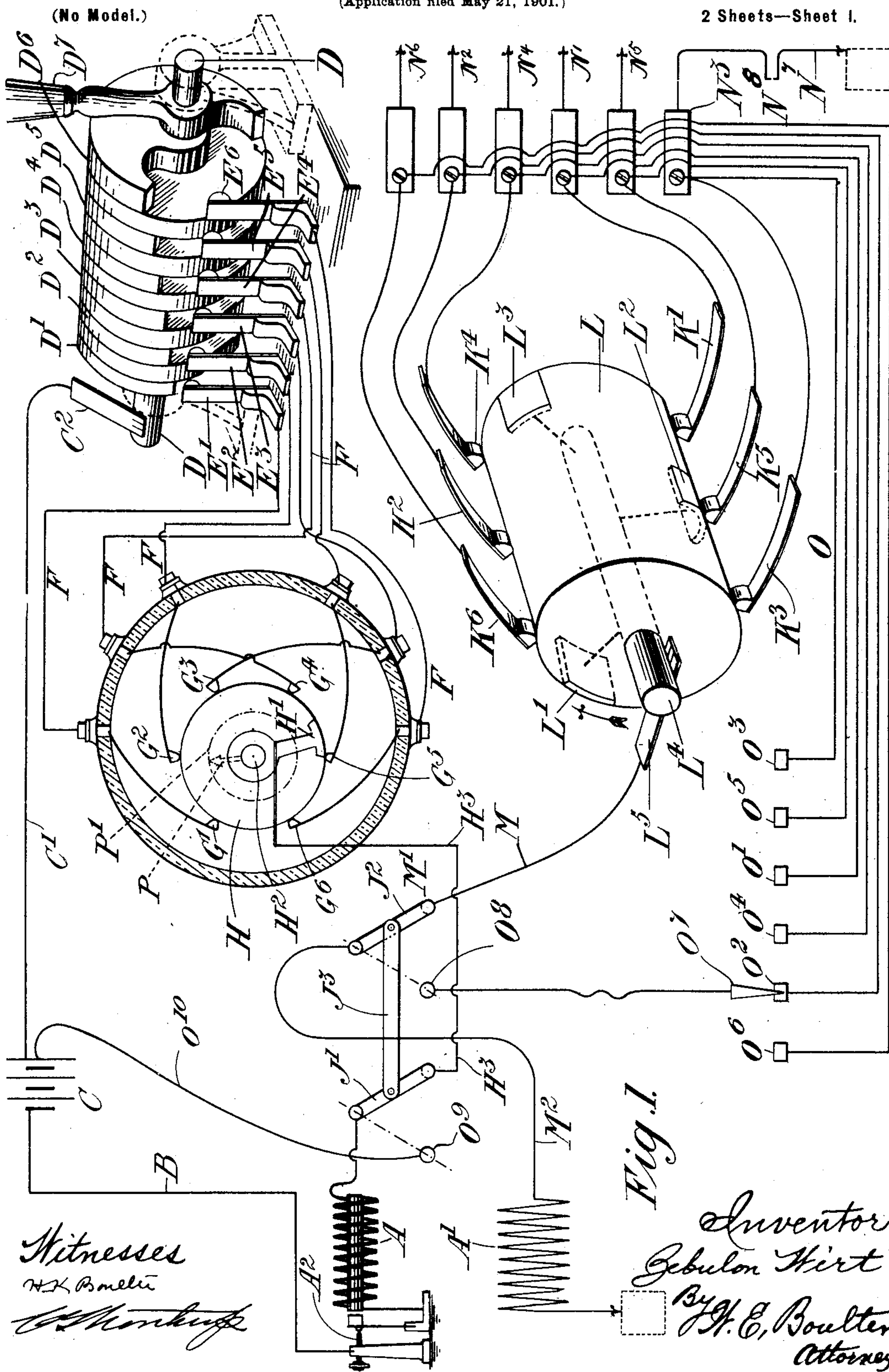


Z. WIRT.

ELECTRICAL IGNITION DEVICE FOR EXPLOSION ENGINES.

(Application filed May 21, 1901.)

2 Sheets—Sheet 1.



No. 685,960.

Patented Nov. 5, 1901.

