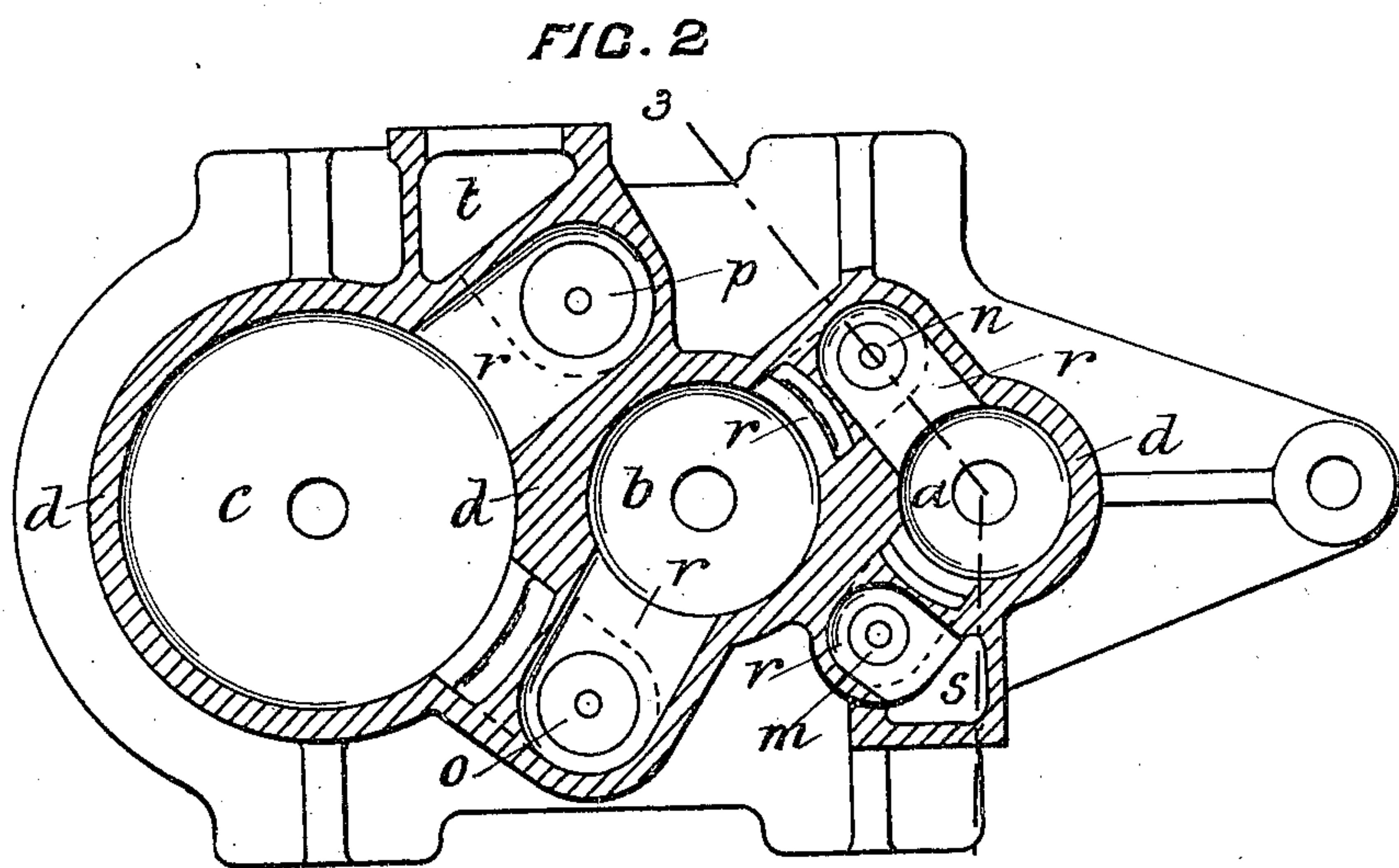
