No. 657,760. Patented Sept. 11, 1900.

I. H. DAVIS.

ELECTRIC IGNITER FOR EXPLOSIVE ENGINES.

(Application filed Nov. 18, 1899.)

(No Model.) 3 Sheets—Sheet 1.

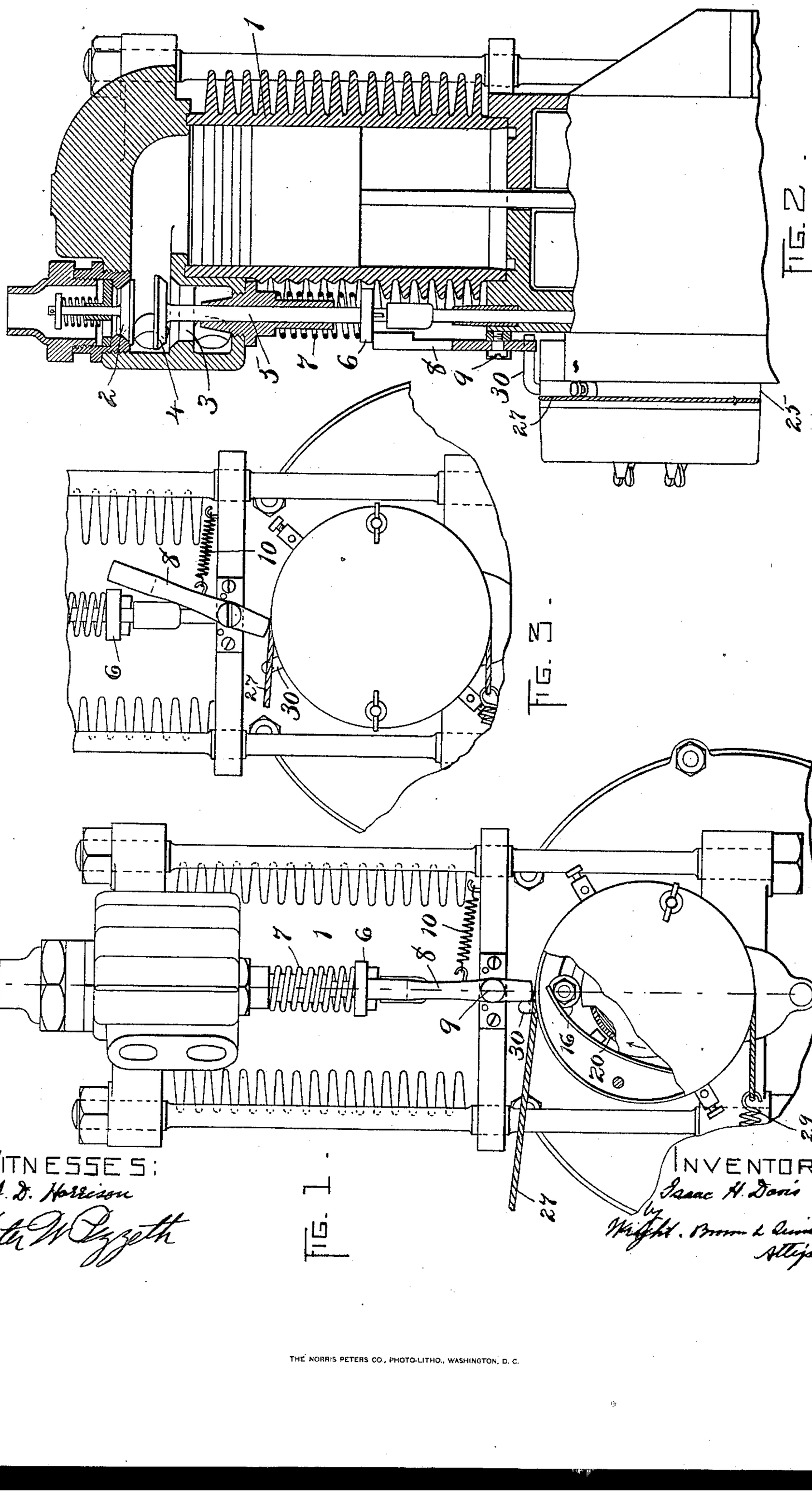

