No. 682,555. Patented Sept. 10, 1901.

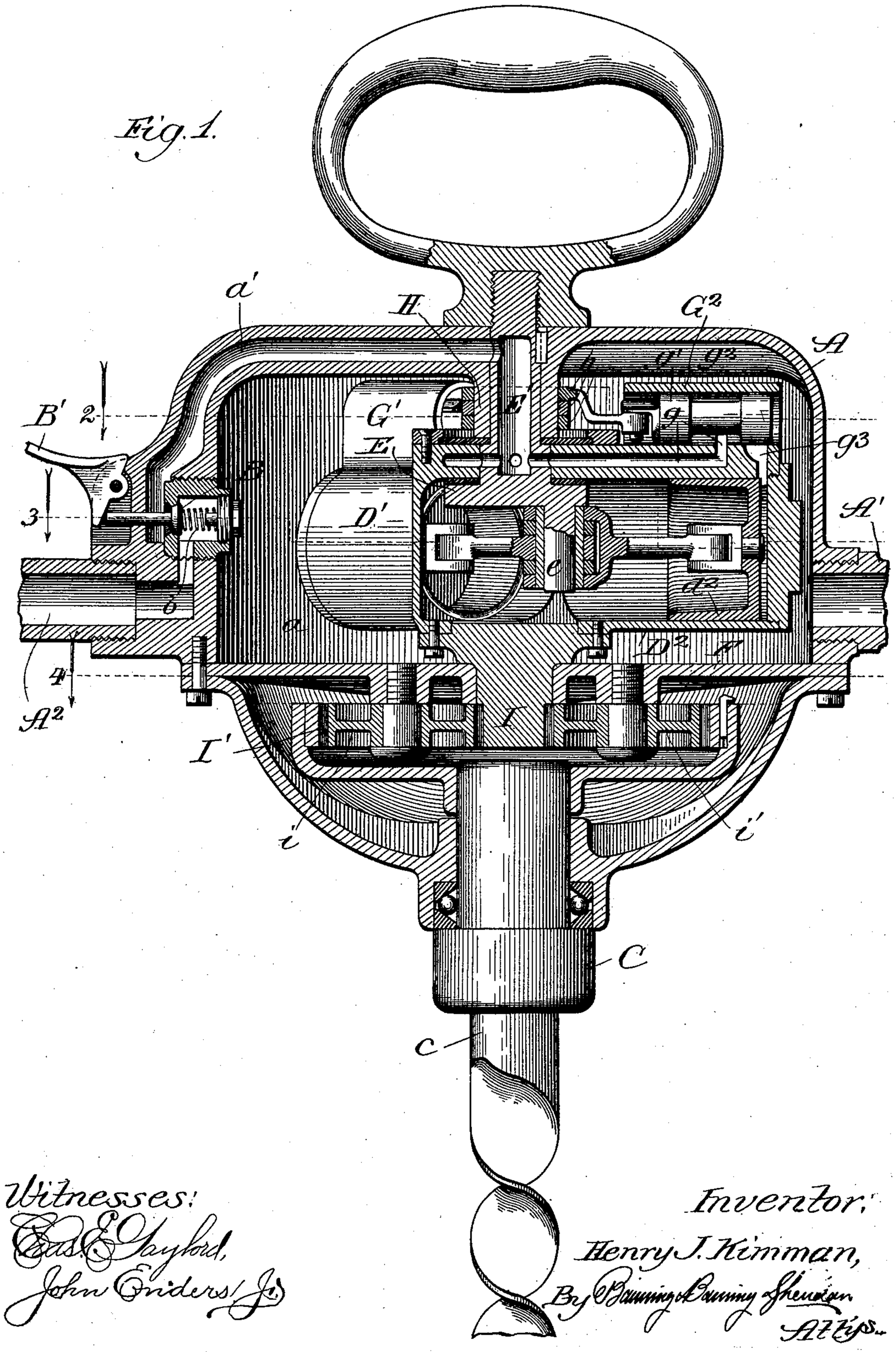
# H. J. KIMMAN.

## DRILL.

(Application filed Mar. 29, 1900.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.

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## DRILL.

(Application filed Mar. 29, 1900.)

(No Model.) 4 Sheets—Sheet 2.

