

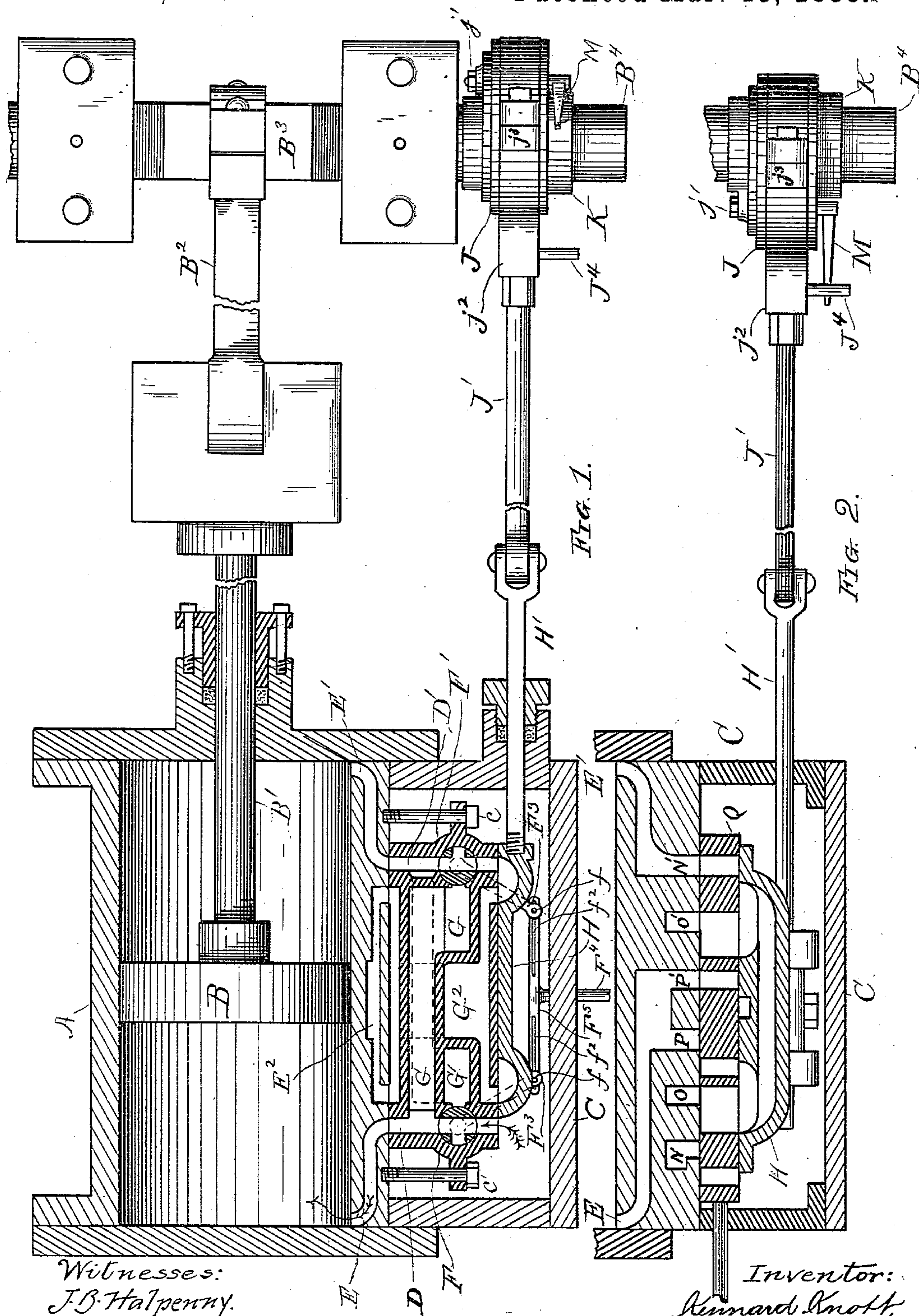
(No Model.)

3 Sheets—Sheet 1.

K. KNOTT.  
VALVE GEAR.

No. 379,400.

Patented Mar. 13, 1888..



Witnesses:  
J. B. Halpenny.  
David Sterling.

Inventor:  
Kennard Knott,  
By Bradley & Fletcher,  
His Attys.

