April 12, 1966 F. H. CREUELS ETAL 3,245,722

MINING FACE CONVEYOR

Filed Sept. 4, 1962 3 Sheets-Sheet 1

FIG. 1

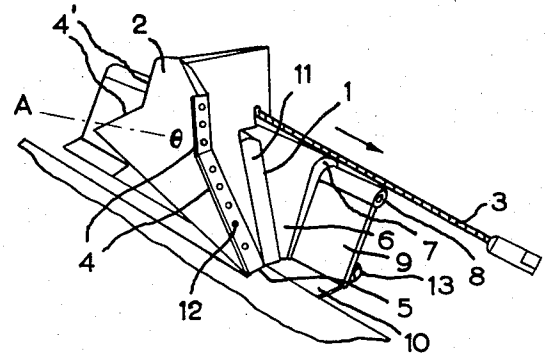

FIG. 4

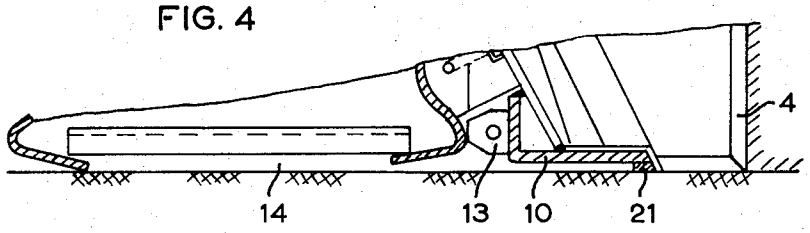

FIG. 6

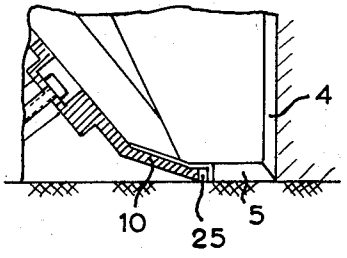

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FIG. 2

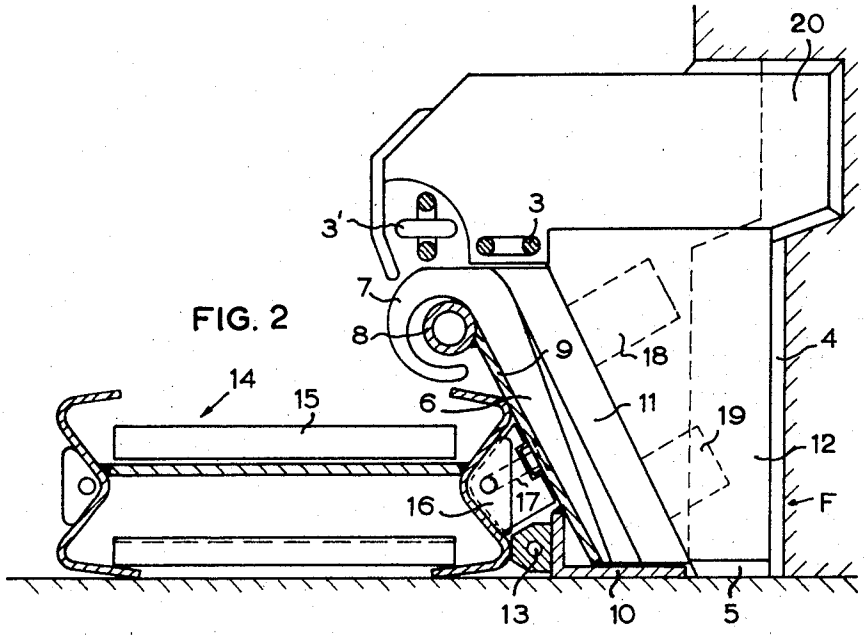

FIG. 3

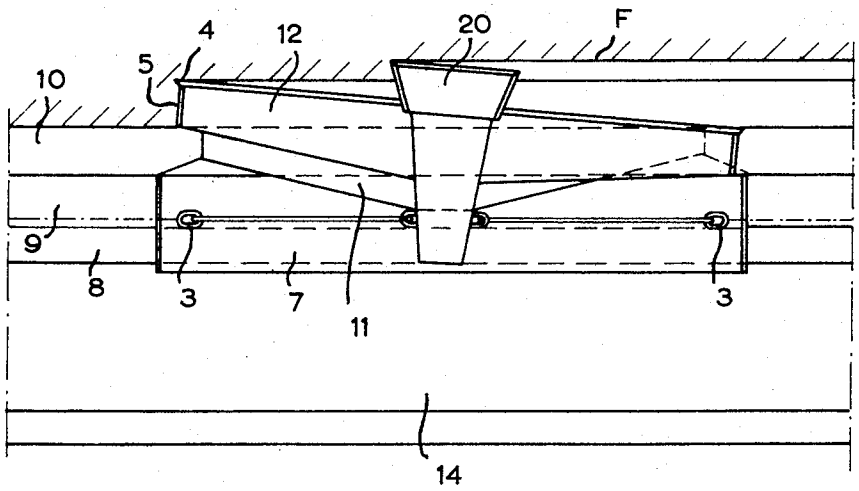

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FIG. 5

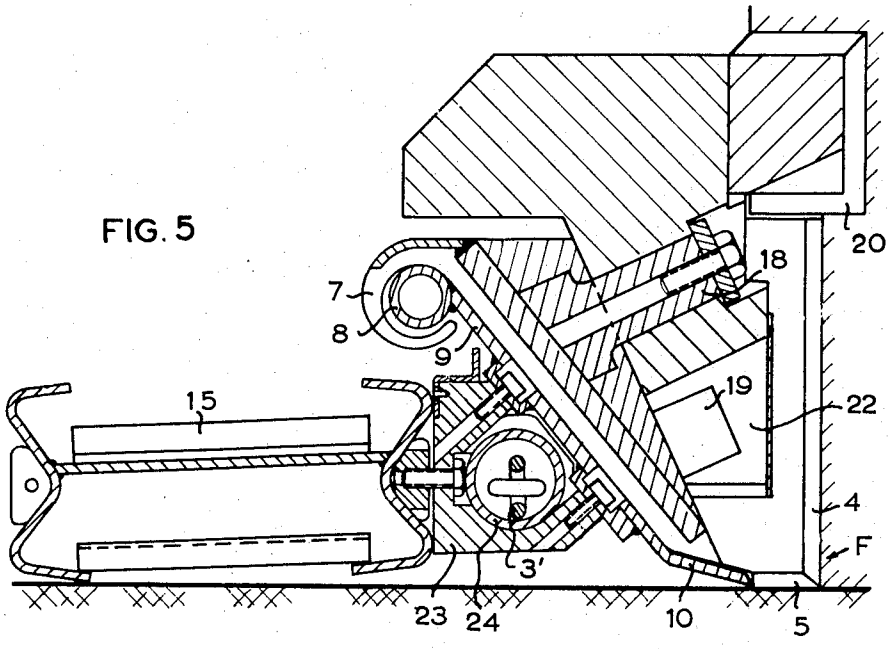
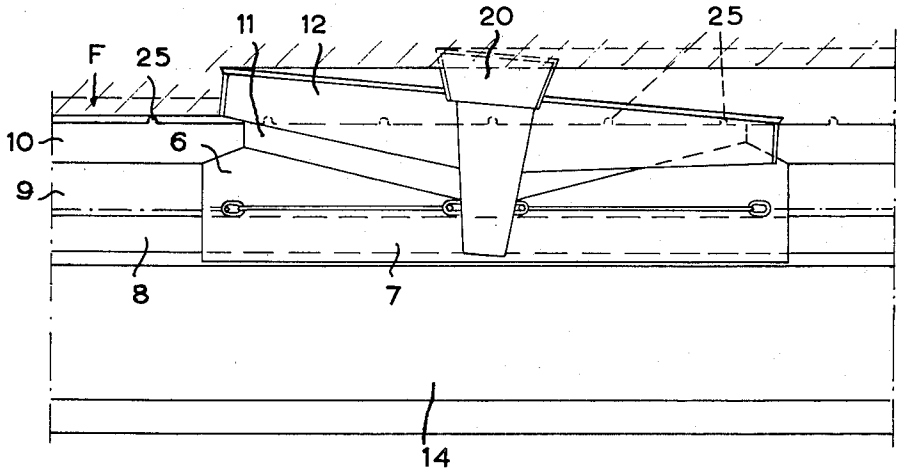


FIG. 7



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MINING FACE CONVEYOR

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Claims priority, application Netherlands, Feb. 20, 1962, 275,042; Feb. 27, 1962, 275,342
8 Claims. (Cl. 299—34)

This invention relates to coal winning apparatus comprising an articulated continuous-flow face conveyor and a coal plough which can be hauled backwards and forwards along one side of the conveyor for winning coal from the face. The manner in which this type of apparatus is utilized in mining is well known, and illustrated and described for example in U.S. Patent 2,745,651.

