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MINING PLANER WITH PIVOTAL LATERAL AND CENTRAL CUTTING MEMBERS

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Fig. 1

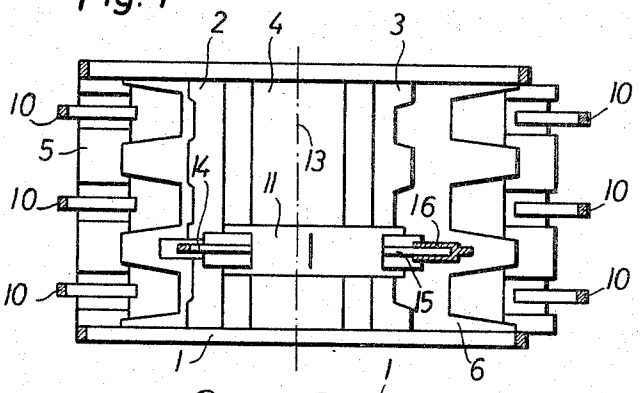


Fig. 2

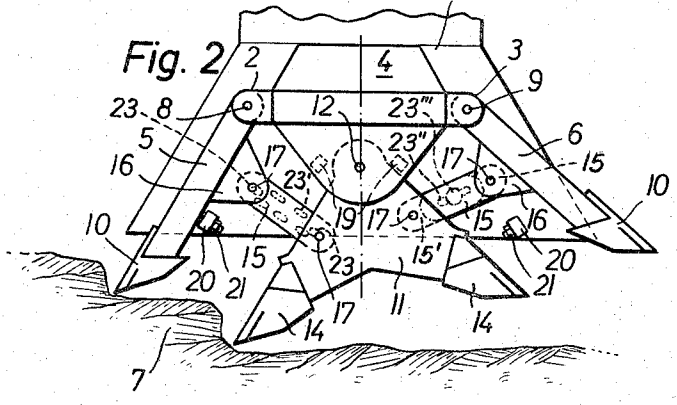
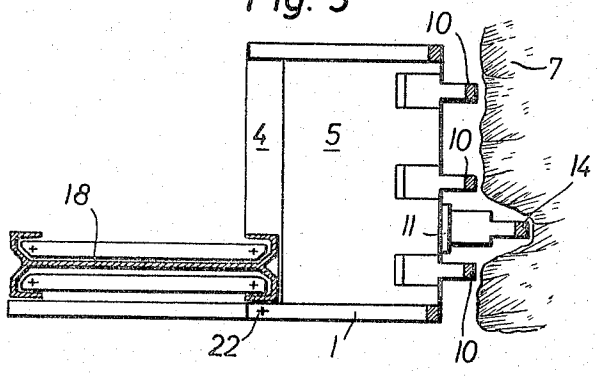


Fig. 3



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MINING PLANER WITH PIVOTAL LATERAL AND CENTRAL CUTTING MEMBERS

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The present invention relates to a mining planer with pivotal lateral and central cutting members, and more particularly to a mining planer adapted to be conducted along a mine face for extraction of mineral, such as coal, therefrom by means of a pair of pivotal lateral members and a pivotal central member such that certain cutting means thereon engage the mine face in a forward direction of travel while other cutting means thereon engage the mine face in a return direction of travel, yet with the cutting means on the lateral members being disposed at a predetermined fixed distance from the cutting means on the central member.

