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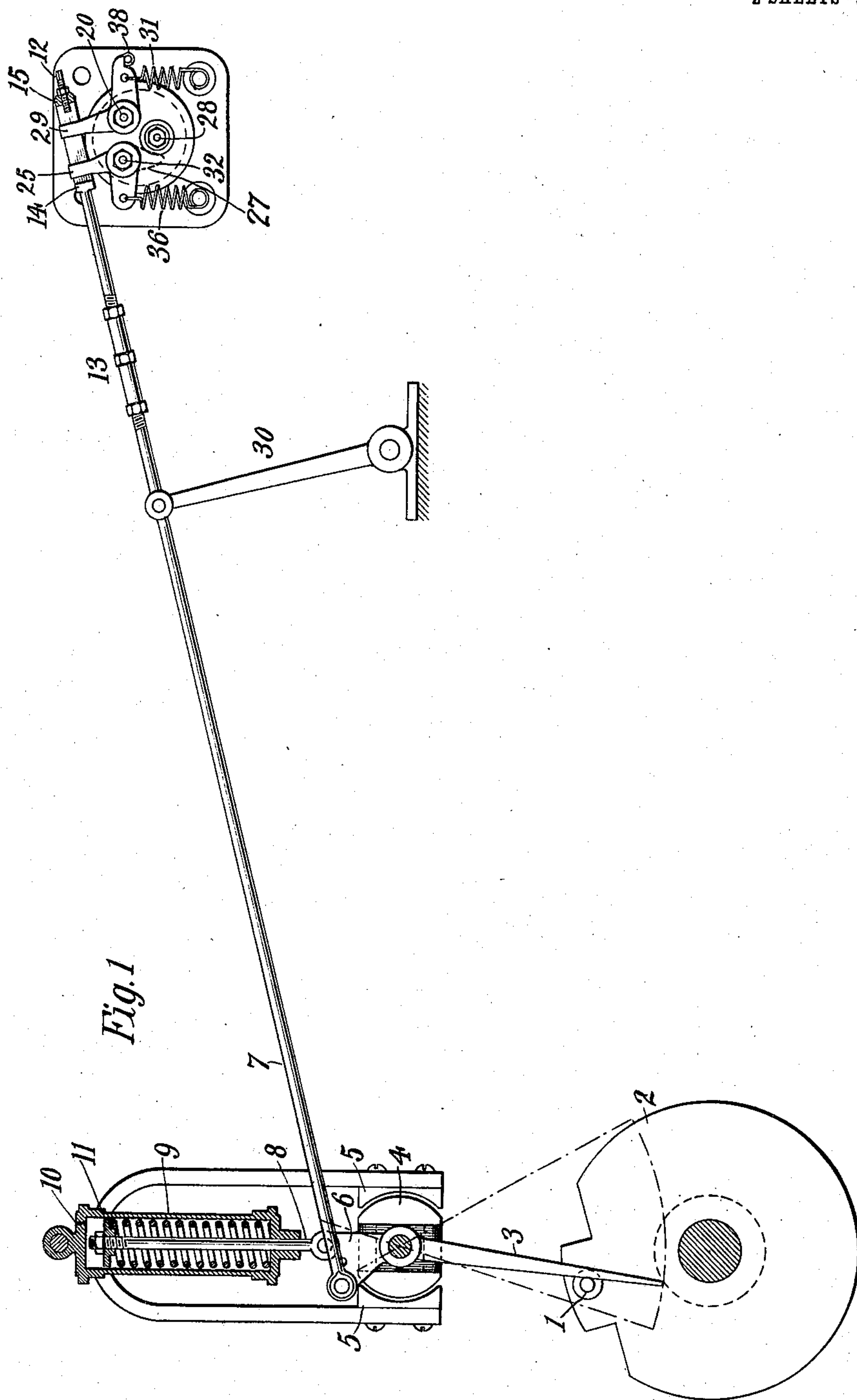
PATENTED OCT. 8, 1907

B. BOTKOWSKI.

IGNITING MEANS FOR EXPLOSIVE ENGINES.

