(No Model.) 2 Sheets—Sheet 1.

A. J. SYPHER.

ROCK DRILL.

No. 485,722. Patented Nov. 8, 1892.

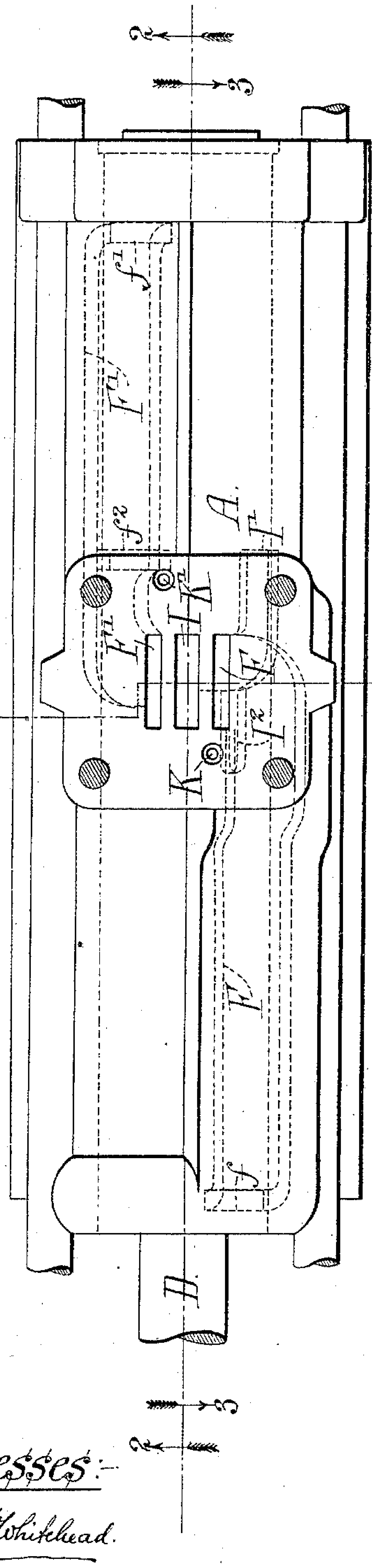

Fig. 1.

