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Baz

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[54] **MINERAL MINING MACHINES**

[76] Inventor: **Angel Davila Baz,** Plaza de Castille, No. 1, 3aC, Alcobendas, Spain

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[52] **U.S. Cl.** **299/34,** 299/80

[51] **Int. Cl.** **E21c 27/44**

[58] **Field of Search** 299/32, 34, 80

[56] **References Cited**

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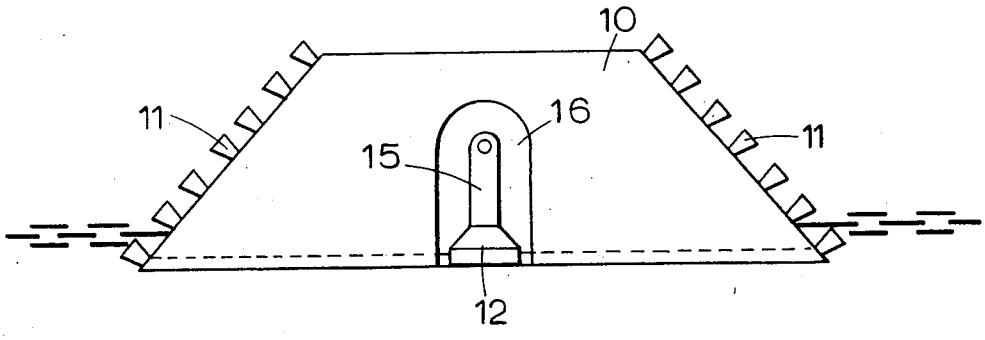
Primary Examiner—Ernest R. Purser
Attorney—Richard C. Sughrue

[57] **ABSTRACT**

A mineral mining plough of the type which has a body with sets of cutting tools at each end, the machine being guided along a longwall mineral face to strip mineral therefrom. In order to guide the plough so as to cut the face down to the floor level one or more adjustable floor cutters are provided. The, or each, adjustable cutter has a blade with a cutting edge which may be operative in one or both directions of travel of the machine. The adjustable cutter is adjustable so that the cutting edge can be inclined downwardly or upwardly, or aligned parallel to, the floor level of the face. By appropriate adjustment of the cutter the plough can be guided to compensate for any deviation relative to the floor level of the face.

13 Claims, 5 Drawing Figures



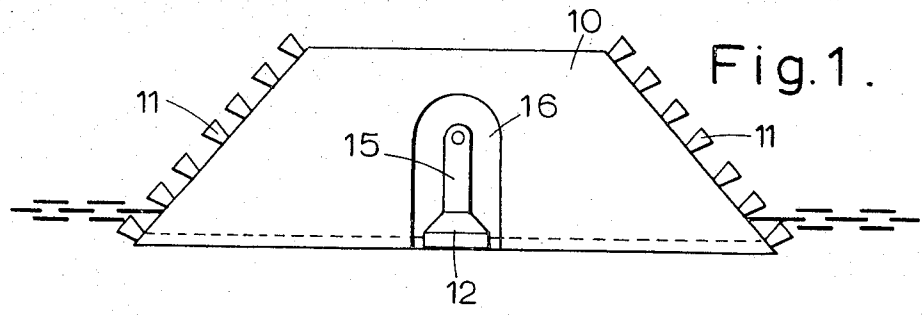


Fig.1.

Fig.2.

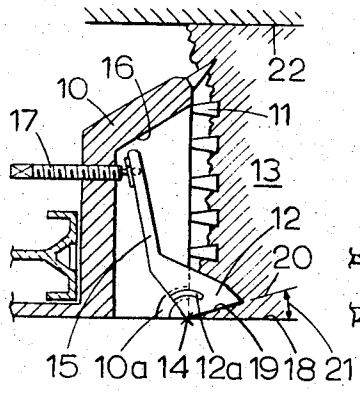


Fig.3.

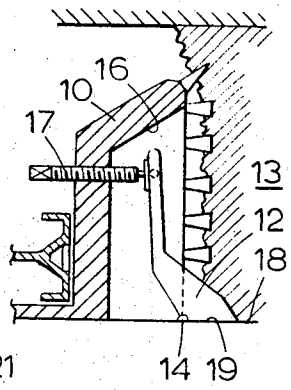


Fig.4.