FIG. 2

FIG. 1

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FIG. 4

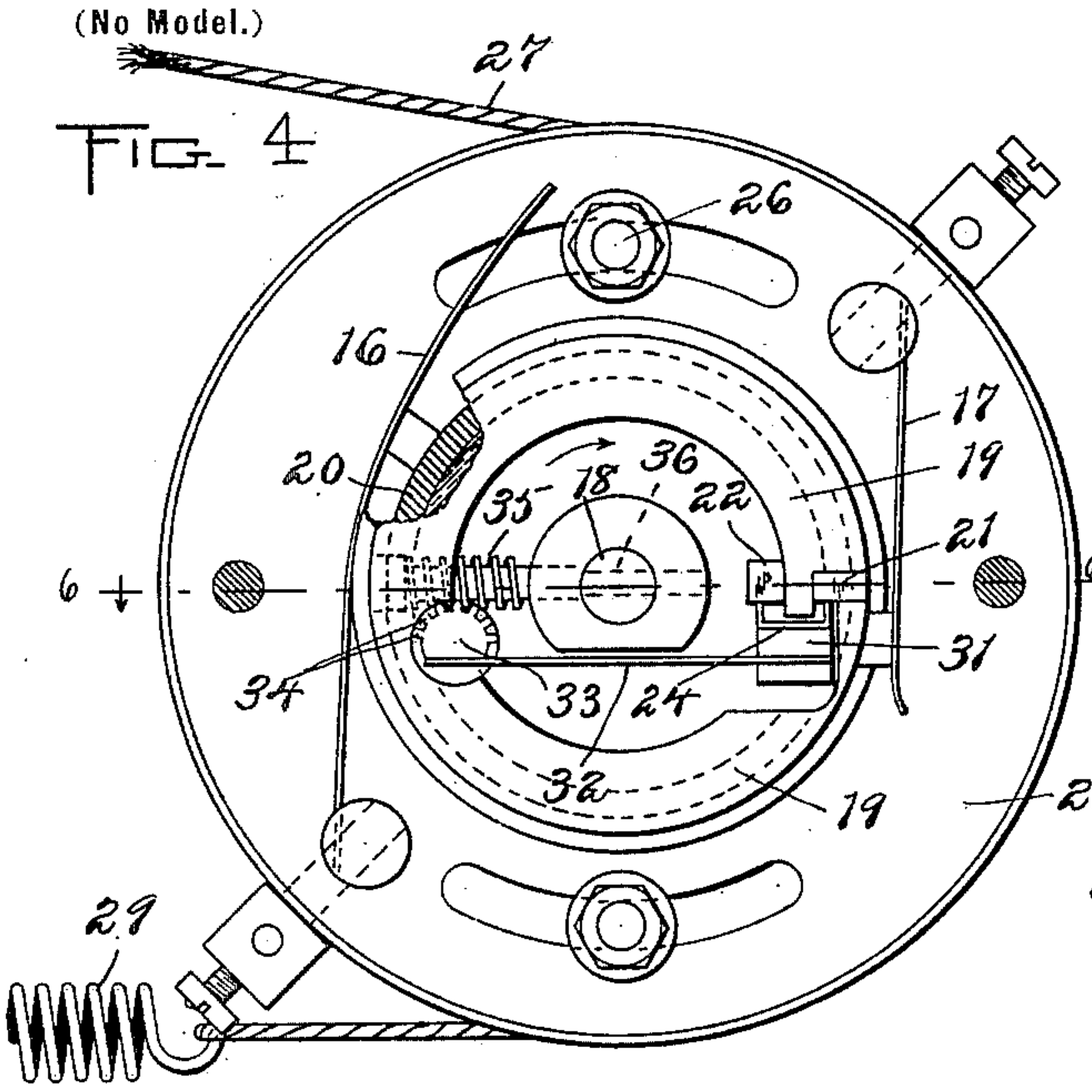


FIG. 7

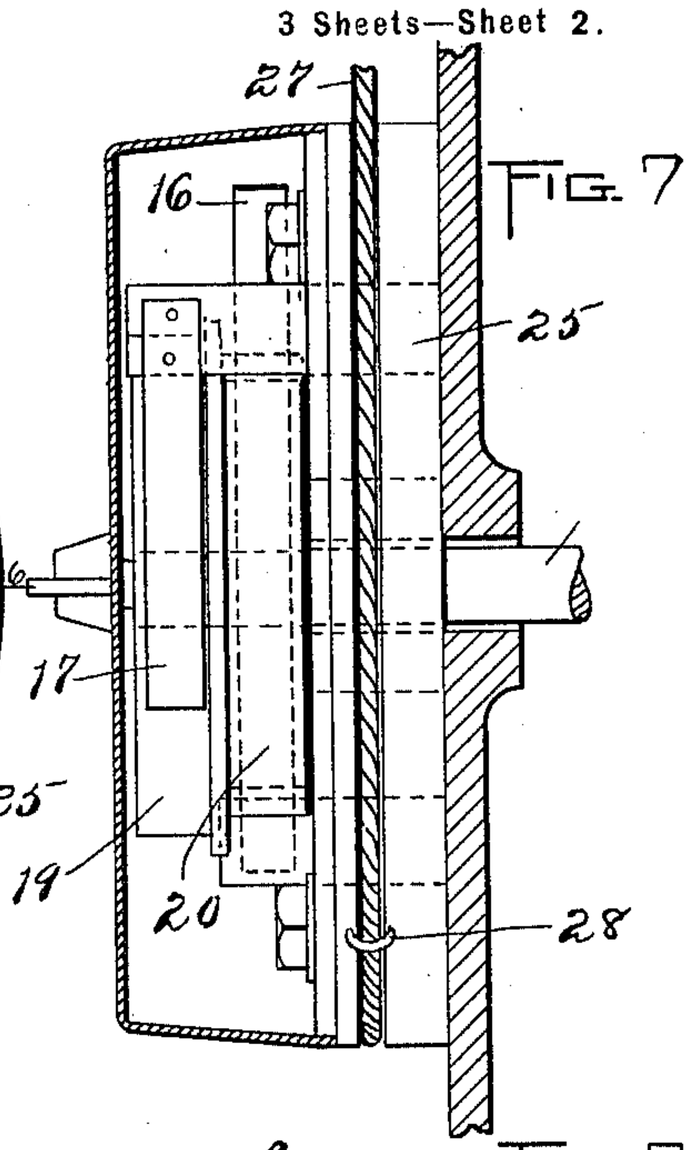


FIG. 6.