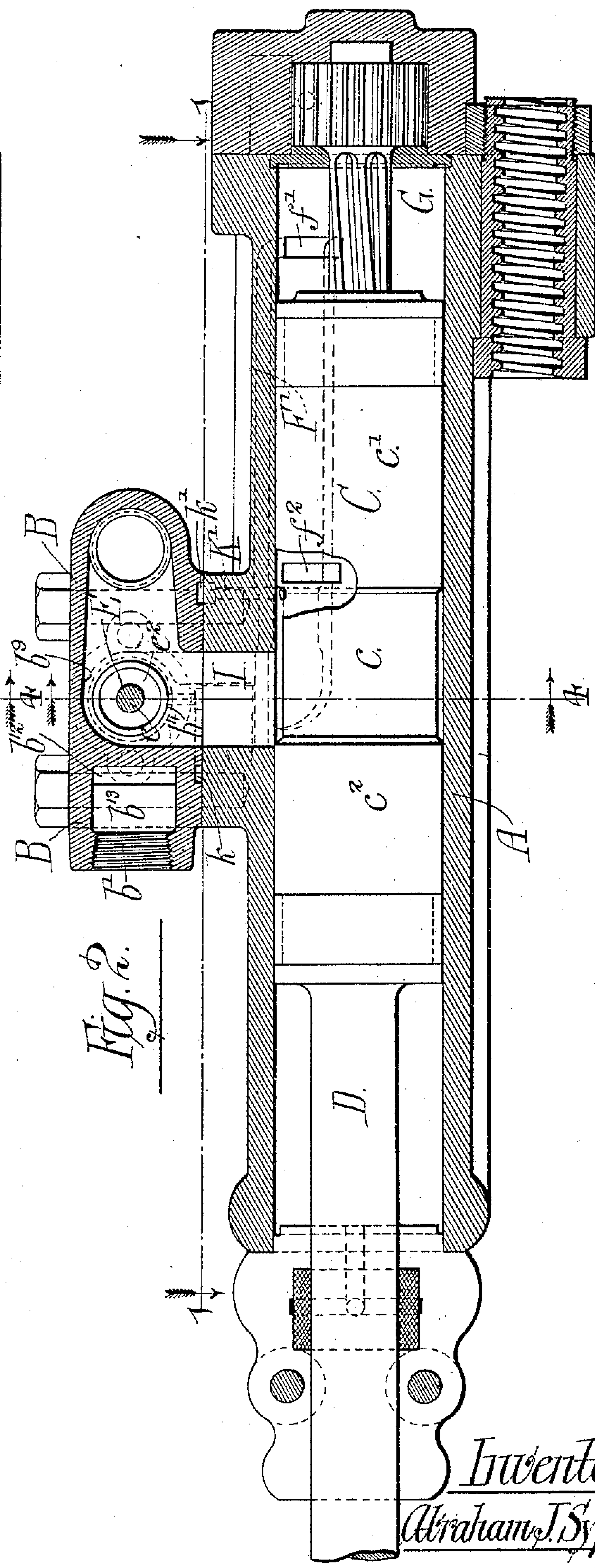

Fig. 2.

Witnesses:-

Louis M. F. Whitehead.

C. E. Tomlinson.

Inventor:-

Abraham J. Sypher.

by:- Dayton Poole & Brown

his Attorneys.

(No Model.)

2 Sheets—Sheet 2.

A. J. SYPHER.

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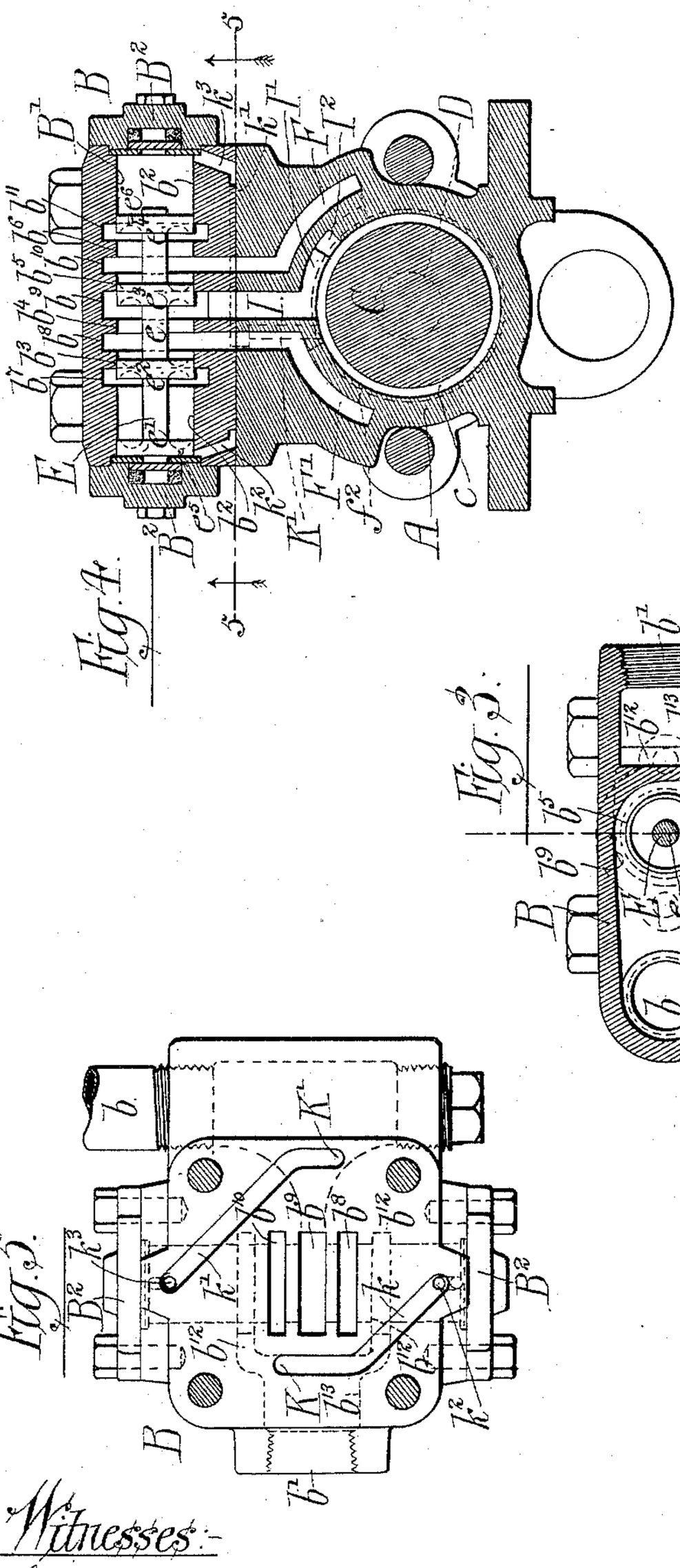