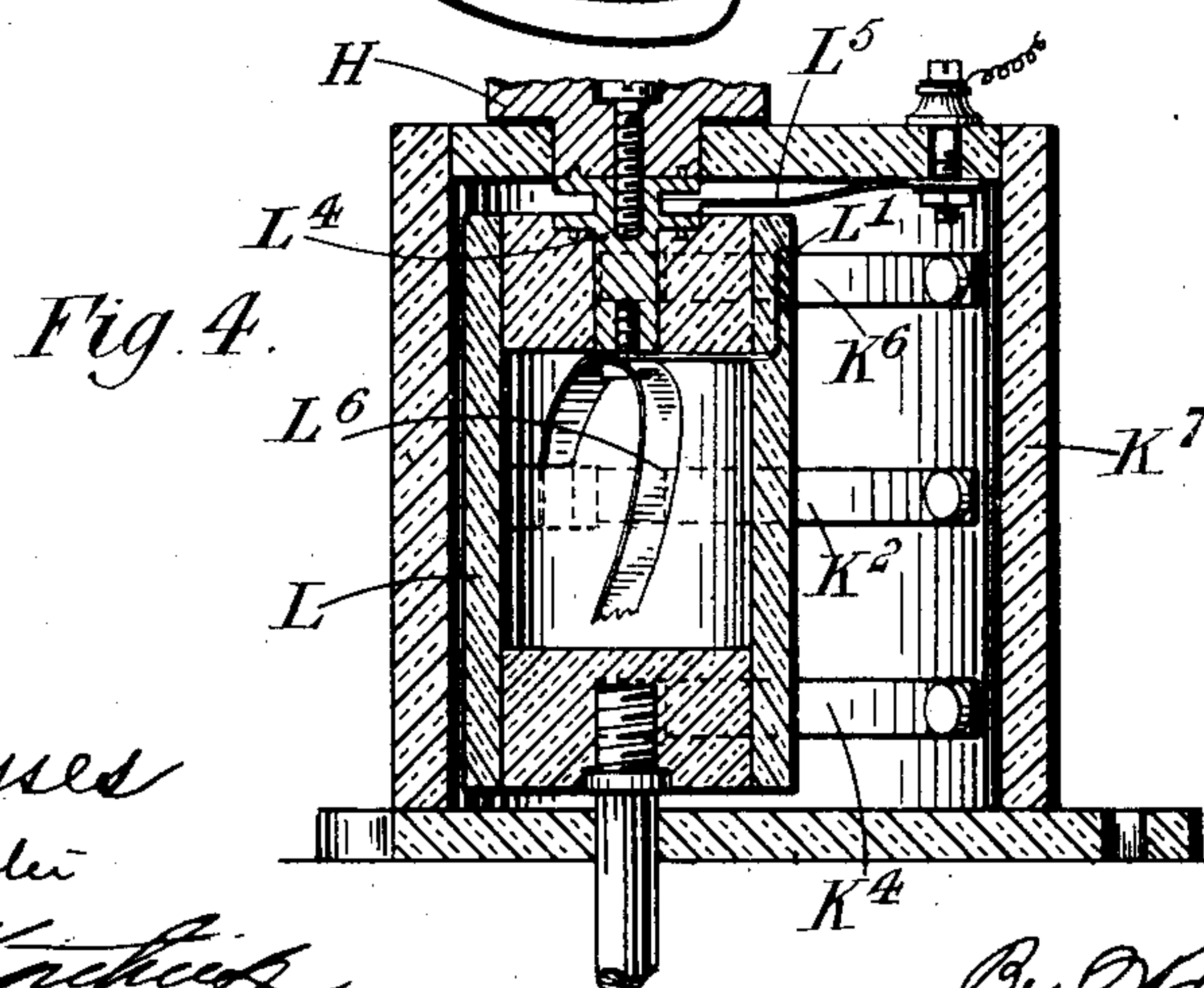