It is known to provide mining planers, such as coal planers, having pivotal lateral members on either side of a central member, with such members being provided with alternate means to engage a mine face in forward and return directions of travel of the planer, the cutting tools on the central member being usually disposed outwardly toward the mine face considerably beyond the cutting range of the cutting means on the lateral members whereby to relieve the forces existent in the coal face so that the ripping chisels or other cutting means on the lateral members may better perform the task of breaking out the coal from the face. Such mining planers may be considered as swinging door chisel holder mining planers having plate-like lead cutters on a central member. These lead cutters are generally mounted pivotally independently of the ripping chisels on the swinging door chisel holders and are prevented from swinging beyond certain limits by rigid stops on the planer. In this way, the lead cutters swing into and away from the coal face according to the direction of travel of the planer. In practice, a lead cutter having a more or less swallow-tailed shape has proven best, with one tip of the swallow-tail engaging the coal face while the other is swung away from the coal face in a forward direction of travel, and with the other tip engaging the coal face while the one tip is swung away therefrom in the other direction of travel of the planer. In cases where such lead cutters are provided with a pair of swinging door chisel holders equipped with ripping chisels, and especially where these swinging door chisel holders are also disposed to pivot within certain limits, the lead cutter and the swinging door chisel holders are often connected together by chains, so as to make the pivoting of the lead cutter dependent upon the pivotal movement of one or the other of the swinging door chisel holders.

This type of arrangement has been found to be quite favorable in practice, but there is the disadvantage that the pivoting movement of the lead cutter is determined by the number of links in the connecting chain, the pitch of the chain, and the choice of the point of connection between the parts. Where the coal seam conditions change in a given instance so as to make a different limitation of the pivoting action of the lead cutter more advantageous, it is necessary with such a construction to replace the entire lead cutter and connecting chain with a different lead cutter and chain combination more attuned to the new seam conditions. A further disadvantage is that the trailing swinging door chisel holder, i.e., the one having its

ripping chisels withdrawn from engagement with the mine face, will swing of its own weight back against the coal face, especially in a tilted bedding where the mine seam is at an angle with the horizontal. In such event, the trailing swinging door chisel holder will drag along the coal face, imposing needless friction upon the system yet without effective cutting action. This is true since a chain linkage can pull the leading swinging door chisel holder into the coal face along with the lead cutter on the central member, but such chain linkage cannot push away from the mine face the trailing swinging door chisel holder.

It is an object of the present invention to overcome the foregoing drawbacks and to provide a mining planer adapted to be conducted in a longitudinal direction back and forth along a mine face in extractive engagement therewith for removal of mineral therefrom in a favorable and efficient manner and especially without any trailing cutting tools needlessly engaging the mine face in a friction generating yet non-productive manner.

It is another object of the invention to provide such a mining planer having swinging door chisel holders and a central member containing lead cutter means thereon, with such central member being pivotal within fixed limits, such that a rigid spacing linkage pivotally connects the central member with each lateral member or swinging door chisel holder to maintain in any pivotal position of the lead cutter means on the central member the lateral members or swinging door chisel holders at a predetermined fixed distance therefrom.

It is a further object of the present invention to provide such a mining planer arrangement whereby upon movement in one longitudinal direction of travel the cutting tools of one of said lateral members and the adjacent cutting tools on the central member corresponding to the direction of travel will engage the mine face while the remaining cutting tools are withdrawn therefrom, whereas the tools in engagement with the mine face will be withdrawn from such engagement while the remaining tools will be placed in engagement upon reverse direction of travel of the mining planer, yet at all times the lateral member cutting tools and the central member cutting tools will be spaced apart from one another in a predetermined fixed distance.

It is still another object of the present invention to attain the desired extractive engagement of the pivotally mounted cutting tools of the planer on one longitudinal side thereof while maintaining the pivotally mounted cutting tools on the other longitudinal side of such planer out of contact with the coal face or the mine face with simple adjustment of the spaced apart distance between the appropriate cutting tools by adjusting the length of the spacer means or by replacing the particular spacer means with those of different length in dependence upon the type of mine face being worked.

