No. 701,891. Patented June 10, 1902.

C. W. KELSEY.

INTERNAL COMBUSTION ENGINE.

(Application filed Jan. 29, 1901.)

(No Model.) 3 Sheets—Sheet 1.

FIG. 1.

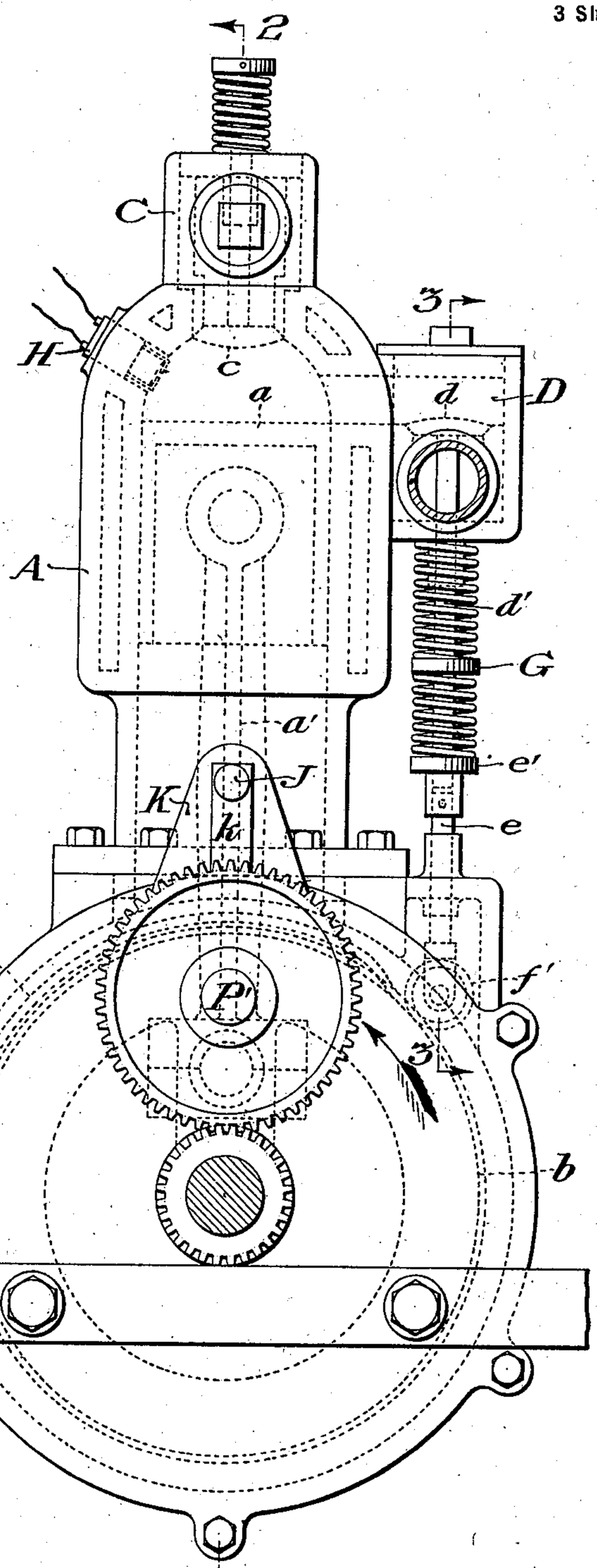

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FIG. 2.