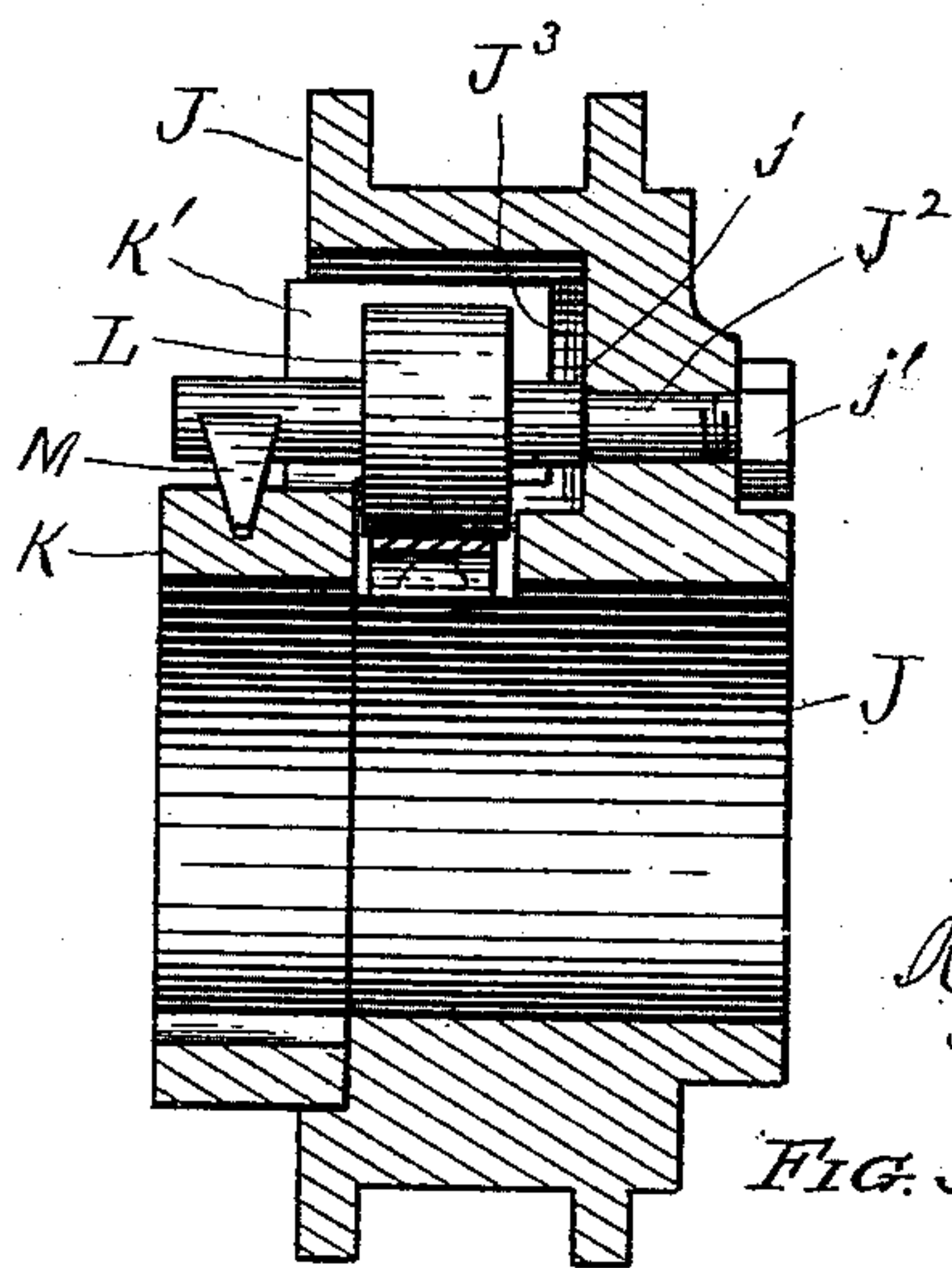
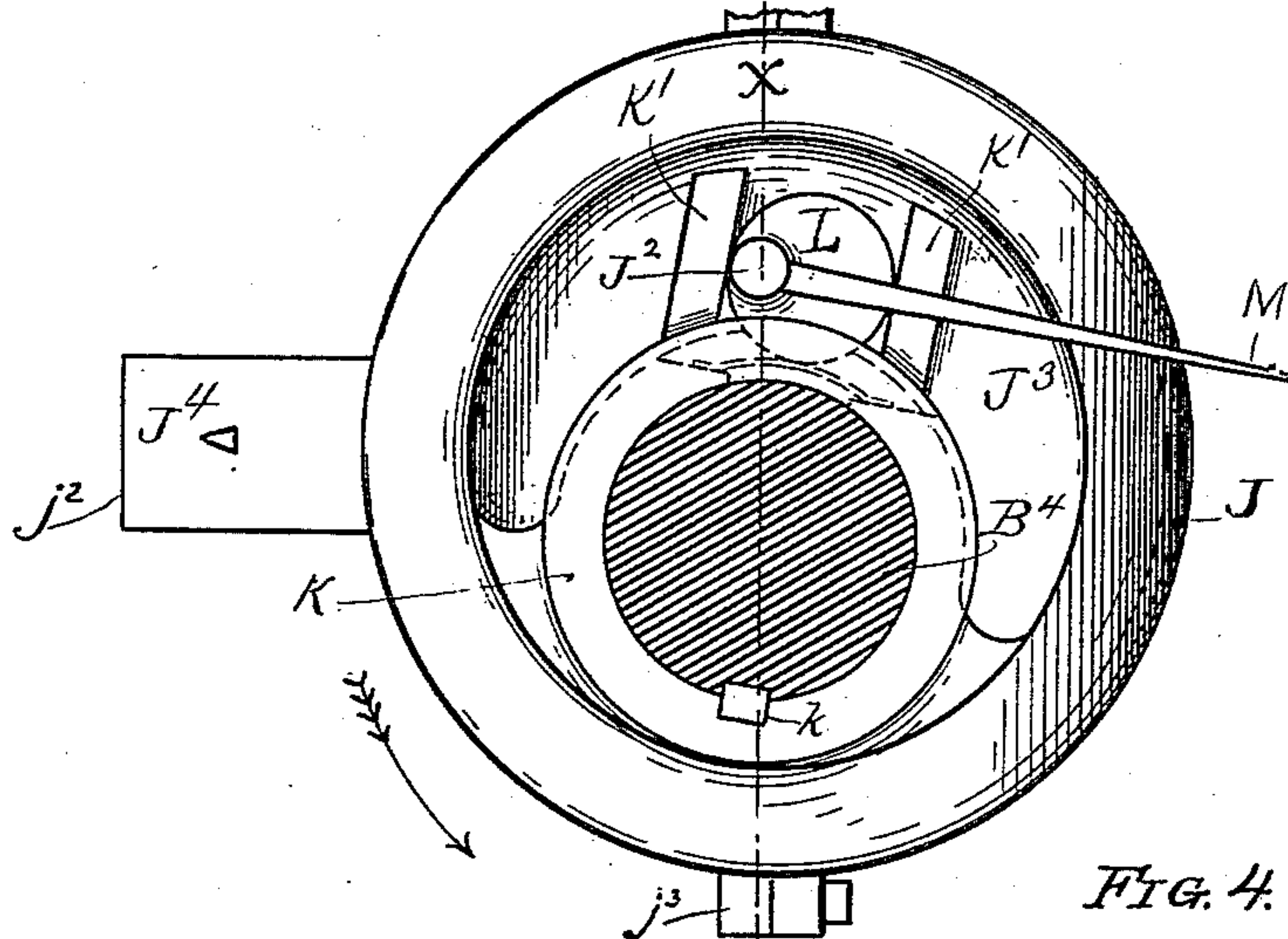
