United States Patent [19]

Paurat

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[54] **MINING AND EXCAVATING APPARATUS**

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[51] **Int. Cl.**.....**E21c 11/02**

[58] **Field of Search** 173/43; 299/70, 67

[56] **References Cited**

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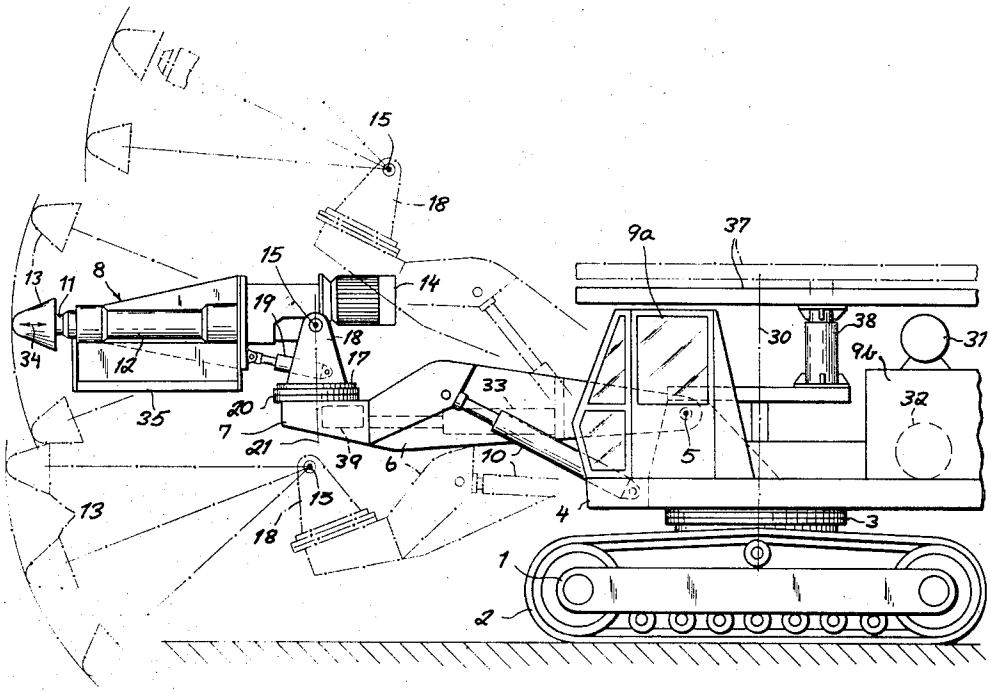
[57] **ABSTRACT**

A percussive mining and excavating apparatus has a carriage supporting a body which is rotatable on the carriage about a substantially vertical axis. An arm has one end pivoted on the body about a horizontal axis and carries on its other end a rectilinearly displaceable hammer. The drive for the hammer, and the hammer itself, are pivotal on this other end of the arm about horizontal and vertical axes so that the hammerhead can attack a wall, floor, or ceiling squarely even when offset from the body. A horizontally or vertically displaceable pair of such electrically-powered hammers can be mounted on the arm and can themselves be individually pivotal about horizontal axes.

