(No Model.) 2 Sheets—Sheet 1.

R. H. ELLIOTT & J. B. CARRINGTON.

DRILL FOR BORING CURVED HOLES.

No. 550,783. Patented Dec. 3, 1895.

FIG. 1.

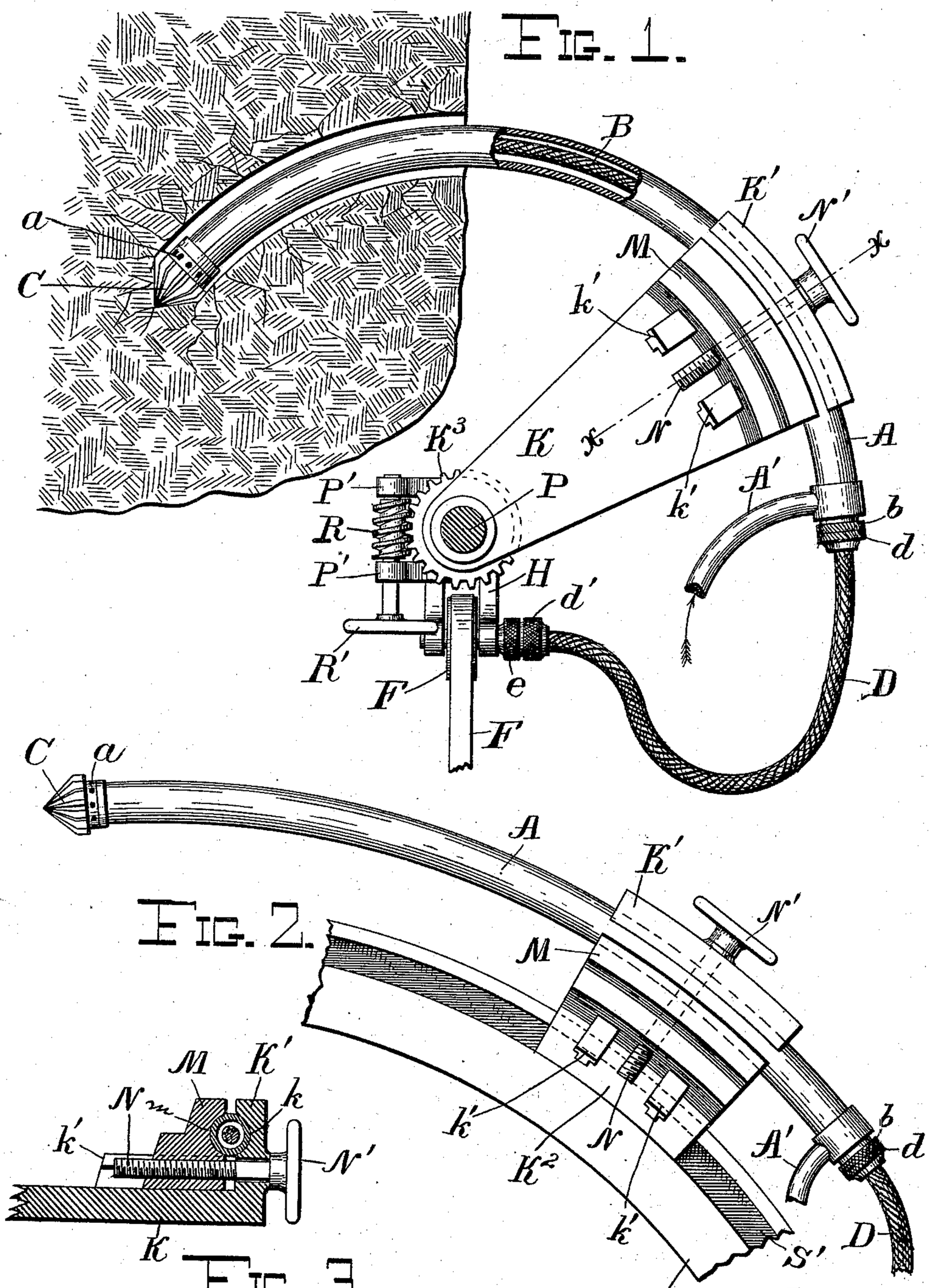

FIG. 2.

FIG. 3.

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(No Model.) 2 Sheets—Sheet 2.

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FIG. 4.