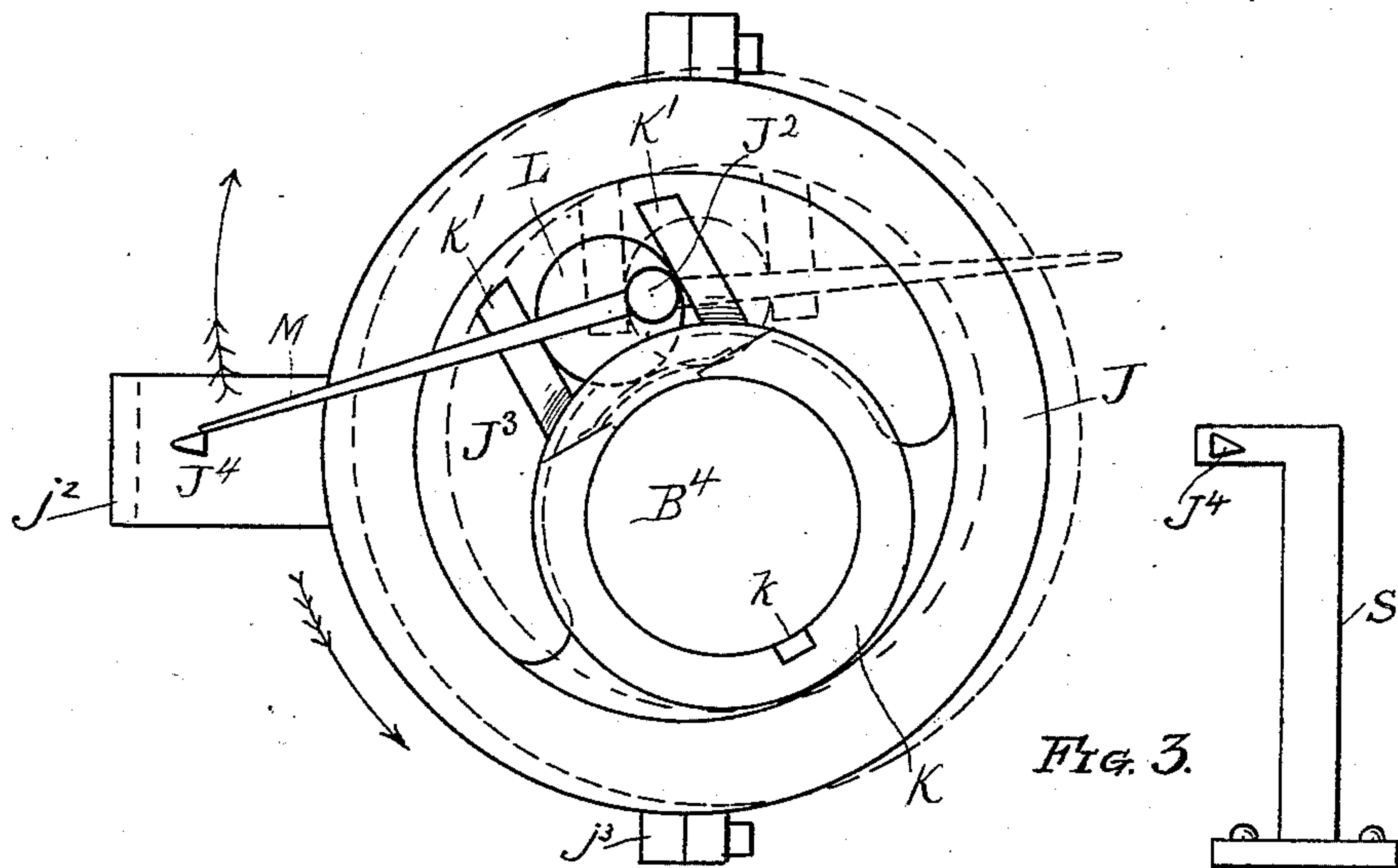
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3 Sheets—Sheet 3.

