Jan. 11, 1927. 1,613,875

H. A. DOUGLAS

LOCKING MECHANISM FOR INTERNAL COMBUSTION ENGINES

Filed June 27, 1925 3 Sheets-Sheet 1

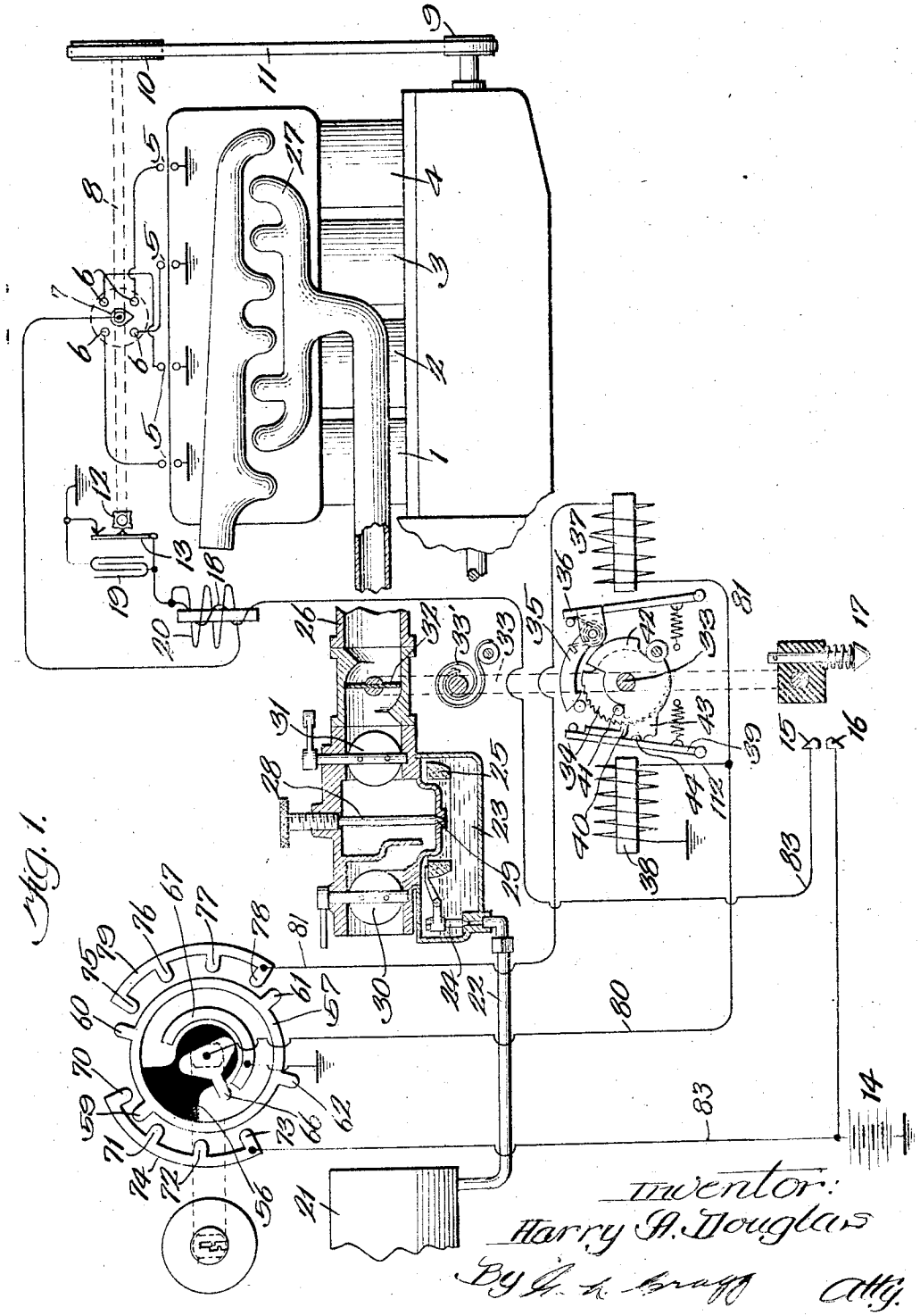


Fig. 1.

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Fig. 2.