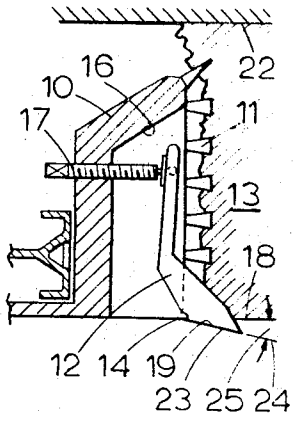
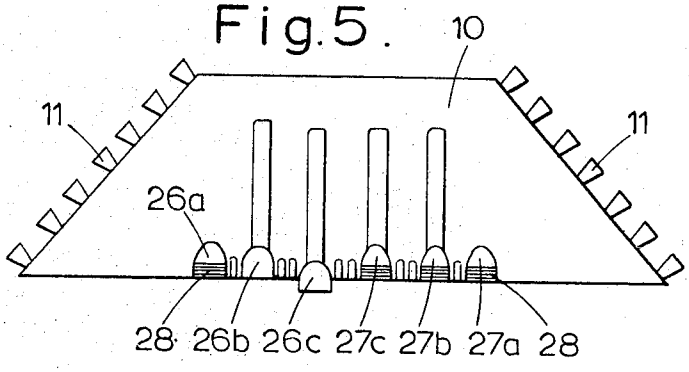


Fig.5.



MINERAL MINING MACHINES

BACKGROUND OF THE INVENTION

The present invention relates to a mineral mining machine or plough.

It is known to win mineral, especially coal, on the longwall system where a plough is moved back and forth along a mineral face to strip mineral therefrom. The proper guidance of the plough frequently presents problems and it is desirable to so guide the plough that it will remove the mineral from the face right down to the floor level of the working. Since the floor is never completely flat the plough tends to rise or fall in relation to the face so that the plough either leaves a layer of mineral at the floor portion of the face or else the plough cuts too deeply to remove part of the newly-exposed floor. When the plough has progressed further into the face these residual layers of mineral, the so called saddles, and the depressions or troughs now forming the floor of the working increase the problem guidance. These effects are more pronounced where the mineral seam is hard and the floor is of a relatively soft nature.

A general object is to provide an improved mining machine which will enable better guidance to be achieved.

SUMMARY OF THE INVENTION

According to the present invention there is provided a mineral mining machine or plough adapted to be moved along a mineral face to cut mineral therefrom and having means for controlling the cutting position of the machine relative to the floor level of the face; said control means being in the form of at least one floor cutter which is adjustable so that a lower cutting edge thereof can be moved between positions where it is inclined upwardly or downwardly relative to the floor level of said face.

The, or each, adjustable floor cutter can be set with its cutting edges in one of three different positions. In a first position the cutting edges is set in an upwardly inclined position to leave a wedge of mineral disposed at the floor of the mineral face; in a second position the cutting edge is in a horizontal position to cut the mineral right down to the floor. In a third position the cutting edge is in a downwardly inclined position to cut right down into the floor. By adjusting the cutter between these positions the plough can be guided, so as is practically possible, so that the mineral face is constantly cut down to the floor level.

In one construction a single floor cutter is provided which is pivotable about an axis extending along the floor and substantially parallel to said face. The floor cutter can have a blade portion, provided with said lower cutting edge, and adjoining a generally upright stem portion, the stem portion and part of the blade portion being accommodated in a recess formed within the body of the machine.

In other constructions a plurality of floor cutters are provided. In one embodiment of the invention there are six floor cutters, three such cutters being operative in one direction of movement of the machine and a further three such cutters being operative in the other direction of movement of the machine.

Preferably, the outermost floor cutters relative to the directions of movement of the machine are affixed so

that the lower cutting edge of each outermost cutter is inclined upwardly from the floor level of said face and the remaining cutters are each adjustable so that its lower cutting edge can be moved between positions where it is inclined upwardly or downwardly relative to the floor level of said face.

