

Feb. 10, 1959

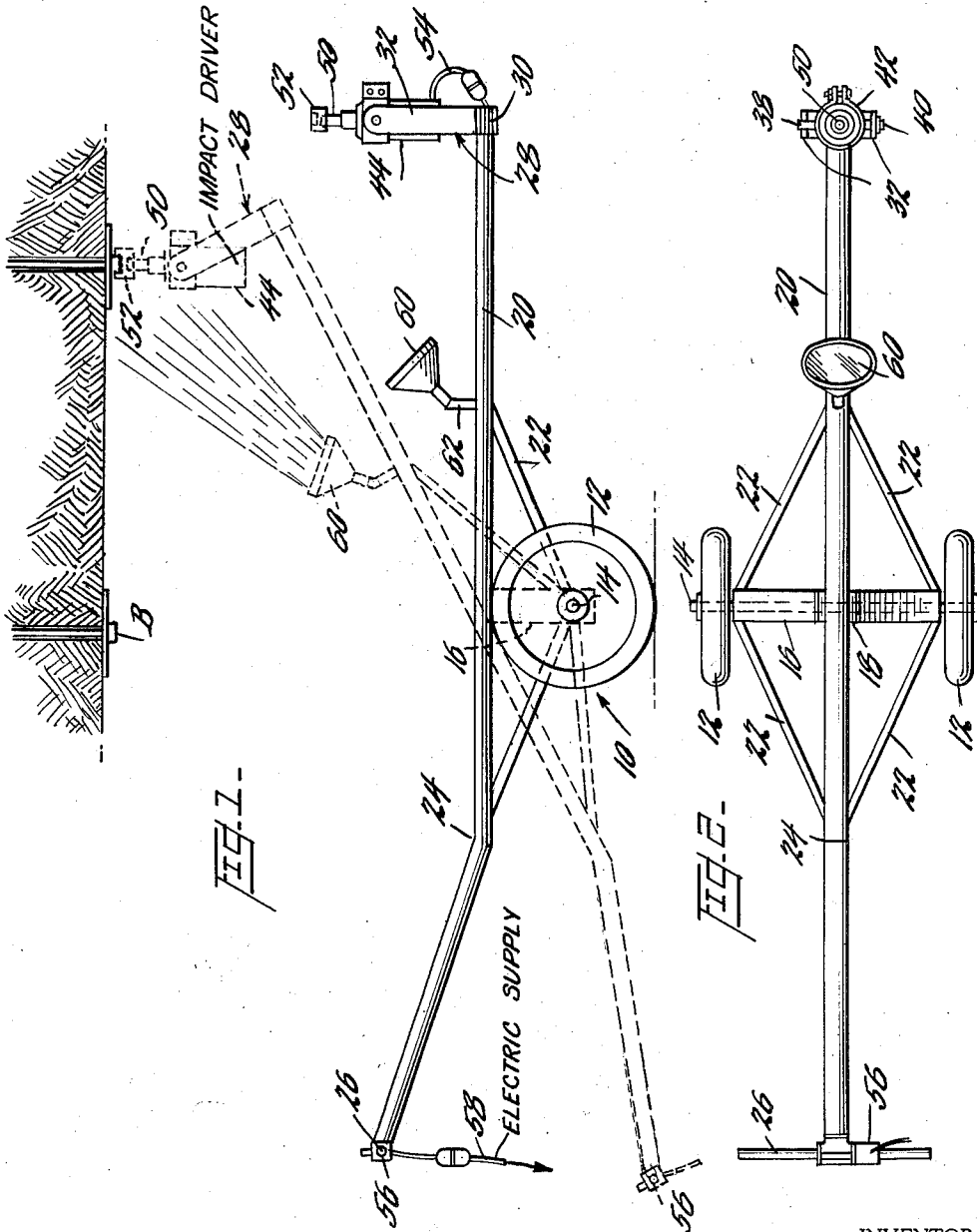
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2,872,835

ROOF BOLT EXTRACTOR MACHINE

Filed Aug. 6, 1957

2 Sheets-Sheet 1



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FIG. 6.