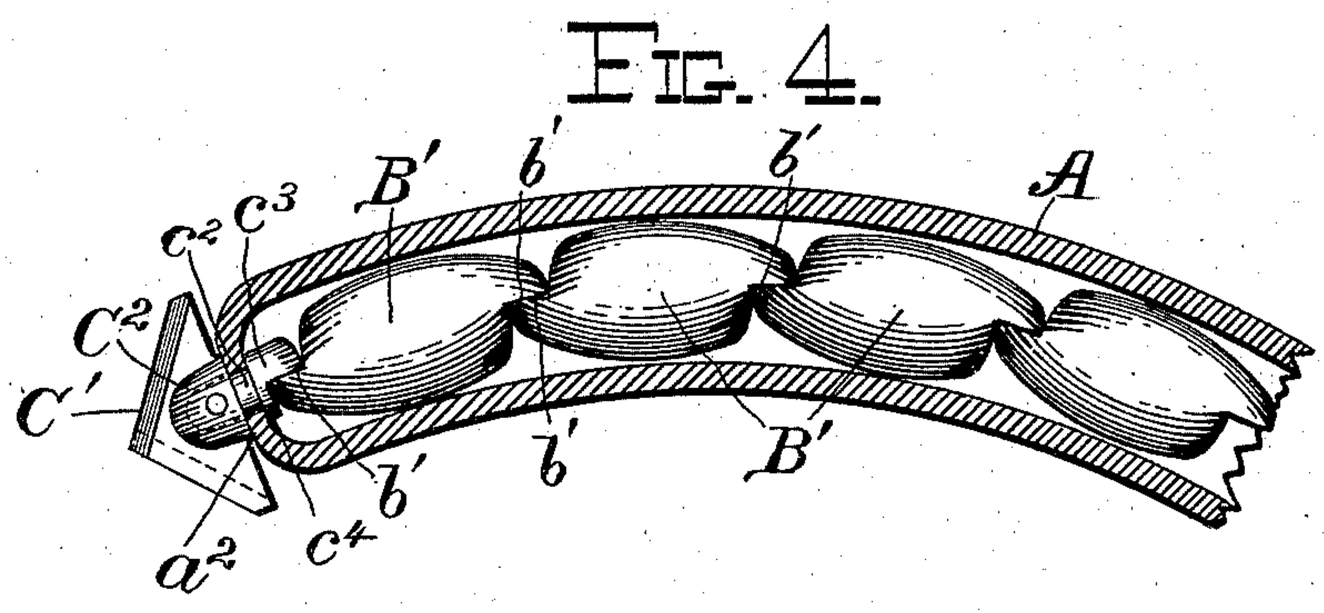


FIG. 5.

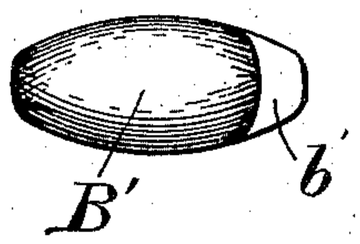


FIG. 6.

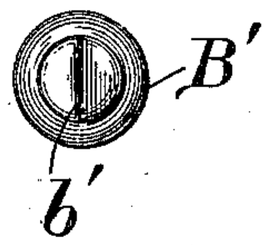


FIG. 7.

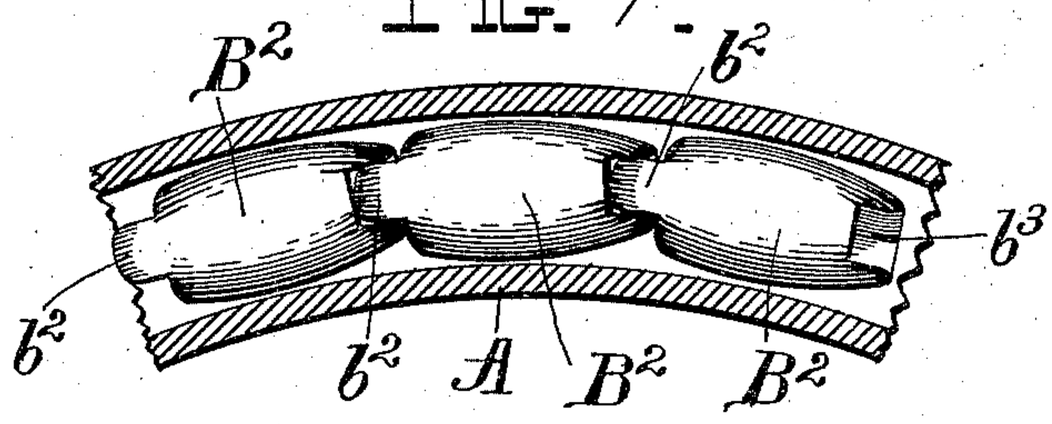


FIG. 8.

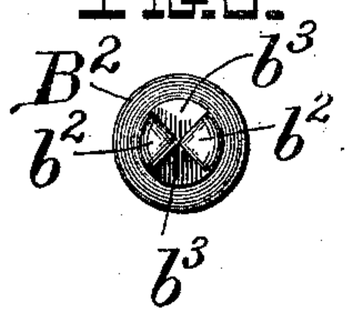


FIG. 9.