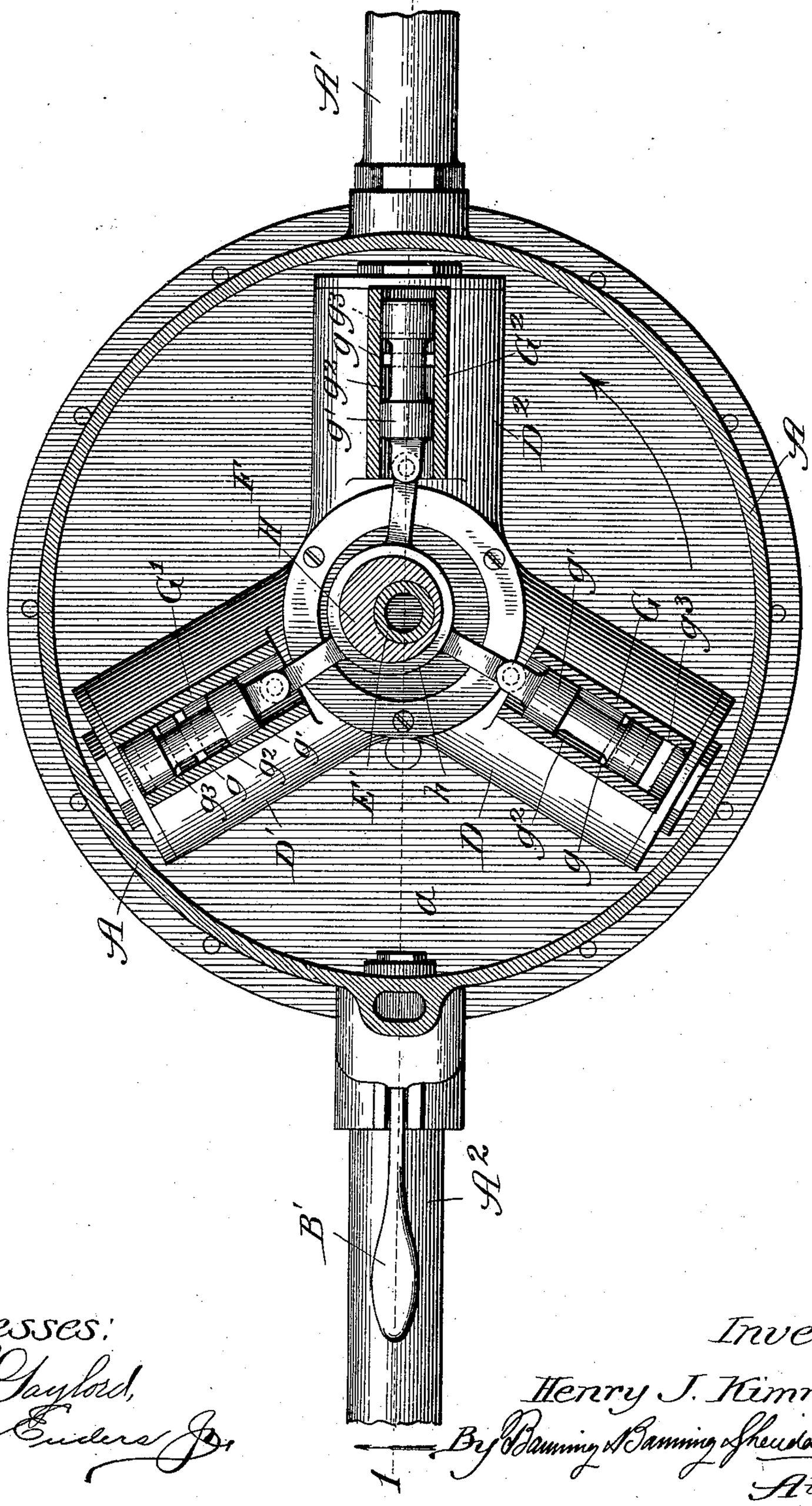


Fig. 2.

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## DRILL.

(Application filed Mar. 29, 1900.)

(No Model.) 4 Sheets—Sheet 3.