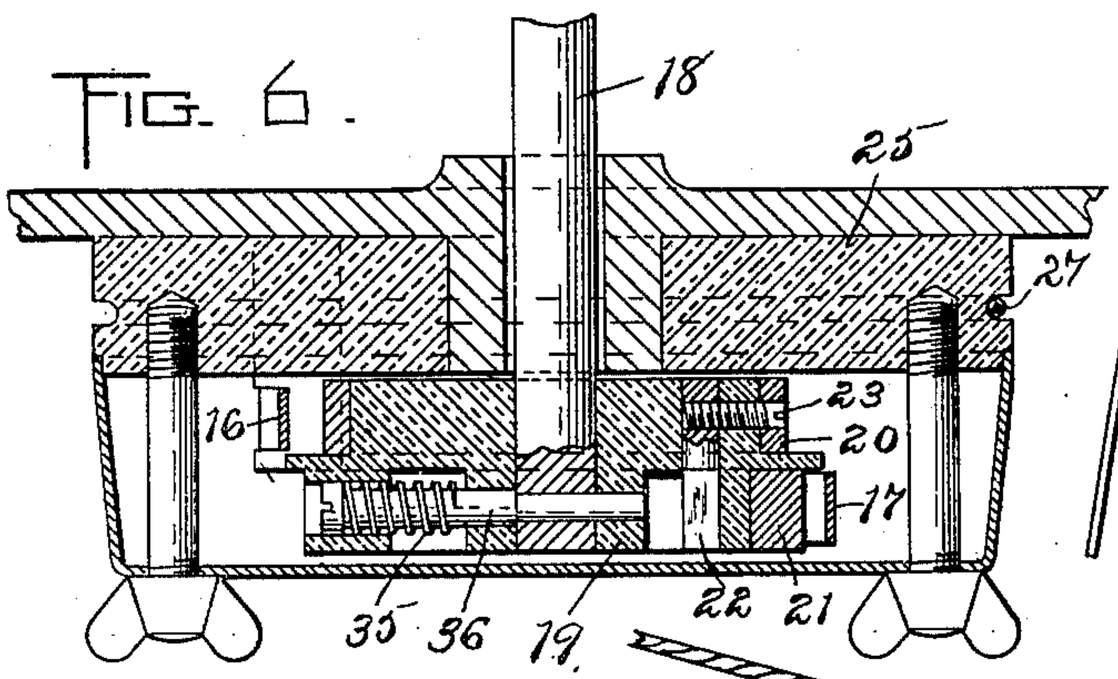


FIG. 8