The machine constructed in this manner can be operated so that the cutting edge of the second floor cutter, relative to the direction of movement of the machine, extends parallel to the floor and the cutting edge of the third floor cutter, relative to the direction of movement of the machine, inclines downwardly towards the mineral face. These second and third floor cutters are preferably constructed and installed in such a way that they can be moved into an operative or into an inoperative position as desired. This can be done, for example, by making each of the adjustable cutters pivotable about an axis approximately parallel to the mineral face or to the floor. The adjustable cutters can also, however, be adjusted from their operative to their inoperative position by some other movement, for example, these adjustable cutters can be movable in the vertical direction. Various forms of adjusting means for adjusting the position of the, or each, adjustable floor cutter can be utilized. For example, the adjusting means can be in the form of a threaded spindle meshing with a threaded bore in the body of the machine and connected to the stem portion of the cutter.

To reduce the cost of the machine it is possible to provide four floor cutters, two such cutters being operative in one direction of movement of the machine and a further two such cutters being operative in the other direction of movement of the machine.

As with the six floor cutter machine, the outermost floor cutters relative to the directions of movement of the machine are affixed so that the lower cutting edge of each outermost cutter is inclined upwardly from the floor level of said face and the remaining cutters are each adjustable so that its lower cutting edge can be moved between positions where it is inclined upwardly or downwardly relative to the floor level of said face.

In the constructions employing a multiplicity of floor cutters it is advisable for the adjustable floor cutters which are situated to the rear of the two or three foremost cutters relative to one direction of motion of the machine to be moved away from the face into an inoperative position so that they do not cause any unnecessary friction or suffer premature wear. Alternatively the cutters can also be so constructed so that they have a cutting edge or edges only operative in one direction of movement of the machine.

The invention may be understood more readily and various other features of the invention may become more apparent from consideration of the following description.

BRIEF DESCRIPTION OF DRAWINGS

Embodiments of the invention will now be described, by way of examples only, with reference to the accompanying drawing, wherein:

FIG. 1 is a schematic front view of a mineral winning machine made in accordance with the invention;

FIGS. 2 to 4 are sectional side views of the machine shown in FIG. 1 depicting the machine in different operating positions; and

FIG. 5 is a schematic front view of a further form of mineral winning machine made in accordance with the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

As shown in FIGS. 1 to 4, a mineral winning machine or plough 10 has a main body which carries detachable and interchangeable cutting tools 11. The tools 11 are directed outwardly and forwardly from the inclined ends of the body. Thus, as the plough 10 is moved in one direction or the other by a drive chain represented in FIG. 1 the tools 11 at the front end of the plough 10 strip mineral from the mineral face denoted 13 in FIGS. 2 to 4. The plough 10 has a sword plate extending beneath a conveyor; the sword plate and the conveyor being partly shown in FIGS. 2 to 4. The cutting position of the plough 10, is in this embodiment, controlled by control means in the form of an adjustable floor level cutter 12. The cutter 12 is adapted to cut in both directions of movement of the plough 10. The cutter 12 is partly received in a recess 16 provided at the centre of the plough body 10 and facing the mineral face 13. As shown in FIGS. 2 to 4 the cutter 12 has a stem portion 15 which extends generally upwards and an adjoining blade portion 19 which inclines outwardly and downwardly from the stem 15. The entire cutter 12 can be pivotably mounted on a shaft 14 disposed at the outer floor edge of the recess 16. The blade 19 of the cutter 12 may have a curved projection 12*a* on each of its side faces and for the sake of clarity the projections 12*a* are only shown in FIG. 2. The projections 12*a* engage in correspondingly shaped grooves 10*a* disposed in the plough body at the side faces of the recess 16. The projections 12*a* and the grooves 10*a* cooperate to form a guide for guiding the pivotal movement of the cutter 12 about the shaft 14. However, with such a guiding means the shaft 14 may be dispensed with. Conversely the shaft 14 can be utilized without any form of guiding means. Also instead of employing the projections 12*a* and the grooves 10*a* as guide means for the cutter 12 other constructions are possible.

A threaded spindle 17 meshes with a threaded bore in the plough body and has an abutment head which is connected to the upper part of the stem 15 of the cutter 12. By adjusting the amount by which the spindle 17 projects into the recess 16 the pivotal position of the cutter 12 relative to the shaft 14 can be varied. Other forms of adjusting means for the cutter 12 can be adopted in lieu of the spindle 17. For example, the pivoting of the cutter 12 can be produced by a hydraulically or pneumatically operated mechanism, by an electrically operated mechanism or by an alternative form of mechanical device.