A coal winning apparatus of this type is known in which the plough (also known as a planer) travels along inclined guide walls which are attached to the conveyor sections and slope from the top of the face side of the conveyor downwardly towards the floor. The design of the apparatus with guide walls inclined in this general manner affords the advantage that the guide walls assist the loading action of the plough as it lifts coal into the conveyor.

In the normal way the plough of such apparatus is designed with cut-limiting stop faces which ride in contact with the coal face so as to limit the depth to which the plough cuts into the face when it is advanced therealong, while the conveyor sections are thrust towards the face by pneumatic or hydraulic cylinders acting on the conveyor side remote from the coal face. In order that the plough can pass the successive conveyor sections the plough has to push these sections back against the forces exerted by the cylinders.

It is observed that the use of this known apparatus involves haulage forces on the plough which are disproportionately great in comparison with the effective cutting resistance experienced by the coal plough. This is in part due to the frictional contact of the cut-limiting faces with the coal face, and the forces required for displacing the conveyor sections against the action of the cylinders.

We have been able to reduce the haulage forces required by a design of apparatus in which cutting depth is limited by fixed means attached to the conveyor and not by the coal plough itself.

According to the present invention, there is provided a continuous-flow articulated face conveyor having plough guide walls which are secured to or form part of one side of the conveyor sections and which are sloped downwardly away from the coal-receiving part of such sections, and having cut-limiting strips which extend laterally from the bottom of said guide walls, the upper surfaces of said strips being horizontal or substantially so, or sloping downwardly towards their outer edges at a substantially smaller angle to the horizontal than said guide walls. The said cut-limiting strips can be integral with said guide walls.

If a conveyor according to the invention is used with an appropriate coal plough, the coal can be advanced while the conveyor sections are held with the outer edges of their cut-limiting strips in contact with the coal face, and this abutment of the strips with the coal face limits the depth of cut of the plough. The strips preserve over the whole length of the conveyor, a passage between the plough-guiding wall of the conveyor and the face. The distance over which the cut-limiting strips project laterally may be such in relation to the dimensions of the plough that the conveyor sections are not laterally displaced away from the face or only to a small extent, as the plough passes.

The cut-limiting strips may be formed by appropriately directed bottom extensions of metal plates forming the said inclined guide walls or by separate plates or other parts.

It has been observed that the use of a conveyor according to the invention not only reduces the frictional forces already referred to but reduces the forces required for clearing loosened coal from in front of the plough. This is apparently due to the fact that the cut-limiting strips enable the coal loosened from the face near the floor to be displaced inwardly over the strips. In the absence of the strips, the foot of the sloping guide wall hinders displacement of this lower coal, and as a result of this and of the fact that movement of this coal up the coal plough is impeded by the overlying coal, a large amount of coal has to be pushed ahead of the coal plough during its movement. The fact that coal pushed forwards in front of the coal plough is moved along a metal strip and not along the floor of the seam helps to reduce the clearing forces to a comparatively low value.

With this further advantage in mind the extent of lateral projection of the cut-limiting strips, measured in the horizontal plane, should preferably be at least half the maximum intended depth of cutting by the plough. This insures the preservation of a reasonable space for the sideways displacement, towards the conveyor, of the coal loosened from the bottom of the face.

While, as already stated, the cut-limiting strips need not be horizontal but can slope downwardly towards the coal face, their angle of inclination, if inclined, should not be too great otherwise they will hinder the movement of the lower coal. Preferably the upper surfaces of the strips, if inclined, should make an angle of less than 20° with the horizontal.

It is found that the angle of inclination of the plough guide walls to the vertical is important. A very large angle of inclination with respect to the vertical involves the need for an unfavorably wide prop-free space while a steep inclination reduces the freedom of movement of coal up the plough between the guide walls and the face. Preferably the angle of the guide walls with respect to the vertical is between 40° and 50°.