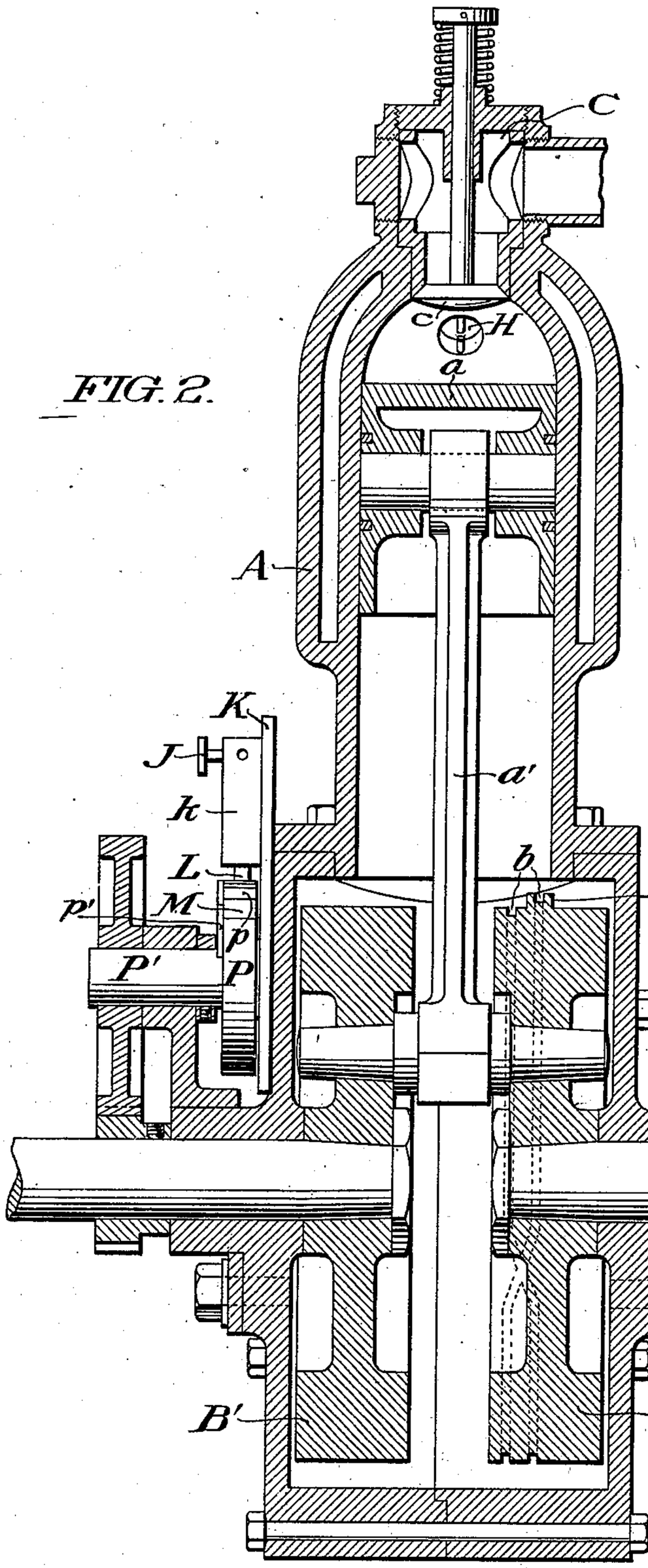

FIG. 3.