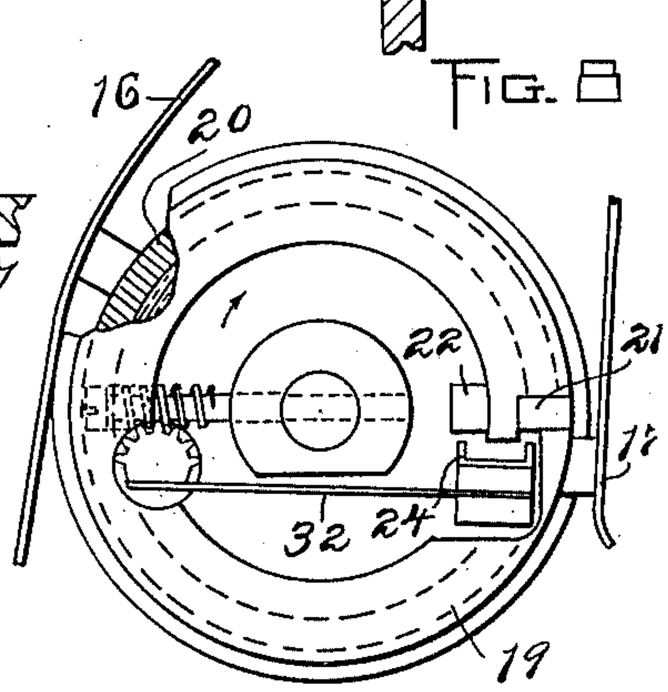
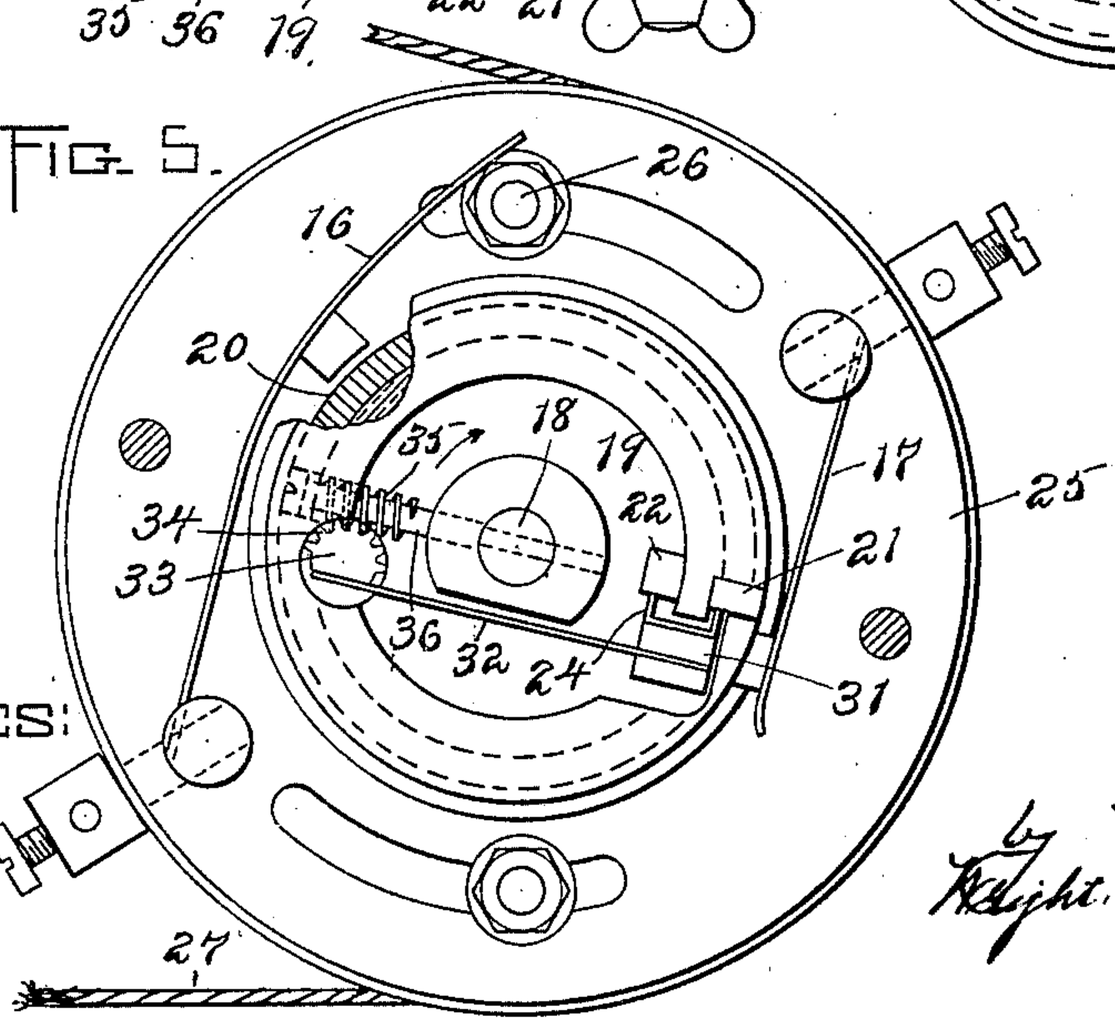