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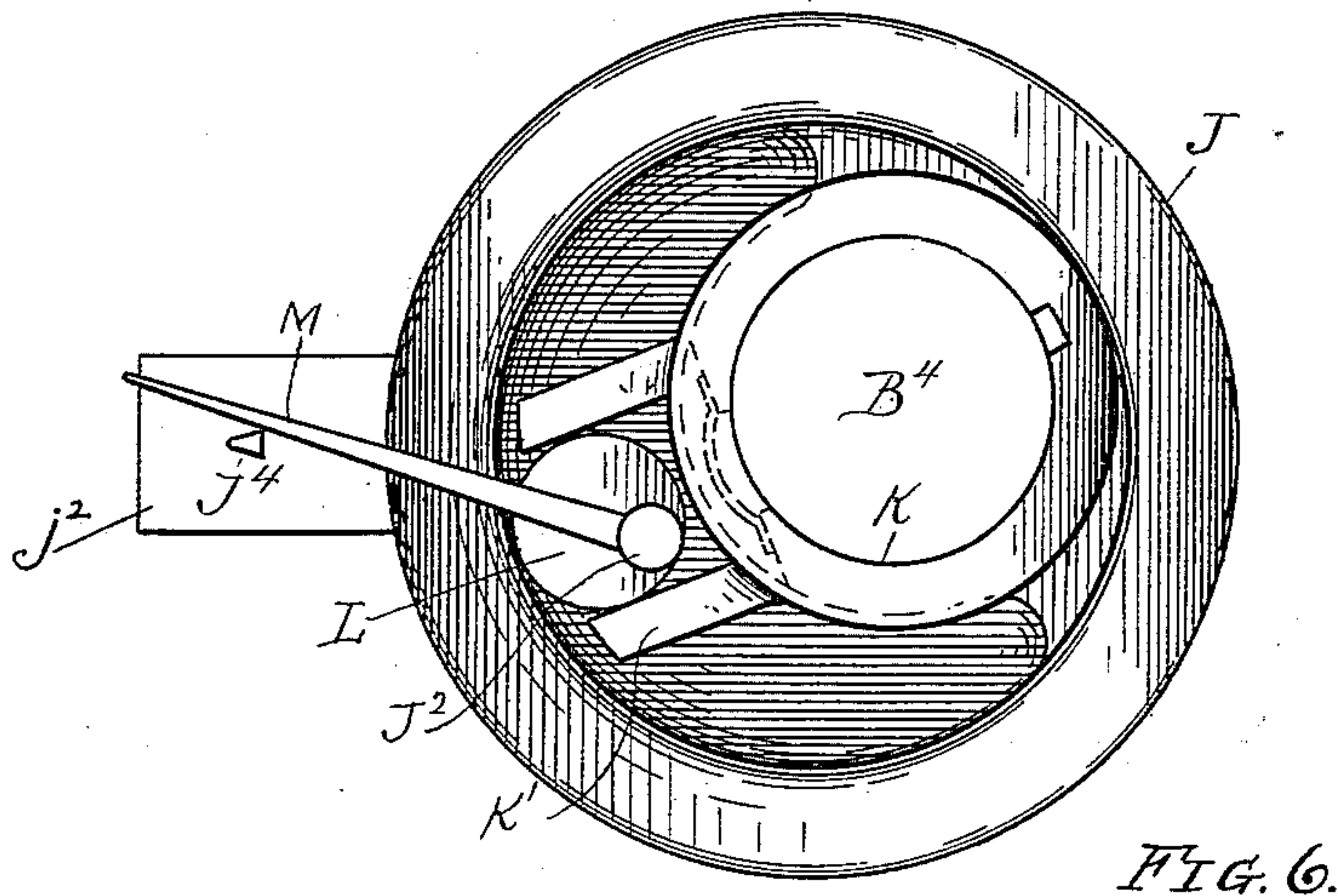


