930,430.

W. C. STEPHENS.

PERCUSSIVE ROCK DRILL.

APPLICATION FILED AUG. 1, 1908.

Patented Aug. 10, 1909.

2 SHEETS—SHEET 1.

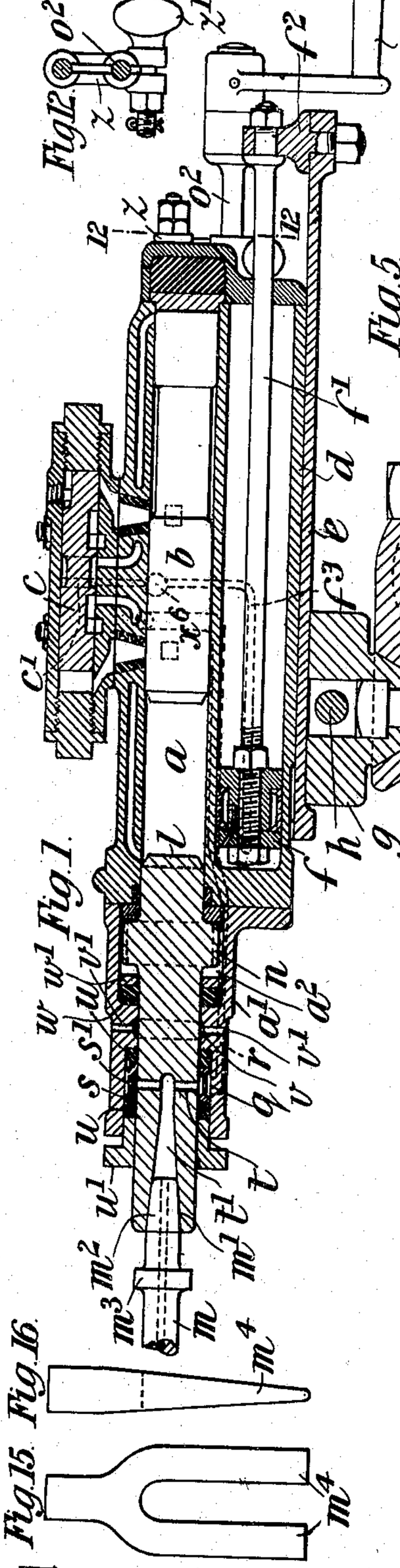

Fig. 1.

Fig. 12.

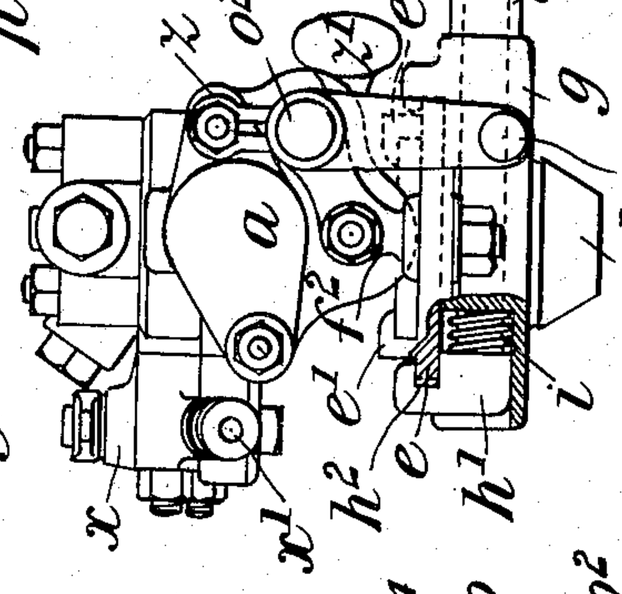

Fig. 5.

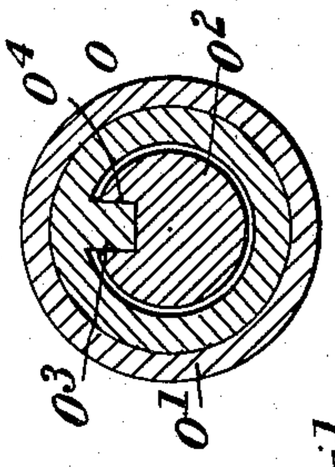

Fig. 13.