FIG. 5.



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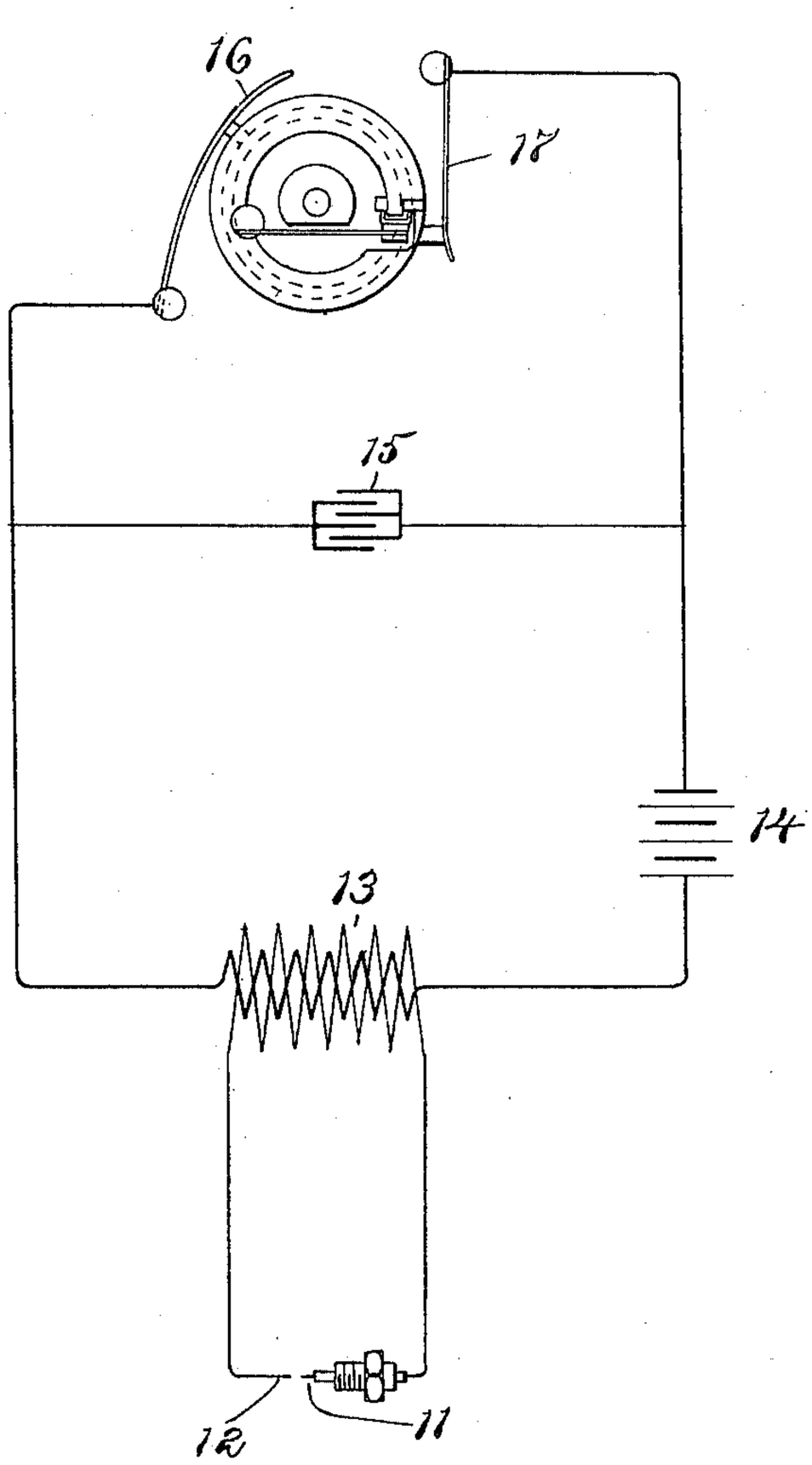