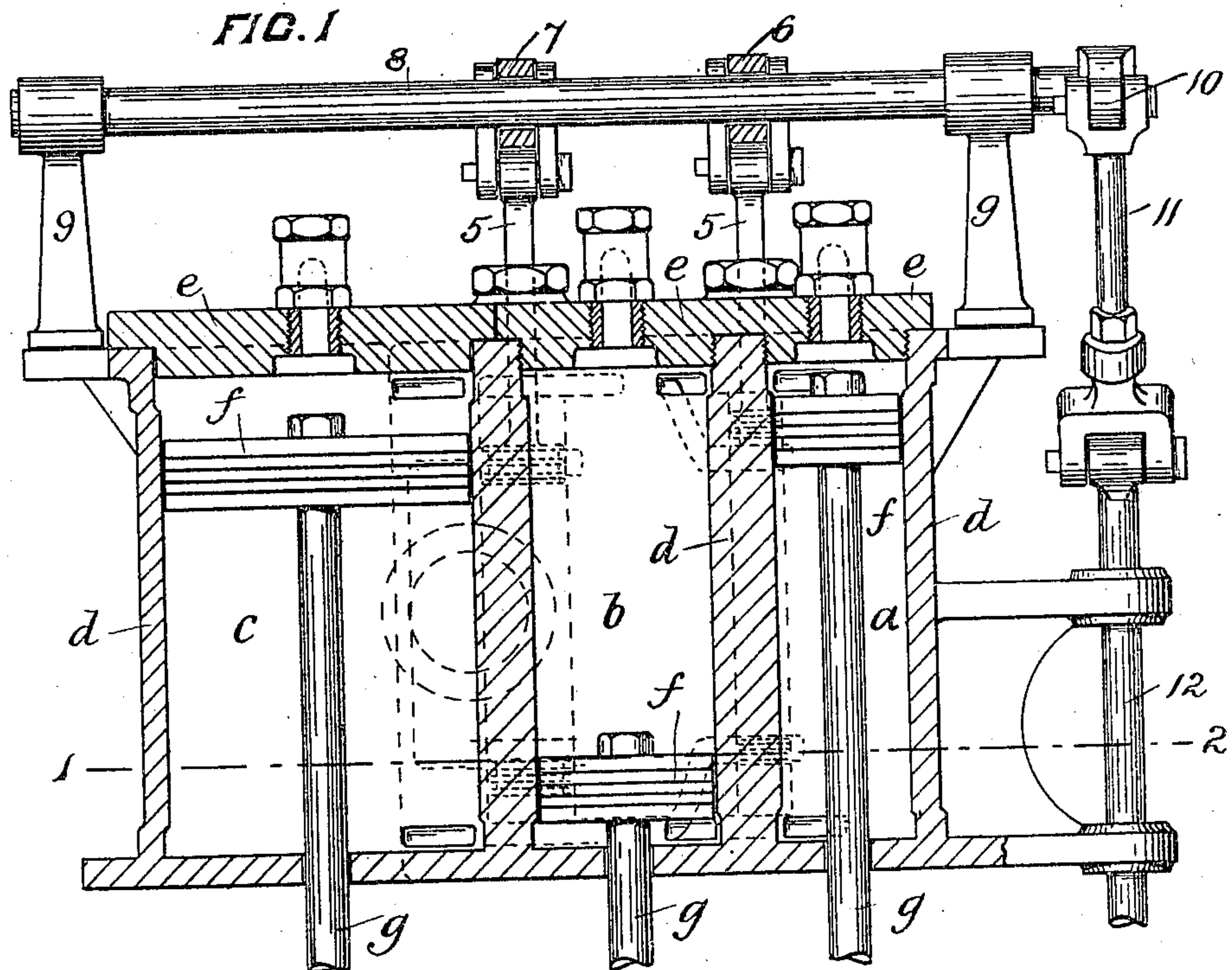