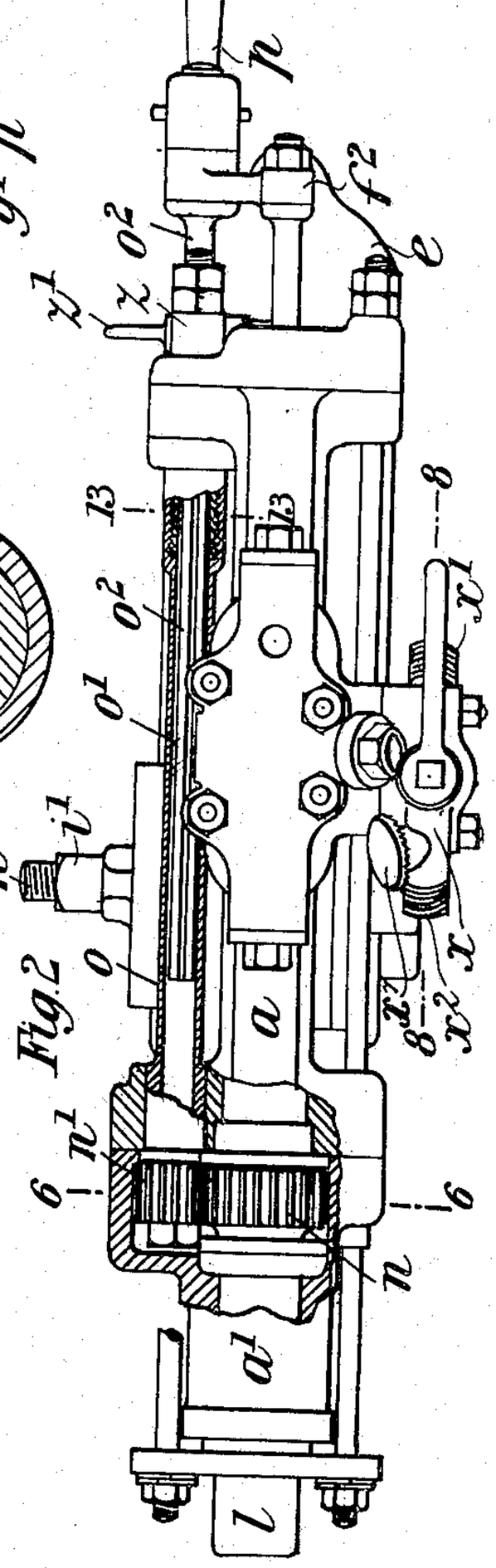

Fig. 2.

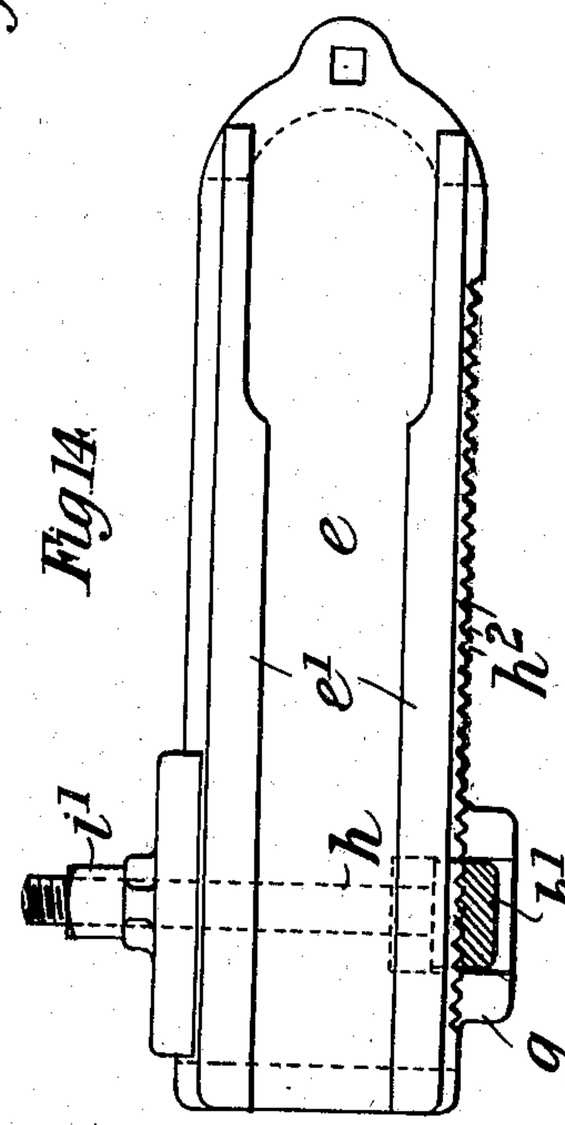

Fig. 14.

