

July 30, 1957

J. F. JOY

2,801,092

COAL BREAKER WEDGE DEVICE

Original Filed Feb. 1, 1947

2 Sheets-Sheet 1

FIG. 1.

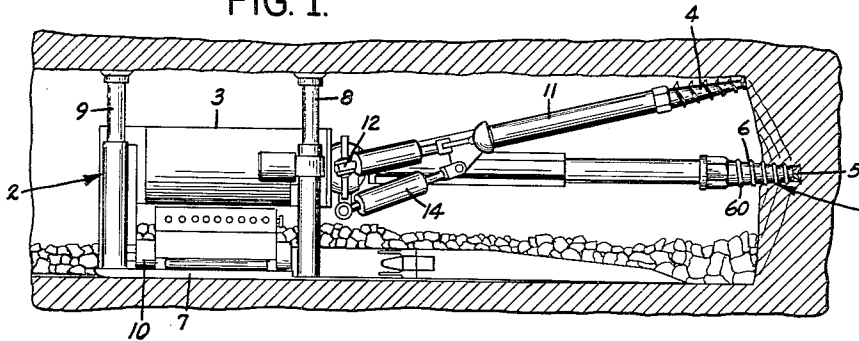


FIG. 2.

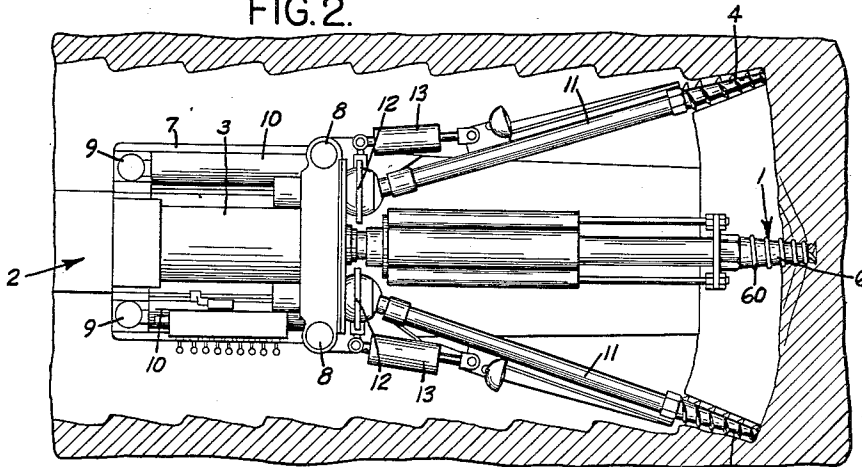


FIG. 5.

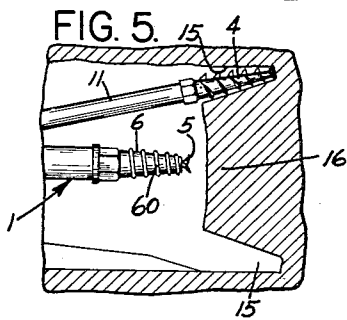


FIG. 6.

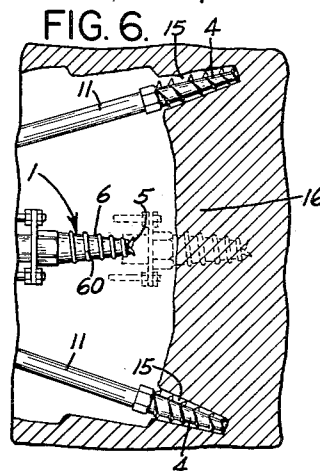


FIG. 7.

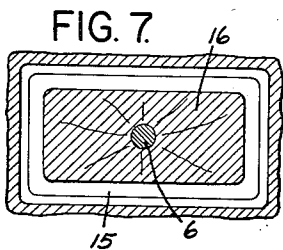
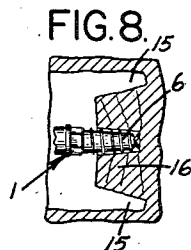


FIG. 8.