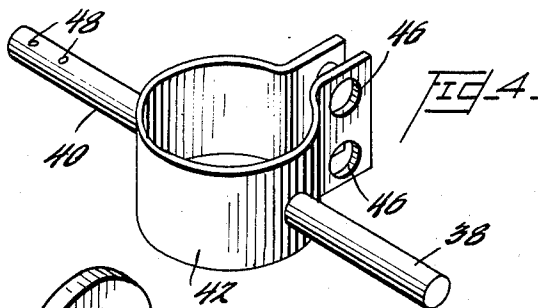
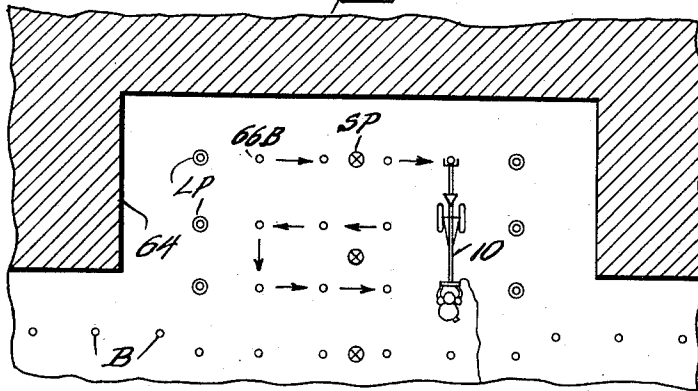


FIG. 5.

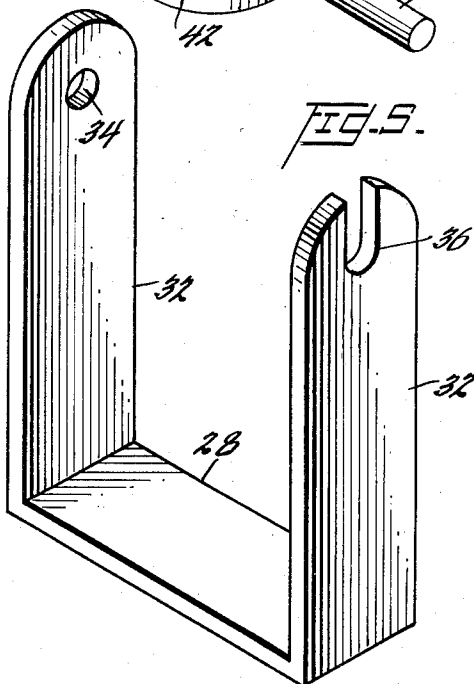
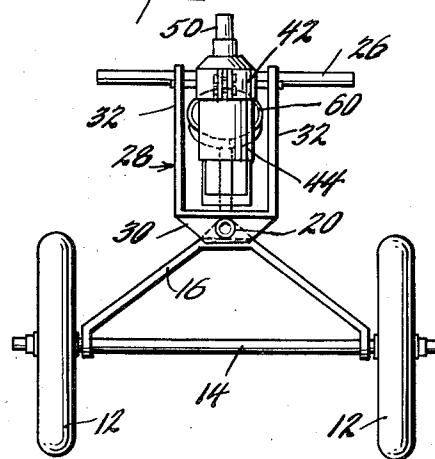


FIG. 3.



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ROOF BOLT EXTRACTOR MACHINE

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Application August 6, 1957, Serial No. 676,584

4 Claims. (Cl. 81-54)

This invention relates to a portable, power operated wrench. More particularly, this wrench is designed to salvage in mining operation, the roof bolts employed for anchoring in place, mine roofs, when such mine is exhausted and about to become abandoned.

With particular reference to coal mines, it is generally known that much of the coal occurs in strata or seams. In the United States, it is ordinarily of doubtful economic wisdom to employ underground mining techniques for the recovery of coal occurring in seams less than about four feet thick. The coal will be overlaid by a series of other strata of varying geological character, extending upward to the earth's surface. Obviously, the manner in which the coal is mined is materially influenced by the type of strata immediately above the coal.

Some geological formations are such that, when the coal is removed from beneath the formation, by entry along the edge thereof, the stratum immediately above the coal will remain undisturbed after removal. A common method for removal of the coal, called the room and pillar method, involves cutting channels into the seam from a central corridor. Between each channel is left a sufficient amount of coal to safely support the overburden. Frequently, cross cuts through the connecting channels are made, for facilitating communication and ventilation, as well as somewhat increasing the recovery of coal.

Frequently, although the strata immediately above the coal is unsatisfactory from a safety point of view, the next stratum above may be employed to remedy the situation. Typically, a layer of shale or slats is found adjacent the coal while above that, is found sandstone or perhaps limestone. The slate, particularly after exposure to the mine atmosphere, tends to break away in substantial chunks or slabs, creating hazardous conditions.