Fig. 16.

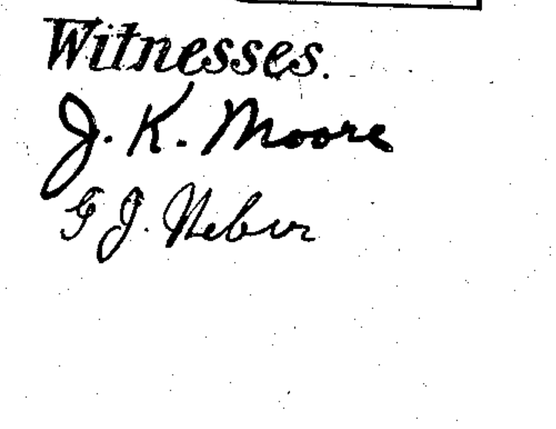

Fig. 15.

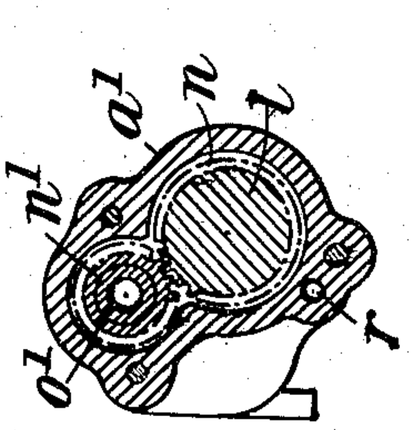

Fig. 6.

Witnesses.

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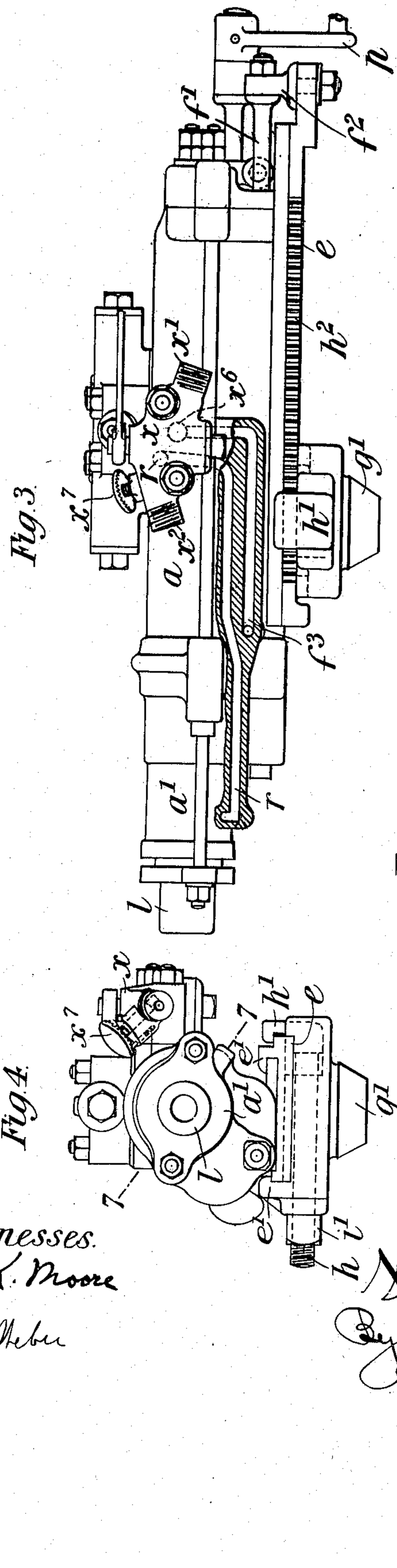
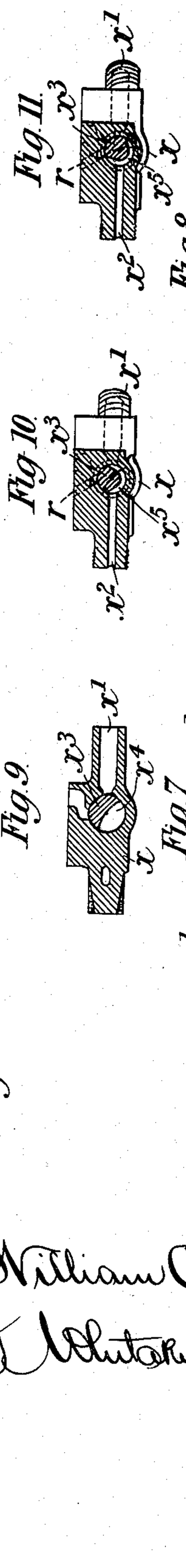
2 SHEETS—SHEET 2.