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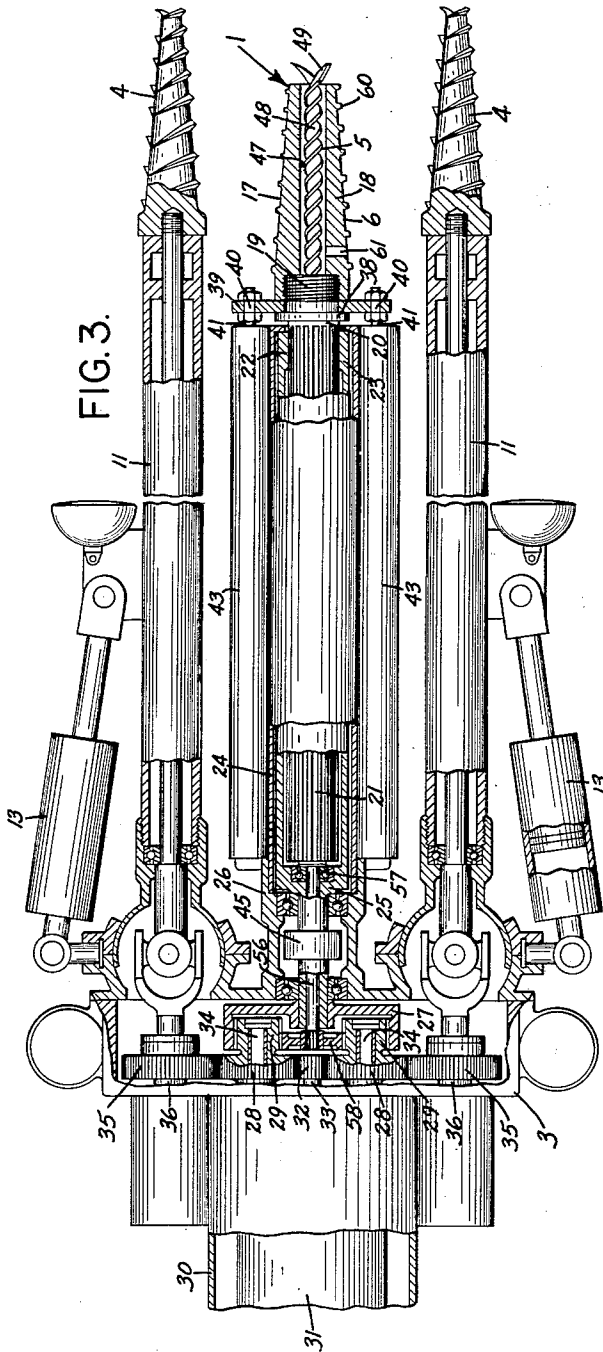
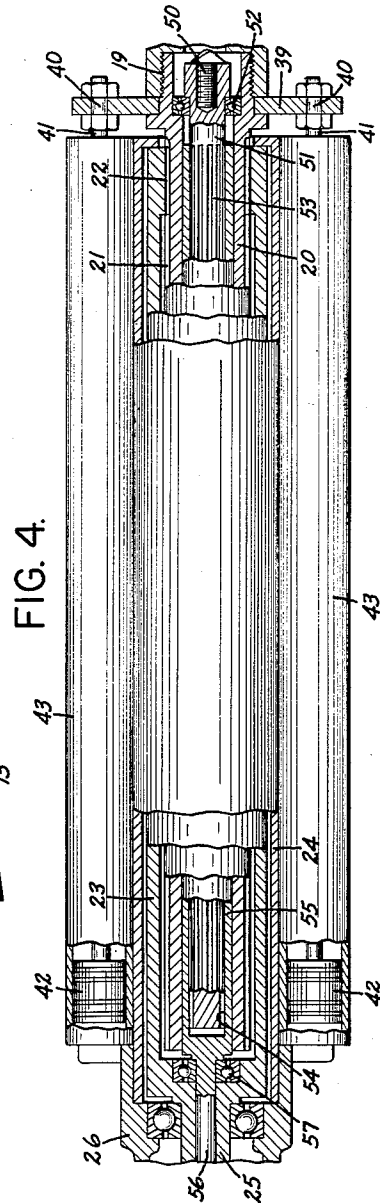
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2 Sheets-Sheet 2



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COAL BREAKER WEDGE DEVICE

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Division of application Serial No. 725,950, February 1, 1947. This application January 29, 1954, Serial No. 407,065

7 Claims. (Cl. 262—9)

This invention relates to a mineral dislodging mechanism and more particularly to a mechanical breaker wedge device for engaging and dislodging mineral such as coal from a solid mine vein.