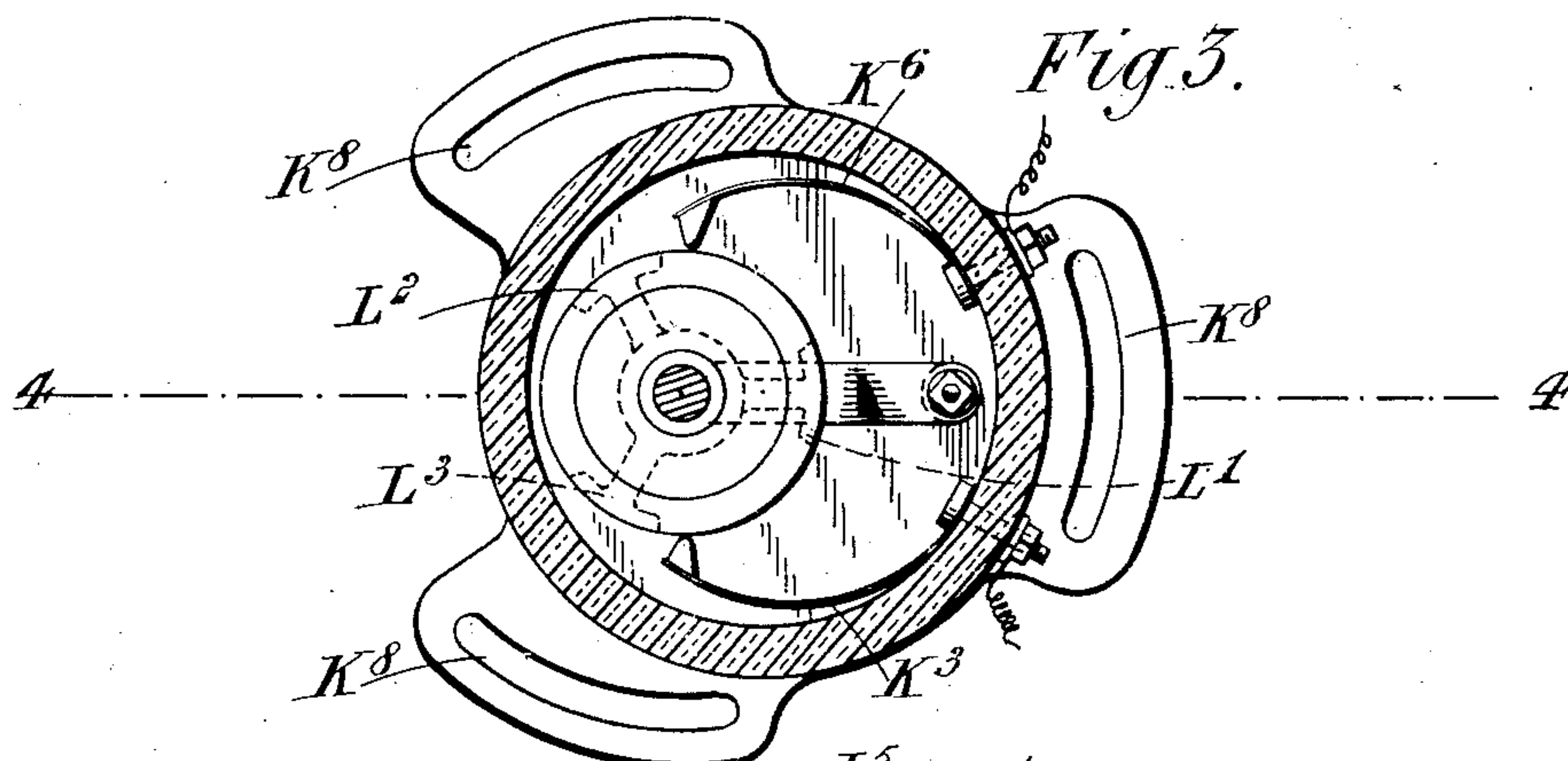