Witnesses.

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UNITED STATES PATENT OFFICE.

WILLIAM CHARLES STEPHENS, OF CORNWALL, ENGLAND.

PERCUSSIVE ROCK-DRILL.

No. 930,430. Specification of Letters Patent. Patented Aug. 10, 1909.

Application filed August 1, 1908. Serial No. 446,449.

To all whom it may concern:

Be it known that I, WILLIAM CHARLES STEPHENS, a subject of the King of Great Britain, residing at Carn Brea, Cornwall, England, have invented new and useful Improvements in or Connected with Percussive Rock-Drills, of which the following is a specification.

My invention relates to percussive rock drills of the hammer type and to that class of such drill wherein the feed motion is automatically effected by air pressure, the chief object of my invention being to construct a drill of this class which is considerably shorter than drills of the same class as heretofore constructed and wherein the feed cylinder has been arranged behind and in alinement with the hammer cylinder, the advantages of a short drill being not only that the drill may be worked in more cramped and narrow places or galleries than the longer class of drill but that a relatively long hole can be bored by means of a single drill bit and without the necessity for moving the support or fixing for the drill.

According to my invention the feed cylinder instead of being arranged behind and in alinement with the hammer cylinder is arranged parallel or side by side with the same and preferably beneath it, the said feed cylinder being adapted to slide upon a suitable cradle to which is also anchored or secured the rod of the piston within the feed cylinder.

To enable my invention to be fully understood I will describe it by reference to the accompanying drawing, in which:—

Figure 1 is a longitudinal sectional elevation of a percussive rock-drill constructed according to this invention and adapted to carry a hollow drill for the supply of water to the bore-hole. Fig. 2 is a sectional plan, and Fig. 3 a sectional side elevation thereof. Figs. 4 and 5 are respectively a front-end view and a rear end sectional view of the drill. Fig. 6 is a section on the line 6—6 Fig. 2, and Fig. 7 is a section on the line 7—7, Fig. 4. Fig. 8 is a section on the line 8—8, Fig. 2 and Figs. 9 and 10 are respectively sections on the lines 9—9 and 10—10 Fig. 8. Fig. 11 is a similar view to Fig. 10 showing a different position of the parts. Fig. 12 is a section on the line 12—12, Fig. 1 and Fig. 13 is an enlarged section on the line 13—13, Fig. 2. Fig. 14 is a plan of the cradle detached. Figs. 15 and 16 are views at right angles of a tool for removing the drill bit from its holder.

a is the main or hammer cylinder, *b* the piston thereof, and *c* the valve for controlling the supply of motive fluid to the said piston from the passage *c'* all of which parts are of usual construction.

d is the feed cylinder arranged parallel with the cylinder *a* and preferably beneath it and *e* is the cradle upon which the cylinder *d* is adapted to slide in guides *e'*, *e'*.

f is the piston of the feed cylinder the rod *f'* of which is anchored or secured to a bracket f^2 on the back of the cradle. This piston may be of any suitable type but is advantageously of the type wherein the pressure fluid acts behind the piston rings to hold them in close contact with the surface of the cylinder to prevent leakage, as shown clearly in Fig. 1. The motive fluid is admitted in front of the piston *f* through a port f^3 from a distributing tap or cock hereinafter described, so that the pressure acting against the said piston and the front of the feed cylinder serves to push the said cylinder together with the hammer cylinder forward.