The invention includes a continuous-flow conveyor as above defined in conjunction with a coal plough or coal ploughs.

A coal plough for use in conjunction with a conveyor according to the invention may be of the type comprising a body portion and a tool holder which has cutting tools at each end for cutting coal from the floor and face of a seam and is rockably mounted to the body portion so that in use the tools which trail the movement of the plough are not pressed hard against the floor or face. Such a plough-conveyor combination may be designed so that the plough body serves to raise coal from the cut-limiting strips while the tool holder part of the plough serves to raise coal from the seam floor.

The outer edges of the cut-limiting strips may lie at a lower level than the nearer side wall of the continuous-flow conveyor so that this wall is held off the floor and the conveyor is supported only at the remote side and at the outer edges of the said strips. This has the advantage that the outer edges of the strips are pressed against the floor of the seam by a large proportion of the weight of the conveyor and of any coal loaded onto it, and this pressure serves to prevent the face side of the conveyor from being lifted by coal grit on the seam floor as the conveyor sections are advanced. In consequence the plough is prevented from climbing. The outer edges of the strips are preferably formed to cut through any coal attached to

the seam floor. The strips may, e.g., be formed by inclined plate portions as aforesaid so that the outer edges of these plate portions scrape the floor as the conveyor sections are advanced, or the strips may be formed by horizontal plates or plate portions having cutting pieces attached to the bottom thereof.

The outer edges of the cut-limiting strips, instead of being straight, may be formed with spaced teeth or other form of local projections, directed towards the coal face, which can easily penetrate any barrier of coal dust or coal grit which might otherwise prevent contact of some of the strips with the coal face. If coal dust becomes compressed between the cut-limiting strip of any conveyor section and the face the plough will be prevented from cutting to the required depth at this section of the face. By providing suitable local projections on the cut-limiting strips as aforesaid, contact of the strips with the face can be insured without unduly increasing the lateral forces on the conveyor. The outer ends of the projections are preferably convexly curved in the horizontal plane.

While reference has been made to a single plough, apparatus according to the invention may incorporate two or more ploughs, e.g., two or more ploughs connected to a single haulage tackle.

The invention will be further described with reference to the accompanying diagrammatic drawings which illustrate embodiments of the invention by way of example.

In these drawings:

FIGURE 1 is a perspective view of a coal plough in position on the guide wall of a conveyor section;

FIGURE 2 is a transverse cross-section of a face conveyor having a plough in position thereon;

FIGURE 3 is a plan view of the plough and part of the conveyor shown in FIGURE 2;

FIGURE 4 is a detail view showing a modification to the apparatus according to FIGURE 2;

FIGURE 5 is a part cross-sectional elevation of a further apparatus according to the invention;

FIGURE 6 is a detail view showing a modification of the apparatus according to FIGURE 5;

FIGURE 7 is a plan view of apparatus according to FIGURE 6.

In the different figures, corresponding parts are denoted by the same reference numeral.

Referring firstly to FIGURE 1, only the guide wall and cut-limiting strip of one conveyor section are shown, but the figure clearly shows the form of the tool holder and body portion of the plough and the positions of these parts in relation to the cut-limiting strip and the seam floor. The plough body **1** rockably supports the tool holder **2**. The tool holder is shown in the position appropriate for cutting during haulage of the plough cable **3** in the direction of the arrow; in this position of the tool holder the cutting edges **4** lie in the vertical plane at which the face cut is to be made and the bottom cutting edge **5** attacks the seam floor. The tool holder is rockably mounted on a pivot bolt (not shown) projecting from the plough body. The pivot axis is the line A which as will be seen is inclined to the horizontal and the contacting bearing faces of the plough body and tool holder are normal to this line, being sloped from bottom to top away from the vertical plane containing the cutting edges **4**. In consequence, when the plough is in use for cutting in the direction of the arrow, the cutting edges **4'** at the trailing end of the tool holder lie in a vertical plane which is spaced from the newly exposed face. When cable **3** is hauled in the reverse direction the tool holder **2** is rocked about its pivot axis so that cutting edges **4** and **5** move respectively away from the face and off the floor and the cutting edges at the other end of the plough move into cutting position.

