No. 749,864. PATENTED JAN. 19, 1904.

T. S. JAMES.

STEAM OR INTERNAL COMBUSTION ENGINE OR MOTOR.

APPLICATION FILED JUNE 25, 1903.

NO MODEL. 4 SHEETS—SHEET 1.

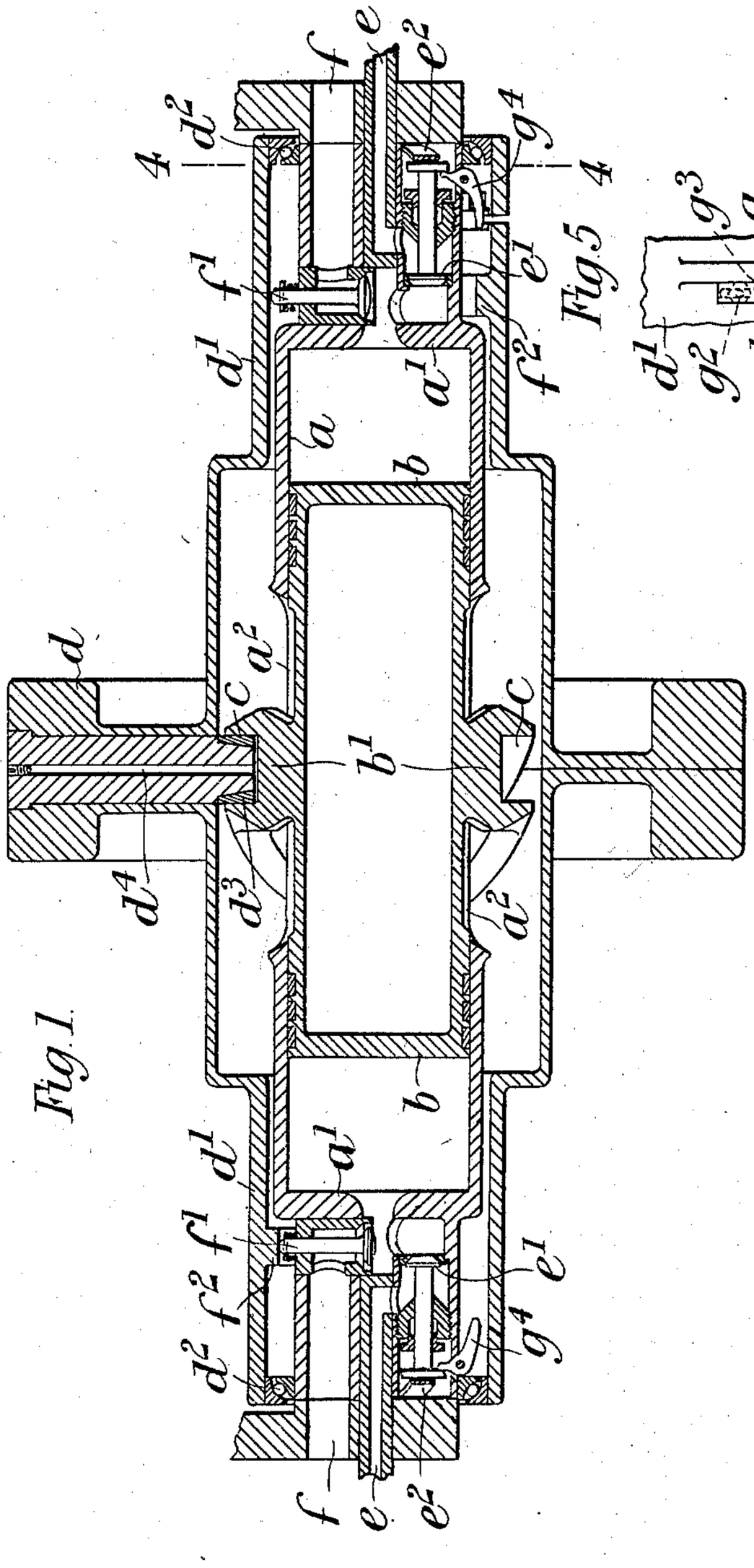

Fig. 1.

Fig. 5.