The cradle *e* is not permanently fixed to the support *g* for carrying the drill but is made movable thereon so that when the hammer and feed cylinders have been moved forward to an extent which is limited by the length of the cradle, the said cradle, which is normally locked to its support may be temporarily released therefrom to allow of its being pushed forward upon the said support to permit of the cylinders again being fed forward in the cradle to increase the depth of the hole being drilled. It will thus be understood that a hole may be drilled the length of which is practically twice as great as the amount of movement provided for in the cradle, and this without changing the drill bit, as during the time that the cradle is being pushed forward, as hereinbefore described, the drill bit will be bearing against the back of the hole and so prevent the cylinders from being pushed forward with the cradle.

Any suitable means may be provided for locking the cradle *e* to its support *g*. In practice I find it advantageous to provide in conjunction with the cradle guides *e'*, *e'* a bolt *h* having a serrated or notched head *h'* which engages with corresponding serrations h^2, h^2 formed on the side of the cradle

as shown clearly in Fig. 14, the said bolt, when tightened up, locking the cradle *e* and support *g* together. The bolt *h* has arranged in conjunction with it a spring *i*, the normal tendency of which is to disengage the serrated head *h'* from the cradle serrations h^2 when the tightening nut *i'* is released, in order to obviate the necessity for moving the bolt by hand, and the tightening bolt *h* and nut *i'* are provided with a quick thread so that a slight turn of the said nut will be sufficient to allow of the disengagement.

The cradle support *g* is advantageously formed with a conical base *g'* which fits into a correspondingly shaped socket *j* on the bracket *j'* by means of which the drill is carried on the usual supporting bar or stand *k*, this arrangement of cone and socket allowing of the ready adjustment of the drill.

The bolster *l* against which the hammer piston *b* operates and which carries the drill bit *m* is rotated to twist the bit by means of gearing, a series of teeth *n* around the bolster being engaged by a gear wheel *n'* mounted on a telescopic shaft *o*, the telescopic sections *o'*, o^2 thereof being secured respectively to the said gear wheel *n'* and to the bracket f^2 upon the cradle *c* so that the shaft *o* will extend as the feed proceeds. The two sections of the telescopic shaft are connected together in such a manner that while capable of moving longitudinally there is no relative motion of rotation between them. In the drawings this is effected by a key o^3 on the part *o'* engaging a key-way o^4 in the part o^2. The portion o^2 of the shaft *o* carried by the cradle *e* is provided with a handle or lever *p* for imparting rotary motion as the drilling proceeds.

For supplying water to the hollow drill *m* I advantageously provide the following arrangement, that is to say, around the bolster *l* within the head *a'* I form a recess *q* into which the water is delivered through a passage *r* from the distributing tap or cock hereinafter described. In the said groove or channel *q* I arrange a ring *s* grooved on its inner and outer surfaces, the said grooves being connected by holes *s'* so that water passing from the passage *r* flows around the outer groove and through the holes *s'* to the inner groove, holes *t* being provided in the bolster so that the water can then flow into the central hole *t'* communicating with the bit *m*. The ring *s* is located between two pieces of packing *u*, *u* a packing gland *u'* also entering the recess *q* to maintain the said packings tight around the bolster. *v* is a groove formed in the head *a'* and open to the air by holes *v'*, *v'* so that any leakage of water past the packings *u*, *u* can escape. The chamber a^2 in the head *a'* in which the teeth *n* on the bolster are located is also provided with a piece of packing *w* and metal washer *w'* to prevent access of any water.

For controlling the supply of pressure fluid to the main piston and feed piston and of water to the drill bit *m* I employ a single tap or cock *x* having inlets *x'* and x^2 for the supply of the pressure fluid and water respectively. The plug x^3 of the cock is formed with recesses x^4 and x^5, the recess x^4 being designed to connect the inlet *x'* with the port x^6 which is formed in one with the ports *c'* and f^3 for supplying the main and feed cylinders while the recess x^5 is designed to bring the inlet x^2 into communication with the passage *r* to the drill bit *m*. The recess x^5 is so arranged relatively with the recess x^4 that when the plug x^3 is turned slightly, when starting the drill, the water supply is first effected, the water passing to the cutting edges of the bit before the drill commences to work, and thus insuring the free flow of water taking place before striking the rock to be drilled so that cut portions of rock are prevented from choking the hole in the bit. By further rotation of the plug x^3 the pressure fluid is then admitted to the cylinders *a* and *d* and the drill then commences to operate the water being full on. If it is found that the water supply is excessive I provide a screw valve or regulator x^7 in the inlet x^2 so that the supply can be diminished. To prevent water leaking around the drill shank within the drill holder portion of the bolster, I provide a conical hole *m'* in the said holder, and I form the said bit with a correspondingly shaped shank m^2, which when jammed back into the hole *m'*, makes a water tight joint. For the extraction of this form of drill bit from the holder, I employ a collar m^3 on the drill bit, and I employ a forked wedge m^4 Figs. 15 and 16, which is placed between the said collar, and the nose of the drill holder the fork embracing the drill shank. By a simple tap with a hammer the wedge forces the collar away from the drill holder, and so extracts the drill bit.