APPLICATION FILED AUG. 27, 1903.

2 SHEETS—SHEET 1.



Witnesses:

Livingston Avenue
Henry Barnes

Inventor

Baris Botkowski
by Henry D. Williams Atty

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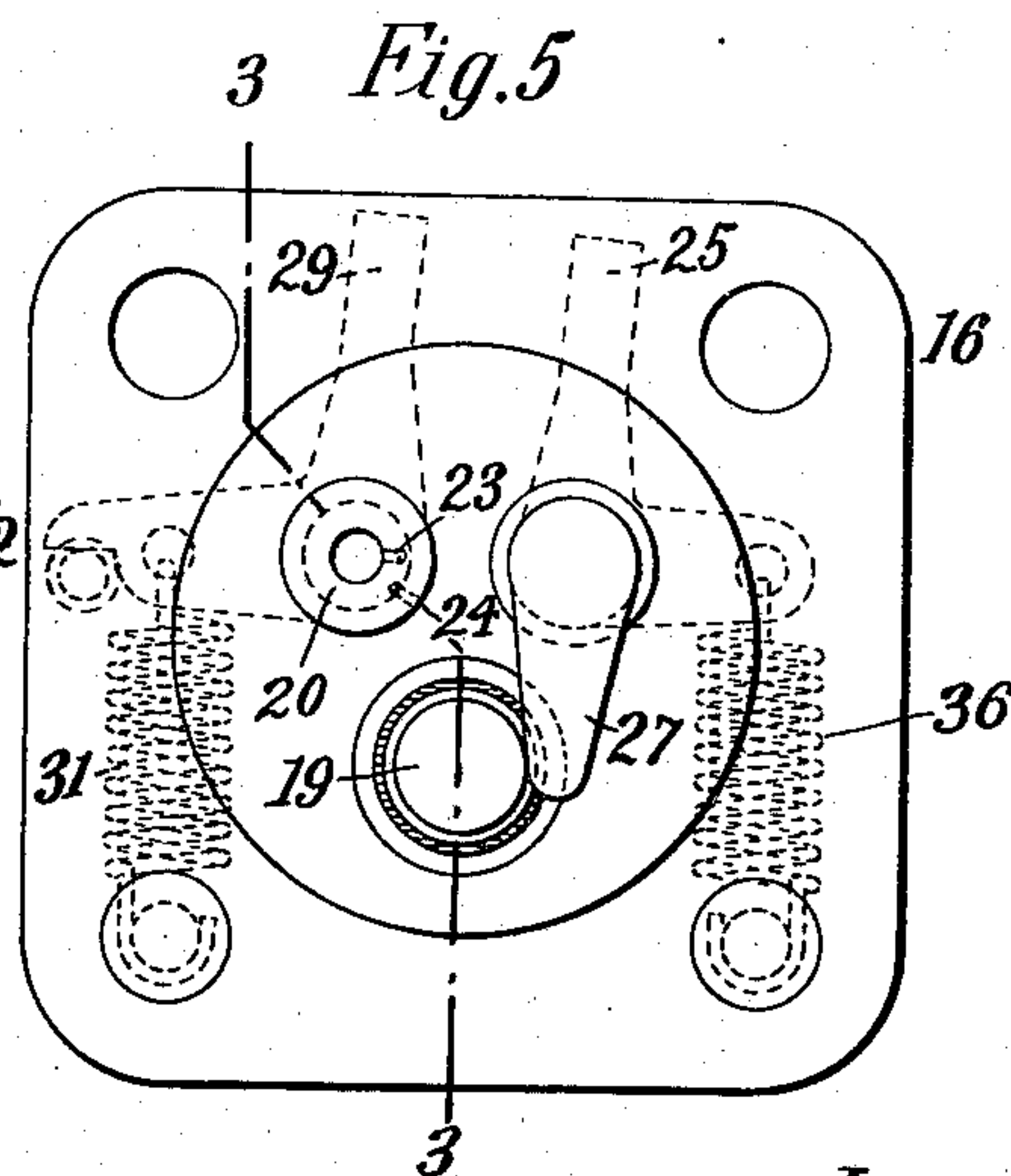