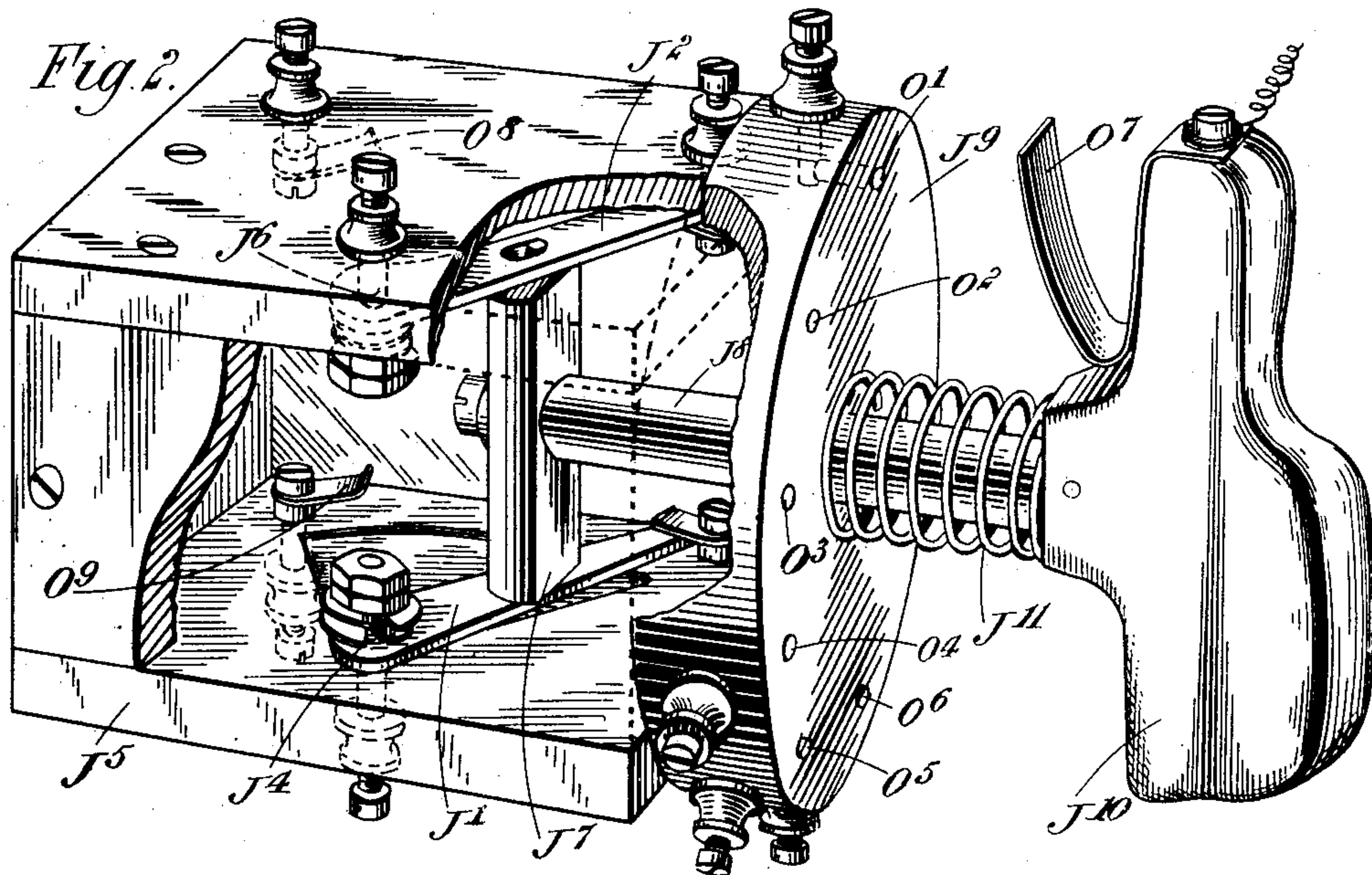
Z. WIRT.