No. 812,199.

PATENTED FEB. 13, 1906.

R. P. GIBBONS.
COMPOUND STEAM ENGINE.
APPLICATION FILED FEB. 4, 1903.

2 SHEETS—SHEET 1.



witnesses

Barbara Lambie
Julia M. McLaughlin

INVENTOR

Robert Pearce Gibbons

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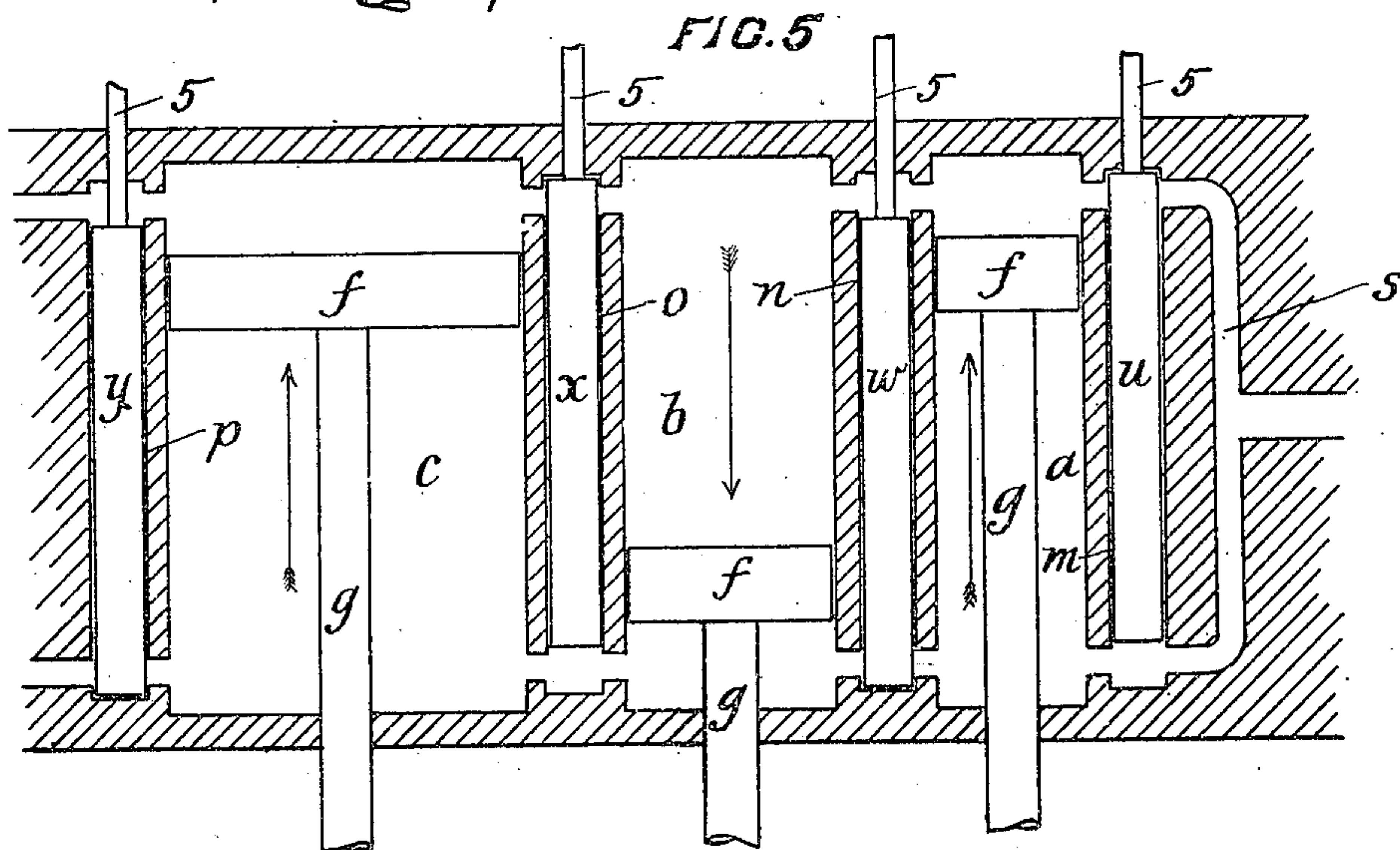