Fig. 1.

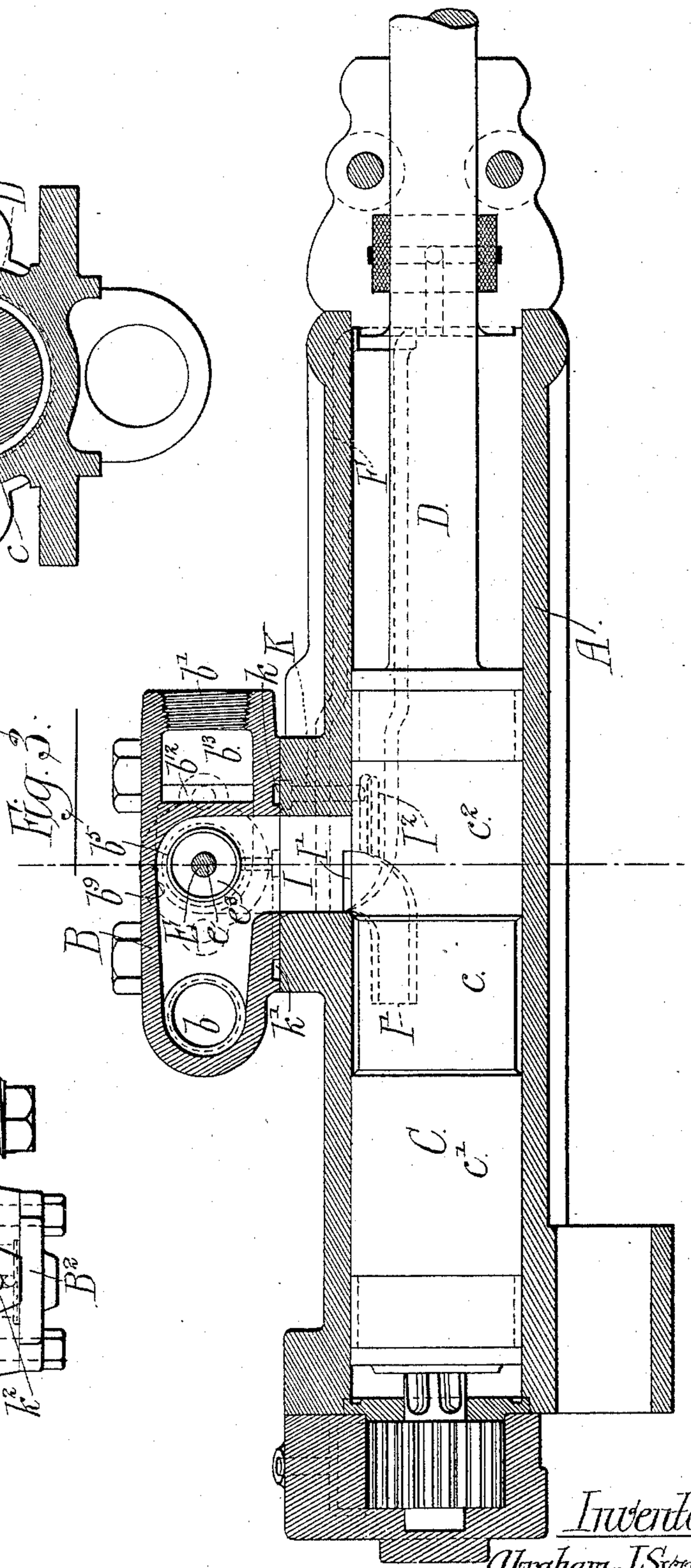

Fig. 2.