FIG. 9.

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UNITED STATES PATENT OFFICE.

ISAAC H. DAVIS, OF BOSTON, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO E. D. MELLEN, OF CAMBRIDGE, MASSACHUSETTS.

ELECTRIC IGNITER FOR EXPLOSIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 657,760, dated September 11, 1900.

Application filed November 18, 1899. Serial No. 737,408. (No model.)

To all whom it may concern:

Be it known that I, ISAAC H. DAVIS, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Explosive-Engines, of which the following is a specification.

This invention relates to explosive-engines; and it consists in certain improvements therein which I shall now proceed to describe and claim.

Of the accompanying drawings, Figure 1 represents a side elevation of a portion of an engine embodying my improvements. Fig. 2 represents a sectional view thereof on the line 2 2 of Fig. 1. Fig. 3 represents a partial side elevation showing certain parts in a different position from Fig. 1. Fig. 4 represents an enlarged side elevation, with parts broken away, of the igniting-circuit breaker and related parts. Fig. 5 represents a similar view, showing parts in a different position. Fig. 6 represents a section on the line 6 6 of Fig. 4. Fig. 7 represents a plan view of said device with the casing in section. Fig. 8 represents a front elevation of the governor in action. Fig. 9 represents a diagrammatic view of the igniting-circuit.

The same reference characters indicate the same parts in all the figures.

Referring to the drawings, 1 is the engine-cylinder, 2 is the check-valve admitting fuel thereto, and 3 is the main exhaust-opening, controlled by the exhaust-valve 4, which is regularly operated by suitable cams (not shown) connected with the crank-shaft of the engine, so as to exhaust the exploded contents of the cylinder. The stem 5 of exhaust-valve 4 is provided with a collar 6, upon which a spring 7 exerts longitudinal tension tending to close the valve.

8 is a dog pivoted at 9 to the frame of the engine and adapted to be swung into the path of the collar 6, so as to hold the exhaust-valve 4 open, as shown in Figs. 1 and 2. A spring 10 normally holds the dog 8 in an inactive position, as illustrated in Fig. 3, said dog being moved into an active position during the cessation of the sparking action, as hereinafter explained.