FIG. 6.

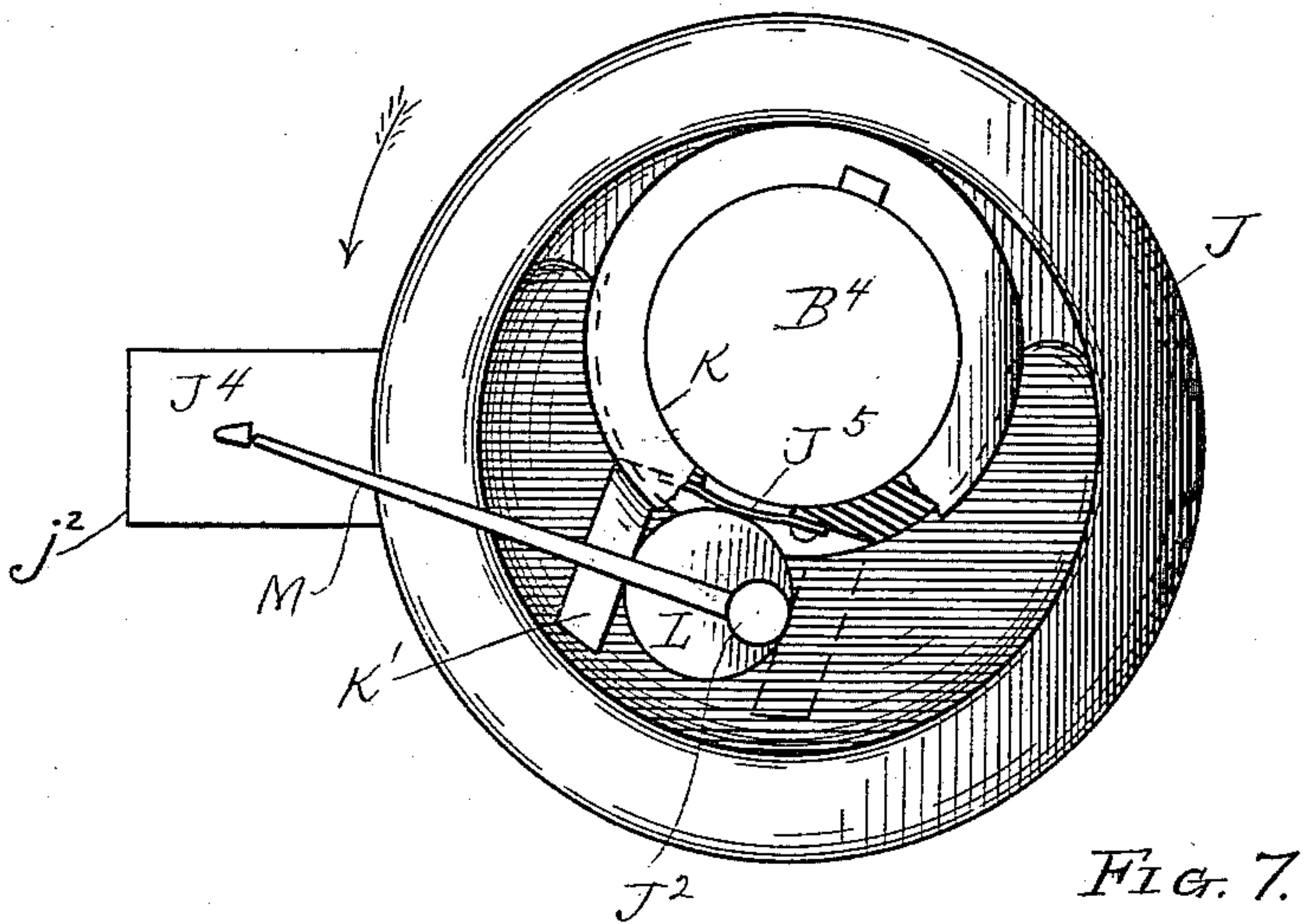


FIG. 7.