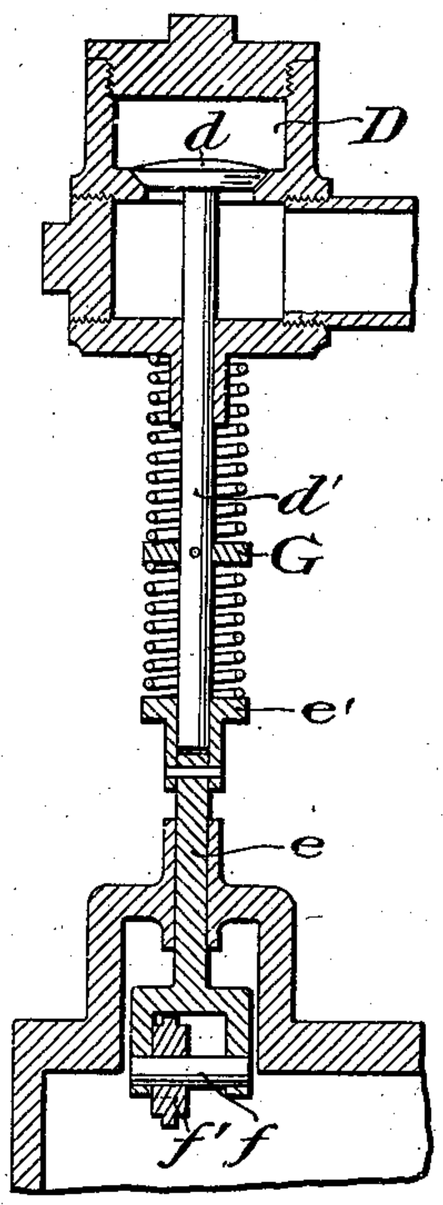

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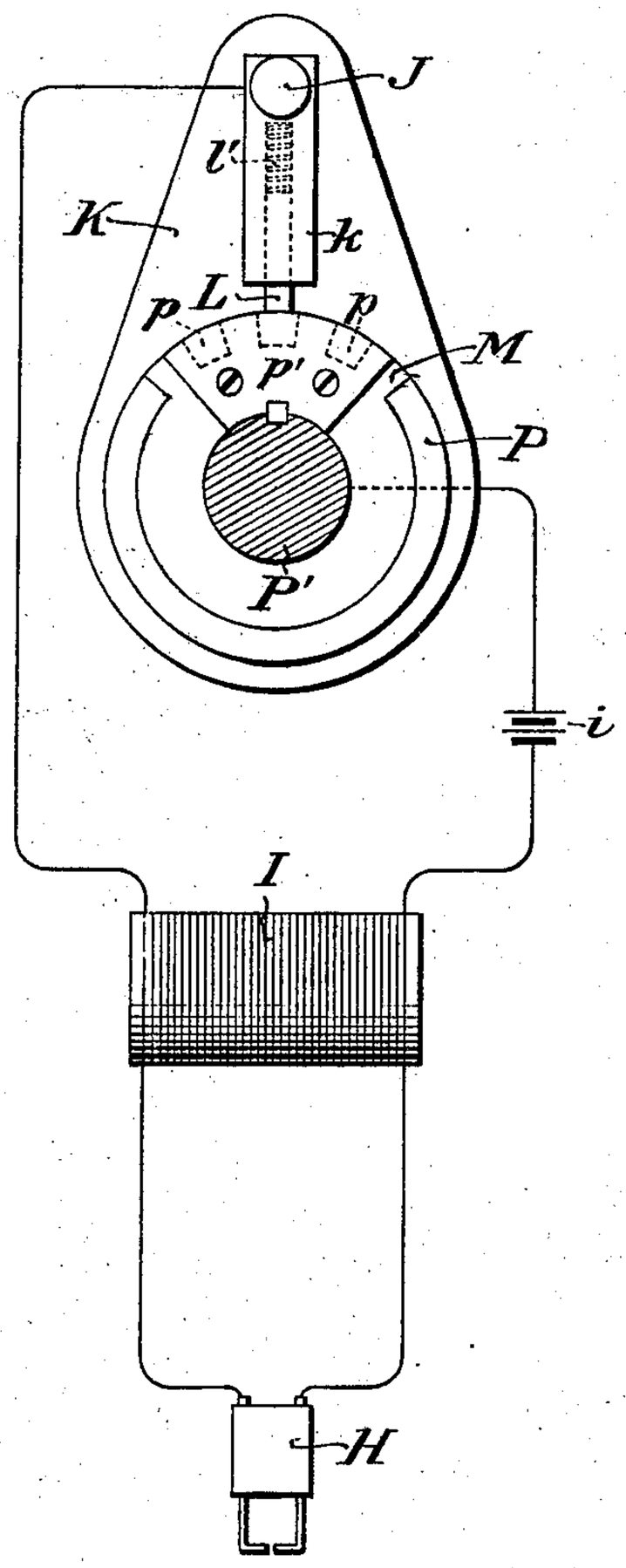
FIG. 4.