Fig. 3.

Witnesses:-

Louis M. T. Whitehead.

W. E. Tomlinson

Inventor:

Abraham J. Sypher.

by:- Dayton, Poole & Brown

his Attorneys.-

UNITED STATES PATENT OFFICE.

ABRAHAM J. SYPHER, OF CHICAGO, ILLINOIS.

ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 485,722, dated November 8, 1892.

Application filed February 9, 1892. Serial No. 420,877. (No model.)

To all whom it may concern:

Be it known that I, ABRAHAM J. SYPHER, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Rock-Drills; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in rock-drills of that kind shown and described in a prior patent, No. 403,496, granted to me May 14, 1889, in which is shown a cushioning device for the piston, consisting of a steam-passage which is controlled solely by the piston, and which therefore does not depend for its action on the motion of the valve mechanism of the drill.

This invention embraces improvements on the cushioning device set forth in said prior patent; and it consists in the matters hereinafter described, and pointed out in the appended claim.

In the accompanying drawings, Figure 1 is a plan view of a drill-cylinder embodying my improvements, the valve-casing being removed to expose the steam-ports. Fig. 2 is a central longitudinal section of the cylinder and valve-casing as seen when looking in the direction of the arrows 2 2, applied to the section-line of Fig. 1. Fig. 3 is a similar section on the same line of Fig. 1, looking in the opposite direction, or as indicated by the arrows 3 3 of said Fig. 1. Fig. 4 is a transverse section through the cylinder and valve-casing, taken on lines 4 4 of Figs. 1, 2, and 3. Fig. 5 is a sectional view on line 5 5 of Fig. 4.

As shown in the said drawings, A indicates the steam-cylinder of the drill; B, a valve-chamber located at one side of the cylinder; C, a piston within the cylinder; D, a piston-rod which passes through one end of the cylinder and to which the drilling-tool is attached, and E a valve-piston located within the valve-casing B.

F F′ are steam-passages leading from the valve-casing to the opposite ends of the cylinder for the purpose of admitting steam to and exhausting it from the same. The outlet or port f of the passage F is located adjacent to the outer head of the cylinder, while the port f' of the passage F′ is located at a point somewhat distant from the inner head or end of the cylinder.

G is a steam-cushioning space or chamber at the inner or rear end of the cylinder, the length or depth of which is determined by the outlet or port f' of the passage F′, which passage affords the sole means of supplying steam to said cushioning-chamber for cushioning the piston. An inlet port or opening f^2, located near the center of the cylinder, admits steam for cushioning the piston to said passage F′.

I is a live-steam port leading from the valve-chest into the central part of the cylinder.

The piston C is provided at its central part with an annular groove or recess c, forming annular bearing-surfaces c' c^2 at the opposite ends of the piston, adapted to fit the bore of the cylinder. The piston thus constructed operates in connection with ports and passages formed in the cylinder and valve-casing to afford steam-pressure alternately at opposite ends of the valve-piston E in a manner to actuate said valve-piston, and thereby control the admission of steam to and its exit from the opposite ends of the cylinder for actuating the main piston, and also operates in connection with the steam passage or port f^2 to admit steam through the passage F′ to the cushioning-space G of the cylinder for cushioning the piston, as hereinafter fully set forth.

The valve-chest B is provided with a steam inlet b and outlet b', and within said valve-chest is formed a cylindric valve-seat B′, within which is located the valve-piston E, which consists of a stem e and four disks e' e^2 e^3 e^4. The said valve-seat B′ is closed at its ends by heads B^2 B^2 and has cylindric end bearing-surfaces b^2 b^2 and intermediate narrow bearing-surfaces b^3 b^4 b^5 b^6, within which the several valve-disks are adapted to closely fit. Between the several annular bearing-surfaces are formed annular recesses b^7 b^8 b^8 b^9 b^{10} b^{11}, of which the middle recess b^9 is in communication with the steam-inlet port b and also with the port or passage I, which leads to the inner surface of the cylinder. The recesses b^8 b^{10} at either side of the central recess are in communication with the steam-passages F F′ of the cylinder, Fig. 4, and the external recesses b^7 b^{11} are in communication with the

exhaust-outlet b by means of passages b^{12}, extending at one side of the valve-seat, as seen in Fig. 5, and opening into the said exhaust-passage, Figs. 2 and 5.