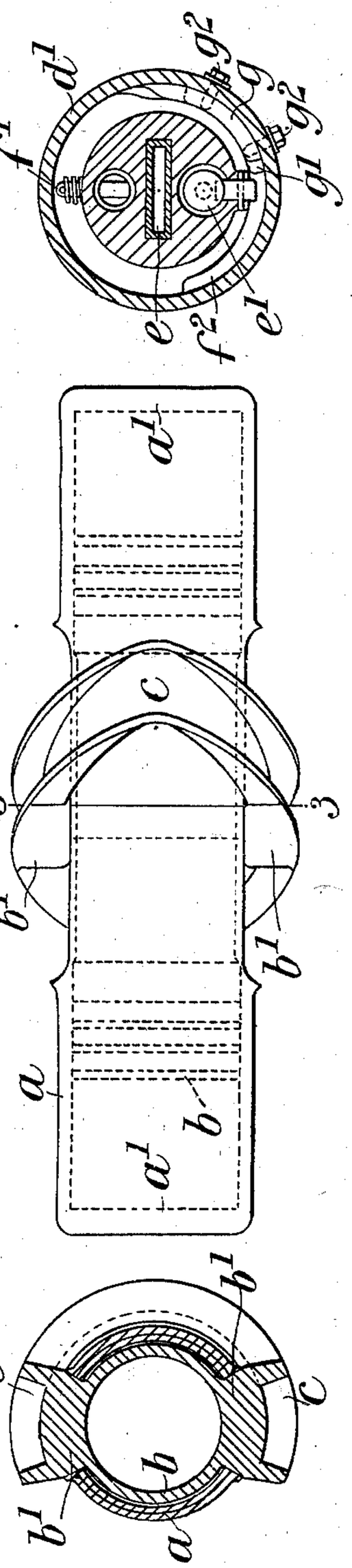

Fig. 2.

Fig. 3.

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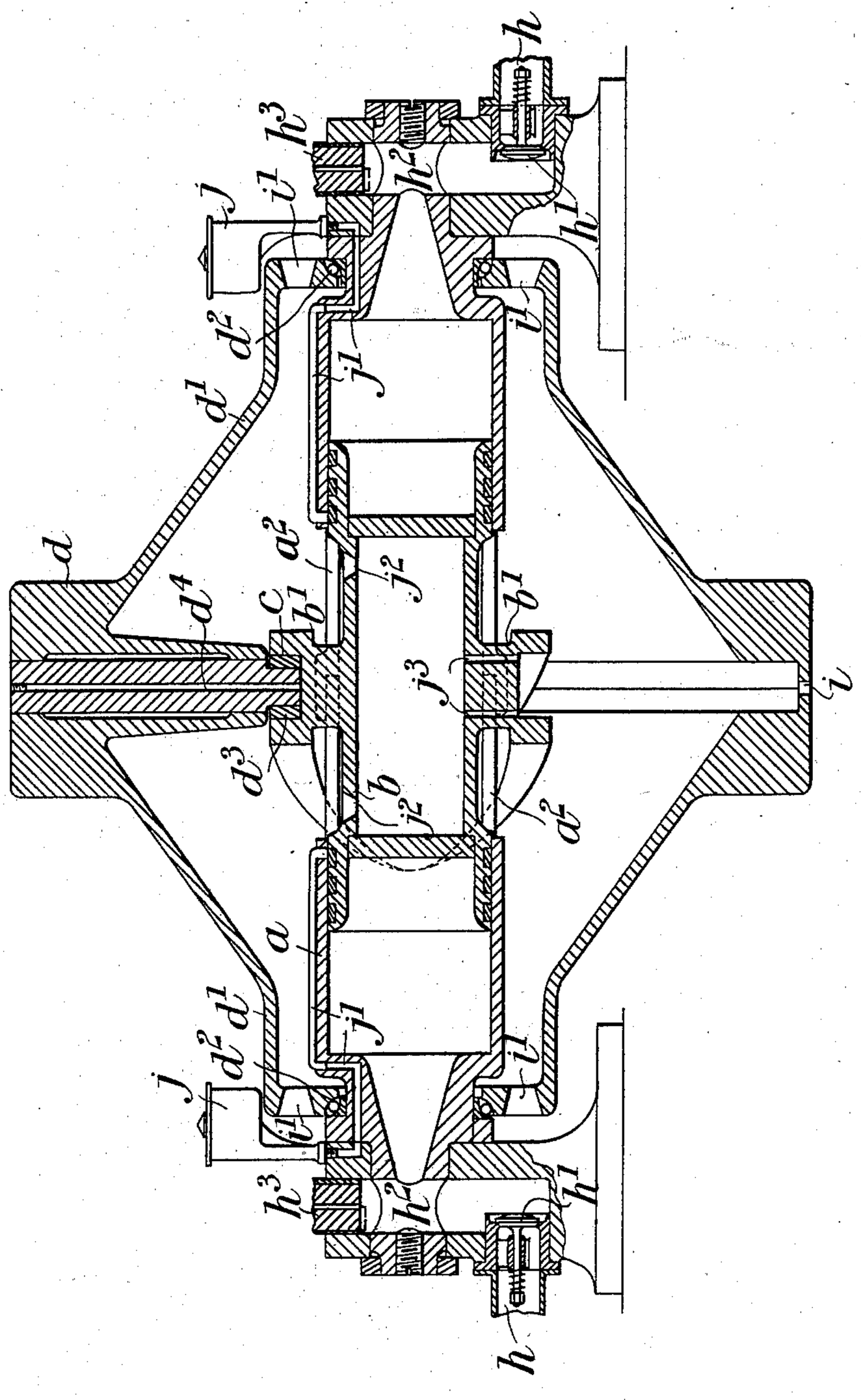
NO MODEL. 4 SHEETS—SHEET 2.