ELECTRICAL IGNITION DEVICE FOR EXPLOSION ENGINES.

(Application filed May 21, 1901.)

(No Model.)

2 Sheets—Sheet 2.



Witnesses

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UNITED STATES PATENT OFFICE.

ZEBULON WIRT, OF LONDON, ENGLAND.

ELECTRICAL IGNITION DEVICE FOR EXPLOSION-ENGINES.

SPECIFICATION forming part of Letters Patent No. 685,960, dated November 5, 1901.

Application filed May 21, 1901. Serial No. 61,241. (No model.)

To all whom it may concern:

Be it known that I, ZEBULON WIRT, a citizen of the United States, residing at Hampstead, London, England, have invented certain new and useful Improvements in or Relating to Electrical Ignition Devices for Explosion-Engines, (for which application has been made in Great Britain under No. 19,223, dated October 26, 1900,) of which the following is a specification.

This invention relates to electrical ignition devices for explosion-engines, and has special reference to explosion-engines having two or more cylinders—such, for example, as that described in the specification of my pending United States application, Serial No. 2,046, filed January 19, 1900—although its use is not restricted thereto.

An ignition device according to this invention is so constructed that if there are two or more cylinders to the engine any of those cylinders may be cut in or out of action without affecting the remainder.

The invention further comprises an arrangement by means of which a spark may be produced for igniting the charge in any particular cylinder—say for starting purposes—when the engine is stationary.

By the employment of the improved ignition device it is possible to operate a multi-cylinder engine with an induction-coil having a single primary and a single secondary winding.

For the sake of clearness that portion of the ignition device which operates when the engine is working is herein described as the “running” portion, while the part which is manually operated when the engine is stationary is called the “starting” portion.

Each of these portions comprises two members, which may be distinguished as the “selector” and “contact-maker,” respectively.

The function of the selectors is to make electrical connections between certain circuits, so that when the contact-maker operates only certain cylinders will be brought into action.

The selector of the starting portion of the device may be constructed so that either of the sparking-circuits, of which there is one to each cylinder, may be arranged so that the contact-maker shall place it into connection with the secondary winding of an induction-

coil, so that when the primary circuit is completed—preferably by the same movement of the contact-maker—the electromotive force generated in the secondary winding causes a spark in the particular cylinder selected. The selector of the running portion of the device is also provided with a contact for each of the cylinders. These contacts are joined to contact-springs which are periodically brought into connection with a moving contact-block, and any particular contact-spring which has been joined up by the selector forms when in contact with the moving block part of a closed circuit in which the primary winding of the induction-coil is in series with a battery. Moving synchronously with the contact-block is another contact-block also operating upon a series of contact-springs placed in positions corresponding to those of the first-mentioned set of contact-springs. This second set of block and springs controls the connections between the sparking-circuit of each cylinder and the secondary winding of the induction-coil, so that as the block comes in contact with each spring the sparking-circuit connected with that spring is placed in series with a secondary coil. The second moving contact-block is arranged to come into contact with its contact-springs just before the first contact-block makes contact with the corresponding spring, so that the secondary circuit is closed just before the corresponding selected primary circuit is completed. Thus if, say, No. 1 cylinder is to be used, each time the synchronously-moving contact-blocks make contact with their respective No. 1 contact-springs the charge in that cylinder is ignited. Contact-springs 2, 3, &c., not being joined up by the selector the primary circuit is not completed when those springs are in contact with the moving block, and thus no spark is produced. Obviously if the “running-selector” is set to join up contact-blocks 1, 3, and 5 the cylinders corresponding to those numbers will be operated.

The above-described contact-springs and contact-blocks may be looked upon as the contact-maker for the running portion of the device, and conveniently the contact-blocks may each be attached to a disk of insulating material, around the periphery of which the

sets of contact-springs are placed. The two disks may be mounted upon a common shaft driven from the engine at any desired speed.

In practice it is found that a convenient running-selector may be made by placing a series of contact-pieces of gradually-increasing length, each joined to one of the contact-springs, so that they come into contact successively with the arms or prongs of a metallic comb. The first position of the comb will then bring contact-spring No. 1 into connection; the second, springs 1 and 2; the third, springs 1, 2, and 3, and so on. This is a very simple and generally useful arrangement, although it does not permit of any single cylinder other than No. 1 being used when working. The selector, however, may be readily modified to effect this, if desired.

The "starting-selector" and contact-maker are conveniently made as one piece of apparatus in the form of a switch with a double set of contacts, one set—the selector group—comprising a ring of blocks each joined to one of the sparking-circuits, and the other set—the contact-maker group—arranged so that when the switch is closed the primary circuit is completed in series with the battery and the secondary circuit in series with the particular sparking-circuit selected also completed. The two sets of contacts may be operated by one switch-lever, the particular sparking-circuit being selected by a preliminary turning movement of the lever or a portion of it so that it is in line with the particular contact-block in the ring.

The switch above described is preferably arranged so that on releasing the handle after using it for starting it moves back automatically and closes gaps in circuits connected with the running device, so that that portion of the apparatus may immediately and automatically come into action.

It will be noticed that two or more cylinders may be operated from the one primary and secondary winding. In fact, if the coil be powerful enough all the cylinders, however many there may be, may be ignited from it.

