

No. 701,300.

Patented June 3, 1902.

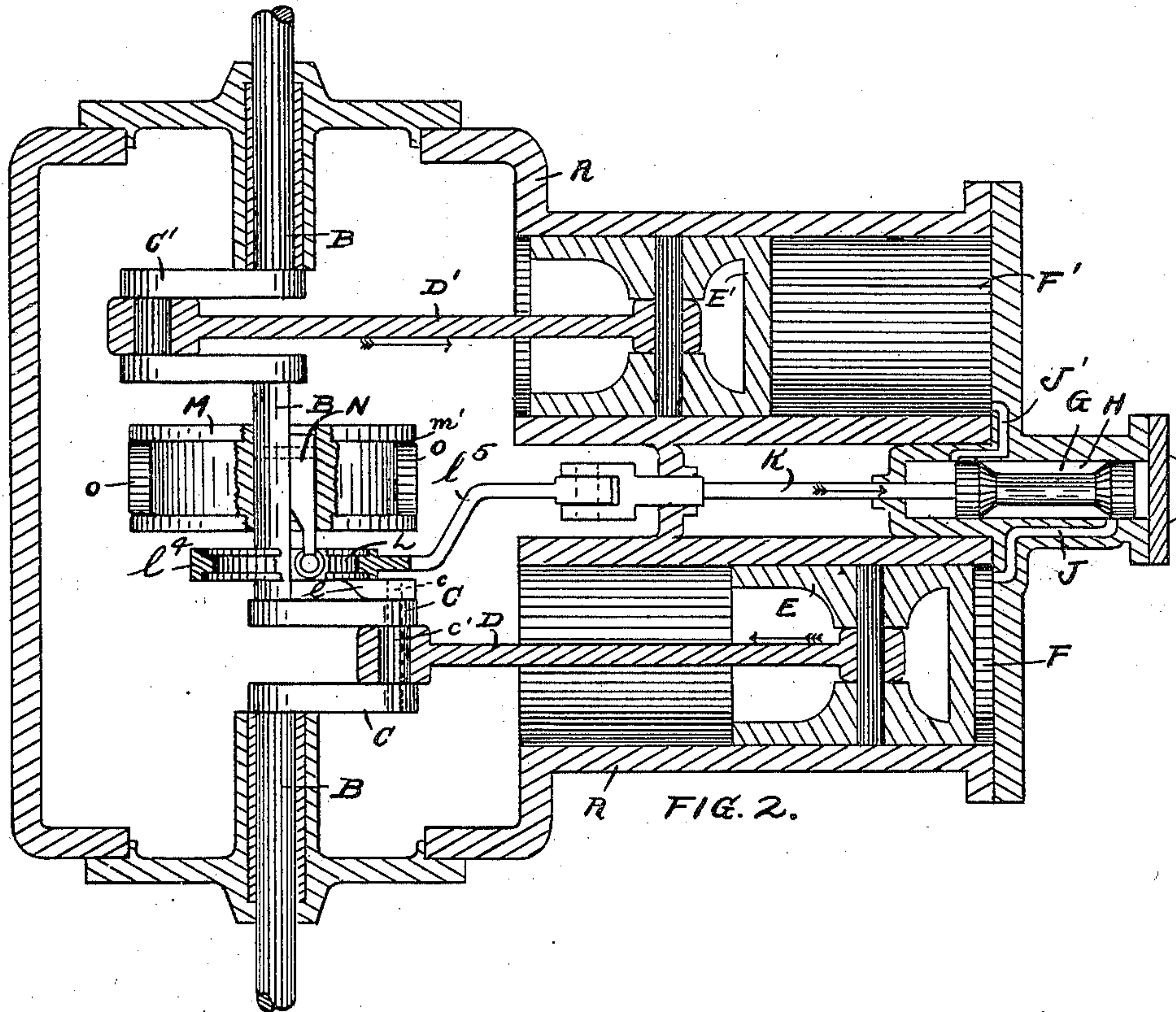
