33 and such guide means usually contemplate as a part thereof a conventional mining conveyor onto which extracted mineral is deposited for removal from the site of mining operations. Understandably, prop 11 cannot be brought desirably close to the mine face in order to achieve maximum support of the roof thereat because of the width necessary to accommodate the mining machine, the guide means thereof, including usually a mining planer, and any other devices and equipment indigenous to the extraction of mineral from the face. Accordingly, the cantilever portion 18 is provided on the roof bar 14 to achieve as far as possible preliminary support of the roof while in unstable condition as a result of the loss of support caused by the removal of mineral from the mine face therebelow.

It will be appreciated by the artisan that as mineral is extracted from the mine face, especially considering a mine face of extraordinary height but even smaller, a certain overhang of mineral will remain, often adhering to the mine roof in a precarious manner. Thus, as the cantilever portion 18 is advanced with the mining arrangement, difficulties will arise due to blockage of its advance by the overhanging mineral, and due to the inherent dangers in an incomplete seating of the roof bar against the roof. Understandably, overhanging roof coal 34 may cause a lateral or angular displacement of the roof bar being advanced due to its presence, and even cause the prop arrangement to tilt laterally under certain conditions. Such dangers and disadvantages are overcome by the modifications of the present invention.

Considering a conventional arrangement of the type described, a preliminary roof support cap and cutter means 19 is provided in accordance with the present invention together with a drive means 23. In the drawing, the cap and cutter means 19 is shown in the form of a U-shaped channel member having a top wall 20 and downwardly depending side walls 21 merely mounted on the top surface 17 of the conventional roof bar 14. This is accomplished in the usual case without the need for modifying in any way the configuration or dimension of the roof bar 14 or any other part of the prop arrangement 10. The side walls 21 serve to limit the lateral displacement of the cap and cutter means 19 with respect to the roof bar 14, the lateral dimensions of these parts being determined to achieve this effect, i.e., such caps will permit the longitudinal relative displacement of the cap and cutter means 19 and roof bar 14 with respect to one another. The top wall 20 of the cap and cutter means 19 is correspondingly flat or even, i.e., linearly straight, in longitudinal direction so as to conform with the configuration of top surface 17 of bar 14. Also, if the configuration in transverse direction of top surface 17 is not similarly flat or even, the top wall 20 will be formed so as to achieve the desired coextensive sliding abutment between these parts. Preferably, the roof bar 14 will have a top surface 17 disposed in a flat horizontal plane and the top wall 20 will correspondingly have the same configuration.

Of course, it will be realized that regardless of the profile of the top surface 17 of bar 14, the undersize of the top wall 20 may be maintained in smooth, flat or even profile, or a corresponding profile may be provided. For example, where the roof bar contains one or more longitudinal grooves defined in top surface 17, the undersize of top wall 20 may be similarly provided with tongues cooperating with such grooves to achieve not only a more complete longitudinal guidance of such parts with respect to each other but also supplemental reinforcements of the top wall 20 provided by the extra dimension of the corre-
sponding longitudinal tongue or tongues. While this feature is not shown in the drawing, the construction or arrangement thereof may be achieved forthwith by the artisan without difficulty.

The headpiece 22 is conveniently provided at the free end of top wall 20 to accommodate a cutting tool 29 shown in the form of a wedge having a cutting blade 30 extending outwardly from the cutting face 35 and a pair of cantilever sections 31 and 32 extending a bit more beyond. Two adjacent sections 33 of the cutting tool 29 are so disposed in the headpiece 22 that the portion of the section of the cutting tool 29 which is removably mounted in the headpiece 22 or in its absence removably mounted in the front end of the top wall 20, i.e., for example in a downward extension of top wall 20 reinforced by corresponding medially widening extending portions of side walls 21 secured thereto. This modification is well within the understanding of the artisan and thus no specific illustration is needed to impart the constructional relationship intended. The headpiece 22 or the modified front end of top wall 20 in which the cutting tool 29 is mounted may be provided with conventional means (not shown) to adjust the angle of attack of a blade 30 as rainfall conditions dictate. Normally, however, the cutting edge of blade 30 will be disposed at the same height in the plane of the interface between the overhanging mineral face 34 and the mine roof 32 so as to scrape mineral aged of the arrangement 10 to clear a path and load-bearing roof surface for the top wall 20 to accommodate preliminarily the load of the roof thereof. The construction of the cap and cutter means 19 with the side walls 21 as well as the top wall 20 has the advantage that the side walls contribute reinforcement to such top wall in carrying preliminarily the load of the roof.

