MACHINE FOR SMOOTHING MINE FLOORS OR THE LIKE

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Filed Sept. 11, 1967, Ser. No. 666,839

Claims priority, application Germany, Sept. 13, 1966, D 105,831

Int. Cl. E21c 27/32; E01c 23/00; E02I 3/76

U.S. Cl. 299—41

BACKGROUND OF THE INVENTION

The present invention relates to a machine which can be utilized to smooth the floor of a coal mine or another underground excavation as well as the surfaces of roads for vehicles in strip mines, gravel pits or the like. By providing a smooth surface for the vehicles which transport coal, rock or other material in a surface mine or in an underground mine, the machine of the present invention renders it possible to transport material at a greater speed, to employ heavier vehicles for transport of such material, and to reduce the wear on the vehicles. As a rule, the floor of a mine is uneven and vehicles travelling on such floors must be driven slowly in order to avoid damage or complete breakdown.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a simple, rugged and versatile machine for smoothing the floors in surface or underground mines or the like. Another object of the invention is to provide a machine which can smooth strips of desired width, which can remove material from horizontal or inclined floors, which can be manipulated in an underground mine or in a surface mine, and which can be readily adjusted to remove layers of desired thickness and/or width.

A further object of the invention is to provide a machine which can treat the floor of a mine to a desired degree of smoothness so that such floor can be used as a roadway for heavy-duty vehicles employed in transportation of materials into and/or from a mine and that such vehicles will undergo little wear.

Briefly outlined, the improved machine comprises a power-operated vehicle having a frame which carries a forwardly extending adjustable support for a tool holder supporting one or more rotary milling cutters and motor means for such cutters.

The tool holder is preferably pivotable on the support about a transverse horizontal axis and preferably supports two coplanar milling cutters which are turnable about a common vertical axis so as to be movable between first end positions in which one of the cutters is located in front of the other cutter and second end positions in which the cutters are located side-by-side and smooth a strip of maximum width.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved smoothing machine itself, however both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevational view of a smoothing machine which embodies the present invention;

FIG. 2 is a top plan view of the smoothing machine;

FIG. 3 is a section as seen in the direction of arrows from the line III—III of FIG. 4; and

FIG. 4 is a larger-scale top plan view of the working end of the machine shown in FIGS. 1 and 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1 and 2 show a machine which is utilized, for example, to smooth the floor F in a coal mine or another underground excavation. The machine comprises a power-driven vehicle 1 which is preferably a track laying vehicle and includes a frame 7, a forwardly facing driver's seat 4 on the frame 7, and a power plant 2 mounted on the frame and including means for driving the tracks as well as a hydraulic unit for adjusting the position of a forwardly extending support 6 in the form of an arm or boom which is secured to the frame 7 by one or more transversely extending pivot pins 6a.

The forward end of the arm 6 carries a tool holder 3 and an intermediate portion of this arm carries a rearwardly facing second driver's seat 5. One or more hydraulic jacks 6b operate between the frame 7 and the arm 6 and serve to move the tool holder 3 to a desired level above the floor F.

The connection between the forward end of the arm 6 and the tool holder 3 comprises a transversely extending horizontal pivot pin or shaft 8 which enables the tool holder to assume a horizontal position irrespective of the angular position of the arm 6. This tool holder carries two coplanar or substantially coplanar disk- or wheel-shaped milling cutters 9 and 10 disposed at the opposite sides of a vertical pivot pin in the form of a king pin 11, see FIG. 3. The tool holder 3 comprises a first portion 3a which is coupled to the arm 6 by the pin 8 and a second portion 3b which is coupled to the first portion by the king pin 11. The second portion 3b carries the motors 13, 14 (see FIG. 4) which respectively drive the cutters 9, 10 through the intermediary of elastic transmissions. In this way, the cutters can follow the outline of an uneven floor F without causing damage to the motors.

As shown in FIG. 2 by arrows X, the motors 13, 14 drive the cutters 9, 10 in opposite directions so that the material removing tools or teeth at the undersides and/or faces of the cutters move laterally and away from the arm 6 when the cutters are disposed side-by-side in a manner as illustrated in FIG. 2. This insures that material which is removed from the floor F does not interfere with forward movement of the vehicle 1.