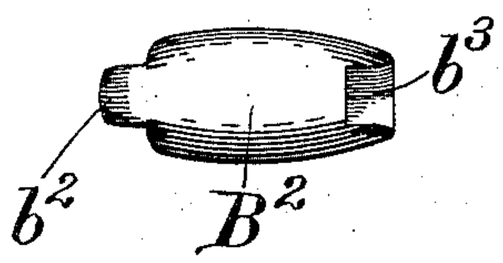
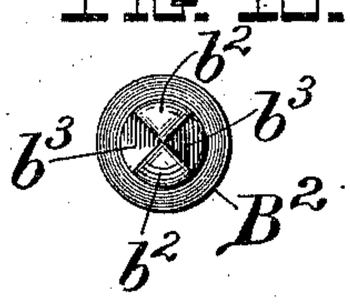


FIG. 10.



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UNITED STATES PATENT OFFICE.

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DRILL FOR BORING CURVED HOLES.

SPECIFICATION forming part of Letters Patent No. 550,783, dated December 3, 1895.

Application filed February 28, 1895. Serial No. 540,007. (No model.)

To all whom it may concern:

Be it known that we, ROBERT H. ELLIOTT, residing at Birmingham, in the county of Jefferson, and JOHN B. CARRINGTON, residing at Jasper, in the county of Walker, State of Alabama, citizens of the United States, have invented certain new and useful Improvements in Drills for Boring Curved Holes; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to improvements in drills for boring curved holes in rock, metal, wood, or any other material that can be bored.

The said invention is primarily intended for boring in rock, but can be readily adapted to boring in other materials, as has already been suggested.

The said invention consists, essentially, of a rigid curved shell pipe or casing, carrying the boring-tool at the forward end thereof, and a flexible shaft or power-transmitting device passing through said curved shell and connecting said boring-tool with the source of power.

Reference is had to the accompanying drawings, in which the same parts are indicated by the same letters throughout the several views.

Figure 1 represents a plan view, partly in section, of our improved drilling-machine as adapted for use in mining, being connected to a jack-post in a mine. Fig. 2 represents a view of a modification in which a guide-segment is substituted for the swinging sector shown in Fig. 1. Fig. 3 represents a section along the line $x\,x$ of Fig. 1. Fig. 4 represents a central longitudinal section of our invention as applied to drills for boring in metal or wood. Fig. 5 represents a side elevation of one of the links or segments of the flexible shaft shown in Fig. 4. Fig. 6 represents an end view of the link shown in Fig. 5 as seen from the left of said figure. Fig. 7 represents another form of flexible shaft in the curved casing. Fig. 8 represents an end view of one of the links or segments of the flexible shaft shown in Fig. 7. Fig. 9 represents a side view of the link or segment shown in Figs. 7, 8, and 10; and Fig. 10 represents an end view of the link shown in Figs. 7, 8, and 9, showing the end opposite to that represented in Fig. 8.

Referring especially to Figs. 1 to 3, in which the device is shown as arranged for use in mining, A represents a hollow pipe made of rigid material and of the desired curvature. This pipe is perforated at its forward end, as at a, to deliver into the bore-hole the air, water, or other fluid which is fed in through the pipe A′ for the purpose of blowing or washing out the chips or cooling the drill-steel, or both.

B represents a wire rope, which is connected by any suitable connection to the drill-steel or boring-tool C at the forward end of the curved pipe A. At the other end of the curved pipe A the said wire rope B terminates in a coupling b, which is connected by the coupling d to the wire rope D, which wire rope is connected by the couplings d' and e to a shaft driven by the pulley E and belt F. Thus motion is transmitted from the said belt to the boring-tool C.

In the form of device shown in Fig. 1 the pipe A is clamped in the groove k of the flange K′, projecting from the sector K, the opposite side of the said pipe engaging in a groove m in the block M, which slides on guides k', and is clamped by means of the screw N, controlled by the hand-wheel N′. The sector K is journaled on the jack-post P, and has rigidly connected to itself the worm-wheel K^3, in which meshes the worm R, journaled in the bearings P′, fast to the jack-post P, and operated by means of the hand-wheel R′. By means of this hand-wheel R′ the feed motion is given to the pipe A and the boring-tool C, and the boring-tool may be withdrawn either by reversing the motion of the hand-wheel R′ or by swinging the sector K by hand about the jack-post P. The pulley E is journaled in the frame H, which may be loosely connected to the jack-post in any desired way.

While we have shown a pulley E as a means of transmitting motion to the wire ropes D and B, any other means for imparting the rotary motion to these ropes may be adopted, if desired.