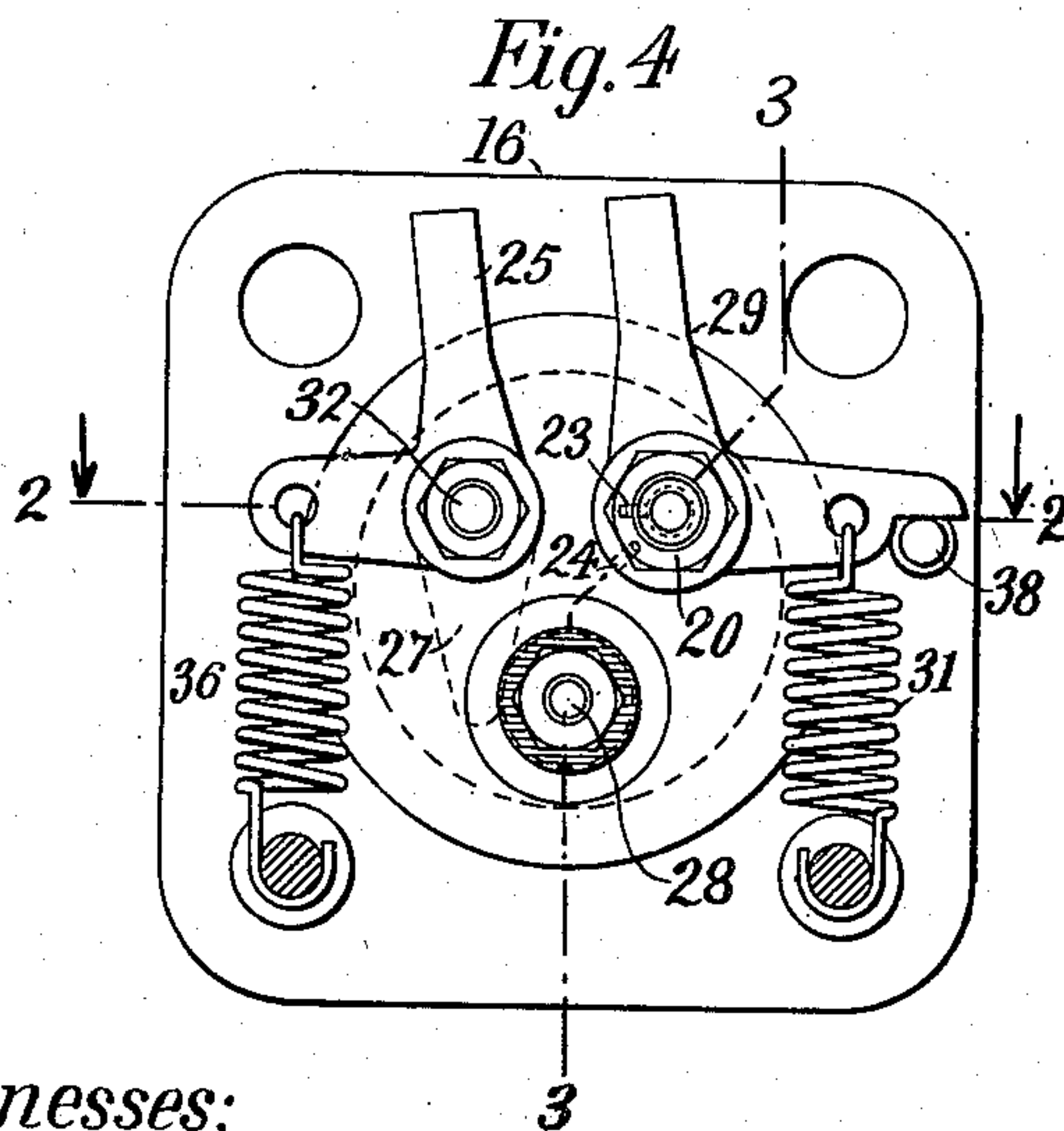
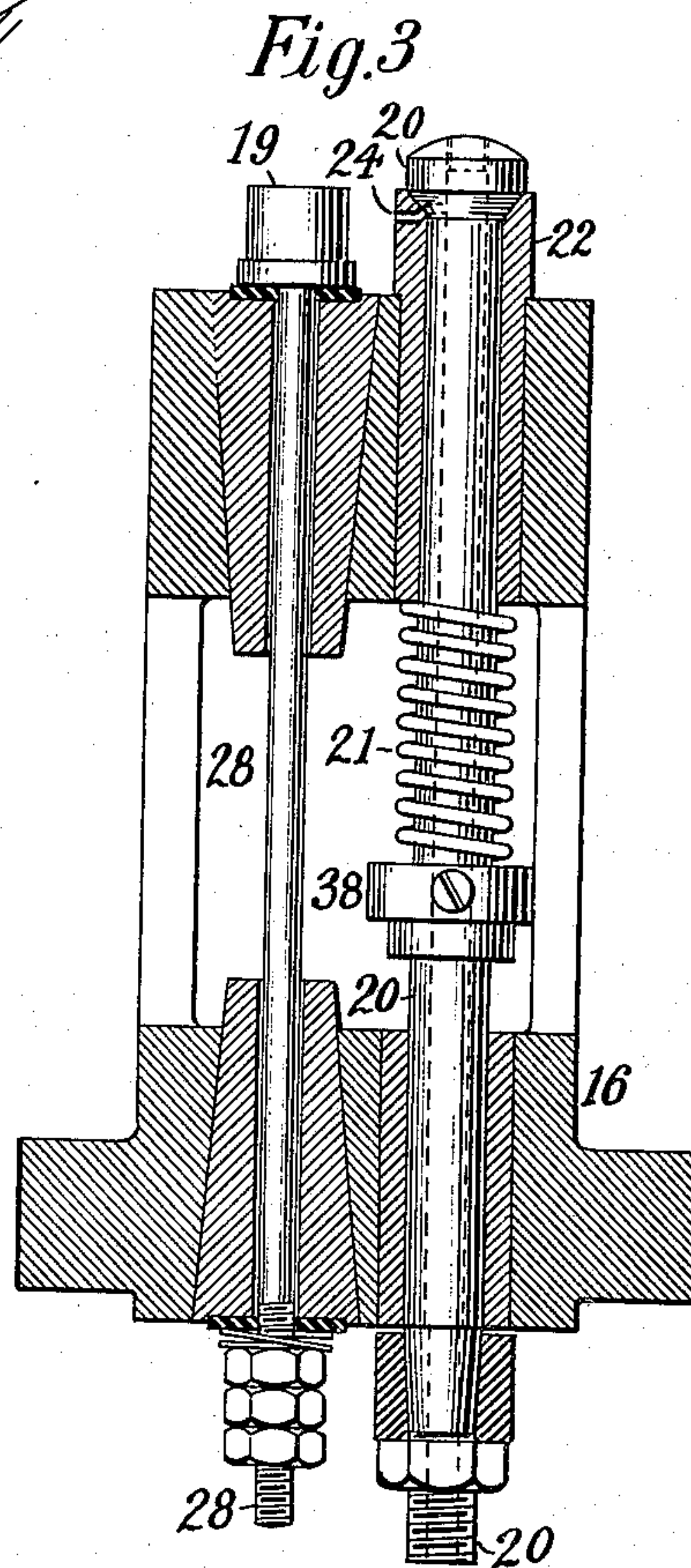