The plough body has an inclined rear wall **6** which is bent over at the top into a hook portion **7** which engages over a guide rail **8** at the top of an inclined guide wall **9** of the conveyor section. A horizontal cut-limiting strip **10** is connected to and extends from the bottom of the guide wall **9**. At each end the plough body is formed with a ramp face **11** which slopes upwardly from the bottom of the plough body. The width of this ramp face at the bottom thereof is substantially the same as the width of the strip **10** and it will be seen that in the plough-conveyor assembly the bottom of ramp face **11** lies on or immediately above the strip **10** so that loose coal lying on strip **10** ahead of the plough will be caused to ride up the face **11**. The tool holder is formed at each end with a ramp face **12** which slopes upwardly from the floor so as to exert a lifting force on coal encountered by this face.

A socket or sleeve **13** is secured behind the guide wall **9** at one end thereof, near floor level. In a corresponding position at the other end of the wall **9** there is a projecting spigot (not visible in the figure). When conveyor sections having guide rail walls of this form are assembled the spigot of one section engages in the socket of the next so as to assist in holding the successive guide walls **9** in end-for-end registration. The spigots must leave ample clearance in the sockets to permit the conveyor sections to articulate. An alternative or additional way of connecting the successive guide walls is to provide the guide rail **8** of each conveyor section with a spigot and a socket at its opposite ends so that the adjacent guide rails can interengage.

FIGURE 2 shows an apparatus according to the invention in part transverse cross-section. It will be seen that the conveyor **14** is of the continuous-flow type providing upper and lower compartments in which travel respectively the upper and lower reaches of an endless conveying means in the form of spaced scrapers **15** attached to endless carrying chains (not shown).

The sloping guide wall **9** of each conveyor section is attached to lugs **16** on the side wall of the conveyor body by bolts **17**.

FIGURE 2 shows at **18** the pivot bolt for the tool holder and at **19** a stop which is connected to the plough body and projects into a groove in the rear of the tool holder. The stop **19** serves by abutment against the ends of the said groove to limit the rocking motion of the tool holder. The plough shown in FIGURE 2 is provided with a deeper-cutting top portion **20** which notches the coal face.

The haulage tackle of the FIGURE 2 apparatus comprises an endless chain **3**, **3'**. The plough is connecting into the reach **3** of the chain and the return parallel (idle) reach is guided along the top of the hook portion **7** of the plough body. The chain extends around chain wheels at the opposite ends of the face in the usual way.

It will be observed that the plough body does not project laterally beyond the outer ends of the strips **10** so that the conveyor sections do not have to be pushed back by the passing plough. As appears from FIGURE 3 the conveyor is held during ploughing with the strips **10** in abutment with the coal face F and this abutment limits the depth of the cut. The plough moves along the trapeziform channel bounded by the guide wall **9**, the strips **10**, and the coal face exposed by the preceding stroke of the plough. The loosened coal falls into this channel and due to its inertia becomes pushed up along the ramp faces of the plough and into the conveyor as the plough advances.

Due to the fact that no pressure is exerted on the coal in the comparatively wide channel, the clearing force required is small. In the particular case illustrated the effective width of the strips **10** (i.e., the width of the strips projecting laterally from the bottom of guide walls **9**) is more than three quarters of, and in fact is almost the same as, the depth of the cut so that there is very ample room for sideways displacement of coal loosened from the bottom of the face. The horizontal floor strip formed by the plates **10** has the additional advantage of opposing the tendency of the coal plough to cut into the floor when this is soft.

When the conveyor sections are advanced towards the face it is important to keep the outer edges of the cut-

limiting strips in contact with the floor to avoid climbing of the plough. With this in mind it is of advantage to design the conveyor so that the weight of the conveyor and its contents assist in holding the outer edges of the cut-limiting strips in contact with the floor. This may be achieved by designing the apparatus so that the outer edges of the strips extend below the level of the nearer side wall of the conveyor.

It is possible for example to make a simple modification of the apparatus shown in FIGURES 2 and 3 in the manner shown in FIGURE 4. In this modified apparatus cutting pieces **21** of strip form are secured to the bottom of the strips **10** at their outer margins. Due to the presence of the cutting pieces **21** the nearer side wall of the conveyor is raised off the floor and the weight of the conveyor is transmitted to the remote side wall of the conveyor and the cutting pieces **21**. When the conveyor sections are advanced the leading edges of the pieces **21** scrape the floor clean of residual coal.

