(No Model.) 2 Sheets—Sheet 1.

J. FRÖLICH.

ROCK DRILL.

No. 435,139. Patented Aug. 26, 1890.

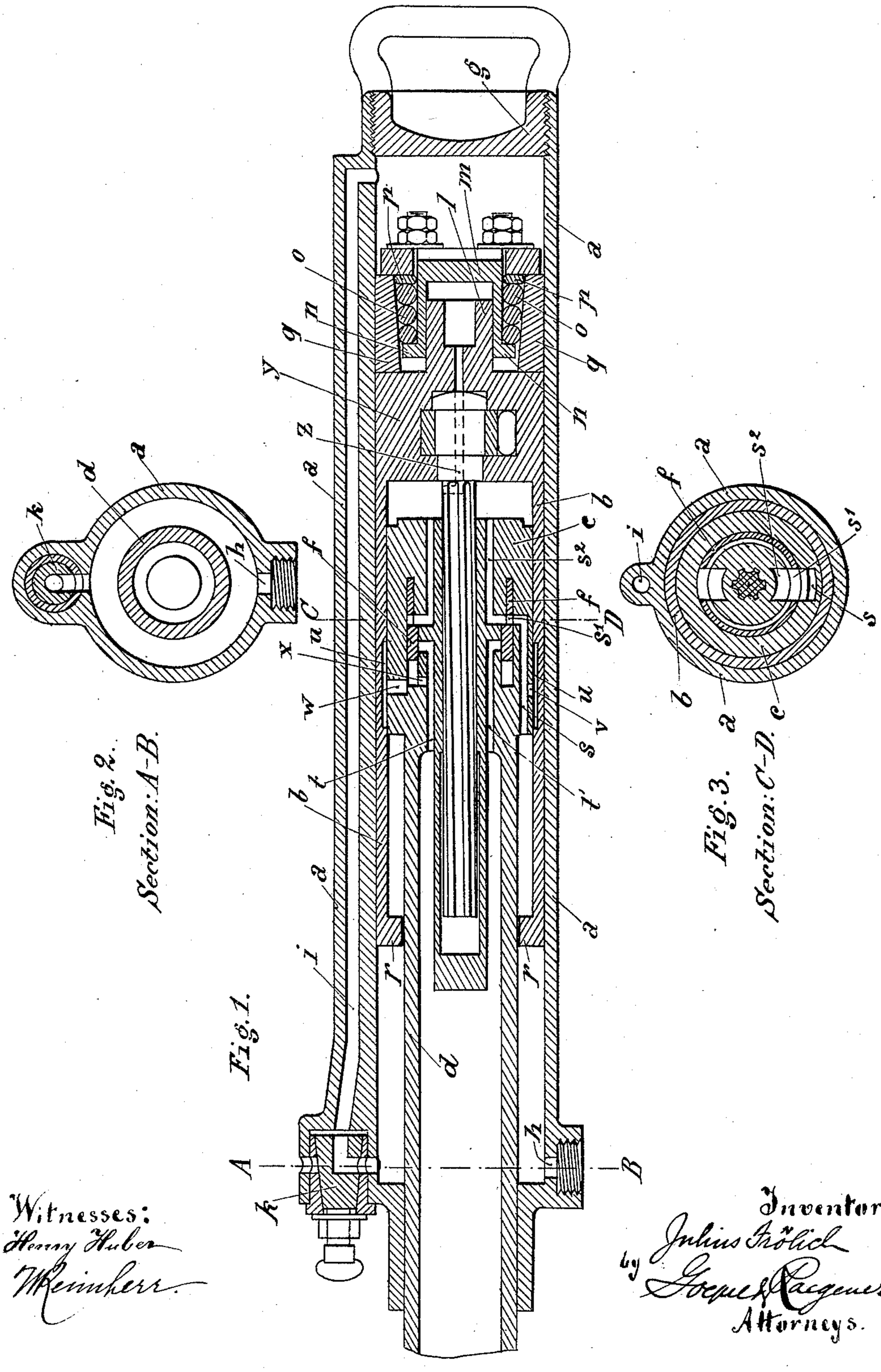

Fig. 2. Section: A-B.

Fig. 1.

Fig. 3. Section: C-D.

Witnesses:
Henry Huber
W. Reinhers.