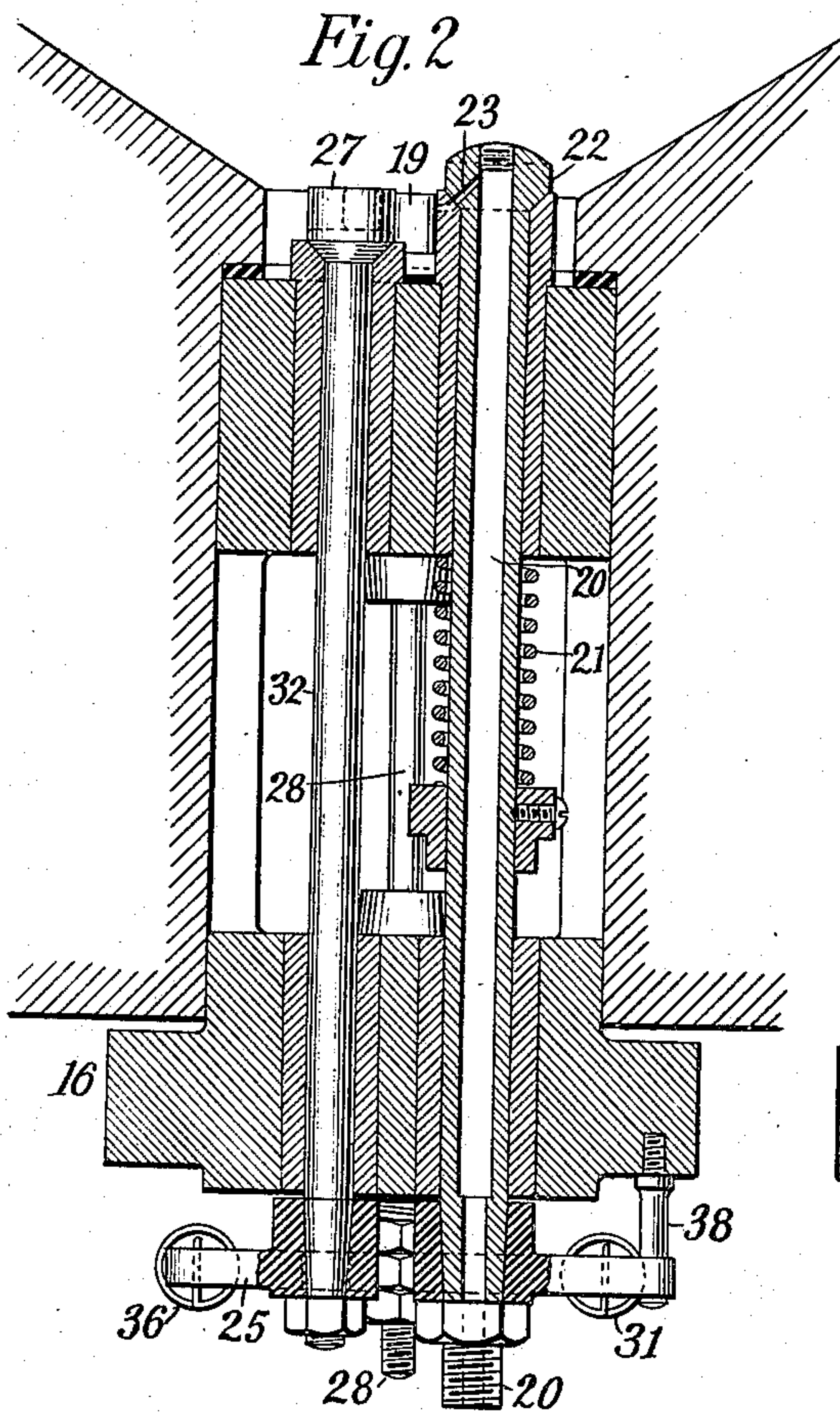
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IGNITING MEANS FOR EXPLOSIVE ENGINES.