Fig. 6



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NO MODEL. 4 SHEETS—SHEET 3.

Fig 7.

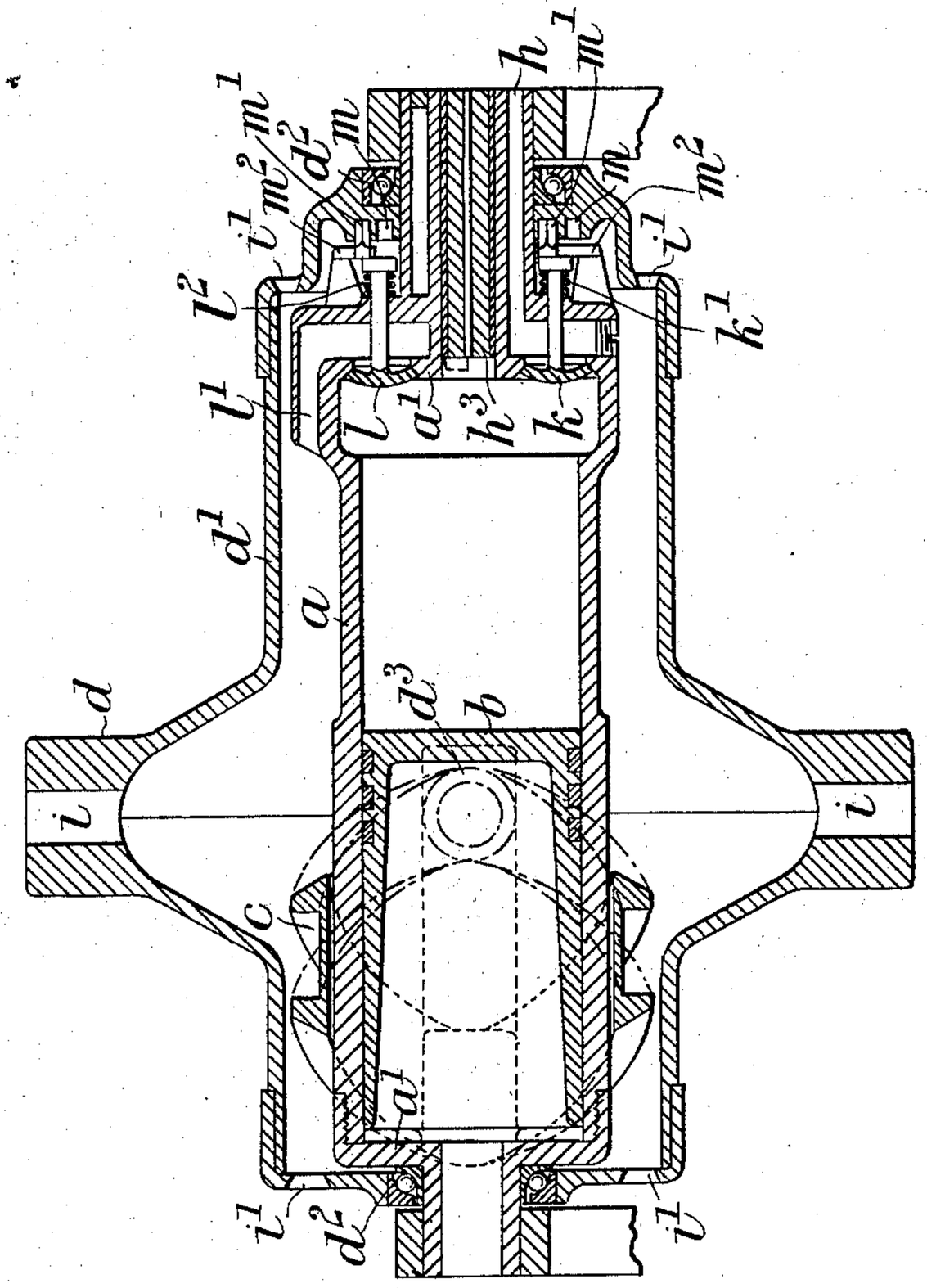
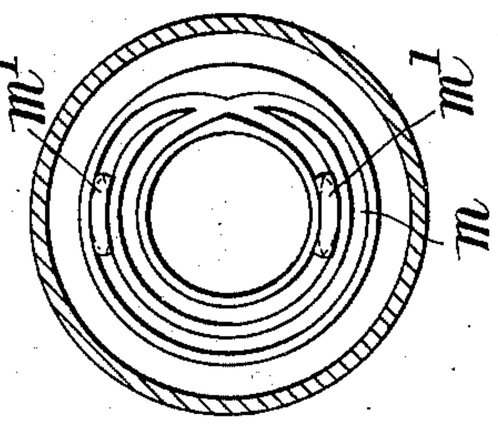