An object of the present invention is to provide an improved dislodging device for mechanically breaking down mineral from a solid mine vein. Another object is to provide an improved breaker device for applying a powerful dislodging force to the mineral to be dislodged. A further object is to provide an improved rotatable breaker wedge device having improved driving means therefor. A still further object is to provide an improved breaker wedge movable axially into the mineral to be dislodged and having improved feeding and driving means therefor. Yet another object is to provide an improved fluid actuated feeding means for a rotatable breaker wedge for applying a powerful dislodging pressure to the mineral to be dislodged and improved extensible driving means for effecting wedge rotation as it is fed axially. Still another object is to provide an improved rotating means for a breaker wedge and embodying clutch means set at a predetermined load and adapted to slip for automatically interrupting drive of the wedge when a predetermined stress load is applied to the mineral to be dislodged. A still further object is to provide an improved breaker device having a drill associated with the wedge thereof and provided with improved driving means. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

This application is a division of my copending application Serial No. 725,950, filed February 1, 1947.

In the accompanying drawings there is shown for purposes of illustration one form which the invention may assume in practice.

In these drawings:

Fig. 1 is a side elevational view of a mining machine, shown in operating position in a mine, in which an illustrative embodiment of the invention is incorporated.

Fig. 2 is a plan view of the mining machine shown in Fig. 1.

Fig. 3 is an enlarged horizontal sectional view through the mining machine, showing certain details of the improved breaker device.

Fig. 4 is an enlarged fragmentary horizontal sectional view showing a portion of the drive mechanism for the breaker wedge, with the wedge in retracted position.

Fig. 5 is a diagrammatic side view showing the mining machine in operating position at the face of a mine vein, with a kerf cutting device in core cutting position and the breaker wedge retracted.

Fig. 6 is a diagrammatic plan view of the mining machine shown in Fig. 5, with both kerf cutting devices in core cutting position, the advanced operating position of the breaker wedge being indicated in dotted lines.

Fig. 7 is a diagrammatic cross sectional view taken through a section of the mine vein showing the core of mineral and its surrounding kerf, with the breaker wedge in core dislodging position.

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Fig. 8 is a diagrammatic view in longitudinal vertical section showing the breaker wedge in advanced mineral breaking position.

In this illustrative embodiment of the invention, the improved mineral dislodging device is generally designated 1 and is incorporated in a coal mining machine, generally designated 2. The mining machine shown herein is preferably of the longwall, floor type slidable on its bottom over the floor of a mine although, evidently, the improved dislodging mechanism may be incorporated in mining machines of other types or may be employed independently of the mining machine.

The mining machine 2 herein comprises, as shown in Figs. 1 and 2, a main frame or body 3 which supports, at its forward end, a pair of universally adjustable, contacting kerf cutting devices 4, and the dislodging device 1 incorporated in the machine includes drilling means 5 and a dislodging wedge device 6. The frame or body 3 is supported on a base or bottom skid 7 which resets upon and is slidable in any direction over the floor of a mine and carried by this sliding base are pairs of upstanding roof-engaging jacks 8 and 9, respectively positioned at the forward and rearward ends of the machine body. Associated with the rear jacks 9 are horizontal jacks or feed rams 10, and these roof-engaging and feed jacks may be operated to effect step by step movement of the machine over the mine floor, in the manner fully disclosed in my copending application above referred to. Since this walking base does not per se enter into the present invention, further description thereof is herein unnecessary.

The kerf cutting devices 4 are carried at the outer ends of elongated booms 11 universally pivotally mounted, as at 12, at the front end of the machine body 3 and these booms have fluid jacks 13 and 14 for swinging the booms to move the kerf cutting devices in relatively opposite directions to effect cutting of a kerf 15 at the roof and floor levels and at the sides of the mine passageway to form a core or projection of mineral 16, in the manner also fully disclosed in the copending application above referred to.