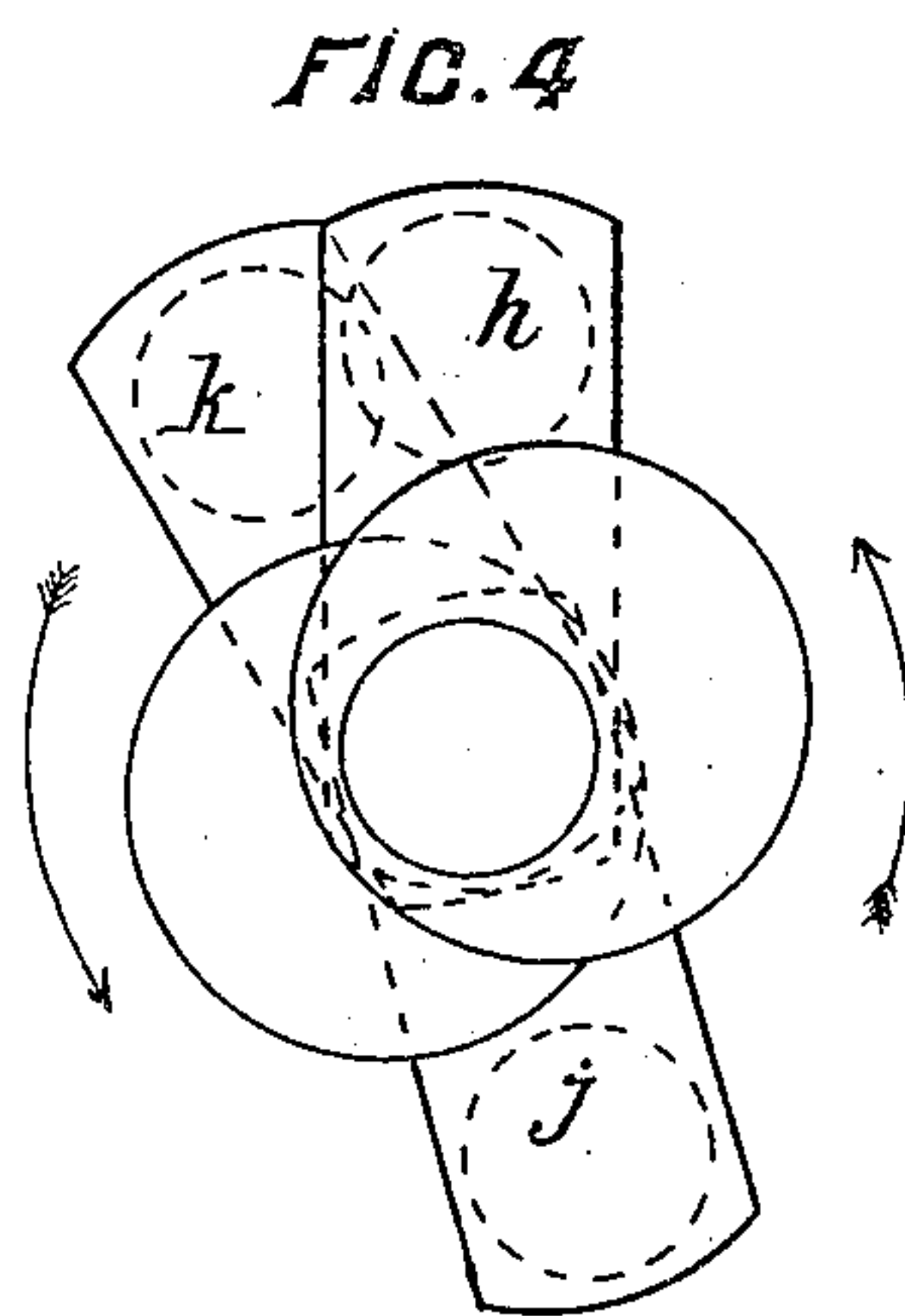
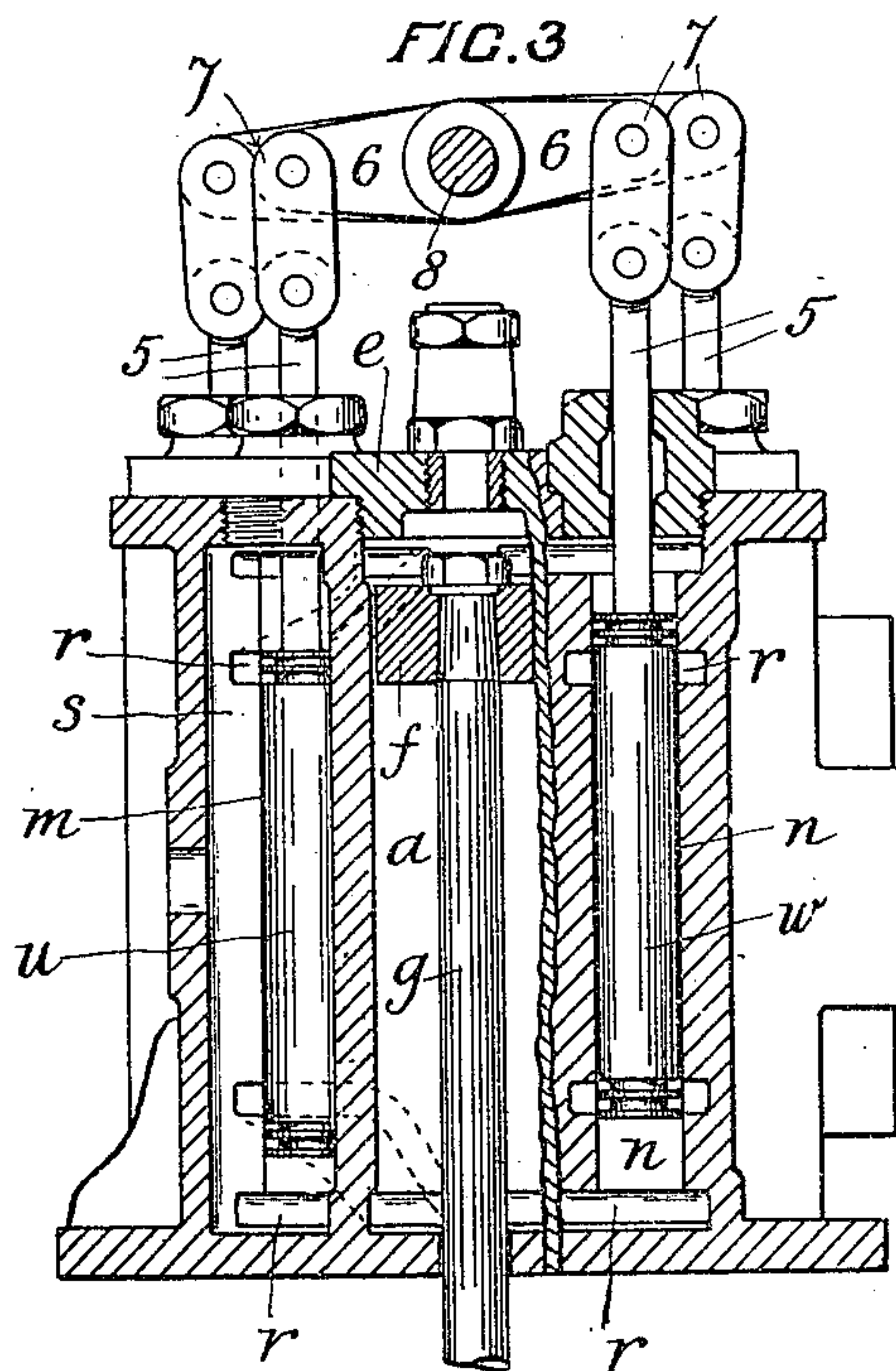
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UNITED STATES PATENT OFFICE.