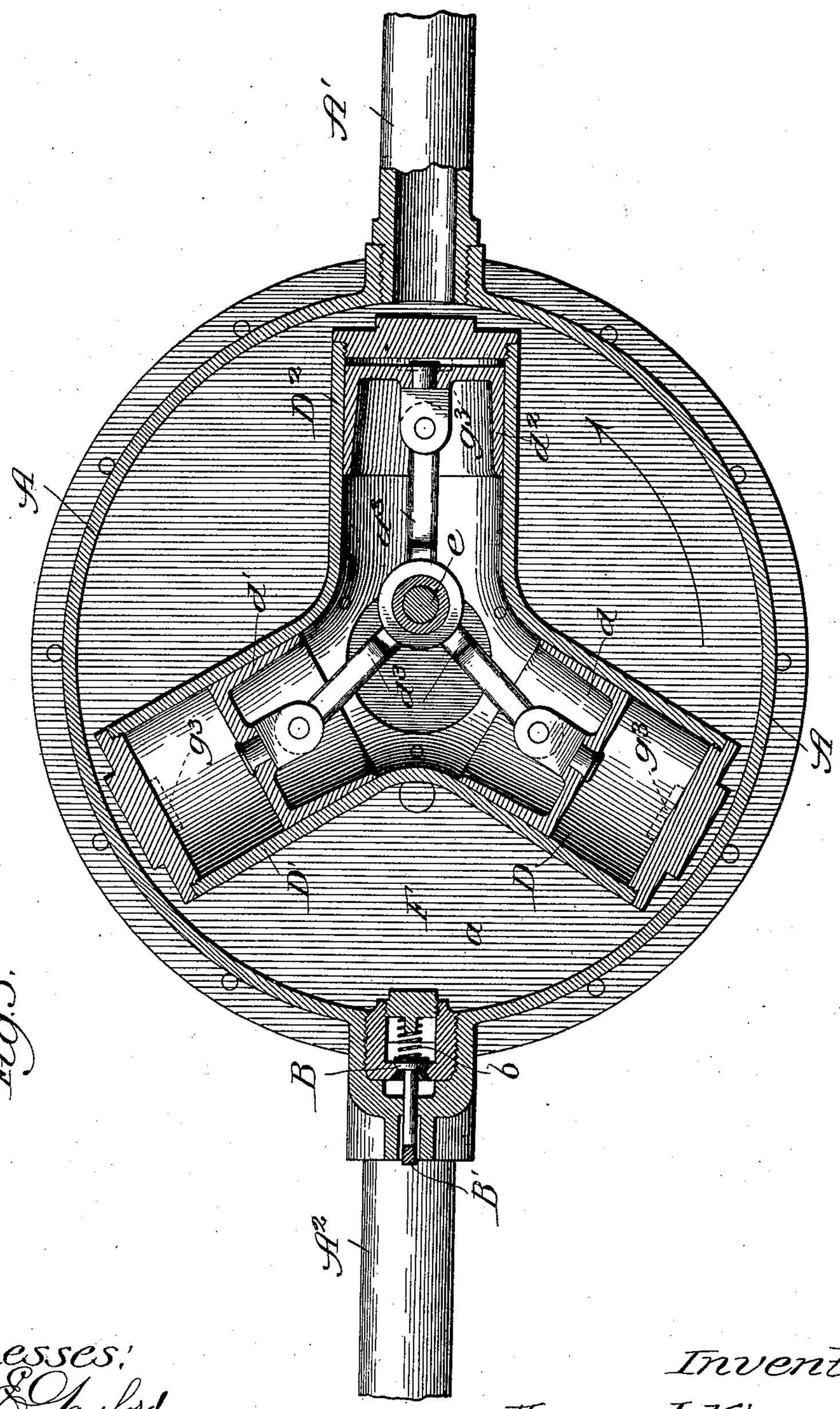


Fig. 3.

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# H. J. KIMMAN.

## DRILL.

(Application filed Mar. 29, 1900.)

(No Model.) 4 Sheets—Sheet 4.