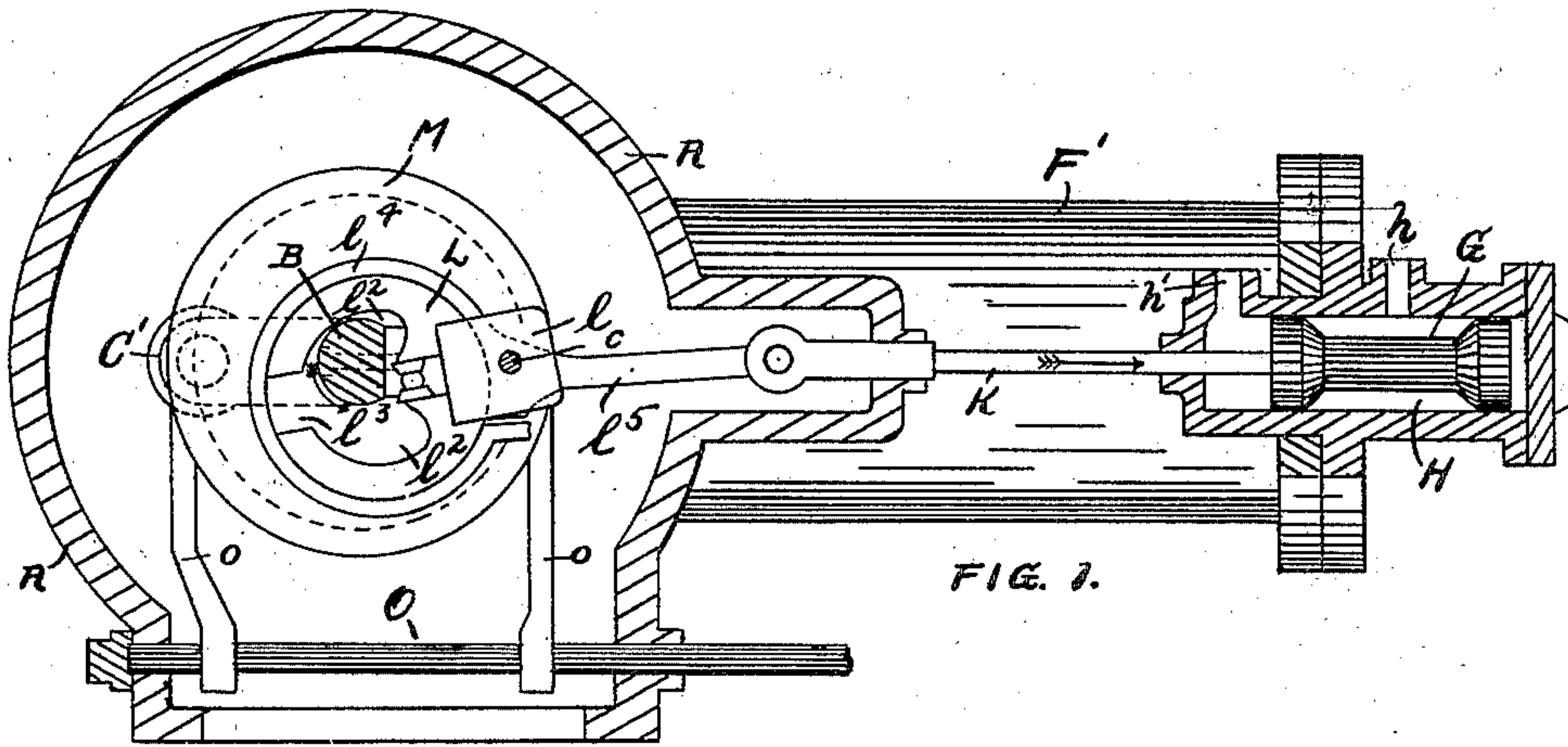
S. I. & W. S. CRAIN.