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2 SHEETS—SHEET 2



Witnesses:

Livingston Tenney
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UNITED STATES PATENT OFFICE.

BORIS BOTKOWSKI, OF NEW YORK, N. Y., ASSIGNOR TO DE LA VERGNE MACHINE COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

IGNITING MEANS FOR EXPLOSIVE-ENGINES.

No. 867,696.

Specification of Letters Patent.

Patented Oct. 8, 1907.

Application filed August 27, 1903. Serial No. 170,931.

To all whom it may concern:

Be it known that I, BORIS BOTKOWSKI, a subject of the Emperor of Russia, residing at the borough of Manhattan, city of New York, county of New York, and State of New York, have invented certain new and useful Improvements in Igniting Means for Explosive-Engines, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to explosion engines and particularly to the explosion producing means thereof, and has for its principal object the enrichment of the explosive medium or mixture of gases in the explosion chamber at the point of ignition so as to permit the explosion of a charge of weak explosive medium.

According to my invention a supplementary charge of highly explosive fuel is injected in proximity to the point of ignition or igniting spark, and ignition is thereby assured at the ignition or sparking point and a flame produced capable of igniting the weakest explosive mixture.

I will now describe the device embodying my invention illustrated in the accompanying drawings and will thereafter point out my invention in claims.

Figure 1 is a diagrammatic view of my device showing also the controlling and operating means. Fig. 2 is an enlarged horizontal section of the sparking and enriching device on the line 2—2 of Fig. 4. Fig. 3 is an enlarged vertical section of the same, on the line 3—3 of Fig. 4, showing the sparking device removed from its socket. Fig. 4 is a front end view of the sparking and enriching device. Fig. 5 is a rear end elevation of the same partially in section.

The operating parts comprise an operating pin 1, located upon a crank or wheel 2 attached to a rotating shaft of the engine. Engaging or abutting the operating pin is an arm 3 attached to the armature 4 which oscillates between the poles 5 of a field magnet of a dynamo or magnetogenerator. Attached to the generator shaft and to the arm 3 is a lever 6 carrying a pivot for the operating arm 7 and also carrying a pivot for a spring controlled arm 8. The spring controlled arm 8 operates in a cylinder 9 provided with an air vent 10 and is provided with a piston 11 working freely in the cylinder 9, and acts to return the lever arm 6, 3, to normal or starting position and by the rapidity of its spring actuation to generate the sparking current in the armature 4. The operating arm 7 is provided with a turnbuckle 13 for nice adjustment of its length and has a flattened portion at its end having two shoulders, the shoulder 14 for actuating the sparking lever of the movable electrode and the shoulder 15 carrying a stop screw 12 which contacts with and actuates the fuel supply valve.

The igniting device is shown as a lever sparking device and comprises a fixed electrode 19 on a conductive

stem 28 suitably held in insulator plugs in the igniter body 16, and also comprises a movable electrode 27 carried upon the shaft 32, this shaft 32 being fitted to oscillate in bearings in the igniter body and having an actuating lever 25 at its outer end. This actuating lever 25 is held by a spring 36 in its normal position with the movable electrode 27 against the fixed electrode 19, and is actuated by the shoulder 14 of the operating arm 7 as the armature of the generator approaches the completion of its current inducing stroke under the actuation of its retraction spring 9. The blow of the shoulder 14 upon the actuating lever 25 causes the movable electrode 27 to be suddenly withdrawn from contact with its cooperating fixed electrode 19 at the moment when current is flowing through such electrodes from the armature of the generator, and thereby produces a fuel igniting spark which jumps from the fixed electrode to the movable electrode. It will be noted that as the armature and movable electrode are both operated by the operating pin 1 located upon a crank or wheel 2 connected with the rotating shaft of the engine, the spark may be produced at any given desired instant in the working cycle of the engine.

The fuel supply valve comprises a hollow supply tube 20, fitted to oscillate in bearings in the igniter body and having at its inner end a conical shoulder or valve 22. A valve duct 23 leads from the hollow bore of the supply tube 20 to the conical face of the shoulder of valve 22, and a discharge duct 24 is formed in the bearing of the supply tube, leading from the seat of the valve 22 and directed toward the point of sparking of the igniting device. The supply tube 20 would be suitably connected to a source of fluid-fuel, such as carbureted gas, under sufficient pressure to enter the combustion chamber against the pressure of gases therein. Normally the valve duct 23 and the discharge duct 24 are not in alinement, but when the supply tube is actuated, the valve duct comes in line with the discharge duct and the fuel supply is discharged through these ducts toward the point of sparking. The valve is held tight by an expansion spring 21 working between the bearing of the supply tube 20 and a collar 38 secured upon the supply tube. An actuating lever 29 is provided at the outer end of the supply tube and is normally held by the spring 31 against a stop pin 38, but is actuated by contact with the screw 12 of the operating arm 7 during the movement of the armature under the actuation of the actuating pin 1 so that the supply valve is opened at the end of this movement of the armature and is closed again at the commencement of the current inducing return movement of the armature. The supply valve is operated mechanically independently of the variations of pressures within the cylinder or combustion chamber. The means for ad-