K K′ are steam-passages leading from the interior of the cylinder outwardly through the wall of the same to the inner surface of the steam-chest, where they are connected with passages k k', formed between the adjacent surfaces of the steam-chest and cylinder-casting and which lead to points adjacent to the ends of the valve-seat B′ and communicate by means of ports k^2 k^3 with the spaces in said valve-seats formed by the cylindric bearing-surfaces b^2 b^2 outside of the end disks of the valve-piston. The passage K is located near the outer end of the cylinder and communicates by the passage k with the space behind the valve-disk, Fig. 4, while the passage K′ is located adjacent to the inner end of the cylinder and communicates with the space behind the disk e^4. Steam entering the valve-chest through the said ports k^2 k^3 acts upon the ends of the valve-piston to move the latter endwise in its seat, in the manner set forth.

At the inner end of the passage I is formed a recess I′, which extends along the inner surface of the cylinder toward the inner end thereof, said recess I′ being deflected laterally, as shown, so as to pass at one side of the passage K. A similar recess I^2, Figs. 3 and 4, extends from said passage I along the inner surface of the cylinder in the opposite direction, or toward the outer end of the cylinder, said recess being shown as forming a branch or extension of the recess I′.

The valve mechanism shown operates as follows: The valve-piston E being at the limit of its throw to the left, as seen in Fig. 4, live steam entering the passage b will pass from the recess b^9, through the recess b^8 and steam-passage F′, to the inner end of the cylinder. At this time steam is free to pass from the inlet b, through the port I, recess I′, and recess c, to the passage K′, which is nearest the inner end of the cylinder, and thence to the space at the end of the valve-chest behind the valve-disk e^4, which is at the right-hand side of Fig. 4, and holds the valve-piston in position for the delivery of steam to the inner end of the cylinder. While live steam is thus being delivered through the passage F to the inner end of the cylinder steam is exhausted from the opposite or outer end of the cylinder, through the passage F, the recesses b^{10} and b^{11}, and passages b^{13} and b^{12}, to the exhaust-outlet b'. As soon as the piston has moved outwardly such distance that the bearing-surface c' at its inner end covers the passage K′ access of live steam to the end of the valve-chest behind the disk e^4 is cut off and the steam contained in that end of the valve-chest leaks through a small aperture e^6 in the disk e^4 to the exhaust-passage b^{11}. When the piston approaches the outward limit of its stroke, the bearing-surface c^2 at the outer end of the piston passes and leaves open the passage K and steam then passes from the port I through said recess c to the passage K and thence through the passages k and k^2 to the valve-chest behind the disk e', whereby the valve-piston E is shifted into position to admit steam through the passage F to the outer end of the cylinder. By reason of the longitudinal extension of the steam-passage I by means of the recesses I′ I^2 communication between the said passage I and the passages K K′ continues after the bearing-surfaces c' and c^2 have passed and covered the main port I.

The inlet opening or port f^2 of the steam-passage F′ is so located, as seen in Fig. 2, as to be uncovered by the bearing-surface c^2 before the piston reaches and covers the port or outlet f' of the passage F′ in its backward or inward movement. As soon as the recess c during such movement comes opposite the inlet f^2 live steam flowing into said recess c from the port I passes from said recess c through the passage F′ and outlet f' of said passage into the steam-cushioning space G. As the piston continues to move inward the outlet f' will be closed as soon as the piston reaches the same, and all of the steam contained in the cushioning-space G will be locked or imprisoned in said space and will be utilized to cushion the stroke of the piston. Expansion of the steam thus confined operates to start the return stroke of the piston, and as soon as the port f' is uncovered live steam will be admitted through the passage F′ from the recess c and will complete the outward stroke of the piston. The principal office of the recess I′ is to secure the admission of steam to the recess c after the port I is covered by the bearing-surface c' of the piston, so that live steam will fill the recess c and passage F and will promptly enter the cushioning-chamber as soon as the outlet f' is opened in the return of the piston.