In order that, when starting, the most suitable cylinder shall be selected for ignition, an indicator may be arranged on the shaft carrying the rotating disks, such indicator pointing to the number of the cylinder in which the charge is, say, under greatest compression.

Obviously if an ignition device according to this invention is used in connection with an engine having only one cylinder the selectors will be unnecessary. The contact-makers, however, may be used, and the system is found to be advantageous owing to the fact that the primary circuit may be a complete metallic one, insulated from the frame of the engine, and thus having no connection with the secondary winding in cases where that winding is earthed.

In the accompanying drawings, Figure 1 is

a diagram showing one arrangement of circuits and apparatus forming an ignition device according to this invention. Fig. 2 is a perspective view, with a portion broken away, of one form of starting-selector and contact-maker. Fig. 3 is a plan of a running contact-maker, part being removed for the sake of clearness; and Fig. 4 is a vertical section on the line 4 4 of Fig. 3.

Like letters indicate like parts throughout the drawings.

With reference first to Fig. 1, A and A' are respectively the primary and secondary windings of an induction-coil. The primary winding A is provided with a spring contact-breaker A² of the usual type and is connected by a wire B to one pole of a battery C, the other pole of which is joined by a wire C' and rubbing-contact C² to the spindle D of a selector. This selector comprises a series of segmental contact-blocks D', D², D³, D⁴, D⁵, and D⁶, all mounted upon the spindle D and in electrical connection therewith. The contact-blocks are spaced upon the spindle—say by means of fiber or other distance-pieces—so that each block is opposite to one of a series of contact-springs E', E², E³, E⁴, E⁵, and E⁶, the blocks being so arranged that by rotating the spindle D by means of a handle D⁷ one, two, or any number of the six blocks may be brought into contact with the corresponding springs. The selector contact-springs E' to E⁶ are joined by wires F to another series of contact-springs G', G², G³, G⁴, G⁵, and G⁶, E' being joined to G', E² to G², and so on. The ends of the contact-springs G' to G⁶ are arranged symmetrically around the periphery of a disk H, of insulating material, which carries at one point a contact-arm H' and is mounted upon a spindle H², which can be rotated. The contact-arm is connected by a wire H³ to the primary winding A, a gap being left in the circuit which may be closed by the action of a switch J'. If now the selector be turned so that the first segmental contact-block D' is alone in contact with its spring E' and the shaft H² be rotated, a current will pass from the battery C through the primary winding A each time the contact-arm H' passes under the spring G'. Again, if the selector be turned farther around, so that blocks D', D², and D³, for example, make connection with their respective springs E' E² E³, then the primary winding will be energized when the contact-arm H' passes under the springs G', G², and G³. The secondary circuit is provided with a series of contact-springs K', K², K³, K⁴, K⁵, and K⁶, which are arranged three on one side and three on the other side of a cylinder L, of insulating material, which is provided with three segmental contact-blocks L' L² L³, all connected to a common spindle L⁴, provided with a brush or rubbing contact L⁵. This rubbing-contact L⁵ is joined by a wire M to a switch-block M', and a switch-arm J² can connect this block through a wire M² to one

end of the secondary winding A', the other end of the secondary winding being earthed. The springs K' to K⁶ are connected to a group of blocks N', N², N³, N⁴, N⁵, and N⁶, the spring K' being connected to the block N', K² to N², and so on, and from each of these blocks a wire leads to the sparking-circuit of a cylinder of the engine. One of these circuits is shown connected to the block N³, a wire N⁷ joining that block to a sparking-gap, (diagrammatically represented at N⁸.) From the sparking-gap the circuit passes to earth or, if desired, by metallic insulated return to the end of the secondary winding. It will of course be understood that the sparking-gap N⁸ is arranged in the usual way within the cylinder. Similar circuits are connected to each of the blocks N', N², N⁵, and N⁶, but are not shown in the drawings. Preferably the shafts L⁴ and H² rotate synchronously. They may, in fact, be portions of the same shaft, and the springs and contact-blocks are so disposed that any given secondary circuit is completed just before the corresponding primary circuit. For instance, the contact-block L² would come in contact with the spring K⁵, completing the secondary circuit through the sparking-gap connected to the block N⁵ just before the primary contact-arm H' came in contact with its spring G⁵.