Inventor
Julius Frölich
by Goepel & Lagemer
Attorneys.

(No Model.)

2 Sheets—Sheet 2.

J. FRÖLICH.

ROCK DRILL.

No. 435,139. Patented Aug. 26, 1890.

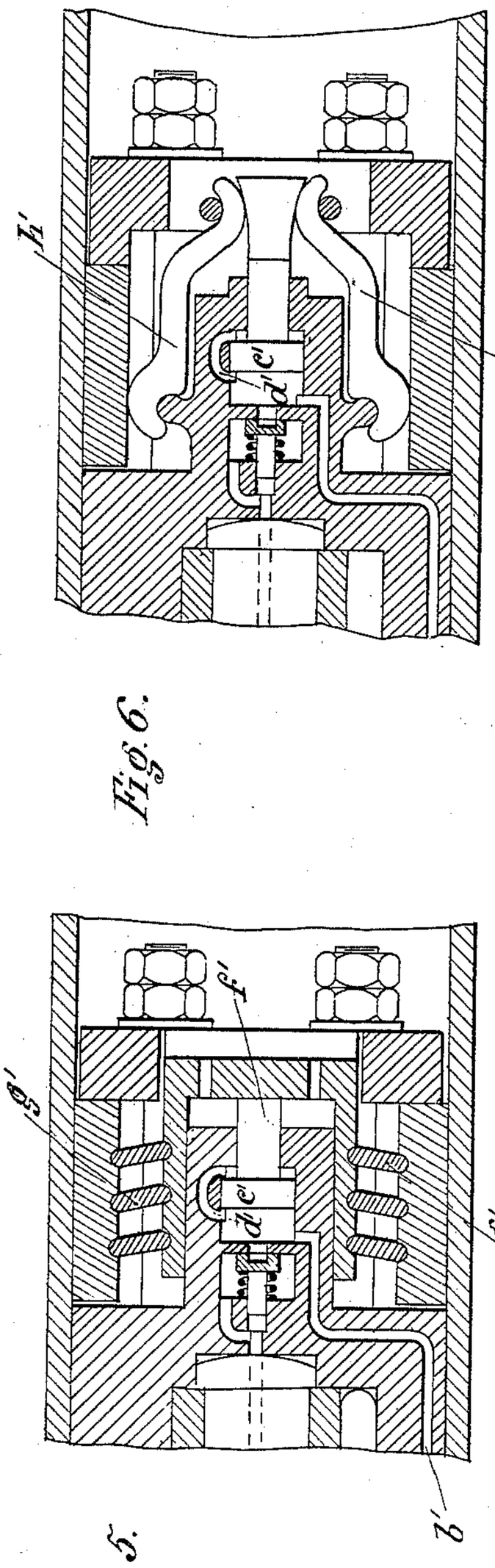

Fig. 6.