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UNITED STATES PATENT OFFICE.

CADWALLADER W. KELSEY, OF PHILADELPHIA, PENNSYLVANIA.

INTERNAL-COMBUSTION ENGINE.

SPECIFICATION forming part of Letters Patent No. 701,891, dated June 10, 1902.

Application filed January 29, 1901. Serial No. 45,192. (No model.)

To all whom it may concern:

Be it known that I, CADWALLADER W. KELSEY, a citizen of the United States, residing at Chestnut Hill, in the city and county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification, reference being had to the accompanying drawings.

My improvements relate more particularly to the mechanism for controlling the exhaust-valve of such engines, and consist in the construction and arrangement of parts hereinafter described and claimed.

In the drawings I have exhibited my improvements as applied to a four-cycle gas or petroleum engine of a compact shape, such as is suitable for use as the motor for a self-propelled vehicle; but it will be understood that my improvements are not thus limited in their application, but may be applied to combustion-engines generally.

Figure 1 is an elevation of an engine embodying my improvements, the internal structure being indicated by dotted lines. Fig. 2 is a vertical central section along the line 2 2, Fig. 1. Fig. 3 is a similar partial section along the line 3 3, Fig. 1. Fig. 4 is a diagrammatic illustration of the devices and connections employed in connection with the sparking device.

In the accompanying drawings, A is the cylinder, the upper portion of which constitutes the explosion-chamber, which does not differ from those commonly employed in engines of this class.

a is the piston reciprocating within the cylinder, and *a'* the piston-rod, the lower extremity of which is pivoted between the two halves of a double fly-wheel B B', appropriately mounted upon a divided main shaft or axle.

C is the inlet-chamber, and *c* the inlet-valve for the gaseous mixture, by the explosion of which the piston *a* is driven.

D is the discharge or exhaust chamber, and *d* the exhaust-valve through which the exploded products of combustion escape. This exhaust-chamber is so situated that the stem *d'* of the valve *d* is in alinement with the periphery of one of the two halves of the fly-wheel, (the half lettered B.)

Upon the periphery of the wheel B a continuous figure-eight groove *b* is cut, as indicated by the dotted lines in Fig. 2. This groove is sunk into the periphery of the wheel at a constant level, except for about a half-circumference, beginning at or near the crossing-point of the groove, which is elevated above the rest, as seen at *b'*.

The valve-stem *d'* is cut off considerably before it reaches the periphery of the wheel B and is extended as a separate bifurcated spindle *e*, which is held in alinement with the stem *d'* by means of the collar or sleeve *e'*, fixed to the former and surrounding the opposing end of the latter. The other and bifurcated end of the spindle *e* carries a pivot *f*, upon which revolves, with capacity for lateral travel, a roller *f'*, the edge of which is fitted with a projecting tongue, which travels within the groove *b* of the wheel B. As the wheel revolves the tongue of the roller *f'* is at all times held within the groove *b*, travel from one to the other of its parallel portions being permitted by the sidewise play of the roller and an angular position sufficient to allow for adjustment at the crossing-point being permitted by the sleeve *e'*, which allows the spindle *e* to rotate. The valve-stem *d'* is held normally in such position as to close its valve *d* by the predominating pressure of the upper of the two coiled cushion-springs which surround the valve-stem with the interposition of the fixed collar G; but during the half-revolution of the wheel B, which brings the elevated portion *b'* of its groove into connection with the roller *f'*, the spindle *e* and with it the valve-stem *d'* are projected upward sufficiently to open the exhaust-valve *d*.

H is a sparking-plug which is inserted into an appropriate aperture in the explosion-chamber, so that its points are presented in opposition within the chamber.