With the cutter 12 set to the position depicted in FIG. 2 the lower cutting edge of the blade 19 is upwardly directed to cut the lower part of the mineral face 13 along a plane denoted 20, which forms an angle denoted 21 with the horizontal floor 18. Consequently a wedge shaped portion of mineral is left at the floor level of the face 13. With the cutter 12 set constantly in this position the wedge shaped portion will progressively increase in thickness so that the entire machine 10 tends to gradually move upwards over the face 13 towards the roof level 22 as it progresses along the face 13 in a cutting cycle. With the cutter 12 set to the position depicted in FIG. 3 the lower cutting edge of the blade 19 is disposed at the floor level 18 and consequently the machine 12 tends to move along a substantially level path to remove the mineral right down to the floor level 18. Finally, with the cutter 12 set to the position depicted in FIG. 4 the lower cutting edge of the plate 19 is downwardly directed to cut into the floor along a plane denoted 24 which forms an angle denoted 25 with the floor level 18. Consequently, a wedge shaped groove 23 is cut into the floor. With the cutter 12 set in this position the groove 23 will progressively increase in thickness so that the entire machine 10 tends to gradually move downwards over the face 13 towards the floor level 18 as it moves along the face 13.

Since the floor level of a mine working varies along the face the conditions represented in FIGS. 2 to 4 are somewhat idealized and merely illustrate the way in which the control means (12,17) operates. In practice, the machine 10 should cut the mineral right to the floor level 18 and not leave a wedge-shaped portion of mineral as in FIG. 2 or produce a wedge-shaped groove 23 as in FIG. 4 except perhaps where control is required to re-direct the plough 10 to cut in the desired manner. Thus, if the plough 10 is tending to cut into the floor the cutter 12 would be set into the position shown in FIG. 2 to raise the plough 10 from the floor. The cutter 12 may in fact be adjusted only slightly so that the desired position is accomplished after several cutting cycles of the plough 10. Conversely if the plough 10 is tending to leave a layer of mineral at the floor portion of the face 13 the cutter 12 would be set into the position shown in FIG. 4 to compensate. Once the deviation of the plough 10 has been corrected the cutter 12 would be set to its neutral position as in FIG. 3. It may however be advisable to set the cutter 12 to the position represented in FIG. 4 or FIG. 2 when the plough 10 is moving over a depression, i.e. a trough, or a projection, i.e. a saddle, in the floor.

Instead of using a single cutter 12 adapted to cut in both directions of movement of the plough 10 as the control means it is possible to provide two separately adjustable cutters each cutter being constructed to cut in only one direction of movement of the plough 10. Each cutter could be provided with an independent adjustment mechanism which allows the cutter to move in an inoperative position when the plough 10 is moving in a direction which is the reverse to the cutting direction of that cutter.

In the construction depicted in FIG. 5 the plough 10 has three floor cutters 26*a*, 26*b*, 26*c* and 27*a*, 27*b*, 27*c* for each direction of movement making six floor cutters in all. The outermost cutters 26*a*, 27*a* are rigidly affixed to the plough 10 whereas the remaining cutters 26*b*, 26*c*, 27*b* and 27*c* are all adjustable in position in the general manner depicted in FIGS. 2 to 4. The outermost or first cutters 26*a*, 27*a* are arranged so that their lower cutting edges 28 are permanently upwardly inclined as depicted in FIG. 2. If the plough 10 is to cut the face 13 up to the floor level 18 then the second cutter 26*b*, 27*b*, dependent upon the direction of movement of the plough 10, will have to be set nominally to the position shown in FIG. 3 so as remove the mineral left by the operation of the first cutter 26*a* or 27*a*. The cutter 26*b* is shown in FIG. 5 to be in the correct position for removing the mineral left by the cutter 26*a* and controlling the plough 10 to move along the desired path. In contrast the cutter 27*b* is shown in FIG. 5 to be in the upwardly inclined position and would be inoperative when the plough 10 is moving towards the left

of FIG. 5. If the combined controlling effect of the two cutters 26*a*, 26*b*, 27*a*, 27*b* is sufficient then the third cutter 26*c*, 27*c* can be made inoperative by being pivoted upwards to the position shown in FIG. 2. The cutter 26*c* or 27*c* would not be positioned as shown for the cutter 26*c* in FIG. 5, i.e. downwardly inclined as illustrated in FIG. 4, unless it is desired to cut into the floor and direct the plough 10 accordingly. Assuming the plough 10 is being moved to the left of FIG. 5 the remaining adjustable cutters, in this case 27*c*, 27*b* would be pivoted upwardly and inoperative.