One of the roof control devices frequently specified by mine inspectors is the roof bolt. Holes are drilled upwardly through the slate and well into the sound stratum of rock above the slate. An expansion shell is pushed into the hole followed by a bolt of suitable length having about its head, a washer of substantial area. By way of example, in one mine, the roof was made up of heavy, brittle, blue slate ranging from six inches to six feet in thickness. Above this was a layer of hard sandstone. According to the standards established by Federal Bureau of Mines, steel bolts $\frac{3}{4}$ inch in diameter were placed on four foot centers, extending at least eighteen inches into the sandstone. Each bolt had a one inch square head and was provided with a steel plate washer $\frac{3}{8}$ inch thick by six inches square.

When a section of mine is to be abandoned after removal of all of the coal that is practicable, a substantial economy can be achieved if some or all of the roof bolts can be safely salvaged. It will be apparent, that apparatus for this purpose must be easily transported about in a coal mine, that it must be adequately powerful to deal with bolts installed under varying conditions and that above all, it must afford a generous margin of safety in

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operation. The apparatus I have devised for this purpose is shown in the accompanying drawings wherein:

Figure 1 is a side view of the apparatus, showing it in full lines, arranged for movement about the mine and, in broken lines, arranged for removing a roof bolt;
Figure 2 shows a top view of the device;
Figure 3 shows an end view of the device;
Figure 4 shows a collar for holding the bolt removing tool;

Figure 5 shows the yoke for supporting the collar; and
Figure 6 is a schematic plan view illustrating the manner in which the bolts are removed.

Referring to the drawings, the extracting tool 10 is provided with a pair of wheels 12 mounted upon an axle 14. Supported on the axle is an arch 16 having a flattened portion 18 for receiving elongated tubular frame piece 20, bent at point 24.

The tubular frame piece 20 may be suitably secured to the arch 16 as by welding and, in similar manner braces 22 connect the frame piece 20 with the outer portions of the arch 16.

At the rear thereof are a pair of outwardly extending handles 26 while at the forward end is a yoke 28.

The yoke 28 is secured to the tubular frame piece 20, with the aid of gusset support plates 30, again by welding.

In the arms 32 of the yoke 28 are bearing hole 34 and bearing slot 36 respectively, for receiving pins 38 and 40, extending outwardly of collar 42. The collar 42 is arranged to receive an impact driver 44 in close fitting fashion. Bolts passed through holes 46 in the collar effectively hold the driver in place.

I find that the electric Impacttool manufactured by the Ingersoll-Rand Company is suitable for use in connection with my invention. However, it will be apparent that there are other devices suitable for exerting a high degree of torque, preferably, in short jerks, for unscrewing the roof bolts. It will be obvious that the shape of collar 42 may have to be modified to suit other impact tools and that another suitable suspension of the tool may be employed so long as the tool is free to swing upon the pins 38 and 40 with its center of gravity well below the axis of such pins. The tool is prevented from extensive endwise movement by means of washers and a pair of cotter pins passed through holes 48 in pin 40.

The impact driver is provided with a rotatable drive shaft 50, operable in either direction for driving or withdrawing threaded fastenings. At its outer end, it is adapted to support a replaceable socket 52, the socket being selected according to the type of threaded fastening to be driven. For the purposes of this invention, it is proposed to employ an eight-point socket slightly oversized, to accommodate the square headed bolts commonly employed in mines.

Electrical connection of the tool is provided through cord 58 which leads through the tubular frame piece to the operating switch 56 on the handle 26. The cord 58 connects the tool 10 with a suitable source of electricity. Mounted upon the front portion of the vehicle (and positioned to flood light the work area) is lamp 60 supported by bracket 62. The electrical connection for the lamp 60 also passes through the tubular frame member 20.

Operation

The invention has been especially designed to protect the operator against the hazards of what might otherwise be an unsafe operation. The length of the vehicle is selected to be at least twice the spacing between roof bolts so that the operator cannot be beneath one of the bolts to be removed at the time he manipulates the operating switch 56 which must be hand held to operate. To carry out the removal operation, the operator, grasping the

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handles 26, brings the vehicle into position for the socket 52 to engage the head of bolt B. In this, he is aided by the lamp 60 which is trained so that it floods the area of operation of the impact wrench. The eight points and oversize of the socket are especially well suited to facilitate engagement of the bolt head. The arrangement of the impact driver upon pins 38 and 40 plus the arrangement of the driver with its center of gravity below the axis of the pins 38 and 40 holds it in vertical position no matter how the vehicle is tilted. The operator is thus enabled, after approximately positioning the vehicle 10, to press down upon the handle 26 to bring the socket 52 into engagement with the head of the bolt B. Engagement may be completed by lightly pressing the operating switch to cause the wrench to take a few turns and, as the operator feels the socket take hold of the bolt head, he may hold the switch 56 for a sufficient period of time to completely dislodge the bolt from its seat. As the handle 26 of the vehicle is raised, the bolt is permitted to drop to the floor, where it may be retrieved by a suitable long handled implement.