Referring now to FIGURE 5, the conveyor of the apparatus here shown is also supported by its remote wall and the outer edges of the cut-limiting strips **10**. However, in this case the strips **10** are rather differently arranged in that they are inclined to the horizontal. The strips are formed by appropriately angled bottom portions of the metal plates forming the inclined guide walls **9** for the plough. The weight of the conveyor and of the coal loaded therein is largely transmitted to the floor via the sharp front edges of the strips **10** so that these edges will under all conditions be in direct contact with the floor and residual coal will be scraped away as the conveyor sections are advanced. In this particular embodiment of the invention the guide wall **9** is inclined at an angle of about 40° to the vertical.

The plough in FIGURE 5 is shown in cross-section to reveal the pivot bolt **18** of the tool holder and the stop **19** which limits its rocking movement. In this embodiment the stop **19** is accommodated in a recess **22** of the tool holder.

The manner of securing the guide wall **9** to the conveyor in the case of the apparatus shown in FIGURE 5 is different from that employed in the apparatus illustrated in the earlier figures. The guide wall is bolted to brackets **23** which are in turn bolted to the nearer side wall of the conveyor and the brackets **23** support tube sections **24** which form guides for the return (idle) reach **3'** of the haulage chain.

In order to insure that the cut-limiting strips cannot be held away from the coal face by compressed coal dust and thus allow of variations in the cutting depth the outer edges of the strips may be formed with spaced local projections which can easily penetrate a coal dust barrier. An example of this feature is illustrated in FIGURES 6 and 7. The apparatus the subject of these figures is the same as that described with reference to FIGURE 5 save for the form of the outer edge portions of the cut-limiting strips. These outer edge portions are formed with convexly curved projections **25**. When, after the coal plough has passed, the conveyor sections are advanced by the rams, the projections **25** force their way through the dust on the floor until they make contact with the coal face. Due to the convex curvature of the ends of the projections the dust is displaced to either side. By way of example the projections may have width and a length of 25 mm. and be arranged at intervals of 50 cm. With conveyor sections 1.5 mm. in length, one thrust cylinder for every four conveyor sections will normally suffice to insure contact of the strips with the coal face so that the maximum depth of cut is made.

It will thus be seen that there has been provided by this invention, structure in which the various objects hereinbefore set forth, together with many practical advantages, are successfully achieved. As various possible embodiments may be made of the mechanical features of the above invention, all without departing from the scope thereof, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative, and not in a limiting sense.

What is claimed is:

1. Mining apparatus comprising a face conveyor having a sloping side wall and a plate member extending outwardly from the bottom of said side wall, and a coal-getting machine slidably mounted on said sloping side wall above said plate member, said plate member extending downwardly to a level below the lower edge of the inclined side wall, whereby the weight of the conveyor is transmitted to the floor through its remote side wall and the outer edge of said plate member, and said plate member engaging the coal face and thereby serving to limit the cut of said coal-getting machine.

2. Mining apparatus according to claim **1**, in which the outer end of the plate member is provided with a number of spaced projections.

3. Mining apparatus according to claim **2**, in which the projections are rounded in a plane parallel to the bottom of the conveyor.

4. Mining apparatus according to claim **1**, in which the plate member is an extension of the lower part of the sloping wall angulated with respect to the horizontal at an angle smaller than the inclination of the sloping wall.

5. Mining apparatus according to claim **1**, in which the sloping side wall is angulated with respect to the horizontal between 40° and 50°, and the plate member is angulated with respect to the horizontal less than 20°.

6. Mining apparatus according to claim 1, in which the sloping side wall is angulated with respect to the horizontal between 40° and 50°, and the plate member is horizontal.

7. Mining apparatus according to claim **1**, wherein the coal-getting machine comprises an inclined body portion adapted to raise coal from said plate member, and an inclined tool holder adapted to raise coal from the seam floor.

8. Mining apparatus according to claim **1**, wherein said plate member extends outwardly from said side wall a distance which is at least half the maximum depth of cut of said coal-getting machine.

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