Referring to Fig. 9, 11 12 represent the ignition-points inside of engine-cylinder, between which the sparks which ignite the explosive mixture in the cylinder are produced. Said ignition-points are included in the secondary circuit of an induction-coil 13, whose primary circuit includes a battery 14 or other suitable source of electrical energy. 15 is a condenser connected in shunt relation with the primary circuit, and 16 17 are current-carrying contacts or brushes included in said circuit. 18 is a shaft revolved by the engine mechanism a predetermined number of times for one revolution of the engine crank-shaft, the shaft 18 being revolved once for every two revolutions of the crank-shaft in a four-cycle engine. 19 is a disk or wheel of insulating material secured to the shaft 18 and having a conductive ring 20, with which the brush 16 is normally in continuous contact. 21 is an isolated section of conductive material embedded in the periphery of the disk 19 and adapted to make contact with the brush 17 once in each revolution of said disk. 22 is a block of conductive material electrically connected with the conductive ring 20 through a screw 23. The blocks 21 and 22 are normally connected electrically by means of a U-shaped conductive piece 24, forming part of a speed-governor, hereinafter described, the construction and operation being such that the primary circuit is made and broken between the brush 17 and the contact 21 once for every revolution of the shaft 18, and a spark is thereby produced between the igniting-points 11 and 12. The brushes 16 17 are mounted upon a normally-stationary but adjustable disk 25, of insulating material, which is adapted to have a rotary movement concentrically with the shaft 18. Assuming the rotation of the shaft 18 to be clockwise in the direction of the arrow, it is evident that a movement of the brush-carrying disk 25 in the direction of rotation of said shaft will time the explosion later in the receding stroke of the engine-piston, while a contrary movement will time the explosion earlier in said stroke. The speed of the engine is thereby varied, for the explosion has less and less effect in rotating the crank-shaft as it occurs nearer to the end of the receding stroke of the piston. As the disk 25 approaches the limit of its clockwise movement the igniting-

circuit may be broken entirely by causing an extension of the brush 16 to abut against a fixed cam-stud 26, as illustrated in Fig. 5, whereby the contact part of the brush is lifted away from the conductive ring 20. An effective starting and stopping switch is thereby provided, and it is to be noted that this switch is always opened or closed at a point where the explosion is less effective. By the use of this device there is therefore no danger of accident by reason of the engine starting at its full power while it may be running at a slow speed and connected to the mechanism which it drives.

To rotate the brush-carrying disk 25, I have illustrated a device comprising a flexible cord 27, preferably attached to the periphery of the disk by a suitable device, such as the staple 28, Fig. 7, and having one end connected to a spring 29 and the other end passing to a suitable point within the reach of the operator or attendant. The end of the spring is attached to a suitable fixed support, and the spring exerts a tension which constantly tends to rotate the disk 25 in a switch-opening direction. The operator's end of the cord 27 may be caught upon a hook or otherwise suitably secured and adapted to be released when the brush-disk is to be operated.

30 is a projection upon the disk 25 adapted to engage the heel of the dog 8 at the limit of the switch-opening movement of said disk and to move said dog against the tension of its spring 10 from the position illustrated in Fig. 3 to that illustrated in Figs. 1 and 2, whereby the exhaust-valve 4 when opened by the mechanism of the engine is held open against the tension of its spring 7. The described arrangement for operating the exhaust-valve enables me to dispense with the relief-valve ordinarily employed in explosive-engines and opened when the engine is started up, so as to relieve the compression in the cylinder.

Should the valve controlling the fuel-supply be left open while the engine is running and the ignition is suspended, the fuel will not be wasted by the opening of the check-valve 2 during the receding stroke of the piston, which occurs when only the usual small relief-valve opening is provided. Said suction is disposed of through the large exhaust-opening.