ROBERT PEARCE GIBBONS, OF KOPA, NEW ZEALAND.

COMPOUND STEAM-ENGINE.

No. 812,199.

Specification of Letters Patent.

Patented Feb. 13, 1906.

Application filed February 4, 1903. Serial No. 141,923.

To all whom it may concern:

Be it known that I, ROBERT PEARCE GIBBONS, a subject of the King of Great Britain, residing at Kopa, Provincial District of Auckland, New Zealand, have invented new and useful Improvements in Compound Steam-Engines; and I do hereby declare the following to be a full, clear, and exact description of the same.

10 This invention relates to the construction of the cylinders and valve-chests of compound steam-engines and to the means for supplying the steam to the first or high-pressure cylinder and from it to the others.

15 The invention has been devised in order to economize the space taken up by the engines and to obtain the greatest amount of power possible from the steam. In most of the compound engines at present in use the
20 steam in passing from one cylinder to the other has to travel through a relatively long distance, thereby losing a certain percentage of its efficiency, while in my present invention the object has been to provide an engine
25 in which the steam may pass directly out of one cylinder into the next, thus saving such loss in efficiency.

In carrying out the invention the whole of the cylinders are formed, preferably, in one
30 casting, the divisional pieces being made of sufficient thickness to allow of steam-valve chests of special form being formed therein. These valve-chests consist of circular holes extending throughout the lengths of the cylinders and parallel therewith. At the ends
35 of each of these valve-chests ports are formed that extend from each end of one cylinder across to the corresponding end of the next cylinder. The slide-valves consist of plungers that fit closely within the chests and are
40 adapted to be moved up and down therein, so as to alternately open and close the ports at each end, and thus serve to admit the fresh steam to the first cylinder and to pass the exhaust from such cylinder on to the
45 next, and so on.

Special means have been devised whereby the proper relative movements of the cylinder-pistons and slide-valves of all the cylinders may be maintained.

In order, however, that the invention may be properly understood, reference will be made to the accompanying sheets of drawings, in which—

55 Figure 1 is a vertical section through the centers of the cylinders. Fig. 2 is a sectional

plan taken on the line 1 2 of Fig. 1. Fig. 3 is a transverse section taken approximately on the line 3 4 of Fig. 2. Fig. 4 is a diagram showing the relative positions of each cylinder's crank. Fig. 5 is a diagrammatic view illustrating the principle of operation of the appliances devised.

In illustrating the invention I have shown it as applied to three cylinders; but it will be
65 readily understood that the appliances employed may be adapted to any desired number of cylinders.

a, *b*, and *c* are the three cylinders, *a* being the high-pressure, *b* the intermediate, and *c*
70 the low-pressure. These cylinders are all preferably made in the one casting *d* and are provided with covers *e*, fitted on their top ends.

f represents the pistons, which are formed
75 in the ordinary manner and operate the cranks and crank-shaft through the rods *g*. The relative positions of the cranks to which each of the rods *g* are connected are shown in Fig. 4, where *h* is the high-pressure crank, *j*
80 the intermediate, and *k* the low-pressure. This arrangement of cranks will insure the proper relative working of each of the pistons *f*.

m, *n*, *o*, and *p* are the steam-chests, which
85 consist of circular recesses made in the casting *d* and which extend parallel to and throughout the same length as the cylinders. The first of these steam-chests *m* has ports *r* at each end that open into a steam-
90 chamber *s*, to which steam is conducted from the source of supply. It has also ports *r* at each end that open into each end of the high-pressure cylinder *a* and which serve to admit the steam from the chamber *s* alternately to
95 each side of the piston in such cylinder. The second steam-chest *n* is provided with two ports *r* at each end that open, respectively, into the two ends of the cylinders *a* and *b*, while the third steam-chest *o* has its ports at
100 each end opening, respectively, into the cylinders *b* and *c*. The last chest *p* has its ports opening, respectively, into the cylinder *c* and into a chamber *t*, that is in communication with the outer air on to appliances for which
105 the exhaust-steam may be required.