9 Claims, 3 Drawing Figures



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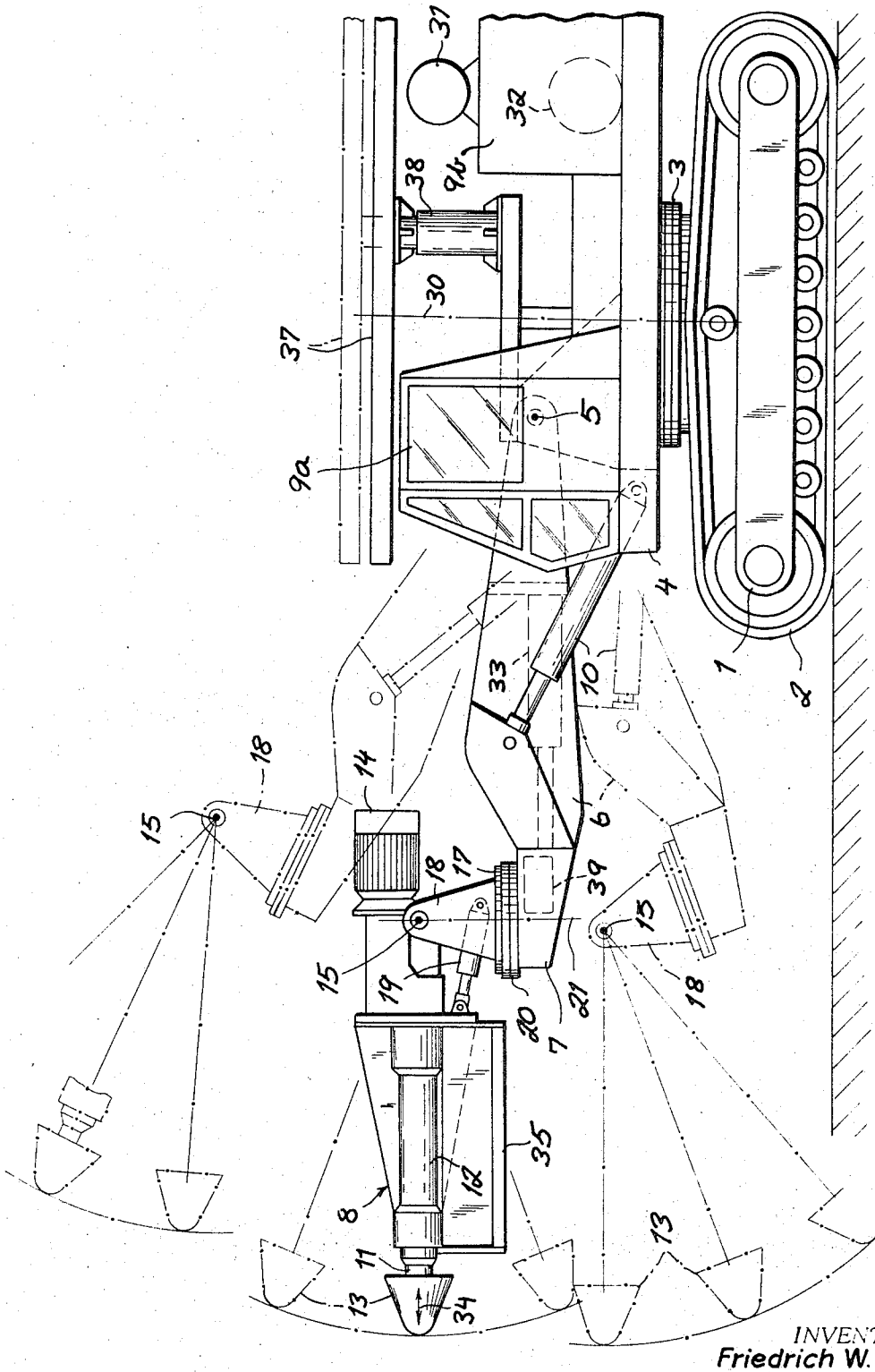