VALVE GEAR.

(Application filed Mar. 2, 1901.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses
Nathan R. Park.
Carl J. Baer

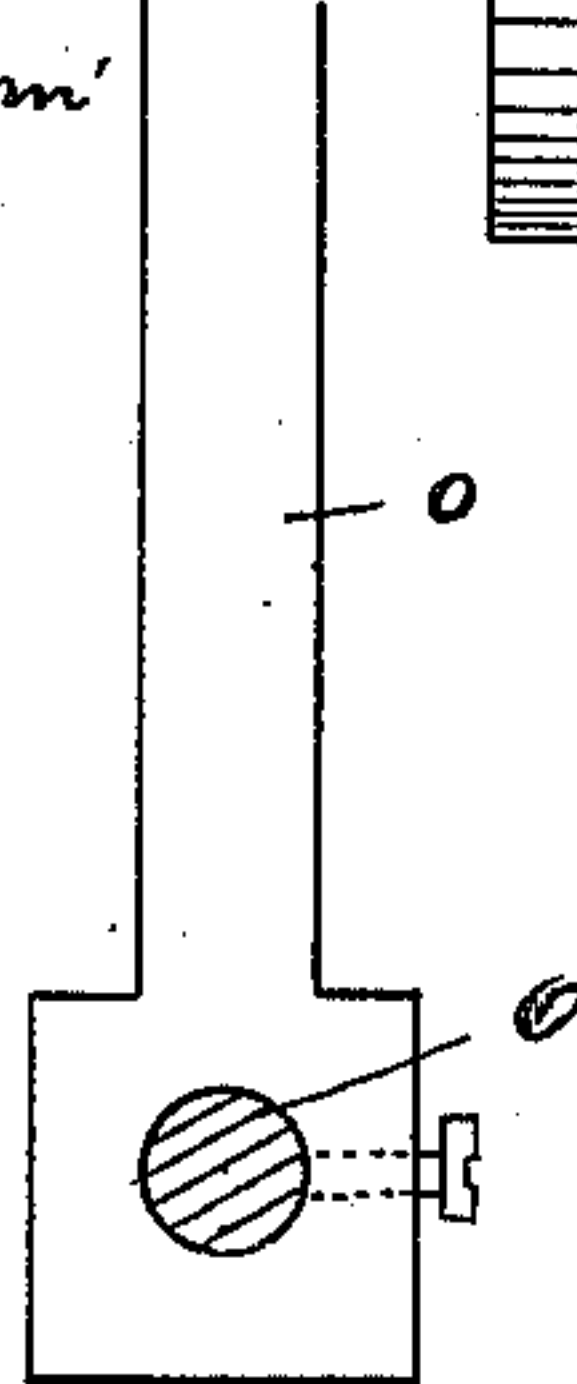
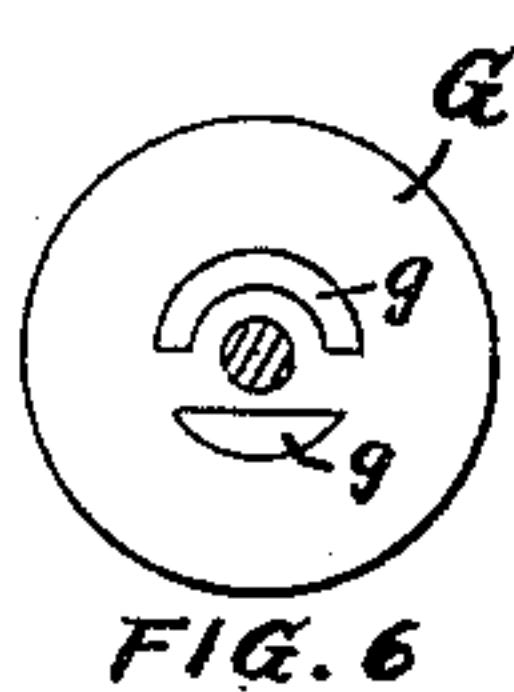
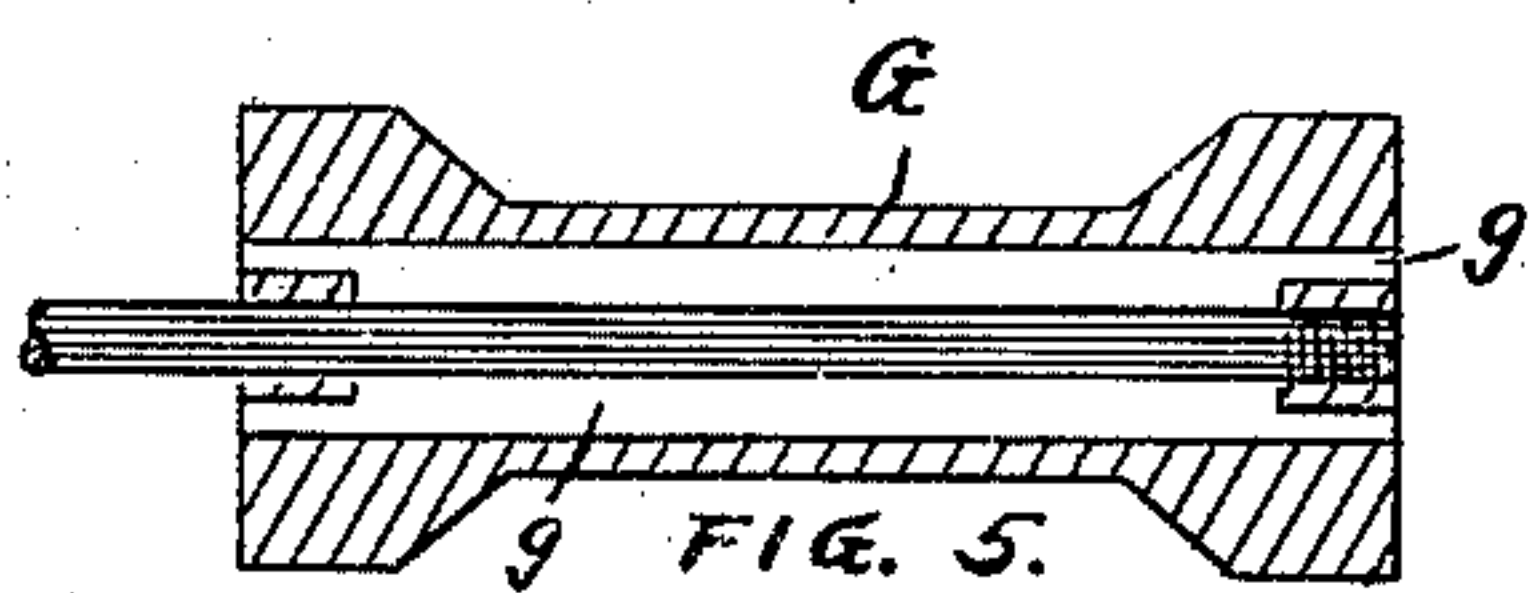
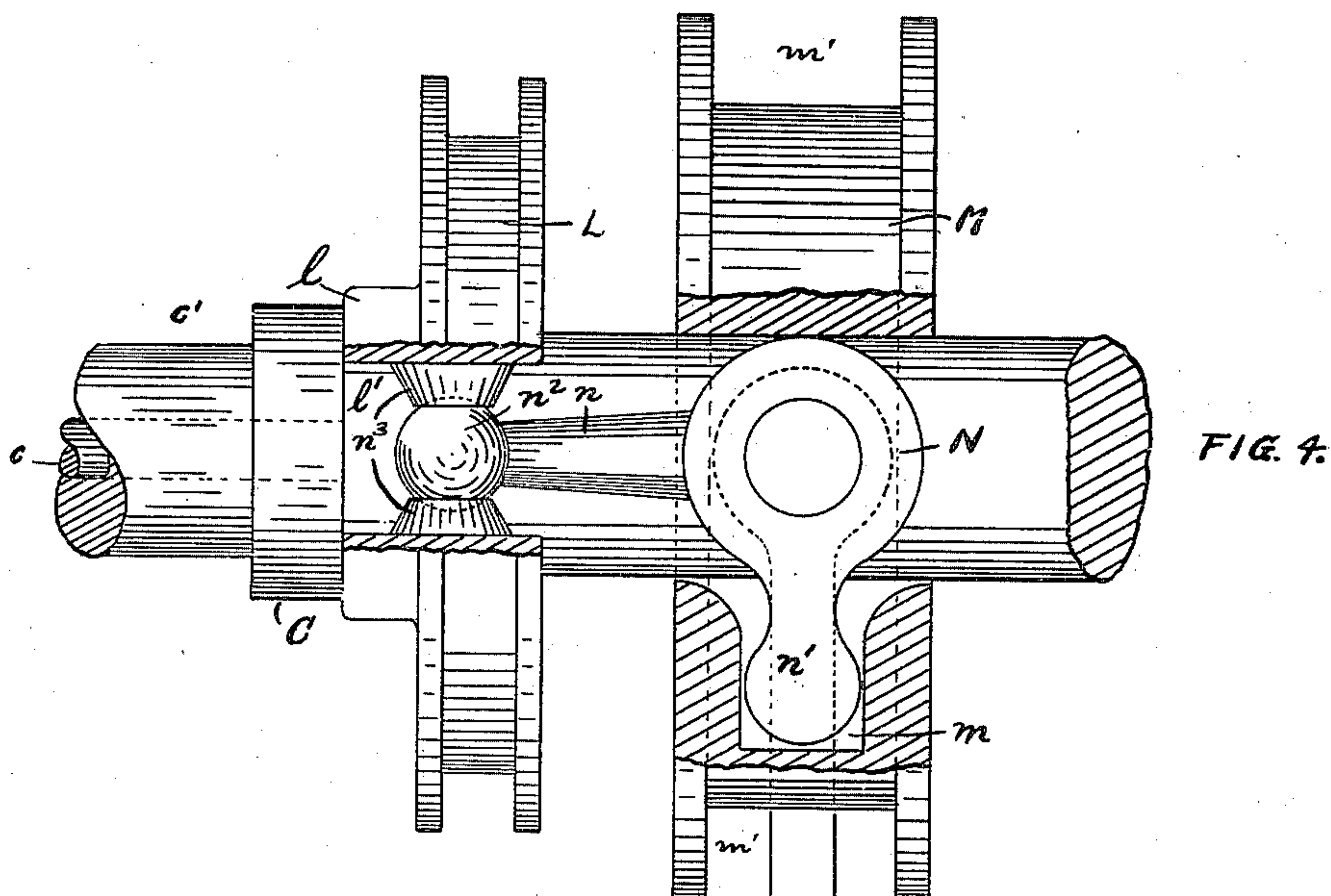