In order to achieve the relative linear displacement in longitudinal direction between the roof bar 14, and especially the cantilever portion 18, and the cap and cutter means 19 during the operation of the arrangement 10, the longitudinal drive means 23 is provided. Such drive means is shown in the form of a piston-cylinder means including the pressure cylinder 24 and the piston rod 25 operatively telescoping arranged for corresponding linear displacement with respect to one another. A piston (not shown) is disposed on the inward end of rod 25 and pressure fluid, such as hydraulic fluid, is fed to the piston-cylinder means 23 which may be in the form of a double acting piston-cylinder arrangement, to achieve the extension or retraction of rod 25 outwardly and inwardly of cylinder 24 as the case may be. The drive means 23 may be considered a drive means capable of changing its operative length in an infinite manner within a predetermined range and desirably under constant urging force of rod 25 outwardly of cylinder 24. The drive means 23 may, of course, be provided in any other desired form so long as the function thereof will satisfy the requirements of the present invention.

It will be seen that the drive means 23 is connected partially at 26 to a depending ear 27 on the underside of roof bar 14 rearwardly of the free end of cantilever portion 18. A simple modification to provide such an ear on the underside of the appropriate roof bar 14 may be undertaken by the workmen in the field with a minimum of effort. The forward or outward end of drive means 23 is connected pivotally at 28 to the cap and cutter means 19, and specifically to headpiece 22, at a level slightly higher than the pivotal connection at 26 in order to achieve a slight incline of the linear or longitudinal drive means 23 in a forward direction toward the mine face, i.e., in the direction toward the free end of cap and cutter means 19.

It will be seen also that the headpiece 22 is similarly disposed in cantilever fashion on cantilever portion 18 of roof bar 14 just as cantilever portion 18 is situated in relation to prop 11. Considering the slidable guiding relation between the U-shaped channel profile of the cap and cutter means 19 with respect to the roof bar 14, upon energizing drive means 23, rod 25 will be extended from cylinder 24 to increase the over-all operative length of the drive means, i.e., within the longitudinal limits of piston connections 26 and 28, whereby headpiece 22 will transmit the urging force of drive means 23 both to the top wall 20 and the cantilever portion 18. Practically, the top wall 20 can be moved forwardly in relation connection at 28 is at a lower level than the edge of cutting blade 30 to avoid any rotation of forces during the energizing of drive means 23 which would cause an undesirable displacement of the edge of blade 30 downwardly or outwards away from the interface disposition thereof closely adjacent mine roof 32. On the other hand, the resultant force caused by drive means 23 on the blade 30 will ensure the shearing or scraping away of overhanging roof coal 34 at the interface, thus providing a cleanly exposed area of roof 32 ahead of arrangement 10. Naturally, the blade 30 should be of sufficient transverse dimension to achieve a width of cut which will accommodate the forward advance of arrangement 10 along the roof without hindrance.

The slightly inclined disposition of the drive means 23 is of extreme importance to the construction and arrangement of the mine. The front end of the blade 30 is situated in a forward urging of rod 25 and in turn blade 30 and top wall 20, the upward force contributed by the drive means will enhance the load bearing capacity of the cap and cutter means 19, especially in the most outward or forward extended position of top wall 20 with respect to cantilever portion 18. This is in addition to the abovedescribed force in the same resultant direction exhibited by the drive means on the edge of blade 30.

In the extended position of drive means 23, i.e., when rod 25 is at fully extended amplitude, the cap and cutter means 19 will be correspondingly at fully extended position and preliminary support of the newly exposed mine roof area will be attained so as to permit safe working in the area adjacent the mine face 33 and the further extraction of mineral by the mining machine such as a picker (not shown) until the arrangement 10 can be advanced in the conventional manner to repeat the cycle.