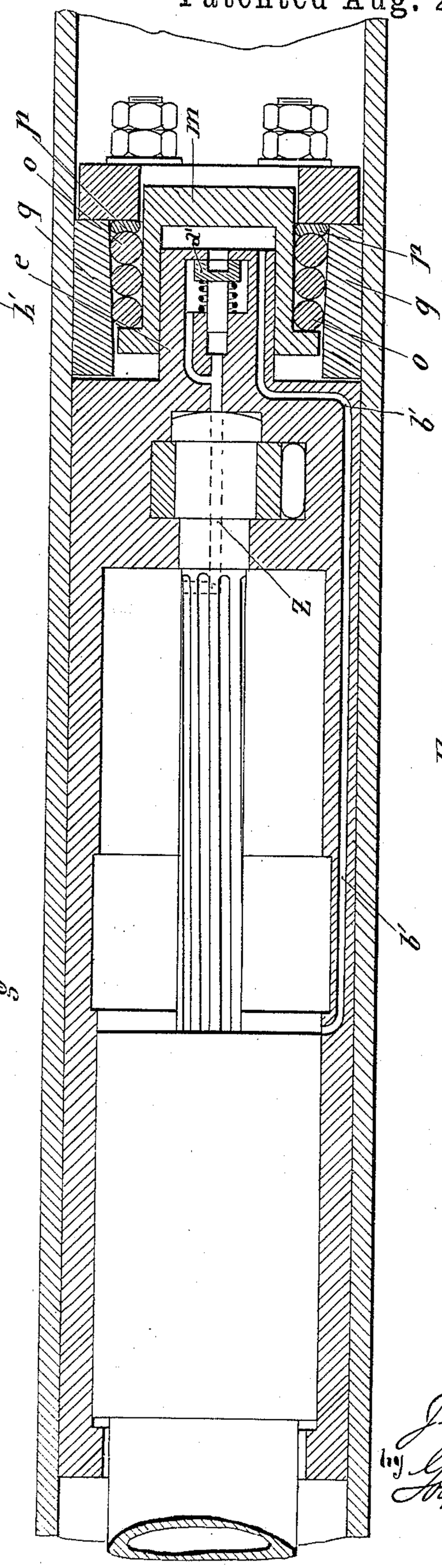

Fig. 4.

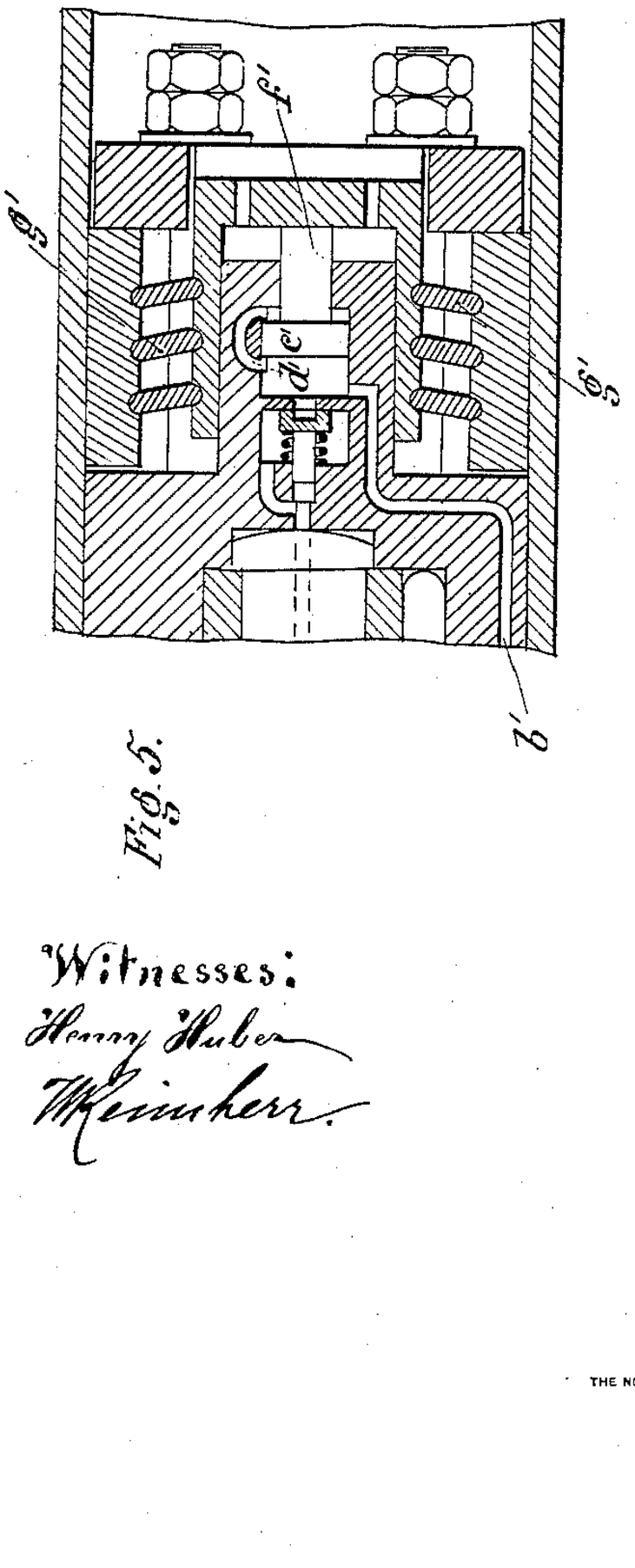

Fig. 5.

Witnesses:
Henry Huber
W. Heinsheimer.

Inventor
Julius Frölich
by Goepel & Raegener
Attorneys.

UNITED STATES PATENT OFFICE.