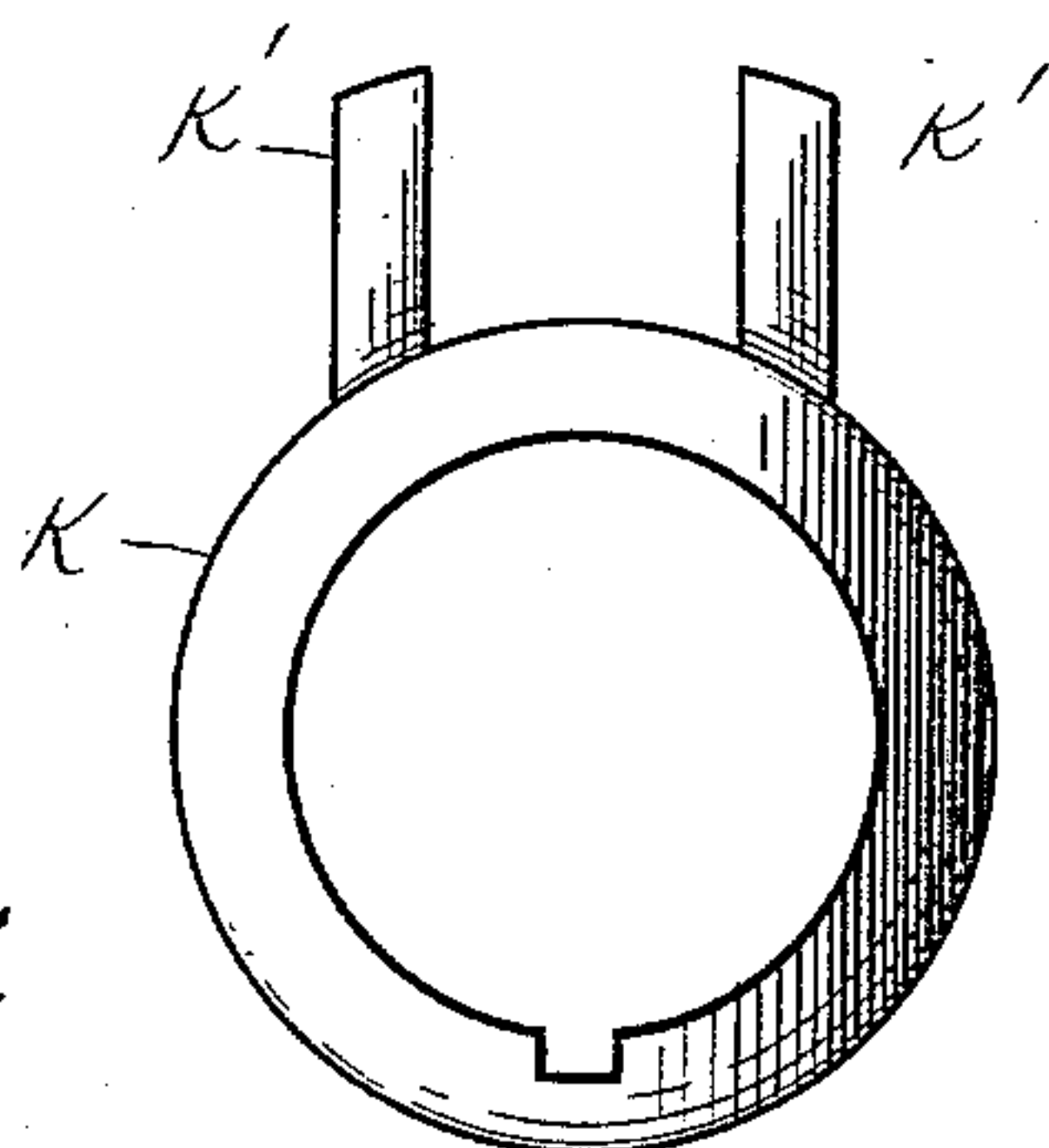


FIG. 8.

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# UNITED STATES PATENT OFFICE.

KENNARD KNOTT, OF CHICAGO, ILLINOIS.

## VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 379,400, dated March 13, 1888.

Application filed May 28, 1887. Serial No. 239,602. (No model.)

*To all whom it may concern:*

Be it known that I, KENNARD KNOTT, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful  
5 Improvements in Steam-Engines, of which the following is a description, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a plan view of a part of a steam-engine having my improvements applied thereto, the cylinder and steam-chest being shown in section. Fig. 2 is a plan view in detail showing the steam-chest in section, with a different valve and reversing mechanism,  
15 while the eccentric is represented in a changed position. Fig. 3 is a side view of the valve-eccentric and the reversing device applied thereto. Fig. 4 is a like view showing the same in a reversed position. Fig. 5 is a sectional view of said eccentric, taken upon the line *x*, Fig. 4. Fig. 6 is a side view of the eccentric, showing the same in the act of being reversed. Fig. 7 is a like side view representing the collar as being partly broken away to  
25 show the means provided to allow the reversing-arm to pass the stud upon the valve-rod and to cause its engagement therewith upon a reversal of the engine, and Fig. 8 is a side view in detail of the collar attached to the  
30 engine-shaft to aid in reversing the eccentric.

Like letters of reference indicate like parts in the different figures.

One object of my invention is to provide a suitable reversing mechanism for reversing  
35 the action of steam-engines, whereby the usual link-motion may be dispensed with, and a single eccentric may be employed to actuate the valve.

A further object is to provide a movable  
40 valve-eccentric applicable to reversing-engines and means for automatically adjusting the same upon the reversal of the engine, so that the valve may occupy the proper relation in lead of the piston, whether the engine be  
45 run in one direction or another, all of which I accomplish substantially in the manner hereinafter more particularly described, and definitely pointed out in the claims.

In the drawings, A, Fig. 1, represents the  
50 usual cylinder of a steam-engine. B is the piston; B', the piston-rod; B<sup>2</sup>, the crank-rod, and B<sup>3</sup> the crank upon the shaft B<sup>4</sup>, journaled in

the usual bearings. C, Figs. 1 and 2, is the steam-chest. In said figures respectively I have shown different ways of reversing the  
55 action of the engine. I will first describe that shown in Fig. 1. Both are equally applicable to my improved eccentric.