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 elevational view partly in section of the mining planer in accordance with the invention showing a tier of cutting means on each pivotal lateral member and a pair of outwardly diverging cutting tools on the pivotal central member, the latter being disposed at substantially mid-height of the tier of cutting tools of the lateral members;

FIG. 2 is a schematic top view of the mining planer of FIG. 1 showing the interrelationship of the cutting tools and pivotal parts in accordance with the invention and the manner in which such cutting tools engage the mine face, and

FIG. 3 is a schematic end view showing the positioning of the central member cutting tools with respect to the tier of cutting tools on the adjacent lateral member whereby the extended range of the central member cutting tools permits a preliminary cut of the mine face to be made sufficient to reduce the counterforces of the mine face to the lateral member cutting tools which thereafter progressively extend further into engagement with the over-all width of the mine seam being worked.

It has now been found in accordance with the present invention that a mining planer adapted to be conducted in a longitudinal direction back and forth along a mine face in extractive engagement therewith for the removal of mineral, such as coal, therefrom may be provided which is inexpensive to construct, durable in use and extremely efficient to operate. Such mining planer generally comprises longitudinally extending base means having a side portion adapted to be disposed adjacent such mine face, a pair of lateral members pivotally mounted on such base means for adjustably limited pivotal movement with the free ends of the lateral members outwardly diverging transversely beyond such side portion of the base means, a central member disposed between the outwardly diverging free ends of the lateral members and pivotally mounted on the base means for limited pivotal movement, and a pair of rigid spacer means pivotally interconnecting the lateral members respectively with the central member, yet maintaining the lateral members at a predetermined distance from the central member at any point of limited pivoting of the central member. The lateral members are provided with cutting tools on their outwardly diverging free ends and the central member is provided with a pair of correspondingly outwardly diverging cutting tools thereon, with all of such tools extending outwardly beyond the side portion of the base means, yet with the cutting tools on the central member extending correspondingly beyond the cutting tools on the free ends of the lateral members.

More specifically, in accordance with a preferred embodiment of the invention, the mining planer comprises base means having a side portion adapted to be disposed adjacent the mine face and forward and return longitudinal ends, corresponding forward and return lateral members pivotally mounted on the base means for adjustably limited pivotal movement and correspondingly having outwardly diverging free ends containing cutting tools thereon extending transversely beyond the side portion of the base means, a central member interposed longitudinally between such free ends and pivotally mounted on the base means for correspondingly limited forward and return movement and correspondingly containing longitudinally spaced apart forward and return cutting means thereon extending beyond the cutting tools on the free ends of the lateral members, and a pair of rigid spacer means pivotally interconnecting the lateral members respectively with the central member, yet maintaining the lateral members at a predetermined distance from the central member. Preferably, the point of pivot of the central member of the base means is spaced from the point of pivot of each lateral member thereon.

Accordingly, upon conducting the planer in a forward longitudinal direction along the mine face, the corresponding forward lateral member cutting tools and the corresponding central member forward cutting tool will be pivotally displaced to the forward limits of pivotal movement of the lateral and central members to extend such tools into extractive engagement with the mine face in rigid spaced apart relation in consequence of the corresponding spacer means thereat, while the corresponding return lateral member cutting tools and the corresponding central member return cutting tool will be pivotally displaced correspondingly to withdraw such tools away from extractive engagement with the mine face in rigid spaced apart relation in consequence of the corresponding spacer means thereat, whereas upon conducting such planer in a return longitudinal direction along the mine face, the corresponding return lateral member cutting tools and the corresponding central member return cutting tool will be pivotally displaced to the return limits of pivotal movement of the lateral and central members to extend such tools into extractive engagement with the mine face in said rigid spaced apart relation while the corresponding forward lateral member cutting tools and the corresponding central member forward cutting tool will be pivotally displaced correspondingly to withdraw such tools away from extractive engagement with the mine face in said rigid spaced apart relation.