Although I have described the tap *x* in combination with my improved drill, the arrangement for preventing leakage between the bit and its holder and the means for extracting the bit from the holder I make no claim to these in this specification as they form the subject of another application of even date herewith Serial No. 446,450.

I sometimes apply to the rear end of the hammer cylinder a clip *z* which embraces either the rod of the feed piston, or the portion o^2 of the telescopic shaft *o*, in the drawings it is shown embracing the latter, the chief function of this clip being to support the weight of the cylinder *a* to prevent its sliding through the cradle *c* when changing bits while boring holes at angles below or above the horizontal, and thus obviating the necessity for the operator to hold up the weight of the machine when changing the

drill bit, or pointing the drill to the various angles; z' is a screw for gripping the jaws of the clip on the rod o^2. The said clip also acts as a brake when boring down holes in soft rock, to prevent too rapid feeding under these conditions.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In a rock drill, the combination with the hammer and feed cylinders arranged side by side, a cradle having a sliding engagement with the feed cylinder and provided with lateral serrated portions, and a piston in the feed cylinder operatively connected with the cradle, of a support for the cradle provided with clamping devices having serrated portions for engaging the serrated portions of the cradle, substantially as described.

2. In a rock drill, the combination with the hammer and feed cylinders arranged side by side, a cradle having a sliding engagement with the feed cylinder, and provided with lateral clamp engaging portions, and a piston in said feed cylinder, operatively connected with the cradle, of a supporting bar, a bracket provided with a clamp for engaging the supporting bar, and a vertically disposed downwardly tapered socket, a cradle support, located beneath the cradle, and provided with a tapered base pivotally engaging said socket, means for securing said cradle support and bracket together, and a clamping bolt disposed transversely of the cradle, and secured to said cradle support, said bolt being provided with clamping means for adjustably engaging the lateral portions of the cradle, substantially as described.

3. In a rock drill, the combination with the hammer and feed cylinders arranged side by side, a cradle having a sliding engagement with the feed cylinders, and provided with lateral clamp engaging portions, and a piston in said feed cylinder operatively connected with the cradle, of a supporting bar, a bracket provided with a clamp for engaging the supporting bar, and a vertically disposed downwardly tapered socket, a cradle support, located beneath the cradle and provided with a tapered base pivotally engaging said socket, means for securing said cradle support and bracket together, a clamping bolt extending through said cradle support, transversely of the cradle, and having serrated clamping means for engaging serrated portions of the cradle, and a spring connected with said bolt and normally tending to disengage the serrated portions of said bolt and cradle, substantially as described.

4. In a rock drill, the combination with the drill cylinder and feed cylinder arranged side by side, the drill cylinder being provided with a rotatable drill support, a cradle supporting said cylinders and having a sliding engagement therewith and a piston in said feed cylinder operatively connected with said cradle, a rotatable sleeve carried by the drill cylinder, and operatively connected with the drill support for rotating the same, a rotatable shaft secured to said cradle connected to said sleeve for rotation therewith and having a longitudinal sliding engagement with said sleeve, and operative mechanism for rotating said shaft, substantially as described.

5. In a rock drill, the combination with the drill cylinder and feed cylinder arranged side by side, the drill cylinder being provided with a rotatable drill support, a cradle supporting said cylinders and having a sliding engagement therewith and a piston in said feed cylinder operatively connected with said cradle, a rotatable sleeve carried by the drill cylinder, and operatively connected with the drill support for rotating the same, a rotatable shaft secured to said cradle connected to said sleeve for rotation therewith and having a longitudinal sliding engagement with said sleeve, means for rotating said shaft and an adjustable friction clamp secured to the cylinders, and frictionally engaging the said shaft, substantially as described.

WILLIAM CHARLES STEPHENS.

Witnesses:
HOWARD FOX,
W. H. DANIELL.