Fig 8.



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NO MODEL. 4 SHEETS—SHEET 4.

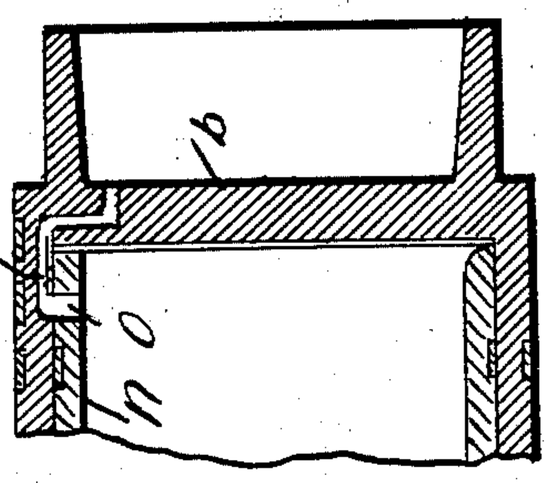

Fig. 10.

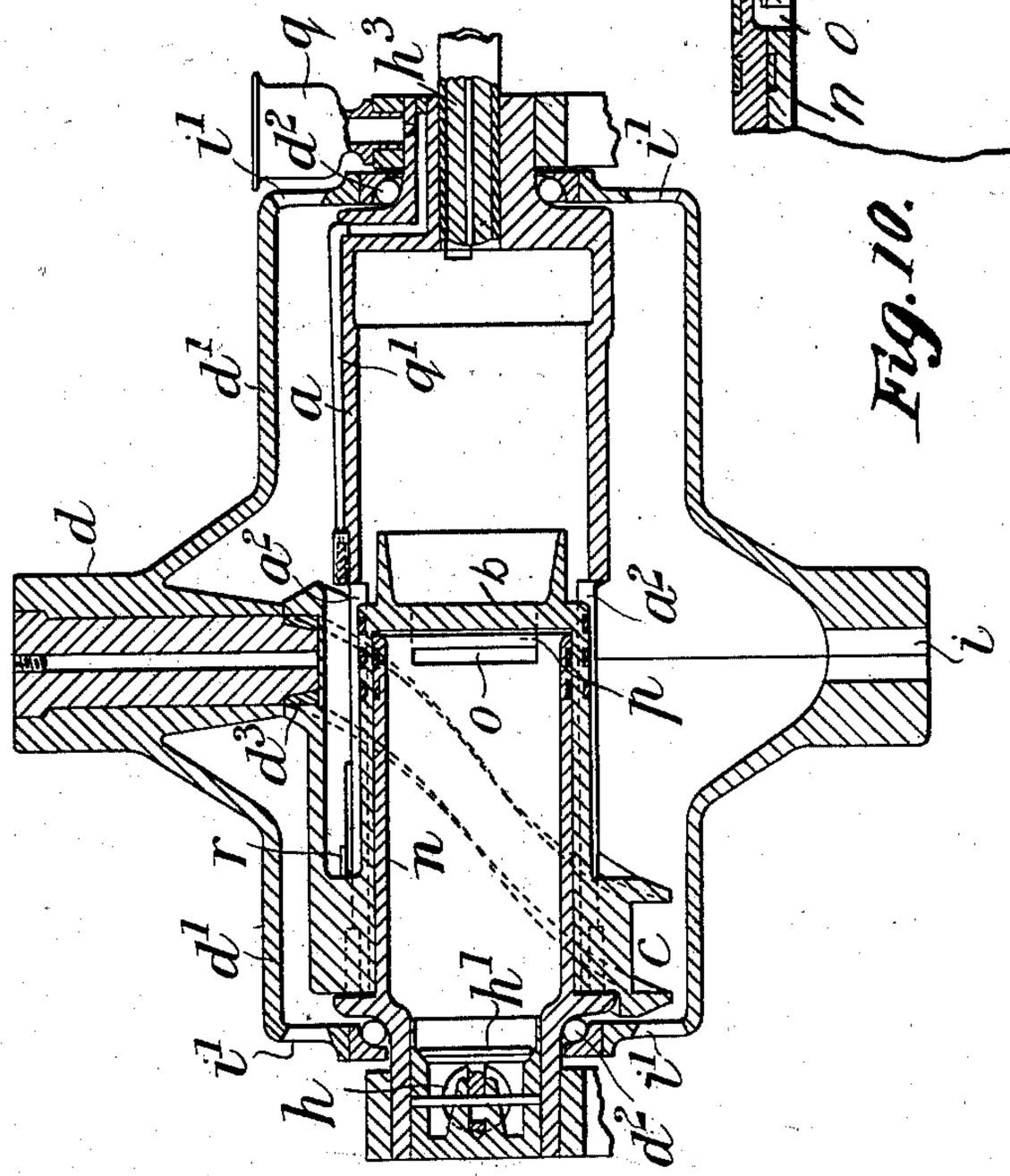

Fig. 9.

Witnesses.
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Inventor.
Thos. S. James.

No. 749,864. Patented January 19, 1904.

UNITED STATES PATENT OFFICE.

THOMAS SPENCER JAMES, OF LONDON, ENGLAND.

STEAM OR INTERNAL-COMBUSTION ENGINE OR MOTOR.

SPECIFICATION forming part of Letters Patent No. 749,864, dated January 19, 1904.

Application filed June 25, 1903. Serial No. 163,104. (No model.)

To all whom it may concern:

Be it known that I, THOMAS SPENCER JAMES, a subject of the King of Great Britain, residing at 16 Edith road, Peckham, London, England, have invented new and useful Improvements in Steam or Internal-Combustion Engines or Motors, of which the following is a specification.

This invention relates to improvements in steam or internal-combustion engines or motors of the kind wherein the reciprocating motion of a piston is converted into rotary motion through the medium of a helical or cam groove and a roller or rollers engaging therewith. Such engines as heretofore made possess a number of disadvantages; and this invention has for its object to overcome these disadvantages and to produce an efficient motor capable of giving good results under conditions met with in practice.

According to the invention I construct my improved motor of a cylinder within which is located the piston, which engages guide-slots formed in the cylinder and is rigidly connected with an external cam-surface inclosing the cylinder. This external cam-surface engages a roller upon a fly-wheel which encircles the cylinder, and it will be understood that as the piston is reciprocated the cam-surface, which is suitably arranged for this purpose, causes the fly-wheel with which it is connected to continuously rotate.