The steam-chests *m*, *n*, *o*, and *p* have fitting within them plungers *u*, *w*, *x*, and *y*, respectively. These plungers are so arranged
110 as to closely fit within the chests and to be free to move up and down therein. The ends of these plungers are so formed as to provide free

steam-passages when such ends are opposite any of the ports *r*. To the top ends of the plungers rods 5 are connected. These rods pass upward through suitable glands in the covers of the cylinders and have their top ends connected to the ends of rocking beams 6 and 7, mounted upon a shaft 8, that is supported in bearings 9, secured to the top of the cylinder-casting. To this shaft 8 a reciprocatory motion is imparted by means of the lever 10, secured to its end and to which a connecting-rod 11 is attached. This connecting-rod is connected to the eccentric-rod 12 or to crank or link motion. The reciprocatory motion of the shaft 8 will thus impart a rocking motion to the beams 6 and 7.

The rocking motion of the beams 6 and 7 will impart the necessary slide-valve motion to the plungers *u*, *w*, *x*, and *y*, and in order that these plungers shall move in their proper relative order the plungers *u* and *w* are connected to opposite ends of the beam 6, while the plungers *x* and *y* are connected to the opposite ends of the beam 7. This manner of connecting will insure that the plungers *u* and *x* shall be at the upmost limit of their stroke, so as to open the bottom ports of the steam-chests *m* and *o*, while the plungers *w* and *y* shall be at the bottom limit of their movement, so as to open the top ports of the steam-chests *n* and *p*. On referring to the diagrammatic view Fig. 5, the reason for this arrangement will be made clear, as this figure shows the relative positions of the cylinder-pistons in regard to each other and to the positions of the different plungers, whose positions relatively to each other are also indicated.

The steam led to the chamber *s* from the source of supply is admitted alternately to the two ends of the cylinder *a* by means of the movement of the plunger *m*. The plunger *n* then allows for the exhaust of this cylinder being admitted to the cylinder *b* alternately at each end, while the plunger *o* in its working alternately opens and closes its ports at each end, so as to allow of the exhaust-steam passing from the cylinder *b* into the respective ends of the cylinder *c*. The exhaust-steam from the cylinder *c* is allowed to escape into the chamber *t* by means of the working of the plunger *p*.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A compound engine comprising a plurality of cylinders and pistons therein arranged adjacent to and parallel with each other, cranks for said pistons successively spaced in such manner that the crank for the larger piston precedes the crank for the next smaller piston by approximately one hun-

dred and ninety degrees, an admission-valve and chamber for the high-pressure cylinder, an exhaust-valve and chamber for the low-pressure cylinder and a valve and chamber between each cylinder of the series but out of line therewith, each cylinder being connected by ports at each end with the valve-chambers preceding and following in series, and a common operating means for all the valves, said means actuating alternate valves in the series in opposite directions in timed relation to the operation of the pistons and in such manner that each valve will open the inlet-port to its piston before the piston completes its stroke.

2. A compound engine comprising a plurality of cylinders and pistons therein arranged adjacent to and parallel with each other, cranks for said pistons successively spaced in such manner that the crank for each piston precedes the crank of the next succeeding piston by approximately one hundred and ninety degrees, an admission-valve and valve-chamber for the initial cylinder of the series, an exhaust-valve and valve-chamber for the terminal cylinder, and a valve-chamber and valve arranged between each cylinder and the one succeeding in the series, each cylinder being connected by ports at its opposite ends with the cylinders preceding and following in the series, and a common operating means for all of the valves, said means constructed to actuate alternate valves in opposite directions in timed relation to the reciprocation of the pistons and in such manner that each valve will open the inlet-port to its cylinder before the piston therein completes its stroke.

3. In a compound engine the combination with the cylinders arranged alongside each other and connected at each end by ports leading to the cylinders immediately preceding and following in the series, the end cylinders of the series being provided respectively with admission and exhaust ports, pistons in said cylinders and connected with the shafts by cranks which are alternately substantially opposite each other, piston-valves seated in the cylinder-bodies and adapted to control said ports, a rock-shaft extending across the cylinder-heads and arms secured thereto and extending oppositely and each connected with one of the valves.

In testimony whereof I have signed this specification, this 23d day of December, 1902, in the presence of two subscribing witnesses.

ROBERT PEARCE GIBBONS.

Witnesses:

C. BROOKE SMITH,
CHAS. W. HARVEY.