I is an induction-coil the situation of which is dictated by convenience and the secondary of which is placed in circuit with the sparking-points. The primary of this coil, with interposition of a battery *i*, is situated in a circuit which includes the axle of the machine (or any other convenient part of the metal work) and a binding-post J.

K is a plate of insulating material, such as fiber, affixed to the side of the machine, hav-

ing fastened upon it a metal plate *k*, upon which the binding-post J is fixed and within which is mounted a rod or brush L, projected by a spring *l'*. Immediately below the projecting end of this rod L is a revolving disk M, of insulating material, which has inserted in a limited segment of its periphery a series of metal blocks *p p*. These metal blocks, separated by short intervals from each other, are placed in electrical connection with the shaft P', which carries the disk, by a metal sector *p'*, secured to one side of the disk. The shaft P' is geared to the main shaft by appropriate gearing, in this case the ratio of the gearing being two to one. To prevent wear, the part of the periphery of the disk M not included in the limited segment spoken of may be covered with a metal sheet P, which is not in contact with sector *p'*.

The operation of my device is as follows: The engine is geared as a four-cycle engine and in the position of the drawings is ready for an explosion to take place, which is occasioned by the sparking effected by the successive breaking of the electric circuit as the metal blocks *p* on the edge of the disk M ride under the rod L. The expansion of the exploded gases drives the piston forward to the extremity of its stroke, upon reaching which the elevated portion of the groove on the periphery of the wheel B is brought into contact with the roller *f'*, whereby during the succeeding half-revolution or return stroke the exhaust-valve *d'* is opened, allowing the exploded products to escape, the valve closing at the extremity of the return stroke. The momentum of the fly-wheels B B' again carries the piston forward, during which half-stroke the exhaustion within the explosion-chamber causes the inlet-valve *c* to open and allow the gaseous mixture for the next explosion to enter the chamber. During the next return stroke, the valve *d* remaining closed, the gases are properly compressed, and upon the completion of this stroke the gearing which has been referred to again brings the metal blocks *p p* of the disk M in position to rapidly make and break the electric circuit and to effect through the spark thereby produced the next explosion, and so on. In this arrangement it will be observed that there is a great economy of parts in causing the main fly-wheel to directly control the exhaust-valve by the mechanism which I have shown, with the further advantage of a proportionally large or extended cam-groove by which the exhaust-valve is actuated. Hitherto this valve has ordinarily been actuated by a comparatively restricted cam-surface, in which case a very slight wear or disarrangement of the parts brings about important differences in the relation which the moment of opening or closing of the valve bears to the position of the other parts. It is of the greatest importance if the engine is to maintain a maximum efficiency that the opening and closure of this valve should occur with absolute and unvarying accuracy. By utilizing the periphery of the comparatively large fly-wheel for this purpose I have attained this end without the necessity of adding any additional part to the engine, while, on the contrary, I have thus effected a simplification of the mechanism by removing a part which has hitherto been present in engines of this character—to wit, a separate cam, wheel, or tappet for controlling this valve.

Having thus described my invention, I claim—

In an internal-combustion engine, the combination with the cylinder and its inlet-valve, the enlarged chamber at the base of the cylinder, the piston in said cylinder and a fly-wheel in said chamber, connected to the piston for operation thereby and provided on its periphery with a cam-groove, of an exhaust-valve chamber on the cylinder and overhanging the fly-wheel chamber, an exhaust-valve in said valve-chamber and provided with a depending valve-stem having a collar between its ends and springs at opposite sides of said collar, a vertical spindle extending through a gland or bearing in the fly-wheel chamber to slide and turn therein and provided at its upper end with a collar or sleeve engaged by the lower end of the valve-stem and also forming a bearing for the lower spring thereon, a transverse pivot or shaft on the lower end of said spring and a laterally-movable roller mounted thereon in engagement with said cam-groove; substantially as described.

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