FIG. 1

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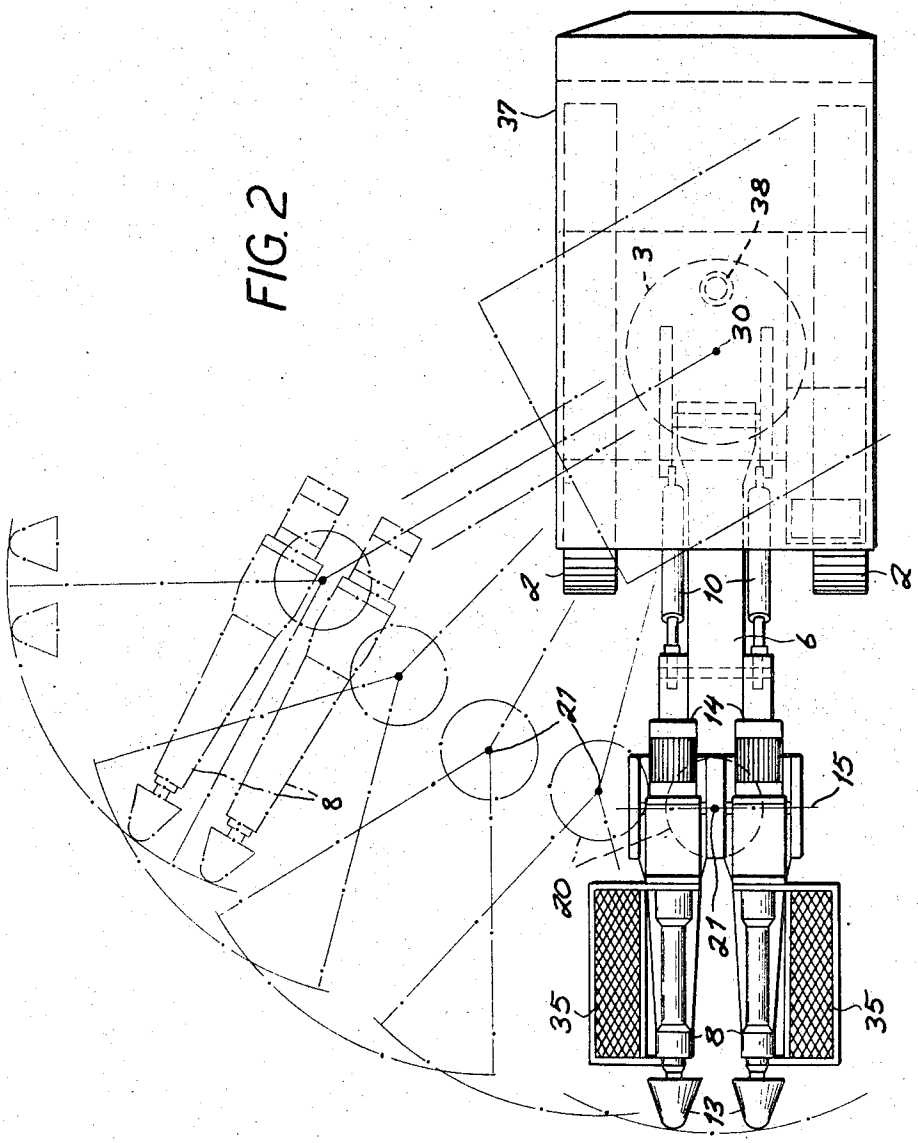
FIG. 2



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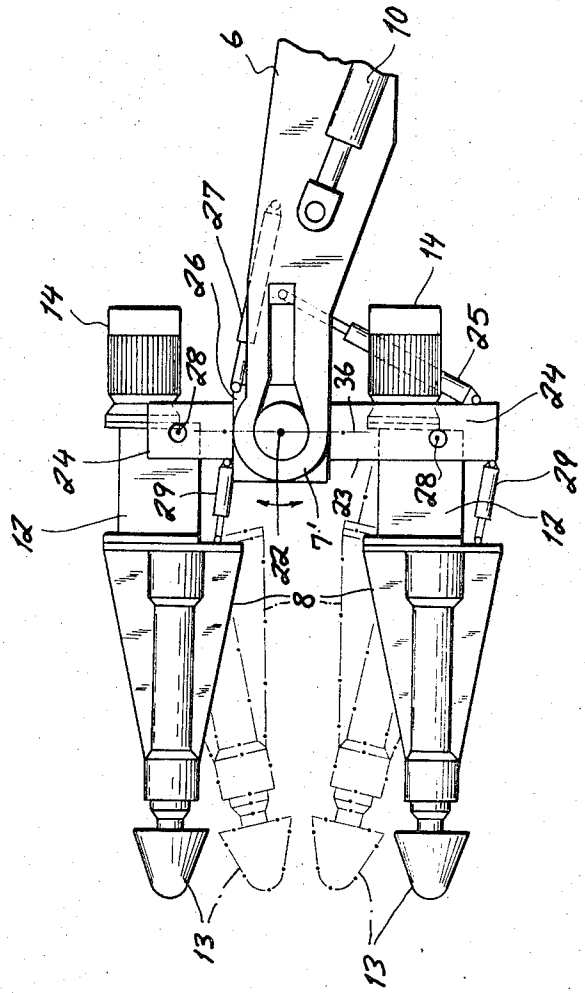

FIG. 3

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MINING AND EXCAVATING APPARATUS

FIELD OF THE INVENTION

The present invention relates to a percussive mining and excavating apparatus. More particularly this invention concerns an apparatus of the rooter, ripper, or scarifier type which is used to break up soft rock and the like by means of hammer blows for forming tunnels or headings, or for above-ground earth removal. In general, the invention relates to vehicular self-propelled mining apparatus for the driving of tunnel shafts with linearly reciprocable tools at the front end of the apparatus.