Within the steam-chest I secure by means of bolts *c c*, or in any well-known way, a cast-  
60 ing provided with double steam-ports communicating through the ways D D' with the usual steamways, E E', at the respective ends of the cylinder, and an exhaust-way, E<sup>2</sup> G<sup>2</sup>. Located near the beginning of the ways D D'  
65 are two-way cocks, F F', provided with arms F<sup>2</sup> F<sup>3</sup>, each of which is provided with studs or pins *f f*, arranged to engage with slots *f<sup>2</sup> f<sup>2</sup>* upon a plate, F<sup>5</sup>, which is rigidly attached to a rod, F<sup>4</sup>, extending outwardly through the  
70 wall of the steam-chest, whereby said cocks, respectively, may be turned one-quarter of a revolution and in opposite directions.

G is a chamber or steamway communicating at one end with the steamway D and at the  
75 other with the two-way cock F', when the latter is properly adjusted therefor; and G' is a chamber or way separated from the chamber G and passing beyond the same, as indicated in dotted lines, and communicating, respect-  
80 ively, with the cock F and steamway D'.

G<sup>2</sup> is an exhaust-port separated from the others, as shown, and communicating with the usual exhaust-way, E<sup>2</sup>.

H is a slide-valve; H', the valve-rod. J is  
85 the valve-eccentric, and J' the eccentric-rod, which is connected with the usual shoulder, *j<sup>2</sup>*, attached rigidly to the eccentric-strap. The valves or cocks F F' are represented as being so turned as to open the ways D D' throughout  
90 their entire length, and when the valve H is in the position shown in said Fig. 1 the steam enters the port D, as indicated by the arrow, the exhaust-steam escaping through the port D' and exhaust-port G<sup>2</sup>. Upon reversing the cocks F  
95 F' the steam is directed into the chamber G', through which it is carried to the opposite end of the cylinder A, while the exhaust passes through the chambers or ways G G<sup>2</sup>. An opposite movement of the valve H reverses the condi-  
100 tions, closing the entrance to the port D, when the steam is admitted through the ports D', G, and D and exhausted through the ways D', G', and G<sup>2</sup>.



As the engine is operated so as to actuate the shaft in a given direction, it is obvious that the eccentric should occupy such a relation to the shaft as to reciprocate the slide-valve in lead of the piston; but upon reversing the engine it is manifest that the conditions stated would be changed were the eccentric rigid with the shaft, and the valve would be so actuated as to produce a great loss of steam, so much so as to render most engines of this class of little practical value. To overcome this objection I cause the eccentric J to be loosely attached to the shaft, but prevented from longitudinal movement thereon. Upon one side of the eccentric, and keyed rigidly to the shaft by means of a key,  $k$ , is a collar, K, provided with projecting lugs  $K' K'$ . A loose pin,  $J^2$ , is passed through the eccentric J and is secured in place by means of a shoulder,  $j$ , and nut  $j'$ , (better shown in Fig. 5,) by which it is free to revolve in its bearing. Formed upon or rigidly attached to said pin is an eccentric, L, which is loosely fitted between the lugs  $K' K'$ . If preferred, the pin may be rigid and the eccentric L may be attached to a loose sleeve thereon. The valve-eccentric J is preferably formed with a recess,  $J^3$ , as shown in Figs. 3, 4, and 5 therein, for the reception of said eccentric L and lugs  $K' K'$ .

Attached rigidly to the pin  $J^2$  is a pointed arm, M, which is extended from the pin diametrically across the eccentric L, the normal position of which is such as to cause the arm M to lie in a plane at right angles to the face of the lugs  $K'$ , whether its free end point in one direction or its opposite. Fig. 4 shows said eccentric L in its normal position, which it retains so long as the shaft revolves in the direction indicated by the arrow. Upon a reversal of the shaft the eccentric L is likewise reversed, so as to cause the arm M to point in a reverse direction to that shown in said figure, which reversal is accomplished as follows: A pin,  $J^4$ , is rigidly attached, preferably, to the shoulder  $J'$  of the eccentric-rod, which is so adjusted as to engage with the extreme end of the arm M in whichever direction the shaft  $B^1$  is rotated.

Assuming the shaft to be rotated in one direction—as, for example, that indicated in Fig. 7—this contact would either bend or break the arm M unless provision were made for one or the other to yield when brought in contact. To overcome this difficulty I preferably place a spring,  $J^5$ , upon the collar against which the eccentric L bears, said spring being so adjusted as to normally retain the eccentric L upon a dead-center, and at the same time to cause the end of the arm M to touch the pin  $J^4$ . Upon said contact, as the shaft rotates in the direction of the arrow in said figure, the arm M presses the eccentric L against the spring  $J^5$ , which yields sufficiently to permit the end of the arm to pass the pin, when the arm is again slightly thrown out. Upon reversing the engine the arm M engages with said pin, as shown in Fig. 3, and rides out upon it, as in Fig. 6,

which produces a half-revolution of the eccentric L, leaving it in the position shown in Fig. 4. This action shifts the position of the valve-eccentric J, which, as stated, is loose upon the shaft, and retains it in such relation to said shaft as to give the proper "lead" to the valve. The relative positions of the valve-eccentric are indicated by the full and dotted lines in Fig. 3. The eccentric L being normally upon a dead-center in whichever direction the engine-shaft is rotated, it is almost sure to retain the eccentric J in its proper position. Should it change by accident it is obvious that it could only remain so during a part of a revolution, as the arm M would readjust it upon the next revolution.