The operation of the device when running will be readily understood from the above description. Should all the selector contact-blocks D' to D⁶ be brought into connection with their corresponding springs, the primary winding A is energized every time the primary contact-arm passes under one of the springs G' to G⁶, and as the corresponding secondary circuit is completed in advance of the primary, sparks occur successively at the sparking-gaps of the six cylinders and the charges are exploded in the proper order. Obviously the secondary contact - springs might be arranged around the periphery of a disk in a way substantially similar to that described with reference to the primary contact-springs G' to G⁶; but it is preferred to arrange them, as described, around a cylinder, in order that there may be as great a distance as possible between succeeding sparking-circuits, thus rendering surface leakage less likely to occur.

The arrangements above described are those necessary for use when the engine is running automatically. Some additional circuits necessary for use when the engine is to be started will now be described.

Six additional circuits O are provided, each connected to one of the blocks N' to N⁶, joined with the sparking-circuits and terminating in separate contact-blocks O', O², O³, O⁴, O⁵, and O⁶. A movable contact-finger O⁷ is provided, which can be brought into connection with either of these blocks and is connected to a switch-block O⁸, which can be placed by the switch-arm J² in connection with the sec-

ondary winding A' through the wire M². Another switch-block O⁹ is connected by a wire O¹⁰ to the battery C and can be connected by the switch-arm J' to the primary winding A. The switch-arms J' and J² are in the diagram forming Fig. 1 connected by a cross-bar J³. Supposing now the engine to be stationary after having been running, the contact-finger O⁷ is placed in connection with the sparking-circuit of the cylinder in which the charge is under compression, and the switches J' J² are then moved over into the dotted position. This has the effect of closing the secondary circuit comprising the secondary winding A' and the sparking-circuit O² N², &c., and also closes the primary circuit consisting of the primary winding A, wire B, battery C, and wire O¹⁰. Consequently the charge in the particular cylinder selected is ignited and the engine started. Preferably the switches J' J² and the contact-finger O⁷ are comprised in one piece of apparatus, one construction of such apparatus being illustrated in Fig. 2.

In Fig. 2 the switch-arm J' is shown pivoted, as at J⁴, to one side of an insulating-casing J⁵, the other switch-arm J² being similarly pivoted, as at J⁶, to the other side of the casing. The switch-arms J' and J² are connected by a cross-bar J⁷, to the center of which a spindle or plunger J⁸ is attached in such a manner that it can rotate about its axis. This spindle J⁸ passes through a hole in a cover J⁹ and is furnished with a handle J¹⁰, a spiral spring J¹¹ being provided between the handle and the cover. Set around the cover J⁹, with their ends projecting, are contact-blocks O', O², O³, O⁴, O⁵, and O⁶, each furnished with a terminal or binding screw, to which wires may be attached. Beneath the handle is a spring which corresponds to the contact-finger O⁷. (Represented diagrammatically in Fig. 1.) When in the position shown, the switches would be in position for automatic running; but when it is desired to start the engine the handle J¹⁰ is turned so that the spring O⁷ is opposite to the contact-block belonging to the particular sparking-circuit selected. When this has been done, the handle is depressed and the switches J' J² make contact with their blocks O⁹ O⁸, the motion necessary to bring this about first bringing the spring O⁷ into contact with the selected block, so that the secondary circuit is closed first in the manner previously described. The function of the spring J¹¹ is to return the switches into the running position automatically as soon as the engine has been started.

Figs. 3 and 4 are respectively a plan with a portion removed, and a vertical section of one construction of running contact-maker. The springs K' to K⁶ are arranged on the inside of a cylinder K⁷, of insulating material, and the segmental contact-blocks L' L² L³ are mounted upon the outside of an inner insulating-cylinder L and joined up, as by straps L⁶, to a shaft L⁴, which is furnished with a

rubbing-contact L^5 . Conveniently the primary contact-maker may be arranged on top of the secondary, and the portion of the disk H is shown in Fig. 4. The cylinder K^7 is provided with slotted lugs K^8 , by means of which its position may be adjusted.

In order that it may be known which cylinder is most suitable for selection for starting purposes, an indicator may be provided. This may be attached to any suitable shaft, and in Fig. 1 an indicator is shown in chain lines at P attached to the shaft H^2 and working in conjunction with a scale which is represented by a chain-line circle P' .