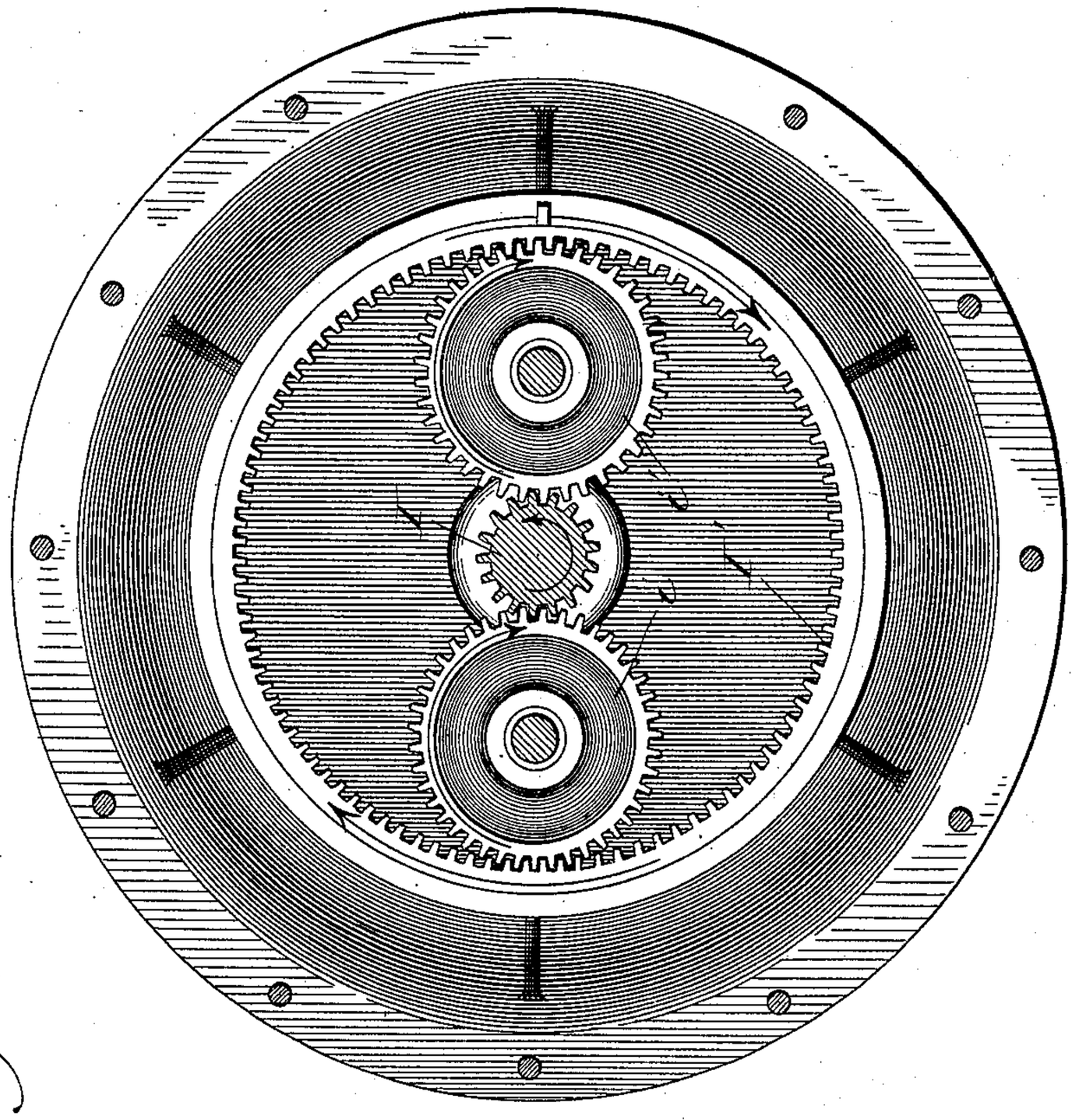

Fig. 24.

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# UNITED STATES PATENT OFFICE.

HENRY J. KIMMAN, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO EDWARD N. HURLEY, OF SAME PLACE.

## DRILL.

SPECIFICATION forming part of Letters Patent No. 682,555, dated September 10, 1901.

Application filed March 29, 1900. Serial No. 10,651. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY J. KIMMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Pneumatic Drills, of which the following is a specification.

The invention relates to that class of rotary drills adapted to be operated by motive fluid, such as compressed air, in which there are two or more cylinders arranged to rotate around a fixed point, and thereby operate or rotate a tool-shank, which in turn is adapted to contain a proper tool, all of which will more fully hereinafter appear.

The object of the invention is to provide a simple, economical, and efficient rotary drill; and the invention consists in the features, combinations, and details of construction hereinafter described and claimed.

In other inventions designed for perfecting the same or similar purposes the casing has been used as a live-air chamber, whereas in my invention it is used as an exhaust-receiver. Again, in the prior art the air is admitted directly into the live-air chamber, whereas in the present invention it is carried through a separate channel from the supply-pipe through a passage in the stationary or fixed crank-shaft into a passage leading from the waste portion of the valve and, according to the position of said valve, admitted into or exhausted from the operating-cylinders. It will also be seen that in this invention the objection which has been met with in similar appliances of the exhaust blowing through the gear mechanism is overcome, the mechanisms being so arranged that the exhaust is admitted into the main casing, which itself is hermetically sealed from the mechanism in the lower portion—namely, the reducing-gear and the tool-shank. The exhaust passes out through a separate pipe, as shown in the drawings.