The governor is constituted as follows: The U-shaped metal part 24, which normally connects the metal blocks 21 and 22, is mounted upon the face of an insulating-block 31, which is attached to the end of a spring-arm 32, carried by a pivot-stud 33. The latter is journaled in the face of the disk 19, eccentric to the shaft 18, and is formed with gear-teeth 34, engaged by a screw-thread 35, formed on a pin 36. Said pin screws into a radial socket in the disk 19, and is also passed through a transverse hole in the end of the shaft 18, so as to afford a means for attaching the disk 19 to the shaft 18. It will be observed that when the pin 36 is screwed up to give the desired tension to the spring 32 said tension will be exerted through the pinion-stud 33 in a direction to hold the pin 36 inward to its seat. Centrifugal force being exerted radially on the free ends of the spring-arm 32, carrying the U-shaped piece 24, will have a component which tends to rotate the end of the arm about the stud 33 as a center, and when a certain speed, determined by the tension of the spring-arm 32, has been attained the U-shaped piece 24 will be thrown away from the contact-blocks 21 22, as shown in Fig. 8, and the igniting-circuit will accordingly be broken and the explosion in the cylinder will cease until the speed has been reduced. The circuit being broken simultaneously at two points between the ends of the U-shaped piece 24 and the contact-blocks 21 and 22 no spark or a very inconsiderable spark will be produced by the break.

I claim—

1. In an electric igniter for explosive-engines, the combination of an engine-revolved contact and a coöperating stationary contact, means to effect a relative concentric adjustment of said contacts to vary the occurrence of ignition with respect to the power-stroke of the engine, and means operated by the adjusting movement for throwing the contacts into and out of coacting relation.

2. In an explosive-engine, the combination of an igniting device, adjusting means associated therewith and adapted to vary the point in the engine-cycle at which ignition occurs, an outlet from the engine-cylinder, a valve controlling said outlet, and a device operated by movement of said adjusting means, for controlling said valve.

3. In an igniter for explosive-engines, a circuit-breaker comprising an engine-revolved contact or circuit-terminal, a current-carrying brush coöperating therewith, a normally-stationary support carrying said brush and adjustable concentrically with the engine-revolved contact, and a fixed cam-abutment arranged to engage said brush after a predetermined adjusting movement of said support in the direction of revolution of the contact, and to thereby move the brush out of coacting relation with the contact.

4. In an apparatus of the character specified, the combination with the engine, of a circuit-breaker comprising an engine-revolved part and a normally-stationary adjustable part, an outlet from the engine-cylinder, a valve controlling said outlet, and mechanism operated by movement of said adjustable part for holding said valve open.

5. In an apparatus of the character specified, the combination with the main exhaust-valve of the engine, of a device for holding said valve open, a circuit-breaker comprising an engine-revolved part and a normally-stationary adjustable part, and a member con-

nected with said adjustable part and adapted to engage said device and place it in operative position during movement of said adjustable part.

6. In an apparatus of the character specified, the combination with the main exhaust-valve of the engine and the spring holding said valve to its seat, of a dog adapted to hold the valve open when opened by other means, a circuit-breaker comprising an engine-revolved part and a normally-stationary adjustable part, and a member connected with said adjustable part and adapted to engage said dog and place it in operative position during movement of said adjustable part.

7. In an apparatus of the character specified, an engine-revolved support, a contact fixed thereto and forming a part of the igniting-circuit, an arm constructed as a spring and having a contact forming a part of the igniting-circuit, said contacts being separable by centrifugal force to break the circuit, a stud supporting said spring-arm and having gear-teeth, and a rotatable screw engaging said teeth and adapted to adjust the tension of the spring-arm.

8. In an apparatus of the character specified, an engine-rotated shaft, a support mounted thereon, contacts mounted on said support and forming part of an igniting-circuit, said contacts being separable by centrifugal force to break the circuit, a spring to hold the contacts together, and a pin rotatable to adjust the tension of said spring and also serving as a key to lock the support to the shaft, the key being held to its seat by the tension of the spring.

9. In an apparatus of the character specified, an engine-rotated shaft, a support mounted thereon, a speed-governor mounted on said support and including a spring, and a member movable to adjust the tension of said spring and acting as a key to secure the support to the shaft, which key is held to its seat by the tension of the spring.

10. In an apparatus of the character specified, an igniting-circuit breaker including an engine-revolved support having a conductive ring and an isolated segmental contact, and a spring-resisted connector mounted on said support and adapted to connect said ring and said contact and to be separated from the two simultaneously by centrifugal force to break the igniting-circuit.

In testimony whereof I have affixed my signature in presence of two witnesses.

ISAAC H. DAVIS.

Witnesses:
R. M. PIERSON,
M. B. MAN.