JULIUS FRÖLICH, OF BARMEN, GERMANY.

ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 435,139, dated August 26, 1890.

Application filed June 8, 1889. Serial No. 313,583. (No model.)

To all whom it may concern:

Be it known that I, JULIUS FRÖLICH, a subject of the King of Prussia, residing at Barmen, in the Kingdom of Prussia, German Empire, have invented new and useful Improvements in Rock-Drills, of which the following is a specification.

My invention relates to improvements in rock-drills actuated by compressed air or by steam, and particularly in the reversing and propelling mechanisms of such machines, the former consisting of a hollow-cylinder valve moving within certain limits in an annular space of the striking-piston, while the latter consists of a cylinder provided with a lateral passage and a regulating-cock, in which cylinder is arranged a braking apparatus composed of a piston firmly connected with the cylinder of the rock-drill, a brake-cylinder, rollers, brake-blocks, and of india-rubber or steel springs.

The improved rock-drill is illustrated in the accompanying drawings. Figure 1 is a longitudinal section of the rock-drill. Fig. 2 is a cross-section on line A B of Fig. 1. Fig. 3 is a cross-section on line C D of Fig. 1. Figs. 4, 5, and 6 show modified constructions of the propelling mechanism.

The rock-drill consists of a long hollow cylinder *a*, in which fits in an air-tight manner and slides the true cylinder *b* of the drilling-engine. In the latter is working the striking-piston *c*, terminated by a hollow piston-rod *d*, with the distributing-cylinder *f* arranged in an annular space of piston *c*. The outer cylinder-valve is closed at its rear end by a plug *g*, while the piston-rod *d* of the rock-drill extends through the fore end of cylinder *a*. The fore part of cylinder *a* communicates through the port *h* with the compressed-air conduit, while the fore and rear hollow spaces of the cylinder communicate with each other through a passage *i*. The passage *i* has a cock *k*, by means of which, on one hand, compressed air is led into the rear spaces of the cylinder *a*, and, on the other hand, by turning the said cock the rear space can be put in communication with the atmosphere, whereby the cylinder *b* can at will be moved forward or backward, which motions are regulated by an automatically-acting braking apparatus. The latter consists of a piston *l*, firmly connected with the cylinder *b* of the rock-drill and arranged in a cylinder *m*, movable thereon. The cylinder *m* is furnished at its front-end with a flange, serving as an abutment for the rollers *o*, arranged around the cylinder and pressed forward by an india-rubber or spring buffer *p*. Round the rollers *o* are arranged brake-blocks *q*, which are pressed by the rollers against the inner surface of cylinder *a*.

The operation of the machine is as follows: The compressed air entering the cylinder *a* through the port *h* passes through the front hollow space between the annular projection *r* of the cylinder *b* and the piston-rod to the inlet-passage *s* and thence through the passage *s'* in the distributing-cylinder valve *f* and the passage s^2 to the back of the piston *c*, driving the latter forward until the boring-tool, which is firmly connected with the piston-rod, strikes against the rock and stops the piston. The energy stored up in the distributing-cylinder valve causes the latter to move forward in such a manner that it closes the inlet-passage *s* and opens the outlet-passages *t t'*, whereby the piston is moved backward. The compressed air behind the striking-piston escapes through the passage s^2, the annular hollow space formed in the distributing-cylinder valve *f*, the outlet-passages *t t'* into the hollow piston-rod, and thence into the open air. As soon as the piston at its return-stroke has arrived at the recess *u*, formed in the cylinder *b*, compressed air enters through port *v*, recess *u*, and passage *w* in front of the distributing-cylinder valve, pushing the latter back into its initial position, whereupon the piston moves again forward. A small aperture *x* serves for permitting the escape at the forward stroke of the piston of the compressed air contained in the annular space in front of the distributing-cylinder valve into the outlet-passages *t t'*. In the beginning of the work the cock *k* is first turned in such a manner that the rear hollow space of the cylinder *a* communicates with the outer air. The cylinder *b* and in consequence the piston *c* are pressed back by the additional pressure in the fore hollow space of the cylinder *a* against the plug *g*, whereupon the fore and rear parts of the cylinder *a* are put in