Advantageously, each lateral member is preferably provided with a plurality of cutting tools in vertically spaced apart superimposed aligned tier relation and each corresponding central member cutting tool is disposed substantially at mid-height of the vertical superimposed lateral member cutting tools adjacent thereto, whereby to provide an initial relieving of the stresses in the mine face by the central member cutting tool in engagement therewith so that the appropriate lateral member cutting tools may engage the mine face to break away the mineral therefrom in a more efficient manner and with less force than otherwise would be necessary. Moreover, in accordance with a particular embodiment of the mining planer construction of the present invention, the lateral members are pivotally mounted on said base means for adjustably limited pivotal movement at longitudinally spaced apart pivot points and the pivot point of the central member is disposed closer to the side portion of the base means than the pivot points of the lateral members such that the cutting tools of the central member will extend in the desired manner beyond the side portion of the base means a predetermined greater distance than the cutting tools of the lateral members.

Suitably, the rigid spacer means are adjustable in length in accordance with the predetermined distance of the lateral members from the central member, or alternatively, the rigid spacer means are removably positioned for pivotally interconnecting the lateral members with said central member to permit replacement of such rigid spacer means by auxiliary rigid spacer means of different effective length than that of the first mentioned rigid spacer means so as to be in accordance with the predetermined distance of the lateral members from the central member. In either case, by simple means, convenient to the mining personnel, the spatial arrangement between the various cutting tools may be varied in dependence upon the type of mine face and/or mine seam being worked at a given time.

Referring to the drawing, the mining planer in accordance with the present invention is shown having a base means **1** extending partly under the adjacent conveyor **18** for guidance purposes and a side portion **4** with longitudinal ends **2** and **3**. A pair of outwardly diverging swinging door chisel holders or lateral members **5** and **6** are pivotally mounted at pivot points **8** and **9** on the longitudinal ends **2** and **3**, respectively, of base means **1**. The pivotal movement is adjustably limited by the stops **20** which can be adjusted by adjusting screws **21**. At the free ends of the lateral members **5** and **6**, cutting tools **10** are disposed which are adapted to engage mine face **7**. A central member **11**, in the form of a swallow-tailed shape lead cutter carrier, is pivotally mounted at pivot point **12** disposed along axis **13** situated vertically in side portion **4** of base means **1**. The central member **11** is arranged for pivotal movement about axis **13** limited by the stops **19** and contains at the outwardly diverging free ends thereof cutting tools **14** which extend beyond the range of cutting tools **10** on lateral members **5** and **6**, whereby to engage the mine face **7** to a depth beyond that at which cutting tools **10** engage such mine face. Since the lateral members **5** and **6** as well as central member **11** are pivotally mounted on base means **1**, the pivotal movement of

central member **11** is extended advantageously within the limited range determined by the stops **19** and **20** to the lateral members **5** and **6** by the provision in accordance with the present invention for the rigid spacer means or spacer arms **15** which pivotally interconnect via elongated openings **23** the adjacent side portions of central member **11** with appropriate ears **16** provided on the inward sides of members **5** and **6** for this purpose, using pivot pins **17**.

In this manner, assuming the mining planer is conducted longitudinally along the mine face in a forward direction toward the left hand side of FIG. 2 as viewed in the drawing, the left hand cutting tool **14** on central member **11** will engage extractively the mine face **7**, as shown, at a greater depth than the corresponding forward lateral member **5** cutting tools **10**. Because of the limited pivotal movement of central member **11**, the forces met at the mine face will displace member **11** to the maximum forward limit of the pivotal range thereof, and due to the fact that the rigid spacer means **15** interconnects central member **11** pivotally with forward lateral member **5**, the forward cutting tools **10** on the free end of forward lateral member **5** will be displaced in the same way until abutting upon the stop **20** and engaging the mine face. On the other hand, considering lateral member **6** to be the return direction lateral member, because of the provision for the corresponding rigid spacer means **15** on the right side of the arrangement shown in FIG. 2, the return cutting tools **10** at the free end of lateral member **6** will be withdrawn from engagement with the mine face in the same way as the corresponding cutting tool **14** on the return side of the mining planer, in the relationship indicated. Upon reversing the direction of travel of the mining planer so that the same is conducted toward the right of FIG. 2 as viewed in the drawing, the opposite result will take place. Thus, the previously withdrawn cutting tools **10** and **14** will engage the mine face while the previously engaged cutting tools **10** and **14** will be withdrawn from the mine face in dependence upon the fixed rigid spaced relation between the lateral members and the central member, but this time at the maximum return pivotal limit of central member **11**.