In this regard, any desirable means may be used to advance arrangement 10 as far as the newly exposed layer of the mine face 33. As this is undertaken, prop 11 and roof bar 14 mounted thereon will be driven forwardly closer to mine face 33 yet rod 25 is at full amplitude, the cap and cutting means 19 will remain more or less in the same longitudinal position. In this manner, roof bar 14 will again extend to a greater degree under cap and cutter means 19 to achieve the position shown in the drawing. At the same time, by suitable reverse actuation of the drive means 23 or by switching the drive means to idle or neutral position, the cylinder 24 will be driven forward via the connection at 26 with ear 27 of roof bar 14 so as to cause retraction of rod 25 thereinto once again. Inasmuch as the roof bar 14 will now undertake the main load of the roof, the lack of positive urging on the part of drive means 23 to enhance the roof supporting load of cap and cutter means 19 during this time will not be significant. The same is true regarding the urging force transmitted to blade 30 since further urging of blade 30 into the overhanging mineral face 34 will normally await renewed removal of mineral from the lower portion of mine face 33. Once this is accomplished, the cap and cutter means 19 and drive means 23 transmitted to blade 30 will be sufficient to scrap away additional layers of overhanging mineral since such overhanging mineral will have been robbed of its support during the next phase of mineral extraction from the lower portion of the mine face.

In spite that cap and cutter means 19 is similarly disposed of cap and cutter means 19 merely mounted on roof bar 14, preferably without any positive constructional interconnection therebetween, such cap and cutter means 19 will still be main-
In supporting engagement with the mine roof due to the advantageous clamping engagement of top wall 20 between top surface 17 and the mine roof under the upward force of prop 11. Prop 11 is normally maintained under continuous urging force against roof bar 14 and in turn mine roof 32, not only to achieve normal support of the roof but also cantilever support of top wall 20 in any position of longitudinal displacement thereof with respect to roof bar 14, considering that the roof itself will prevent any upward displacement of top wall 20 which could endanger the support relationship of parts.

It will be realized, in accordance with the present invention, that the drive means, such as the piston-cylinder arrangement shown, operates the cap and cutter means 19 in a simple manner from a position exteriorly of the roof bar and, therefore, necessitates no change in the conventional form of the roof bar to achieve the adaptation of roof propping units now in existence to the present invention. This is also true of the cap and cutter means since the same is provided with a channel construction allowing such cap and cutter means merely to be mounted upon an existing roof bar. By reason of the channel profile of the cap and cutter means cantilevered on the roof bar, and the fact that the roof bar is urged by the prop continuously in engagement with the roof, the roof bar will hold the cap and cutter means precisely in position not to support preliminarily the roof in extended position of the cap and cutter means but also to deliver the thrust of the drive means to the cutting blade on the free end of the cap and cutter means precisely at the interface between the roof and the overhanging mineral. An advantage of the present constructional relationship of parts is that the combination may be adjusted in design within the purview of the artisan to meet any special requirements so long as the prop 11 continuously urges the bar and in turn the cap and cutter means in the desired anchoring fashion while, of course, permitting under slight released pressure the advance of the arrangement 10 toward the mine face when desired. Generally, the cap and cutter means 19 will be maintained along the underside surface of the mine roof throughout the mining operations, and the cutting blade 30 will be maintained parallel to the roof and always precisely urged in forward position of the arrangement of the invention not to scrape mineral adhering to the roof via the cutting blade but also to support preliminarily the roof before the appropriate bar is advanced to take the mine roof load thereat.

The essentially simple cross-sectional shape or profile of the cap and cutter means and its positioning relative to the roof bar permit economy of manufacture and avoidance of the need for modification of existing equipment while enjoying a new combination relationship of parts sufficient for preliminary support and preliminary scraping of mineral ahead of such support without additional means than those described. The right angle thrust of the drive means of the blade allows longitudinal scraping of overhanging mineral to take place rather than scraping transverse the longitudinal direction of the roof cap or roof bar, as has been utilized in the past. Any overhanging mineral, such as top coal left hanging at the roof on either side of the arrangement of the invention, will be of no consequence. This is true since such laterally disposed overhanging mineral will eventually collapse of its own weight without interfering with the further advance of the arrangement of the invention or be removed by other means as desired. In no case will such laterally adhering mineral hinder the forward advance of arrangement 10 in the desired manner, as will be apparent from the foregoing description. A dual purpose is thus achieved in accordance with the present invention of not only providing preliminary roof support as soon as possible after mineral is extracted from the mine face but also in stripping overhanging mineral at the roof as soon as possible as well.

While in the past, preliminary roof supporting caps have been utilized, they have not been free from the disadvantages caused by adhering overhanging mineral and such arrangements could only be utilized for preliminary roof support after extraneous attempts were made to clear such overhanging mineral ahead of the preliminary roof support means. By way of the present invention, the clearing of overhanging mineral and the attaining of preliminary roof support are achieved essentially simultaneously and without the danger of undesired displacement of the preliminary roof support or the main roof support from its intended disposition and without the perils of unsafe contact between the supporting means and the roof due to the interposition of adhering overhanging mineral.