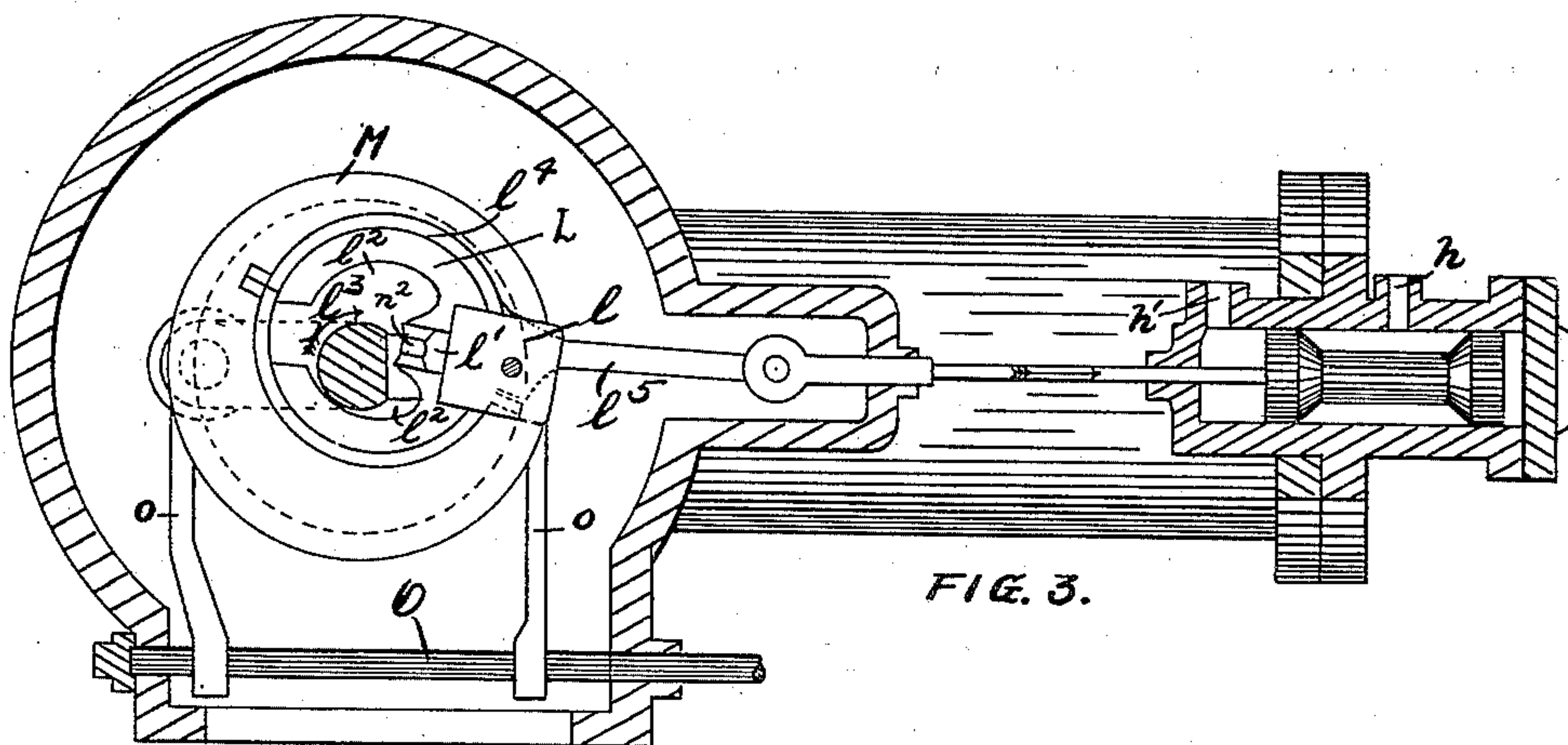
Inventors
Sidney I. Crain
Walter S. Crain
By Attorneys
Parkinson & Richards