justing the length of the operating arm permit the supply valve to be opened and the movable electrode to be operated at any desired instant to produce the igniting spark. By discharging the fuel toward the point of sparking immediately before the spark is formed, an enrichment of the mixture or medium at and in immediate proximity to the point of ignition is obtained, resulting in the production of a flame at the point of ignition such as will readily cause ignition of the entire body of explosive medium in the explosion chamber.

It is obvious that various modifications may be made in the construction shown and above particularly described within the spirit and scope of my invention.

What I claim and desire to secure by Letters Patent is:—

1. In combination with the combustion chamber of an internal combustion engine, a movable electrode and fixed electrode, an actuating lever for the movable electrode, a valve for supplying supplemental fuel enriching fluid, an actuating lever for such valve, and an operating lever provided with means for successively operating the actuating levers of such valve and the movable electrode.

2. In combination with the combustion chamber of an internal combustion engine, a movable electrode and fixed electrode, a supplemental fuel supply valve having a discharge duct located in proximity to the point of sparking, and common operating means for the supply valve and movable electrode.

3. In combination with the combustion chamber of an internal combustion engine, a movable electrode and fixed electrode, a supplemental fuel supply valve, an igniter body carrying the movable electrode and fixed electrode and the supplemental fuel supply valve, retractive means for normally holding the movable electrode in contact with the fixed electrode and for normally holding the valve closed, and common operating means for both the movable electrode and the supplemental fuel supply valve.

4. The combination of an explosion chamber and charging means therefor, an electric igniting device, a supply tube having a valve shoulder thereon, such valve shoulder having a valve duct therein, a bearing for such supply tube having a seat for such valve shoulder and a supply duct through such seat, and terminating in proximity to the point of ignition, retractive means for holding the valve shoulder to its seat, and means for rotatively operating the supply tube, substantially as set forth.

5. The combination with the combustion chamber of an

internal combustion engine, of a supplemental fuel supply valve, an igniting device, an oscillating arm actuated by the engine and operating an electric current generator, and an operating arm connected to said oscillating arm and actuating in common the supplementary fuel supply valve and the igniting device.

6. The combination, with the combustion chamber of an internal-combustion engine, of an igniting device therein, supplemental-fuel-injecting means, and means for operating the igniting device and the supplemental-fuel-injecting means constructed and operating to begin the fuel injection before the operation of the igniting device and to interrupt it substantially at the instant of ignition.

7. The combination, with the combustion chamber of an internal-combustion engine, of an igniting device therein, supplemental-fuel-injecting means, and means for operating the igniting device and the supplemental-fuel-injecting means constructed and operating to begin the fuel injection before the operation of the igniting device and to interrupt it substantially at the instant of ignition, said operating means being adjustable to vary the time at which the fuel injection begins.

8. The combination, with the combustion chamber of an internal-combustion engine, of an igniting device therein, supplemental-fuel-injecting means provided with an admission valve, and means for operating the igniting device and the valve constructed and operating to open the valve before the operation of the igniting device, and to close the valve and operate the igniting device substantially simultaneously.

9. The combination, with the combustion chamber of an internal-combustion engine, of an igniting device therein provided with an external operating lever, a supplemental-fuel valve provided with an operating lever, and an actuating member for said levers operating in timed relation with the engine and provided with abutments arranged to engage and actuate said levers alternately when the actuating member is reciprocated.

10. The combination, with the combustion chamber of an internal-combustion engine, of an igniting device located therein, and means, operating independently of the means for supplying the engine with combustible mixture, for injecting a small quantity of combustible gas into the combustion chamber in the immediate vicinity of the igniting device during the compression stroke of the engine and previous to the igniting operation.

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

BORIS BOTKOWSKI.

Witnesses:

LIVINGSTON EMERY,
HENRY BARNES.