The drilling and dislodging device 1, as shown most clearly in Figs. 3 and 4, is arranged centrally of the machine body, and the wedge device 6 comprises a wedge 17 having a tapered body 18, herein detachably secured, as by a threaded connection 19, to a tubular shaft 20. The shaft 20 is mounted for axial movement and has longitudinal splines 21 which are engaged by splines 22 carried by an outer tubular drive shaft 23. The shaft 23 is suitably enclosed within a tubular housing 24 and has a reduced rearward portion 25 suitably journaled within bearings supported by a bearing support 26 suitably secured to the machine body. Fixed to the rearward portion of the shaft 23 is an internal gear 27, and formed integral with and driven by spur gears 28 are spur gears 29 which mesh with and drive the internal gear. The machine body 3 comprises a casing 30 which encloses a motor 31, herein preferably an electric motor, which has a spur pinion 32 fixed to its power shaft 33. Meshing with the spur pinion 32 at the opposite sides thereof and driven thereby are the spur gears 28 suitably journaled on shafts 34 supported by the machine body. The gears 28 at their remote sides mesh with and drive spur gears 35 supported by shafts 36 suitably journaled within the sides of the machine body, and these shafts are operatively connected to the kerf cutting devices 4 for rotating the latter, in the manner also fully disclosed in the above mentioned copending application.

In this instance, positioned between a collar 38 integral with the forward portion of the shaft 20 and the rear end of the wedge body 18 is a transverse plate 39 relative to which the shaft is rotatable. If desired, suitable bear-

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ings may be arranged between the shaft collar 38 and the wedge body at the opposite side of the plate 39, to absorb end thrust. Secured to the opposite sides of this plate at 40, are the forward ends of piston rods 41 which project rearwardly through the front cylinder heads and have feed pistons 42 secured to their rear ends. The pistons 42 are reciprocable in horizontal fluid cylinders 43, herein arranged in parallel relationship at the opposite sides of the tubular housing 24 and suitably secured to the latter.

Associated with portions of the drive shaft 23 for the wedge 17 is a conventional torque clutch 45 which serves the dual purpose of prevention of overload of the driving gearing and associated connections as well as that of providing means for building up a predetermined mineral breaking pressure or stress load within the mineral prior to the kerf cutting operations. The application of a preloading pressure or stress load within the mineral, prior to the kerf cutting operations involved in the formation of the kerf 15 completely about the area in which the predetermined pressure or stress has been established, has the effect of breaking down the mineral structure to where the mineral thus produced may be caused to conform to whatever sizes become desirable, and such preloading of the mineral will be found particularly desirable in mine veins or coal seams of a structure tending to break away in relatively large lumps. In this construction, the shaft 23 is preferably made in two parts, and the torque clutch 45 is connected between the shaft parts. When the mineral dislodging wedge meets a predetermined opposition to its rotation during the dislodging operation, the torque clutch will automatically slip to prevent overloading of the parts. It is therefore obvious that this arrangement permits the introduction of the dislodging wedge into the mineral of a mine vein and the building up of a predetermined breaking pressure or stress load in the mineral to be dislodged, according to the setting of the torque clutch, either prior to or simultaneously with the kerf cutting operations.

Again referring to the specific structure of the drilling and dislodging device, it will be observed that arranged centrally within an axial bore 47 in the wedge body 18 is the drilling means 5 which includes a drill auger 48 having a drill bit 49 at its forward end in advance of the wedge, and this drill auger is detachably connected, as by a threaded connection 50, within the forward portion of an axially movable shaft 51. The forward end of this shaft is journaled in a bearing 52 supported within the forward portion of the tubular shaft 20 and has longitudinal splines 53 which are engaged by splines 54 carried by a tubular shaft 55. The shaft 55 is arranged centrally within the tubular shaft 20 and has a reduced rearward portion 56 journaled in a bearing 57 supported within the rearward portion of the tubular shaft 23, as clearly shown in Fig. 4. Fixed to the rear end of the shaft portion 56 is a spur gear 58 meshing with and driven by the spur gears 29, as shown in Fig. 3.