communication again with each other by turning the cock *k*. The cylinder *b*, with the piston *c*, would now at once be pushed forward up to the fore stuffing-box, owing to the additional pressure in the rear hollow space, unless it be held in its position by the braking apparatus which is connected with the rear cover *y* of the cylinder of the rock-drill. This is effected in the following way: At the return-stroke of the piston the space of the cylinder *m* communicates through passage *z* with the rear space of cylinder *b*, and consequently with the open air. Owing to the high air-pressure in the cylinder *a*, the cylinder *m* moves toward piston *l*, the buffers *p* press the rollers *o* forward, and force the brake-blocks, owing to the inclined surfaces of the latter, against the walls of cylinder *a*, holding thus the cylinder *b* in its position. At the forward stroke of the piston *c* compressed air enters through passage *z* into the cylinder *m*, removing the latter from piston *l*, while the brake is held in sufficient tension by the spring-buffers *p* for preventing the machine from moving forward. When the piston makes the longest desired stroke, the piston *c* strikes then against the ring *r* of cylinder *b*, and the latter is taken along by the piston—*i. e.*, the forward stroke takes place—and this until the machine is reversed and the brake at the return-stroke of piston *c* is applied again in the above-described manner.

In some cases the spring-power will not be sufficient to hold, at the forward stroke of the piston, the brake in sufficient tension for preventing cylinder *b* from moving in cylinder *a*. In such cases I make use of the modified construction illustrated in Fig. 4.

A valve *a'* is arranged here in the piston *l*, preventing compressed air from entering cylinder *m* through passage *z*. The brake remains then applied until the piston *c* makes its longest stroke and the compressed air at the back of the piston can pass through passage *b'* into the space of cylinder *m*. The brake may be applied or taken off also by means of a differential piston *c'*, (see Fig. 5,) the larger area of which enters at the longest stroke through the passage *b'* in communication with the compressed air, lifts the piston *c'*, and thus takes off the brake until compressed air passes through passage *d'*, and also into the smaller space of the cylinder. After the machine has been reversed the two cylinder-halves enter in communication with the exterior atmosphere and the brake is put on, owing to the additional pressure on the smaller area *f'* of the piston.

Instead of the rollers *o* flat wedge-pieces *g'*, (see Fig. 5,) or dissimilar levers, such as *h'* in Fig. 6, may be applied, which operate the brake-blocks in the same manner.

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

1. A rock-drill actuated by means of compressed air or steam, consisting of a hollow-cylinder valve *f*, moving in an annular space, of the striking-piston *c*, and of the necessary inlet and outlet passages *s* s^2 and *t t'*, in combination with a propelling mechanism consisting of a hollow cylinder *a*, having a lateral longitudinal passage *i* and a regulating-cock *k*, and of a self-acting braking apparatus, substantially as described, and shown in the drawings.

2. In rock-drills actuated by means of compressed air or steam, the combination of a hollow-cylinder valve *f*, furnished with a passage *s'* and movable within certain limits in the annular space of the striking piston *c*, in combination with the inlet and outlet passages *s* s^2 and *t t'*, and with the recess *u*, arranged in the cylinder *b* and serving to reverse the engine, the said recess having a port *v* and a passage *w*, substantially as set forth, and shown in the drawings.

3. In rock-drills actuated by means of compressed air or steam, the combination of a hollow cylinder *a*, provided with a lateral passage *i* and a regulating-cock *k*, in which cylinder the boring-machine itself is contained, in combination with a self-acting braking apparatus firmly connected with the cylinder *b* and consisting of the piston *l*, the cylinder *m*, communicating through passage *z* with the rear space of the boring-cylinder *b*, the rollers *o*, the brake-blocks *q*, and the shoulder *r* or passage *b'*, substantially as set forth, and shown in the drawings.

4. In a propelling mechanism for rock-drills, a self-acting braking apparatus consisting of the piston *l*, with valve *a'*, cylinder *m*, with passage *z*, rollers *o*, and brake-blocks *q*, substantially as set forth, and shown in the drawings.

5. In a propelling mechanism for rock-drills, a self-acting braking apparatus consisting of the differential piston *c'*, with valve *a'* and passage *d'*, cylinder *m*, with passage *z*, wedge-pieces *g'* or dissimilar levers *h'*, substantially as set forth, and shown in the drawings.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JULIUS FRÖLICH.

Witnesses:

ZURMANN KOEPPEN,

CARL WIECHMANN.