The operation of the device as applied to a typical coal mining operation is illustrated in Figure 6. The exhausted working face 64 of a cross-entry is shown with a series of line props LP along the two respective sides of the cross-entry. It may be desirable to place an additional row of safety posts SP along the center of the entry, midway between the two rows of line posts. After inspecting the roof to determine its condition, the operator will begin at either the right or left corner, for example 66-B to remove the first bolt and he will continue taking alternate rows of bolts, first from left to right and then from right to left in the manner illustrated by the arrows running between the bolt locations B. In this manner, an orderly retreat is made and the roof slate tends to slowly sag, falling in one general area at a time, without disturbance of the overlying stratum. The device produces a substantial saving through salvage while operating in a safe manner so as to have received the approval of official authorities.

I claim:

1. Apparatus for driving large, headed threaded fasteners in an overhead location comprising a two-wheeled carriage, an arched arbor supported at its ends between the wheels thereof, an elongated frame member supported near its mid point upon the arch for rocking movement about the axle of the carriage, a yoke affixed to the frame adjacent one end thereof with the yoke arms upwardly extending, a pair of bearings in the respective arms of the yoke; a driving motor having an upwardly extending drive shaft, a pair of stub shafts, having a common axis, extending outwardly, above the center of gravity of said motor, said shafts being journaled in the yoke bearings to permit the motor to swing freely within said yoke, a drive socket upon the outer end of the drive shaft for engaging the head of a fastener; a handle at the end of the frame member opposite the driving end to enable tilting the frame about the axle to bring the drive socket into engagement with the depending head of a fastener; and a motor control mounted adjacent the handle, said motor being inoperative without continuous manipulation of the motor control and said frame member being of such length that the driving end is out of reach of a human being at the handle end, whereby an operator of the apparatus is prevented from approaching the driving end during its operation.

2. Apparatus for driving large, headed threaded

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fasteners in an overhead location comprising a two-wheeled carriage, an elongated frame member supported near its mid point above the axle of the carriage for rocking movement thereabout, a driving motor having an upwardly extending drive shaft, a suspension for the motor, adjacent one end of the frame for suspending the motor to hang freely vertical, independent of the rocking of the frame, a drive socket upon the outer end of the drive shaft for engaging the head of a fastener, a handle at the end of the frame member opposite the driving end to enable tilting the frame about the axle to bring the drive socket into engagement with the depending head of a fastener; and a motor control mounted adjacent the handle, said motor being inoperative without continuous manipulation of the motor control and said frame member being of such length that the driving end is out of reach of a human being at the handle end, whereby an operator of the apparatus is prevented from approaching the driving end during its operation.

3. Apparatus for driving large, headed threaded fasteners in an overhead location comprising a two-wheeled carriage, an elongated frame member supported near its mid point above the axle of the carriage for rocking movement thereabout, an upwardly extending drive shaft, a suspension therefor, adjacent one end of the frame for suspending the shaft in a vertical position, independent of the rocking of the frame, a driving motor for said shaft, a drive socket upon the outer end of the drive shaft for engaging the head of a fastener; a handle at the end of the frame member opposite the driving end to enable tilting the frame about the axle to bring the drive socket into engagement with the depending head of a fastener; and a motor control mounted adjacent the handle, said motor being inoperative without continuous manipulation of the motor control and said frame member being of such length that the driving end is out of reach of a human being at the handle end, whereby an operator of the apparatus is prevented from approaching the driving end during its operation.

4. Apparatus for driving large, headed threaded fasteners in an overhead location comprising a mobile carriage, an elongated frame member rockably supported near its mid point upon the carriage, a driving motor having a drive shaft, means adjacent one end of the frame suspending the driving motor to freely pivot with its drive shaft in constant vertical position, means on the end of the drive shaft for engaging the head of a fastener, an operating handle upon the end of the frame member opposite the motor suspension for tilting the frame member to bring the head engaging means into operative position and a control for the motor mounted on the operating handle, the motor being inoperative without a human operator at the control and the frame member being of greater length than the arm spread of an adult human, thereby to avoid the possibility of injury to the operator through his presence at the operative head of the apparatus while it is in motion.

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