It will thus be seen that during running of the motor 31 the wedge 17 may be rotated at a relatively slow speed and the drill auger 48 may be concurrently rotated relative to the wedge at a relatively high drilling speed, and during rotation of the wedge and drill auger the feed pistons 42 may be moved under the influence of pressure fluid in the feed cylinders 43 to feed the wedge and drill auger either toward or from the work. During such feeding movement of the wedge and drill auger, the drive between the motor 31 and the wedge and drill auger is maintained by the splined telescopic shafts in an obvious manner. The tapered body 18 of the wedge has spiral vanes 60 of a screw type tooth construction so that as the drill auger is advanced to drill a hole in the mineral, the following wedge enters the hole formed by the auger bit and the wedge, due to its construction, imparts a powerful dislodging pressure to the mineral in a manner to be more fully described. The cuttings from the auger

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bit are conveyed rearwardly through the central opening 47 in the wedge, and the latter is traversed by holes 61 to provide for egress of these cuttings.

When the mining machine is located in operating position at the face of a mine vein, the booms 11 may be swung inwardly and downwardly by the fluid jacks 13 and 14 to position the kerf cutting devices 4 close together for sumping near the floor level and the walking base may then be operated to sump the rapidly rotating cutting devices within the mineral of a mine vein. When the cutting devices have penetrated full depth, the machine base may be held firmly in position by the front roof-engaging jacks 8 and the fluid jacks 13 may then be concurrently operated to move the cutting devices 4 horizontally away from each other to form kerfs at the floor level across the full width of the working face. When the transverse cuts at the floor level have been completed, the fluid jacks 14 may be concurrently operated to swing the booms 11 upwardly to move the cutting devices in a vertical direction from the mine floor to cut vertical kerfs at the sides of the working face. When the cutting devices are positioned at the mine roof, upward swinging thereof is discontinued and the fluid cylinders 13 are again operated to swing the booms inwardly towards one another to cause the cutting devices to cut kerfs along the mine roof until they substantially meet near the horizontal center of the face, thus completing the cutting cycle with the closed rectangular kerf 15 surrounding the core of mineral to be dislodged.

Simultaneously with the kerf cutting operations or subsequent thereto, the feed cylinders 43 may be operated to advance the auger drill 48 and the breaker wedge 17, as the same are rapidly rotated through the telescopic drive shaft connections, toward the working face to cause the drill to form a drill hole in the mineral centrally of the core or mineral-projection 16 which is bounded by the kerf 15, and as the hole is formed, the small end of the wedge enters the hole. As the rotating wedge is forced forwardly into the mineral by the feed cylinders 43, it exerts a tremendous mineral breaking pressure or dislodging stress on the projecting core of mineral in lateral directions toward the kerf bounding the core, thereby to break away or dislodge the mineral. If desired, the mineral dislodging wedge 17 may be forced into the mineral prior to the freeing of the mineral at its boundary by the cutting of kerfs at the bottom, sides and top of the working face, and when the wedge is so employed, the torque clutch 45 provides for building up of a predetermined mineral dislodging pressure or mineral breaking stress within the mineral face so that when the boundaries of the mineral are freed by the kerf cutting devices in the manner above described, the mineral is broken away in lumps of controlled size, thereby reducing the undesirable tendency of the mineral breaking away in excessively large lumps. Thus the mineral dislodged from the working face may be caused to conform, within certain limits, to whatever sizes become desirable. It is further obvious that in this arrangement the torque clutch 45 permits the insertion of the coal dislodging wedge 17 into the face of a mine vein and the building up of a dislodging pressure or stress therein, according to the setting of the torque clutch 45, either prior to or simultaneously with the kerf cutting operation.

If desired, instead of starting the initial sumping cuts at the floor level, sumping of the kerf devices may be effected at the roof level and the cutting devices may be moved horizontally outwardly along the roof, then downwardly along the opposite sides of the working face and then horizontally inwardly along the floor level. The depth of the kerf cut in the mineral depends largely on the distance of the mining machine with respect to the mineral face and the extent of the inclination of the booms supporting the kerf cutting devices. Either during or following the kerf cutting operations, the auger and wedge mechanism may be extended, the auger drill-

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ing a hole centrally of the core defined by the boundaries of the kerf and the wedge following up, rotating more slowly than the drill, and by reason of its screw type tooth construction, entering the hole drilled by the auger and exerting a tremendous mineral dislodging pressure to the coal sufficient to break down the most stubborn mass of mineral.