I claim:

1. In a mineral mining machine guided for movement along a mineral face and having a body carrying cutting tools; the improvement comprising control means for controlling the cutting position of the machine relative to the floor level of said face, said control means being in the form of at least one floor cutter disposed at a zone at the longitudinal centre of the body, said floor cutter having a plane lower cutting surface projecting outwardly from the body with a rear end which is located directly at the floor level adjacent said face, the cutting surface of the floor serving to define the floor level forwardly of the body in the direction of the face, and means of adjusting the position of the floor cutter so that its lower cutting surface can be moved about its rear end between positions where it is inclined upwardly or downwardly relative to the floor level at the rear end thereof.

2. A machine according to claim 1 and further comprising means for guiding the floor cutter in relation to the body.

3. A machine according to claim 1, wherein a single floor cutter is provided which is pivotable about an axis extending along the rear end of its cutting surface and substantially parallel to said face.

4. A machine according to claim 3, wherein the floor cutter has a blade portion, provided with said lower cutting surface, and adjoining a generally upright stem portion, the stem portion and part of the blade portion being accommodated in a recess formed within the body of the machine.

5. A machine according to claim 4, wherein the floor cutter is pivotable about a shaft extending along the outer floor edge of the recess.

6. A machine according to claim 4, wherein said adjusting means acts upon the stem portion of the cutter.

7. A machine according to claim 6, wherein said adjusting means is in the form of a threaded spindle meshing with a thread bore in the body of the machine and connected to the stem portion of the cutter.

8. A machine according to claim 1 wherein a plurality of floor cutters are disposed generally centrally of the body.

9. A machine according to claim 8, wherein four floor cutters are provided, two such cutters being operative in one direction of movement of the machine and a further two such cutters being operative in the other direction of movement of the machine, the outermost floor cutters relative to the directions of movement of the machine being affixed so that the lower cutting surface of each outermost cutter is inclined upwardly from the floor level at the rear end thereof and the remaining cutters are each adjustable so that their lower cutting surfaces can be moved between positions where they are inclined upwardly or downwardly relative to the floor level at the rear ends thereof.

10. A machine according to claim 8, wherein six floor cutters are provided, three such cutters being operative in one direction of movement of the machine and a further three such cutters being operative in the other direction of movement of the machine, the outermost floor cutters relative to the directions of movement of the machine being affixed so that the lower cutting surface of each outermost cutter is inclined upwardly from the floor level at the rear end thereof and the remaining cutters are each adjustable so that their lower cutting surfaces can be moved between positions where they are inclined upwardly or downwardly relative to the floor level at the rear ends thereof.

11. A machine according to claim 10, wherein the second floor cutter for each direction of movement of the machine is set to a position parallel to the floor level at the rear end thereof and the innermost floor cutter for each direction of movement of the machine is set to a position where its lower cutting surface is inclined downwardly towards the floor level at the rear end thereof.

12. In a mineral mining machine guided for movement along a mineral face and having a body carrying an adjustable floor cutter for controlling the cutting position of the machine relative to the floor level of the face; the improvement comprising arranging the floor cutter at the longitudinal centre of the body and providing the cutter with a plane lower cutting surface movable about an axis disposed at the floor level adjacent the face and generally parallel to the face.

13. A coal cutting machine guided for movement alongside a coal face; said machine comprising an elongate body having a recess at one side which is disposed at its longitudinal centre; a plurality of cutting tools carried by the body; a floor cutter for controlling the position of the machine, said cutter being disposed partly within the recess and being composed of a blade portion and a generally upstanding stem portion, the blade portion having a plane lower cutting surface pivotable about an axis which extends parallel to the coal face and is disposed at the floor adjacent the face to pass through a rear end of the cutting surface, and means acting on the stem portion of the cutter to vary the inclination of the cutting surface.

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