In the accompanying drawings, Figure 1 is a longitudinal section of a double-acting steam-engine constructed according to the invention. Fig. 2 is an elevation of the piston, the view being at right angles to Fig. 1. Fig. 3 is a section on the line 3 3, Fig. 2. Fig. 4 is a section on the line 4 4, Fig. 1. Fig. 5 is a plan view of one of the adjustable cams for operating the inlet-valves. Fig. 6 is a view similar to Fig. 1 of an explosion-engine made according to the invention and having two explosions per revolution of the fly-wheel. Fig. 7 is a view similar to Figs. 1 and 6 of a modified construction of the explosion-engine, wherein one explosion takes place to every two revolutions of the fly-wheel. Fig. 8 is a transverse sectional view of the fly-wheel casing, showing the valve-operating cam-plate carried thereby. Fig. 9 is a view similar to Fig. 1 of a modified construction of explosion-engine wherein an explosion takes place for each revolution of the fly-wheel. Fig. 10 is a detail of a part of the piston and internal chamber shown in Fig. 9, showing the registering ports therein.

Similar letters of reference refer to the same or corresponding parts in all the figures.

Referring first to Figs. 1 to 5, a is the cylinder, which is closed at each end, as shown at a' a'; and b is the piston, which is in the form of a hollow cylinder closed at each end. This piston b is formed with a pair of projections b' b', which extend through longitudinal slots a^2 in the cylinder a and are integral with or rigidly connected to the cam-groove c, which encircles the piston, as clearly shown in Figs. 1 and 2. d is the fly-wheel, the said fly-wheel being integral with the casing or sleeve d', running upon ball-bearings d^2 upon the extensions of the ends of the cylinder a, carrying the valve-gear hereinafter described. The fly-wheel is provided with an internal roller d^3, which engages the cam-groove c, as clearly indicated in Fig. 1. e is the steam-inlet passage at each end of the cylinder, and f is the exhaust-passage, e' being the valve controlling the admission of steam to the cylinder, and f' the exhaust-valve. Each valve e' is normally pressed upon its seat by a spring e^2 and is lifted therefrom at the proper point by a cam-surface upon the inside of the fly-wheel sleeve d'. To enable the degree of expansion to be regulated as required, this cam-surface is made in two parts g g', (see Figs. 4 and 5,) the part g being fixed and the part g' adjustable relatively with the part g, so that the length of the cam can be varied, the part g' being secured in place by means of studs g^2, which pass through a slot g^3 in the sleeve d'. This cam g operates the valve e' through the medium of the pivoted lever g^4, and it will be evident that by lengthening or shortening the cam I can correspondingly lengthen or shorten the time during which admission of steam is allowed to take place. The exhaust-valve f' is operated by the cam f^2, also provided upon the internal periphery of the casing d'. d^4 is a passage in the fly-wheel for the lubrication of the

cam-groove *c*. With this arrangement it will be clear that as the piston reciprocates the fly-wheel *d* is caused to continuously rotate. With a cam constructed as shown in the drawings it will be seen that the fly-wheel makes one revolution for a complete to-and-fro movement of the piston, although, as will be obvious, the said cam can be constructed to multiply this motion, if desired.

In Fig. 6 I have shown my improvements applied to a double-acting explosion-engine, two explosions being obtained for each revolution of the fly-wheel. The construction of this engine is identical in principle with that above described, and the description of the above engine applies to this modification also, in so far as the cylinder, piston, and fly-wheel are concerned; but in lieu of the inlet and exhaust passages and valves of the steam-engine I provide each end of the cylinder with an inlet-passage *h* for the combustible mixture, which is forced or induced through the said passage in any suitable manner, the flow being ontrolled by the valve *h'*. This valve gives access to the combustion-chamber h^2, wherein the explosive mixture is ignited by the sparking-plug h^3 in the ordinary way. The exhaust takes place through the longitudinal slots a^2 a^2 in the cylinder *a* when the ends of the piston pass the ends of these slots, the exhaust-gases passing thus into the annular space between the cylinder and the fly-wheel casing *d'*, whereupon the centrifugal action generated by the rotation of the fly-wheel *d* causes these gases to pass to the periphery, whence they escape through the outlets *i*, provided therein for the purpose. Inlets *i' i''* are provided near the center of the fly-wheel casing *d'*, through which the centrifugal action draws in air. This entrance of air clears out the exhaust-space. *j j* are two lubricators, which supply lubricant to pipes or passages *j'*, communicating with the interior of the cylinder. The excess of lubricant finds its way through the holes j^2 j^2 in the piston and out through the passages j^3 into the groove *c*.