The principal object aimed at in the construction of this tool is to obtain a high-speed engine adapted to consume as little motive fluid as possible. This result is obtained by employing a stationary eccentric, which is set at the required points in the throw of the crank-shaft to obtain the necessary cut-off for the operation of the valves while the cylinders rotate about the eccentric. As is well known, in engines of this type the travel of the eccentric is quickest when the movement of the piston is slowest, and this is the case in my invention, whereby I obtain a very quick port-opening and an equally quick release, thereby enabling the cylinders as they are rotated to move at an exceedingly rapid rate, the air not having to travel through tortuous passages as it passes in or out. In other engines of this character the opposite is the case, especially with engines in which the cylinders are oscillated, as then the valve-motion is slowest when the piston is at the center or end of its stroke.

In the accompanying drawings, Figure 1 is a vertical sectional elevation of a rotatable drill constructed in accordance with my improvements and taken on line 1 of Fig. 2; and Figs. 2, 3, and 4 are sectional plan views taken on lines 2, 3, and 4, respectively, of Fig. 1 looking in the direction of the arrows.

In constructing a machine in accordance with my improvements I make a casing A of the desired size, shape, and strength to hold the operative and other parts in position. This casing is preferably circular in contour when looked at in plan view and can be of any desired shape, though preferably rectangular when viewed in vertical sectional elevation. The casing, as above described, is adapted to contain the operative and other parts in position for use, and I have so constructed it as not only to hold these parts in position for use, but also to protect them from dirt, dust, &c., while at the same time providing an inner chamber, which is in reality an exhaust, out of which the exhaust-pipe $A'$ leads. This casing is also provided with an inlet $A^2$, leading from the same source of motive fluid, preferably compressed air, and connects with a passage $a'$, which is the inlet-passage leading to the center of the casing, as hereinafter described. Intermediate the inlet-opening and the inlet-passage is located a throttle-valve B of any desired form, though I prefer to make one which is seated in the valve-opening and held therein by means of a helical spring $b$, which has its stem projecting outwardly and adapted to be operated by

means of the lever B′. The arrangement, as shown in Fig. 1, is such that the valve is at all times kept closed and is only opened when extraneous pressure is used for such purpose.

Rotatably mounted in suitable position in the casing is a tool-shank C of any desired construction and arrangement and adapted to hold a drill *c*, though any other desired tool, such as a tap or reamer, can be used. To rotate this tool-shank, a plurality of fluid-pressure cylinders D, D′, and D² are preferably provided, all formed in one integral cylinder-casting and arranged in radial relation to each other, the axes of which are at an angle of one hundred and twenty degrees to each other. This cylinder-casting is rotatably mounted at its upper portion on the lower end of the crank-shaft E and at its lower portion in the diaphragm F, which separates the exhaust-chamber from the mechanism below the same. Each and all of the fluid-pressure cylinders are provided with reciprocating pistons *d*, *d′*, and *d²*, connected, by means of the pitman *d³*, to the wrist-pin *e* of the crank-shaft, each forming, as it were, a single-acting engine.

The arrangement shown and described above is such that the casing is always stationary and the cylinders or cylinder-frame rotates about a fixed point. It is desirable, therefore, that while the cylinders are rotating the motive fluid be permitted to enter into the fluid-pressure or operating cylinder between the piston and the cylinder-head at the rear, so as to operate the same and permit the exhaust of motive fluid therefrom at the proper time. In order to accomplish this result, the cylinder-frame, as shown particularly in Figs. 1 and 2, is provided with valve-chambers G, G′, and G², the axis of which is arranged in line with the axis of the fluid-pressure cylinder, one for each. The cylinder-frame is also provided with an inlet-passage *g*, leading from the axial opening E′ in the crank-shaft, which forms a continuation of the main inlet-passage to each valve-chamber, so that as a piston-valve *g′* reciprocates in each of such chambers the annular recess *g²*, formed thereby, connects the inlet-opening of the cylinder-frame with the passage *g³* in the rear of the cylinder and fluid under pressure (see Fig. 1) passes in through the inlet A², inlet-passage *a′*, passage E′ of the crank-shaft, passage *g* in the cylinder-frame, through the annular passage *g²*, and down through the passage *g³* between the piston and the cylinder-head to force the piston forward. When the piston-valve is in another position—that is, the position farthest to the left of that shown in Fig. 1—the passage *g³* is connected with the exhaust-chamber *a* of the casing, so as to permit the motive fluid to exhaust from the cylinders in succession into the exhaust-chamber and pass out to the open air through the exhaust-opening A′.