As a result of this invention an improved mineral dislodging device is provided for mechanically dislodging the mineral of a mine vein in an expeditious and extremely efficient manner. By the provision of the improved feeding and driving means for the breaker wedge, the latter may apply a powerful dislodging pressure to the mineral to be dislodged as it is rotated thereby to break away the mineral in relatively large lumps. By the provision of the improved driving means for the breaker wedge embodying the torque clutch set at a predetermined load the drive of the wedge may be automatically interrupted when a predetermined stress load is applied to the mineral. By applying a powerful dislodging stress to the mineral to be dislodged prior to the freeing of the mineral at its boundaries the size of the lumps of mineral obtainable may be controlled in an improved manner. These and other objects of the invention will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a device of the character disclosed, a support, a breaker wedge engageable with the mineral of a solid mine vein for dislodging the mineral, motor means on said support, means for feeding said wedge axially relative to said support, driving means for said wedge operable independently of said feeding means and including extensible driving connections between said motor means and said wedge for rotating the latter, said wedge having an opening extending centrally therethrough, a drill extending axially through said wedge opening and movable axially with said wedge by said feeding means, and extensible driving connections between said motor and said drill for rotating the latter relative to said wedge.

2. In a device of the character disclosed, a breaker wedge for dislodging the mineral of a mine vein, said wedge having an axial bore, a drill extending axially through and rotatable relative to said wedge, motor operated means for rotating said wedge and said drill, and separate motor operated means for feeding said wedge and said drill axially as they are rotated comprising an extensible fluid actuated cylinder and piston device, operation of said feeding means adapted to be interrupted while rotation of said wedge and said drill is continued, said motor operated means for rotating said wedge and drill including a motor relative to which said wedge and said drill are axially movable and extensible driving connections between said motor and said wedge and drill, said driving connections extending longitudinally in parallelism with said cylinder and piston device.

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3. In combination, a support, fluid operated feeding means including parallel fluid cylinders arranged on said support and pistons reciprocable in said cylinders, said pistons having forwardly extending piston rods, a thrust plate secured to the front ends of said piston rods, a mineral breaker wedge journaled on said thrust plate centrally between the connections of said piston rods with said plate, said plate receiving the thrust of said wedge, said wedge having an axial bore, a rotary drill extending through said wedge-bore, bearing means operatively associated with said thrust plate for receiving the thrust of said drill, and extensible driving connections operable independently of movement of said feeding means extending longitudinally between said cylinders for rotating said wedge and drill.

4. In combination, a support, fluid operated feeding means including parallel fluid cylinders arranged on said support and pistons reciprocable in said cylinders, said pistons having forwardly extending piston rods, a thrust plate secured to the front ends of said piston rods, a mineral breaker wedge journaled on said thrust plate centrally between the connections of said piston rods with said plate, extensible driving connections operable independently of movement of said feeding means extending longitudinally between said cylinders for rotating said wedge, said wedge having an opening extending centrally therethrough, a drill extending axially through said opening, mounting means for said drill, means for extending said drill axially, and extensible driving connections for rotating said drill relative to said wedge, said latter connections arranged coaxial with said first mentioned extensible connections.

5. In combination, a rotatable and axially movable mineral dislodging wedge, a rotatable and axially movable drill coaxial with and rotatable relative to said wedge for forming a pilot hole in the mineral to be dislodged for receiving the narrow front end of the wedge, means for feeding said wedge and drill axially during their operation, a motor, and rotating means driven by said motor including extensible concentric transmission means respectively connected to said wedge and said drill.

6. A combination as set forth in claim 5 wherein said rotating means includes means for rotating said drill at a substantially higher speed than the speed of rotation of said wedge.

7. The combination as set forth in claim 5 wherein said means for axially feeding said wedge and drill includes power operated extensible means arranged in side by side parallelism with said extensible transmission means.

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