BACKGROUND OF THE INVENTION

A power shovel is a well-known and highly useful tool for excavating above ground. Large quantities of earth can be quickly and easily removed from a site with such an apparatus; these machines, operating with angularly displaceable tools, however, cannot be employed where the material to be removed is so hard that the bucket teeth cannot break it, so that some form of picking must be carried out.

Coal and the like is often mined, at least in soft-rock formations, with the aid of a hammering apparatus having a rectilinearly displaceable hammer that can be swung about a horizontal and vertical axis relative to a carriage. The hammerhead pounds the formations to be moved, thereby breaking them up and permitting their removal by means of a customary loader or shovel. Such a device is used almost exclusively for the cutting of headings, since it has a highly limited reach and is very inefficient when swung widely up or to the side.

OBJECTS OF THE INVENTION

It is therefore an object of the present invention to provide an improved mining and excavating apparatus.

Another object is the provision of a percussive mining and excavating apparatus which overcomes the above-mentioned disadvantages.

Yet another object is to provide an excavating machine which can be used with good effect in all applications where a conventional apparatus is useless or of limited versatility.

SUMMARY OF THE INVENTION

The above objects are attained according to the present invention by an apparatus (vehicle) having a horizontally displaceable chassis, support or carriage which carries a body, turntable, cabin or turret that can rotate relative to the carriage about a substantially vertical axis. An arm, jib or outrigger, or beam is carried by this body with its one end pivoted on the body about a horizontal axis and its other end serving to support a rectilinearly extensible hammer means which is itself mounted for pivotal movement about both a vertical and horizontal axis on its end of the arm. The hammer represents any linearly reciprocable tool which may be used for excavation.

This system allows the hammer to always face the wall, ceiling, or floor squarely, even when the area to be worked is widely offset from the carriage. Thus, the carriage, once it has been driven adjacent the area to be worked, remains still while the body is turned, the arm raised and lowered, and the hammers pivoted to enable them to attack large regions of wall, floor, or ceiling. Thereafter a loader or small power shovel can remove the broken-up rock. The system is particularly satisfactory for full-face excavating operations.

According to another feature of this invention a pair of such rectilinearly extensible hammers are provided, each with its own drive motor. They can be vertically or horizontally spaced, and each can be pivotal about a horizontal axis independently of the other.

In accordance with yet another feature of the present invention the means for raising and lowering the arm and for rotating the body on the carriage is hydraulic, as is conventional with such devices, and the motors that serve to reciprocatingly displace the hammerheads are electric. A generator can be provided on the body to power these motors, independently of the drives, or they can be connected to a completely external electric power source.

DESCRIPTION OF THE DRAWING

The above and other objects, features and advantages will become apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a side elevational view of an apparatus according to the present invention;

FIG. 2 is a top view of the apparatus shown in FIG. 1; and

FIG. 3 is a side view of a portion of a variant of the apparatus of this invention.

SPECIFIC DESCRIPTION

As seen in FIGS. 1 and 2 the apparatus according to my present invention has a carriage 1 fitted with a pair of treads 2 so that it can be displaced along the ground above or below the surface. A body 4 is carried by means of a large collar 3 on the carriage so that it can rotate relative to this carriage 1 about a vertical axis 30. The body 4 carries an operator cabin 9*a* and a drive-motor housing 9*b* that receives the hydraulic drive motor 32 for displacing the carriage 1 along the ground and rotating the body 4 on this carriage 1. An electric generator 31 is mounted on top of this housing 9*b*. A large plate 37 which extends over substantially all of the body 4 is mounted on a cylinder 38 so that it can be displaced upwardly against the roof of a tunnel to stabilize the apparatus or to serve as a stage for workmen.