In Fig. 7 there is illustrated an internal-combustion engine which is similar to that above described, with the exception that it is single-acting only and works on the Beau de Rochas cycle, there being an explosion for each two revolutions and the inlet and exhaust valves being mechanically controlled. *k* is the inlet-valve for the explosive mixture which enters through the passage *h*, and *l* is the exhaust-valve which controls the flow of the exhaust-gases from the cylinder to the passage *l'*, which communicates with the annular exhaust-chamber, as before. Both these valves are normally held by their seats by springs *k'* and l^2, respectively. To control the valves, I make use of a cross-cut face-cam *m*, (see Fig. 8,) which rotates with the fly-wheel sleeve or casing *d'* and with the grooves of which engage a pair of slides *m' m'*, movable in upright guides m^2. The grooves in the cam *m* are so disposed that at the required moments the slides *m'* are moved against the ends of the valve-stems, so as to open the valves *k* and *l* and retain them open for the requisite intervals.

Fig. 9 shows my improvements applied to an engine of the Day type—that is to say, to an engine which is single-acting, but which gives an explosion for each revolution of the fly-wheel. In this construction of engine the piston *b* is open at one end and slides telescopically upon an internal cylindrical chamber *n*, provided at one end of the cylinder *a*. This chamber is in communication with the passage *h* for the supply of the explosive mixture, which supply is controlled by the induction-valve *h'*. The chamber is also provided with a port *o*, which when the piston is at that end of its stroke shown in the figure is in communication with a port *p* in the side of the piston and which places the interior of the chamber in communication with the front end of the cylinder *a*. This engine operates as follows: Assuming that the charge has been exploded and that the piston has been driven forward into the position shown in the drawings, the products of combustion escape through the slots a^2 into the annular exhaust-chamber, whence they are driven off centrifugally, as has been above described. The forward movement of the piston has compressed the charge which was drawn into the chamber *n* through the valve *h'* and which now escapes through the ports *o* and *p* into the combustion-chamber of the cylinder. This charge is compressed on the return stroke of the piston and exploded, whereupon the cycle begins again.

q is a lubricator which supplies lubricant to the tube *q'* normally closed by a valve, which is periodically opened by the pin *r*—that is to say, each time the piston reaches the end of its stroke to the right. It is obvious that as an alternative the cam can be placed or formed in the fly-wheel casing and the pin and roller made fast to the piston.

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 steam or explosion engine or motor the combination with the cylinder and piston, of a cam-groove which encircles the cylinder and of a roller engaging therewith one of the said members being rigidly connected to the fly-wheel of the engine and the other to the piston by connections running in slots in the cylinder, substantially as described.

2. In a steam or explosion engine or motor, the combination with the cylinder and piston, of a cam-groove which encircles the cylinder and is united to the piston by connections running in slots in the cylinder, of a fly-wheel inclosing the cam-groove and of a roller upon the fly-wheel which engages the said cam-groove, substantially as described.

3. In a steam or explosion engine or motor, the combination with the cylinder and piston, of a cam-groove encircling the cylinder and secured to the piston by connections working in slots in the cylinder, of a fly-wheel inclosing the cylinder and mounted on bearings upon the ends thereof, of inlet and outlet valves for controlling the admission and exhaust of the motive fluid and of means, such as cams, in connection with the fly-wheel for operating the said valves, substantially as described.

4. In an explosion engine or motor the combination with the cylinder and piston, of a cam-groove encircling the cylinder and secured to the piston by connections extending through slots in the cylinder, of a fly-wheel inclosing the cylinder, the said fly-wheel being mounted on bearings upon the ends of the cylinder and forming an annular exhaust-space, of peripheral outlets from the annular exhaust-space, of central air-inlets to the said exhaust-space and of a cam rotating with the fly-wheel for controlling the inlet and exhaust valves, substantially as described.

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Witnesses:
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