FIG. 1 shows more specifically not only the vertically spaced apart superimposed aligned tier relation of the cutting tools **10** on the free ends of the lateral members **5** and **6**, but also the disposition of the central member **11** with the cutting tools disposed substantially at mid-height of the vertically superimposed lateral member cutting tools adjacent thereto. Additionally, FIG. 1 illustrates the fork seating of the ears **16**.

FIG. 3 illustrates not only the approximate mid-height position of the appropriate cutting tool **14** with respect to the adjacent tier of cutting tools **10**, but also the manner in which the cutting tool **14** in extractive engagement with the mine face **7** relieves the mine face structure sufficiently to permit the appropriate cutting tools **10** thereafter engaging this portion of the mine face to break up the coal in a more efficient manner without unduly encountering excessive forces in the mine face.

As the artisan will appreciate, the rigid spacer means **15** may take the form of spacer arms having a plurality of elongated openings **23'** therein to accommodate pins **17** at different points along their longitudinal extent as shown in phantom lines in the left spacer means **15** of FIG. 2. Such arms **15** may be replaced by similar arms of a different length therefrom, i.e., the length between the opposing pivot openings **23**, whereby to change the distance between the corresponding lateral members and the central member. On the other hand, a pair of overlapping sub-arms **15'** and **15''** (see phantom lines in right spacer means **15** of FIG. 2) may be utilized in place of an arm of fixed length, one of such sub-arms containing a slide groove **23''** thereon for retaining slidably the other such sub-arm in sliding contact therewith, yet permitting the over-all length of the two sub-arms to be changed in dependence upon the degree of overlap of the two sub-arms in contact with one another. Such sub-arms may be fixed in a plurality of extended or retracted positions, as the artisan will appreciate, by suitable cooperating pin openings in one of the sub-arms through which connecting bolts **23'''** may be passed to secure the sub-arms together at different overlapping lengths, whereby the rigid relationship sought will be attained yet the particular length of the interconnected sub-arms, i.e., with respect to the pivot points accommodating pins **17**, may be changed in dependence upon changes in the nature of the mine seam being worked.

Of course, conventional means may be utilized to conduct the mining planer of the invention back and forth along the mine face and the conveyor **18** and suitable arrangements for accomplishing this may be appreciated from a study of U.S. Patents 2,745,651; 2,691,514; and 2,823,908. Any suitable means may thus be utilized, such as an endless drive chain **22** attached to the mining planer with the remote ends of such chain being looped over drive drums at the longitudinal ends of the mine seam being worked. While the mining planer of the invention may be dragged along the mine floor, it is preferable to provide guiding means to retain the mining planer in pressing engagement with the mine face, and such guiding means may take the form of a conventional mining conveyor **18** on which the mineral, such as coal, is deposited for removal from the site of mining operations. Advantageously, the construction of the present invention permits an adjustment to be made in the pivotal range of the cutting tools yet avoids the disadvantage previously encountered concerning the dragging of the trailing cutting tools, i.e., on the side opposite that of the direction of travel, against the mine face. Moreover, since the pivotal lateral members are linkably connected by rigid spacer means with the central member which is mounted for movement within a limited pivotal range, the pivotal movement of the lateral members within their pivotal range to their stop means **20** is facilitated. The pivotal range of the lateral members is suitably restricted in relation to the range of pivotal movement of the central member because of the adjustable fixed length connection therewith attained by the use of rigid spacer means in accordance with the present invention. As opposed to the previous practice of replacing the lateral members or the central member where the mine conditions varied, in accordance with the present invention it is only necessary to change the rigid spacer means or at least change their effective length in the manner aforesaid. The rigid spacer means feature of the present invention attains a push-pull linkage of the lateral members with the central member, which leads to advantages impossible to attain with a chain linkage connection heretofore utilized.