A large arm or boom 6 has one end pivoted on the body 4 for movement about a horizontal axis 5 and carries on its other end 7 a hammer 8. The end 7 of this boom 6 can also be displaced away from the body of the boom by means of an internal hydraulic cylinder 33 to extend or shorten the boom. A pair of heavy-duty hydraulic cylinders 10 attached between the boom 6 and the body 4 serve to raise and lower the boom end 7.

The hammers 8 are each received between a pair of flanges 18 formed on a turntable plate 17 which is rotatable about a vertical axis 21 relative to another turntable plate 20 fixed at the head 7 of the boom 6 and rotatable by a hydraulic rotary drive motor 39 located in the head 7. These flanges 18 define a horizontal rotation axis 15 for the hammers. Means is provided for rotating the two plates 17 and 20 relative to each other and cylinders 19 are shown to rotate the hammers 8

about their axis 15. Each of these cylinders 19 is braced between its hammer 8 and one of the flanges 18.

Each hammer 8 has a hammerhead 13 mounted on a shaft 11 telescoped in a cylinder 12. An electric motor 14 which is connected to the generator 31 serves to reciprocate the hammer-head 13 back and forth in the longitudinal direction of the hammer 8 as shown by arrow 34. Since the electric motors 14 and generator 31 are fully separate from the various hydraulic drives for positioning the hammers 8, these hammers can be mounted on a piece of equipment having drives which could not normally be expected to suffice for them. It is also possible to just connect the hammers by a cable to an electric power source at the site or in the tunnel.

FIGS. 1 and 2 further show how each hammer 8 can carry a horizontal stage 35 which lies below the hammer and serves as a standing place for workers installing timbering or otherwise working up above the surface.

In FIG. 3 an alternate embodiment is shown wherein the boom 6 has a head 7' in which is journaled a generally upright beam 23 which is pivotal on the boom about a horizontal axis 22. A hydraulic cylinder 25 attached between the lower end of the beam 23 and the boom 6 controls the angle of this element 23. A pair of vertically spaced but parallel hammers 8 as described above are mounted on opposite ends of the beam 23. These hammers 8 are individually pivoted on forks 24 at the end of the beam 23 to swing about respective axes 28 under the effect of expansible and contractile hydraulic cylinders 29.

In addition to being pivotal about the axis 22, the beam 23 is provided with a flange 26 which is tangentially engaged by a hydraulic cylinder 27 whose other end is fixed to the beam 6 so that it can be rotated about its own axis 36. Thus, the hammers 8 can be set at just the right angle for task to be performed, and can even be set at an angle to each other for special circumstances.

I claim:

1. An excavating apparatus comprising:

a horizontally displaceable support;

a body mounted on said support for rotation about a generally vertical axis fixed on said support;

an elongated arm pivotally mounted at one end on said body for swinging movement about a generally horizontal axis fixed on said body;

means for swinging said arm about said horizontal axis;

a turntable comprising a lower plate fixed at the other end of said arm and an upper plate carried on said lower plate and rotatable relative thereto about a second generally vertical axis fixed on said lower plate;

means at said other end for rotating said upper plate relative to said lower plate about said second vertical axis;

a tool mounted on said upper plate and pivotal relative to same about a second generally horizontal axis, said tool having a head and drive means for linearly reciprocating same perpendicularly to said second horizontal axis; and

means on said upper plate for pivoting said tool about said second horizontal axis.

2. The apparatus defined in claim 1 wherein said tool is a hammer, said head is a hammerhead and said drive means is operable for rectilinearly and reciprocatingly displacing said hammer head.

3. The apparatus defined in claim 2 wherein said hammer is telescopingly extensible.

4. The apparatus defined in claim 2 wherein said drive means includes an electric motor.

5. The apparatus defined in claim 3, further comprising hydraulic means for rotating said body about the first-mentioned vertical axis on said support.

6. The apparatus defined in claim 5 wherein said drive means includes an electric motor.

7. The apparatus defined in claim 3 wherein a pair of said hammers are carried on said arm.

8. The apparatus defined in claim 7 wherein said hammers are vertically spaced, said apparatus further comprising means for individually pivoting said hammers about respective axes parallel to said second horizontal axis.

9. The apparatus defined in claim 8 wherein said hammers are horizontally spaced, said apparatus further comprising means for individually pivoting said hammers about said second horizontal axis.

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