Considering that the headpiece 22 is an optional feature of the present invention, where the same is omitted the outward end of the piston rod 25 will be connected directly, i.e., pivotally, with the free end of cap and cutter means 19. The connection may be by way of a transverse pin mounted between the adjacent portions of the parallel side walls 21, in a manner within the understanding of the skilled artisan aware of the present invention. In such modification, not illustrated because of its simplicity, the cutting tool 29 may be similarly mounted a the free end of cap and cutter means 19, such as by the modification aforesaid, utilizing a downwardly depending flange extension of top wall 20 thereat, perhaps together with medially inwardly directed extensions of side walls 21. Of course, other mounting means from the outward end of piston rod 25 and also for the cutting tool 29 at the free end of cap and cutter means 19 may be used, but illustration or specific discussion thereof is unnecessary. Such modifications will occur to the artisan in the light of the over-all aspects of the present invention.

Thus, in accordance with the present invention, a roof supporting arrangement for a mine roof adjacent a mine face in a mineway may now be provided which comprises prop means including at least one extensible pit prop carrying a cantilevered longitudinal roof bar at the upper end portion thereof for disposition in supporting and anchoring engagement between the mine floor and mine roof of such mineway with said roof bar extending in a direction toward such mine face and bearing the load of the mine roof thereat, said bar including a forward cantilever portion, a preliminary roof cap and cutter means mounted slidably on said forward cantilever portion for linear movement in longitudinal direction between a retracted position and an extended position with respect thereto to provide preliminary roof load bearing support, energizable slightly upwardly inclined longitudinal drive means including first and second cooperating drive parts interconnected for energized infinite relative linear displacement toward and away from each other to change the over-all effective length of said drive means within a range corresponding to the linear movement of said cap and cutter means with respect to said cantilever portion, one of the drive parts being pivotally connected at a first point to said forward cantilever portion and the other of the drive parts being pivotally connected at a second point longitudinally spaced from and slightly vertically above said first point to said cap and cutter means, and a cutting blade mounted on the outer end portion of said cap and cutter means with the edge of said blade directed toward the interface be-
between the mine roof and mine face, whereby upon energizing said drive means to displace said parts relatively away from each other to change the effective length thereof, said cap and cutter means are moved toward said extended position on said forward cantilever portion to provide an enhanced roof load bearing support and in turn said blade is urged along said interface to cut away attendant mineral from the mine face longitudinally along the mine roof.

In particular, such roof cap and cutting means include a roof cap of inverted U-shaped cross-section overlying said roof and an enhanced portion of said roof cap whereby said drive means includes a slightly upwardly inclined piston-cylinder means connected at a lower corresponding point to said roof bar and at an upper corresponding point to said roof cap.

Arrangement according to claim 2 wherein said head piece is rigidly fixed to said roof cap and said cutting blade is in the form of a cutting wedge removably secured to said head piece such that the edge of the blade is disposed in transverse direction substantially within the overlying plane of the mine roof surface thereat and operatively facing the adjacent mine face.

What is claimed is:

1. Roof supporting arrangement for a mine roof adjacent a mine face, which comprises prop means including at least one extensible pit prop carrying and effectually supporting said load of a cantilevered longitudinal roof bar, a preliminary roof cap and cutting means mountable slidably on said roof bar and having an outer end portion extensible in longitudinal direction partially outwardly beyond said bar yet in stable effectually supporting engagement therewith even when in extended position partially outwardly therebeyond, energizable slightly upwardly inclined longitudinal drive means of changing the overall effective length connected pivotally at the corresponding lower longitudinal end thereof to said roof bar, and at the corresponding upper longitudinal end thereof to said roof cap and cutting means and enhancing said stable supporting engagement of said roof cap on said roof bar and thereby providing essentially the entire load-bearing support for said roof cap, and a cutting blade mounted on the outer end portion of said cap and cutting means with the edge of said blade adapted to be directed toward the interface between such mine roof and mine face, whereby upon energizing said drive means to change the effective length thereof by increasing such length said cap and cutter means connected thereto are extended thereby partially outwardly beyond said bar to provide preliminary roof support thereat and in turn said blade is urged along said interface to cut away attendant mineral from the mine face longitudinally along the mine roof.