S. I. & W. S. CRAIN.
VALVE GEAR.

(Application filed Mar. 2, 1901.)

(No Model.)

2 Sheets—Sheet 2.



Witnesses
Nathan R. Park.
 Carl J. Baer

Inventors
Sidney I. Crain
Walter S. Crain
 By Attorneys
Parkinson & Richards

UNITED STATES PATENT OFFICE.

SIDNEY IRVIN CRAIN AND WALTER S. CRAIN, OF CINCINNATI, OHIO, ASSIGNORS OF ONE-THIRD TO STEWART SHILLITO, OF CINCINNATI, OHIO.

VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 701,300, dated June 3, 1902.

Application filed March 2, 1901. Serial No. 49,628. (No model.)

To all whom it may concern:

Be it known that we, SIDNEY IRVIN CRAIN and WALTER S. CRAIN, citizens of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Valve-Gears, of which the following is a specification.

The object of our invention is to provide an improved valve-gear by means of which an engine may be controlled and reversed while in motion; and our invention consists of the combinations and arrangements of parts hereinafter described and claimed.

In the drawings, Figure 1 is a vertical section of a steam-engine equipped with a valve-gear embodying our invention; Fig. 2, a horizontal section corresponding to Fig. 1; Fig. 3, a vertical section corresponding to Fig. 1, but showing the engine reversed; Fig. 4, an enlarged sectional elevation of the valve-gear; and Figs. 5 and 6 an enlarged section and end view, respectively, of the valve.