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 planer adapted to be conducted in a longitudinal direction back and forth along a mine face in extractive engagement therewith for the removal of mineral therefrom, which comprises longitudinally extending base means having a side portion adapted to be disposed adjacent such mine face, a pair of lateral members pivotally mounted on said base means with the free ends of said lateral members outwardly diverging transversely beyond said side portion of the base means, a central member disposed between said outwardly diverging free ends and pivotally mounted on said base means for limited pivotal movement, said lateral members having cutting tools on said free ends and said central member having a pair of correspondingly outwardly diverging cutting tools thereon, all of said tools extending outwardly beyond said side portion of said base means and the cutting tools on said central member extending correspondingly

beyond the cutting tools on said free ends, and a pair of rigid spacer means pivotally interconnecting said lateral members respectively with said central member yet maintaining said lateral members at a predetermined distance from said central member at any point of limited pivoting of said central member.

2. Mining planer adapted to be conducted in a longitudinal direction back and forth along a mine face in extractive engagement therewith for the removal of mineral therefrom, which comprises base means having a side portion adapted to be disposed adjacent such mine face and forward and return longitudinal ends, corresponding forward and return lateral members pivotally mounted on said base means and correspondingly having outwardly diverging free ends containing cutting tools thereon extending transversely beyond said side portion, a central member interposed longitudinally between said free ends and pivotally mounted on said base means for corresponding limited forward and return pivotal movement and correspondingly containing longitudinally spaced apart forward and return cutting tools thereon extending beyond the cutting tools of said free ends, the point of pivot of said central member on said base means being spaced from the point of pivot of each said lateral member thereon, and a pair of rigid spacer means pivotally interconnecting said lateral members respectively with said central member yet maintaining said lateral members at a predetermined distance from said central member, whereby upon conducting such planer in a forward longitudinal direction along a mine face, the corresponding forward lateral member cutting tools and the corresponding central member forward cutting tool will be pivotally displaced to the forward limit of pivotal movement of said central member to extend such tools into extractive engagement with the mine face in rigid spaced apart relation in consequence of the corresponding spacer means thereat while the corresponding return lateral member cutting tools and the corresponding central member return cutting tool will be pivotally displaced correspondingly to withdraw such tools away from extractive engagement with the mine face in rigid spaced apart relation in consequence of the corresponding spacer means thereat, whereas upon conducting such planer in a return longitudinal direction along the mine face the corresponding return lateral member cutting tools and the corresponding central member return cutting tool will be pivotally displaced to the return limit of pivotal movement of said central member to extend such tools into extractive engagement with the mine face in said rigid spaced apart relation while the corresponding forward lateral member cutting tools and the corresponding central member forward cutting tool will be pivotally displaced to withdraw such tools from extractive engagement with the mine face in said rigid spaced apart relation.

3. Planer according to claim 2 wherein each said lateral member is provided with a plurality of cutting tools in vertically spaced apart superimposed aligned tier relation and each corresponding central member cutting tool is disposed substantially at mid-height of the vertically superimposed lateral member cutting tools adjacent thereto.

4. Planer according to claim 3 wherein said lateral members are pivotally mounted on said base means at longitudinally spaced apart pivot points and the pivot point of said central member is disposed closer to said side portion of said base means than the pivot points of said lateral members such that the cutting tools of said central member extend beyond said side portion of said base means a greater distance than the cutting tools of said lateral members.

5. Planer according to claim 2 wherein said rigid spacer means are adjustable in effective length to change the predetermined distance of said lateral members from said central member.

6. Planer according to claim 2 wherein said rigid spacer means are removably positioned for pivotally interconnecting said lateral members with said central member, whereby said spacer means are replaceable by auxiliary rigid spacer means of different effective length than that of the first mentioned rigid spacer means in accordance with the predetermined distance of said lateral members from said central member.

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