2. Arrangement according to claim 1 wherein said roof cap and cutting means includes a roof cap of inverted U-shape cross-section overlying said roof bar in sliding supporting engagement therewith and said drive means includes a slightly upwardly inclined piston-cylinder means connected at a lower corresponding point to said roof bar and at an upper corresponding point to said roof cap.

3. Arrangement according to claim 2 wherein said roof cap carries a head piece at the outer end portion thereof in which said cutting blade is mounted and said piston-cylinder means is connected to said roof cap via said head piece.

4. Arrangement according to claim 3 wherein said roof cap includes a top wall linearly flat in said longitudinal direction and downwardly depending lateral flanges defining transversely confining side walls and said roof bar includes correspondingly a top surface linearly flat in said longitudinal direction and side surfaces which are dimensioned to fit transversely within the U-shaped confines of said roof cap top wall and side walls for guided slideable displacement of said roof cap along said roof bar.

5. Arrangement according to claim 4 wherein said head piece is rigidly fixed to said roof cap and said cutting blade is in the form of a cutting wedge removably secured to said head piece such that the edge of the blade is disposed in transverse direction substantially within the overlying plane of the mine roof surface thereat and operatively facing the adjacent mine face.

6. Roof supporting arrangement according to claim 1 for a mine roof adjacent a mine face in a mineway, which comprises prop means including at least one extensible pit prop carrying a cantilevered longitudinal roof bar at the upper end portion thereof for disposition in supporting and anchoring engagement between the mine roof and mine roof of such mineway with said roof bar extending in a direction toward such mine face and bearing the load of the mine roof thereat, said bar including a forward cantilever portion, a preliminary roof cap and cutting means mountable slidably on said forward cantilever portion in interposed physical relation between the upper surface of said forward cantilever portion and the space to be occupied by such mine roof thereabove for linear movement in longitudinal direction between a retracted position and an extended position with respect thereto to provide preliminary roof load bearing support, energizable slightly upwardly inclined longitudinal drive means including first and second cooperating drive parts interconnected for energized infinite relative linear displacement toward and away from each other to change the overall effective length of said drive means within a range corresponding to the linear movement of said cap and cutter means with respect to said cantilever portion, one of the drive parts being pivotally connected at a first point to said forward cantilever portion and the other of the drive parts being pivotally connected at a second point longitudinally spaced from and slightly vertically above said first pivot point and means of changing the overall effective length connected pivotally at the corresponding lower longitudinal end thereof to said roof bar and at the corresponding upper longitudinal end thereof to said roof cap and cutting means and enhancing said stable supporting engagement of said roof cap on said roof bar and thereby providing essentially the entire load-bearing support for said roof cap, and a cutting blade mounted on the outer end portion of said cap and cutter means with the edge of said blade directed toward the interface between the mine roof and mine face, whereby upon energizing said drive means to displace said parts relatively away from each other to change the effective length thereof said cap and cutter means are moved toward said extended position on said forward cantilever portion to provide preliminary roof load bearing support and in turn said blade is urged along said interface to cut away attendant mineral from the mine face longitudinally along the mine roof.

7. Arrangement according to claim 6 wherein said roof cap and cutting means includes a roof cap of inverted U-shape cross-section overlying said roof bar in sliding supporting engagement therewith and said drive means includes a slightly upwardly inclined piston-cylinder means connected at a lower corresponding point to said roof bar and at an upper corresponding point to said roof cap.

8. Arrangement according to claim 7 wherein said roof cap carries a head piece at the outer end portion thereof in which said cutting blade is mounted and said piston-cylinder means is connected to said roof cap via said head piece.

9. Arrangement according to claim 8 wherein said roof cap includes a top wall linearly flat in said longitudinal direction and downwardly depending lateral flanges defining transversely confining side walls and said roof bar includes correspondingly a top surface linearly flat in said longitudinal direction and side surfaces which are dimensioned to fit transversely within the U-shaped confines of said roof cap top wall and side walls for guided slideable displacement of said roof cap along said roof bar.
defining transversely confining side walls and said roof bar includes correspondingly a top surface linearly flat in said longitudinal direction and side surfaces which are dimensioned to fit transversely within the U-shaped confines of said roof cap top wall and side walls for guided slidable displacement of said roof cap along said roof bar.

10. Arrangement according to claim 9 wherein said head piece is rigidly fixed to said roof cap and said cutting blade is in the form of a cutting wedge removably secured to said head piece such that the edge of the blade is disposed in transverse direction substantially within the overlying plane of the mine roof surface thereat and operatively facing the adjacent mine face.

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