It will not always be practicable in a mine,

the space therein being ordinarily very contracted, to arrange the parts as shown in Fig. 1, and therefore some such arrangement as is shown in Fig. 2 may be adopted, where the arrangement of the parts is generally similar to that shown in Fig. 1, except that the sector K is replaced by a segment S, which is provided with a groove s', in which a tongue from the block K^2 projects. In this form of construction the feed may be by hand, or any desired mechanism for moving the block K^2 along the segment S may be adopted.

In the form of device shown in Figs. 1 to 3 the flexible shaft is shown as made of a wire rope, which would probably not be rigid enough to operate except in coal or soft rock or soil; but in Figs. 4 to 10 the flexible shaft is made of rigid integral links or segments whose ends admit of lateral movement relative to each other and yet which present a rigid resistance to torsional strains.

In Fig. 4 the curved shell A is bent, as at a^2, to form a journal-bearing for the stem c^2 of the drill-spindle C^2, to which the tool C′ is secured. This spindle terminates in a flat lug c^3 and is shouldered, as at c^4, against which lug and shoulder one of the end lugs b' of the link B′ bears. The opposite lug of the link is obversely disposed to engage the adjacent lug of the next link, as shown in Fig. 4.

In the form of flexible shaft shown in Fig. 7 the links B^2 are provided with lugs b^2 and recesses b^3, obversely disposed in the ends of the links, as shown in detail in Figs. 5 to 10. These links are flexibly connected together by inserting the lugs of each link in the corresponding recesses of the adjacent link. It will be seen that by this construction a flexible shaft is secured which affords a rigid resistance to torsional strains. The front end of the flexible shaft is connected to the tool as shown in Figs. 1, 2, and 4 or in any other convenient way, and the rear end of the shaft is connected to the source of power as shown in Fig. 1 or in any other way desired. By this mode of construction the flexible shaft may be readily inserted in or removed from the curved shell and defective links may be conveniently renewed.

By having the pipe A struck in the form of an arc of a circle of any desired radius a curve of any desired curvature may be obtained in the bore-hole.

It will be obvious that many modifications of the herein-described apparatus might be made which could be used without departing from the spirit of our invention.

Having thus described our invention, what we claim, and desire to secure by Letters Patent of the United States, is—

1. A device for boring curved holes, comprising a curved rigid shell, with apertures near the front end thereof, a flexible shaft mounted in said curved shell with fluid spaces between said shaft and the interior of the shell; a boring tool attached to said flexible shaft; means for rotating said shaft; and means for forcing air or other fluid into the said shell to escape through said aperture substantially as described.

2. A device for boring curved holes comprising a rigid shell curved in the form of an arc of a circle with apertures near the front end thereof, means for moving said shell about the center of said circle, a flexible shaft mounted in said shell with fluid spaces between said shaft and the interior of the shell, a boring tool attached to said flexible shaft, means for rotating said shaft, substantially as described, and means for forcing air or other fluid into said shell to escape through said apertures.

3. In a mining drill, the combination with a curved rigid shell, a holder for said rigid shell, pivoted at the inner end of its radius of curvature, means for moving said holder about its pivot, a flexible shaft mounted in said shell, a boring tool attached to the front end of said flexible shaft, and means for rotating said flexible shaft, substantially as described.

4. In a mining drill, the combination with a curved rigid shell in the form of an arc of a circle, a holder for said rigid shell, means for moving said holder about the center of curvature of said shell, a flexible shaft mounted in said shell with fluid spaces between said shafts and the interior of the shell, a boring tool attached to the front end of said flexible shaft and means for forcing air or other fluid into said curved shell and openings for the passage of the fluid near the front end of the shell, and means for rotating the flexible shaft, substantially as described.

5. A device for boring curved holes comprising a rigid curved shell, an arm rigidly connected to said shell and pivoted at the center of the radius of curvature thereof, means for moving said arm about its pivot, a flexible shaft mounted in said shell, a boring tool attached to said flexible shaft and larger in diameter than said shell, and means for rotating said shaft, substantially as described.

6. In a mining drill the combination with a curved rigid shell, a holder for said rigid shell, pivoted at the center of curvature thereof, a worm wheel on said holder, and a worm engaging in said worm wheel mounted in said shell, a boring tool attached to the front end of said flexible shaft and larger in diameter than said shell, and means for rotating said flexible shaft, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

ROBERT H. ELLIOTT.
JOHN B. CARRINGTON.

Witnesses for R. H. Elliott:
J. B. ROBINSON,
H. C. KENNARD.
Witnesses for J. B. Carrington:
PHILLIP RICHARDSON,
J. H. HAYES.