To give the reciprocating piston-valve proper motion and at the proper time, an eccentric-hub H is formed on the upper portion of the engine-casing and surrounding the crank-shaft, around which the eccentric-straps *h* are passed, and each of which is connected to the proper piston-valve, as shown particularly in Fig. 2. The eccentric being stationary and the cylinder-frame rotatable, it will be seen that the proper motion is given to the reciprocating valves at the desired time either to admit motive fluid into the fluid-pressure cylinders or to permit it to be exhausted therefrom.

A particular advantage derived from the construction of an engine or rotatable drill made in accordance with these improvements is that the relative travel of the eccentric is quickest when the motion of the piston is slowest, so that I obtain a very quick port-opening and equally quick release, thereby enabling the cylinders as they rotate to move at an exceedingly rapid rate, as the compressed air does not have to travel through tortuous passages, but is admitted and exhausted directly. It will also be seen that there is no waste fluid in the ports.

In order to connect the cylinders with the tool-shank and rotate such tool-shank by the rotary movement of the cylinder-frame, the lower journal of the cylinder-frame is provided with a pinion I, meshing with intermediate gears *i* and *i′*, in turn meshing or engaging with the teeth of an internal annular gear I′, arranged on the upper end of the tool-shank. By this arrangement it will be seen that as the cylinder-frame rotates the proper rotation and speed are given to the tool-shank.

I claim—

1. In a machine of the class described, the combination of a cylinder-frame provided with a plurality of fluid-pressure cylinders having a fixed relation to each other arranged to rotate around a common central point and with a valve-chamber open at both ends, arranged in line with each of the fluid-pressure cylinders, a reciprocating valve in each of the valve-chambers, and a fixed eccentric connected with each and all reciprocating valves, whereby as the cylinder-frame is rotated the valves are given their proper motion, substantially as described.

2. In a machine of the class described, the combination of a casing, a crank-shaft the body portion of which is fixed therein to prevent its rotation, an inlet-passage formed partly in the casing and axially through the body of the crank-shaft, a cylinder-frame rotatably mounted upon the crank-shaft and provided with a plurality of pressure-cylinders and a valve-chamber in line with each fluid-pressure cylinder and with an inlet-passage for each valve-chamber leading from the axial opening in the crank-shaft, a reciprocating valve in each of the valve-chambers, a fixed eccentric surrounding the crank-shaft, and means connecting the fixed eccentric

with the reciprocating valves, whereby as the cylinder is rotated the valves are given a proper motion to permit the introduction and exhaust of fluid-pressure into and out of the fluid-pressure chambers, substantially as described.

3. In a machine of the class described, the combination of a cylinder-frame provided with a plurality of fluid-pressure cylinders having a fixed relation to each other arranged to rotate around a common central point, a valve-chamber open at both ends arranged in line with each of the fluid-pressure cylinders, a reciprocating valve in each of the valve-chambers, a crank-shaft, the body portion of which is secured in the casing against rotation and provided with a fluid-inlet passage extending axially through a portion of the same, a fixed eccentric around the crank-shaft away from contact with the live-fluid pressure, and eccentric-straps around the fixed eccentric, each connected with a respective piston-valve, substantially as described.

4. In a machine of the class described, the combination of a casing, a crank-shaft fixed therein against rotation, an inlet fluid-passage formed partly in the casing and axially in the crank-shaft, a cylinder-frame provided with a plurality of fluid-pressure cylinders having a fixed relation to each other rotatably mounted upon the fixed crank-shaft, a piston within each fluid-pressure cylinder, a pitman-rod for each piston connecting it with the fixed crank-shaft, a valve-chamber open at both ends arranged adjacent to and in line with each fluid-pressure cylinder, a piston-valve for each valve-chamber, a fixed eccentric around the crank-shaft and fluid-inlet passage operatively connected with the piston-valves, a fluid-passage connecting each valve-chamber with its respective pressure-cylinder when the valve is in position to open the fluid-inlet passage and connecting with the open end of the valve-chamber when the valve is in position to close the fluid-inlet passage, substantially as described.

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