In lieu of the spring  $J^5$  the arm M may be made to spring or yield sufficiently to permit it to slip by the pin  $J^4$ . The latter, if preferred, may be placed upon one of the lugs  $J^3$  or other part of the eccentric-strap, or upon a post, S, secured rigidly to the floor, as in Fig. 3, and the arm M adjusted accordingly in its relation to the eccentric L. It is obvious that there may be two or more of said pins  $J^4$  in the path traversed by the arm.

In Fig. 2 I have shown a different means for reversing the action of the engine, which consists, briefly, in providing duplicate sets of steam-ports, as  $N N'$  and  $O O'$ , communicating with the respective ends of the cylinder, exhaust-ports  $P P'$ , and a sliding plate, Q, having openings arranged to coincide with one or the other of said sets of ports, together with a double valve, H, arranged to operate in conjunction therewith. The sliding of said plate so as to close one and open the other set of ports serves to reverse the engine. I make no claim herein to said construction, as the same is fully described in my application heretofore filed as Serial No. 213,977, September 20, 1886.

In Fig. 1 the casting in the steam-chest in which is formed the various steamways is shown as applied to an ordinary steam chest and cylinder of the usual pattern, with which it is detachably connected. It would be obvious to one skilled in the art that the same could be somewhat simplified in details of construction if built with the engine.

I do not herein claim the reversing mechanism shown in Fig. 1, except in combination with the adjustable eccentric; but as the same may when properly manipulated be used with good results with a rigid eccentric, I reserve the right herein to make a separate application for a patent therefor.

Having thus described my invention, I claim—

1. A device for automatically adjusting the valve-lead in steam-engines, consisting of a valve-eccentric loosely mounted upon the engine-shaft, a smaller eccentric loosely connected therewith and in turn with a rigid collar upon the crank-shaft, and provided with an arm extending from its axis and adjusted to engage upon its revolution with a rigid stud, whereby said small eccentric may be revolved



and thus shift the valve-eccentric in its relation to the crank-shaft upon the reversal of the engine in either direction, substantially as described.

5 2. The combination, in a steam-engine, of a valve-eccentric loosely mounted upon the shaft, a smaller eccentric in operative connection therewith, and with a rigid collar upon the crank-shaft and an arm extending from its  
10 axis and adjusted to engage with a stud in the orbit of its revolution, whereby said smaller eccentric may be rotated upon the reversal of the engine and normally retained upon its dead-center in whichever direction the engine  
15 is propelled, substantially as described.

3. The combination, in a steam-engine, of a valve-eccentric loosely mounted upon the shaft, a smaller eccentric in operative connection therewith and with a rigid bearing arranged  
20 eccentrically to the crank-shaft, an arm extending from the axis of said smaller shaft and adjusted to engage with a stud in the orbit of its revolution, and means for permitting said arm to yield during such engagement while  
25 the shaft is rotated continuously in one direction and to resume its normal position when said stud is passed, substantially as and for the purposes specified.

4. The combination, with a steam-engine  
30 and mechanism for reversing its movement, of the loose valve-eccentric J, rigid collar K, connected with each other by means of the pin J<sup>2</sup> and eccentric L, and means, as the arm M and stud J<sup>4</sup>, for revolving said eccentric L  
35 upon the reversal of the engine, substantially as and for the purposes described.

5. An automatic lead-adjusting mechanism for reversible steam-engines, consisting of a valve-eccentric loosely mounted upon the en-

gine-shaft, a secondary eccentric adjusted to  
40 rotate between parallel lugs or faces extending laterally from a collar rigidly attached to the shaft and in turn connected by means of a pin with said valve-eccentric, and a finger attached  
45 to said smaller eccentric and adjusted to engage with a stud projecting laterally from the eccentric-strap, said finger being arranged in the plane of the greatest eccentricity of said small eccentric, substantially as and for the  
50 purposes set forth.

6. The combination, with a steam-engine and means for reversing its action, of the loose valve-eccentric J, a collar rigidly mounted upon the shaft and provided with lugs K' K',  
55 an eccentric, L, loosely fitted between said lugs, pin J<sup>2</sup>, connected with said valve-eccentric, stud J<sup>4</sup>, finger M. and means, as the spring J<sup>3</sup>, for permitting said arm to yield upon engagement with the stud J<sup>4</sup> and to thereafter  
60 resume its normal position, in which the dead-center of the eccentric L is in a plane at right angles to the active faces of said lugs, substantially as and for the purposes specified.

7. The combination, with a steam-engine, of a valve-eccentric loosely mounted upon the  
65 engine-shaft, means, substantially as specified, for changing its eccentricity with relation to a given radial line through said shaft, double steamways arranged in the steam-chest, a double slide-valve, and the two-way cocks F  
70 F', with means for rotating the same in opposite directions, substantially as and for the purposes described.

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