It will be noticed that in the particular construction of running selector illustrated in Fig. 1 if one cylinder only is to be used that cylinder must be No. 1, if two are to be employed Nos. 1 and 2 must be selected, and so on. This is a simple and convenient arrangement in practice; but it is obvious that by making the contact-blocks D' to D^6 movable independently any single cylinder or any desired grouping of cylinders could be used.

It is to be understood that the particular forms of selector and contact-maker described and illustrated are merely given by way of example and that other constructions operating in substantially the same way may be employed.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In an explosion-engine the combination of a plurality of cylinders, a sparking-circuit for each cylinder, an induction-coil having a primary and a secondary winding, a source of electric energy connected with the primary winding, a plurality of contacts corresponding to the number of cylinders, a contact-maker for automatically placing each of these contacts successively into connection with the primary winding and the source of electric energy, a selector controlling gaps in the contact-circuits so that the contact-maker can only close the circuit of predetermined contacts, a plurality of contacts connected to the sparking-circuits of the cylinders and a contact-maker automatically operating to place each of such contacts successively in connection with the secondary winding substantially as set forth.

2. In an explosion-engine the combination of a plurality of cylinders, a sparking-circuit for each cylinder, an induction-coil having a primary and a secondary winding, a source of electric energy connected with the primary winding, a plurality of contacts corresponding to the number of cylinders, a contact-maker for automatically placing each of these contacts successively into connection with the primary winding and the source of electric energy, a selector controlling gaps in the contact-circuits so that the contact-maker can only close the circuit of predetermined contacts, a plurality of contacts connected to the sparking-circuits of the cylinders, a

contact-maker automatically operating to place each of such contacts successively in connection with the secondary winding, and a manually-operated contact-maker for cutting out the automatic contact-makers when starting the engine, substantially as set forth.

3. In an explosion-engine the combination of a plurality of cylinders, a sparking-circuit for each cylinder, an induction-coil having a primary and a secondary winding, a source of electric energy connected with the primary winding, a plurality of contacts corresponding to the number of cylinders, a contact-maker for automatically placing each of these contacts successively into connection with the primary winding and the source of electric energy, a selector controlling gaps in the contact-circuits so that the contact-maker can only close the circuit of predetermined contacts, a plurality of contacts connected to the sparking-circuits of the cylinders, a contact-maker automatically operating to place each of such contacts successively in connection with the secondary winding, a manually-operated contact-maker for cutting out the automatic contact-makers when starting the engine and a second selector connected to the starting contact-maker and to each of the sparking-circuits so that the charge in any selected cylinder may be ignited for starting purposes substantially as set forth.

4. In an explosion-engine the combination of a plurality of cylinders, a sparking-circuit for each cylinder, an induction-coil having a primary and a secondary winding, a source of electric energy connected with the primary winding, a plurality of contacts corresponding to the number of cylinders, a contact-maker for automatically placing each of these contacts successively into connection with the primary winding and the source of electric energy, a selector controlling gaps in the contact-circuits so that the contact-maker can only close the circuit of predetermined contacts, a plurality of contacts connected to the sparking-circuits of the cylinders, a contact-maker automatically operating to place each of such contacts successively in connection with the secondary winding, a manually-operated contact-maker for cutting out the automatic contact-makers when starting the engine, a second selector connected to the starting contact-maker and to each of the sparking-circuits so that the charge in any selected cylinder may be ignited for starting purposes and an indicator to show which cylinder should be selected substantially as set forth.

5. In an ignition device for an explosion-engine a starting contact-maker and selector comprising two pivoted switch-arms operatively connected, contact-blocks at each end of the stroke of the arms, a spindle operatively connected to the switch-arms and rotatable relatively thereto, a contact-spring carried by the spindle and contact-blocks so

disposed that when the spindle is pushed in, connection is made between the contact-spring and the selected contact-block before the pivoted switch-arms make contact with
5 their blocks substantially as set forth.

6. In an explosion-engine the combination of a plurality of cylinders, sparking-circuits for such cylinders, an induction-coil having one primary and one secondary winding and
10 means for igniting the charge in a selected

cylinder by a spark from the secondary winding substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ZEBULON WIRT.

Witnesses:

HAROLD WADE,
HARRY B. BRIDGE.