Reference-letter A denotes a casing; B, a driven shaft; C C', crank-arms for driving shaft B; D D', piston-rods connected with crank-arms C C'; E E', pistons connected with piston-rods D D'; F F', cylinders in which pistons E E' operate; G, a valve; H, a valve-chamber; J J', ports leading from the valve-chamber to the cylinder; K, a valve-rod; L, a valve-actuating eccentric, and M a collar slidably mounted on shaft B and utilized for shifting eccentric L.

The shaft B, crank-arms C C', piston-rods D D', pistons E E', cylinders F F', valve G, valve-chamber H, ports J J', and valve-rods K K' are the usual working parts of a steam-engine and operate as follows to produce rotations of shaft B: Referring to Figs 1 and 2, steam is admitted to valve-chamber H through opening *h*, where it passes through port J to cylinder F, driving piston E in the direction indicated by the arrow. In the meantime cylinder F' is being exhausted through port J' and opening *h'*. At the proper time in the cycle of operations valve G throws cylinder F' into communication with the live steam and exhausts cylinder F through its central longitudinal opening *g* and opening *h'* in valve-chamber H.

The motion of the valve G is controlled by eccentric L, carried by block *l*, which is pivoted to crank-arm C by pin *c*, which is coaxial with crank-pin *c'*. Shaft B is flattened upon one side and carries a bell-crank lever N, having an arm *n* with a bearing in eccentric L and arm *n'* with a bearing in collar M. On the end of arm *n* is a ball *n²*, partially inclosed by the concave surface of washers *n³*, which ride in the centrally-located slot *l'* in eccentric L. The outer end of arm *n* is rounded, as shown, and engages slot *m* in collar M. At *l²* eccentric L is cut away to permit it to swing on pin *c* to either side of shaft B, and at *l³* it is slotted to permit the passage of shaft B in placing it in or removing it from position. Ring *l⁴* and bent arm *l⁵* serve to connect eccentric L with valve-rod K. Collar M is splined to shaft B—i. e., is free to slide longitudinally thereon while rotating therewith—and is operated by means of fingers *o*, which engage channel *m'* and are carried by shaft O. It will be seen that by means of fingers *o* and collar M eccentric L may be swung to and from and across shaft B and that owing to the fact that it is pivoted in the crank-line its positions on either side of the shaft will be symmetrical with respect to that line, and for corresponding positions on opposite sides of the shaft the motion of the valve will be the same relatively to the horizontal motion of the cranks, and that the valve motion is always controlled by a single determinate moving agent. It will also be observed that the curvature of the arc on which the eccentric swings gives it angularity and that the shorter the arm on which the eccentric swings the greater the angularity. Thus by properly locating the pivotal point the proper angle may be obtained for cut-off lead and lap.

In operation, when it is desired, reverse the direction of rotation of shaft B, as indicated in Fig. 1. The eccentric L is swung on pin *c* to the other side of the shaft by means of fingers *o* on shaft O, as shown in Fig. 3. When it is desired to shorten the stroke of valve G, and consequently reduce the supply of steam to the cylinders, the eccentricity of eccentric L is reduced by swinging it toward shaft B, and when it is desired to completely shut off the supply of steam the eccentric is swung to

a central position, the permanent eccentricity due to the mounting on pin *c* being equal to the lap of the valve.

While we have illustrated our invention as applied to two single-acting cylinders, its application is obviously not limited to that construction.

We claim as our invention—

The combination of a crank-shaft; an eccentric pivoted in the line of the crank, permanently eccentric to the extent of the lap of the valve, to swing across the crank-shaft; a collar splined to the crank-shaft; a flattened surface on the crank-shaft; a bell-crank lever

pivoted to the flattened surface on the crank-shaft; a slot in the eccentric; washers engaging the slot and having concave spherical bearings; a ball on one arm of the bell-crank lever engaging the spherical bearings in the washers; an engagement between the other arm of the bell-crank lever and the collar; and means for moving the collar longitudinally on the shaft, substantially as specified.

SIDNEY IRVIN CRAIN.

WALTER S. CRAIN.

Witnesses:

GEORGE B. PARKINSON,
BRAYTON G. RICHARDS.