It is obvious that the passage K′, which admits steam to the valve-chest for the purpose of shifting the valve into position to deliver steam through the passage F′ to the inner end of the cylinder, will be uncovered by the bearing-surface c^2 of the piston at the same time as or before the inlet-opening f^2 is uncovered by said surface, so that the shifting of the valve to admit steam to the inner end of the cylinder will occur at about the same time that steam is admitted through the said inlet f^2 and recess c to said passage F′. The construction described, however, makes the supply of steam to the cushioning steam-space dependent solely upon the movement of the piston and entirely independent of the valve movement. The advantage of this construction is that it insures the delivery of a suitable quantity of steam for the cushioning into the cushioning-chamber before the piston reaches the port f' without regard to the promptness with which movement of the main valve takes place. In all drills of a similar character, as heretofore made, wherein the action of

the valve mechanism is relied upon to give a supply of steam for cushioning purposes it is necessary to give a long lead to the valve in order that it may be with certainty actuated soon enough to admit steam to the cushioning-chamber, and with any lead it is practicable to give there will be more or less uncertainty as to the accomplishment of this end. In the construction herein shown no lead in the valve is required, inasmuch as the admission of cushioning-steam is controlled solely by the piston, and the shifting of the valve may take place at any time after the passage *k'* is uncovered and before the piston passes and uncovers the port *f'* in its return or outward movement. In my said prior patent, No. 403,496, an independent passage separate from the steam-passages is employed to admit steam to the cushioning-space at the end of the cylinder, and the outlet of said separate passage is arranged adjacent to the head of the cylinder with its inlet so located as to be covered by an annular bearing-surface at the end of the piston remote from the cushioning-chamber. The construction herein described has the same advantages possessed by that shown in said prior patent as far as the controlling of the admission of cushioning-steam to the cushioning-space by the piston itself is concerned, while at the same time it avoids the necessity for the employment of a separate steam-passage in the wall of the cylinder. The location of the outlet-opening *f'* at a distance from the end of the head of the cylinder, so that the escape of steam from the cushioning-chamber is cut off by the passage of the end of the piston over said passage, has the advantage of positively locking or imprisoning the steam within the chamber and avoiding the compression of steam within the supply-passage, as well as within the chamber, at the time the movement of the piston is being arrested by the cushioning action of the steam. It is clear that if the area of the steam-passage were equal to the area of the cushioning-space, then in such case the steam would be compressed during the inward movement of the piston only one-half as much as it would be if such passage were not in communication with the cylinder at the time of compression. It follows that a much better cushioning effect is produced by closing the supply-passage to the cushioning-chamber in the manner described, it being obvious that in this construction movement of the piston must necessarily be arrested when the steam behind it reaches a certain degree of compression, while if the supply-passage were in constant communication with the steam-cushioning chamber the piston, if carried inward with sufficient force, might compress the steam sufficiently to force it all into the passage, and the piston would then be free to strike the inner end of the cylinder. The construction herein described, therefore, has the advantage over that shown in my said prior patent not only in the avoidance of a separate steam-passage, but in the location of the port which supplies the cushioning steam-chamber in such position that it is closed by the piston and no escape of steam from the chamber is possible after the piston has reached and covered the said opening.

While I have referred to the use of steam as a means of actuating the drill, yet it is to be understood that the same results will be produced by the use of compressed air or other gaseous agency under pressure for operating the drill.

I claim as my invention—

The combination, with the cylinder and steam-supply pipe therefor, said cylinder being provided with steam supply and exhaust passages, with a live-steam port independent of said steam supply and exhaust passages and in constant communication with the steam-supply pipe and with a cushioning-chamber at one end, of a piston within the cylinder provided with an annular recess and a main valve actuated by the passage of steam through said recess and controlling said steam supply and exhaust passages, one of said steam supply and exhaust passages being provided with an inlet-opening located at the central part of the cylinder and in position to take steam from the annular recess of the piston when said recess is in communication with the live-steam port of the cylinder, and with an outlet opening or port located at a distance from the end of the cylinder equal to the length of the cushioning-chamber, whereby steam is supplied to the cushioning-chamber through said supply and exhaust passage independently of the action of the valve, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

ABRAHAM J. SYPHER.

Witnesses:

C. CLARENCE POOLE,

TAYLOR E. BROWN.