The cutters 9, 10 can be moved to a large number of additional positions in response to turning of the second position 3b about the king pin 11. For example, and as shown in FIG. 4, the cutter 9 can be moved in front of the cutter 10 in response to counterclockwise rotation of the second portion 3b through 90 degrees beyond the position shown by solid lines. The cutters 9, 10 will then
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smooth a relatively narrow strip A of the floor F. When in the solid-line positions of FIG. 4, the cutters 9, 10 will smooth a strip B of maximum width. Of course, the cutters 9, 10 may be moved to a number of intermediate positions (see the arrows Y) to smooth strips whose width exceeds that of the strip A but is less than that of the strip B. Also, the cutter 10 can be moved in front of the cutter 9.

The means for turning the lower portion 3b in the directions indicated by arrows Y comprises one or more hydraulic cylinder and piston units. The two portions 3a, 3b of the tool holder 3 are turnable on antifriction bearings 12 shown in FIG. 3.

The jack 66 can move the tool holder 3 up and down from the solid-line position of FIG. 1 to the phantom-line position or even beyond such phantom-line position. Additional cylinder and piston means is provided to turn the tool holder 3 about the pivot pin 8 in order to change the inclination of the common plane of the cutters 9 and 10. This is also shown in FIG. 1 by phantom-lines.

The seat 4 will be utilized by the driver when the machine operates to smooth the floor F in a direction toward the main face, i.e., in a direction to the left, as viewed in FIG. 1 or 2. The driver will occupy the seat 5 when the excavation is too narrow and the machine must move rearwards. Of course, the machine has dual controls 16 which can be reached from either of the two seats. The seat 5 can be installed on the tool holder 3. The driver also manipulates the controls which regulate the flow of hydraulic fluid to and from the cylinder and piston units serving to move the arm 6 up and down about the pivot pin 60, to turn the second portion 3b about the king pin 11, and to turn the tool holder 3 about the pivot pin 8.

Due to the fact that the machine is designed for the purpose of smoothing the surface of a floor or the like, i.e., that it need not necessarily perform any other type of work, its parts can be readily assembled and designed with a view to insure rapid, accurate and efficient smoothing of rocky or like surfaces. The speed at which the vehicle 1 is driven when the teeth of cutters 9, 10 remove material from the floor F depends on the depth of cuts and on consistency of the material. The arm 6 may but need not turn on the frame 7 about a vertical axis because the vehicle itself can travel in a curve to effect removal of material along the floor of a straight or meandering mine shaft.

What is claimed as new and desired to be protected by Letters Patent is:

1. A machine for smoothing the surface of a mine floor or the like, comprising a vehicle having a frame; a tool holder; support means adjustably securing said tool holder to said frame; two disk-shaped rotary milling cutters mounted on said tool holder and disposed in a common plane, said rotary cutters having axes of rotation substantially normal to said common plane; and drive means operatively connected to said milling cutters for rotating the same in opposite directions and in such a manner that forward edges of said disk-shaped cutters turn away from each other to move the material engaged by said cutters during forward movement of the vehicle in lateral direction away from a longitudinal plane of symmetry of the machine.

2. A machine as defined in claim 1, wherein said drive means comprises a pair of motors respectively coaxially arranged with said rotary milling cutters for respectively driving the latter.

3. A machine as defined in claim 1, wherein said support means comprises an arm and pivot means securing said arm to said frame for movement about a substantially horizontal axis.

4. A machine as defined in claim 1, further comprising drive means mounted on said tool holder and elastic transmission means connecting said drive means with said cutter means.

5. A machine as defined in claim 1, wherein所述 vehicle is a track laying vehicle and said support means comprises an arm extending forwardly as considered in the direction of forward movement of said vehicle.

6. A machine as defined in claim 1, wherein said tool holder defines a pivot axis normal to said common plane and spaced from said axes of rotation of said cutters for turning movement of said cutters in said common plane about said pivot axis between a first position in which a plane including the axes of rotation of said cutters extends normal to said longitudinal plane of symmetry and a second position in which said plane including the axes of rotation of said cutters coincides with said plane of symmetry.

7. A machine as defined in claim 6, wherein said axes of rotation of said cutters are disposed at the opposite sides of and equally spaced from said pivot axis.

8. A machine as defined in claim 1, further comprising first and second driver's seats respectively carried by said frame and said support means.

9. A machine as defined in claim 8, wherein said first driver's seat faces said tool holder and said second driver's seat faces said frame.

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U.S. Cl. X.R.

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