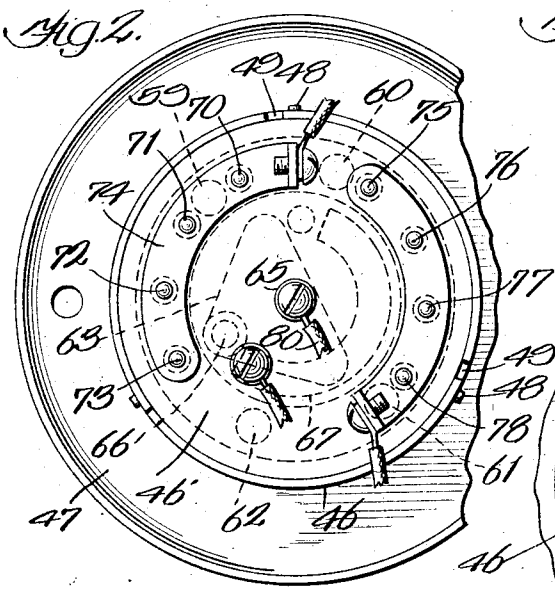


Fig. 3.

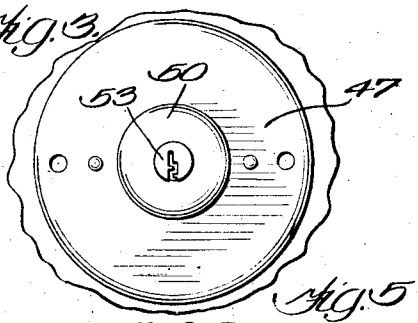


Fig. 5

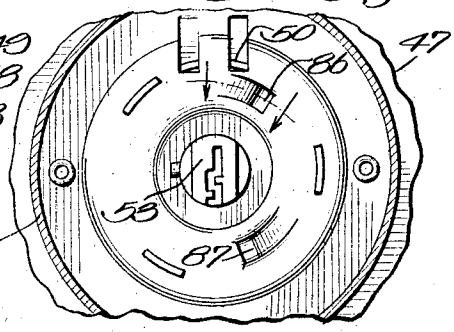


Fig. 4.

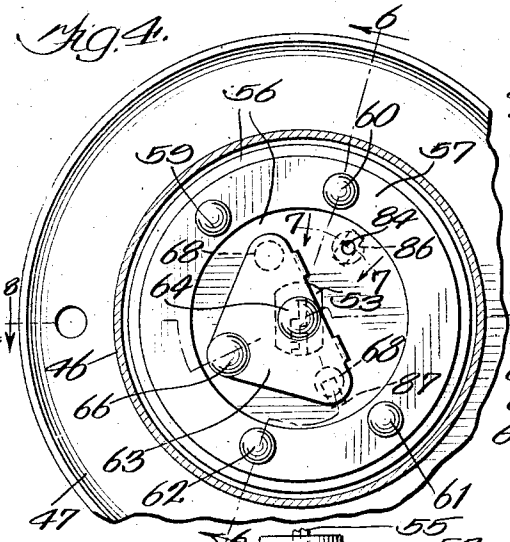


Fig. 6.

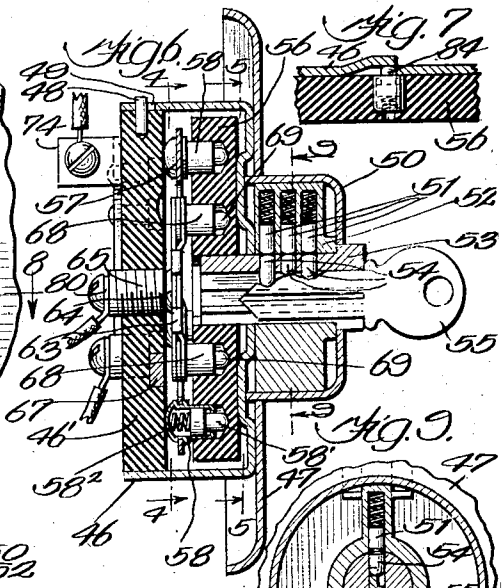
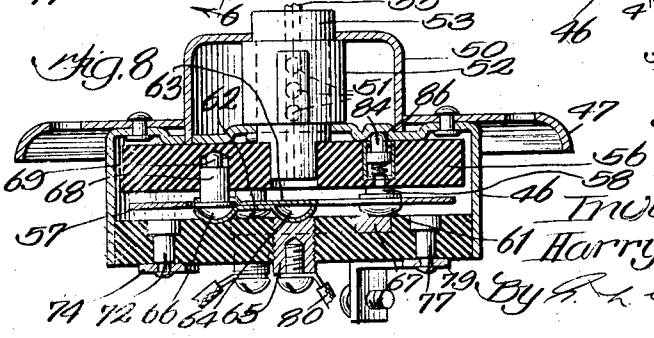


Fig. 7

Fig. 9.

Fig. 8



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LOCKING MECHANISM FOR INTERNAL COMBUSTION ENGINES

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Fig. 10

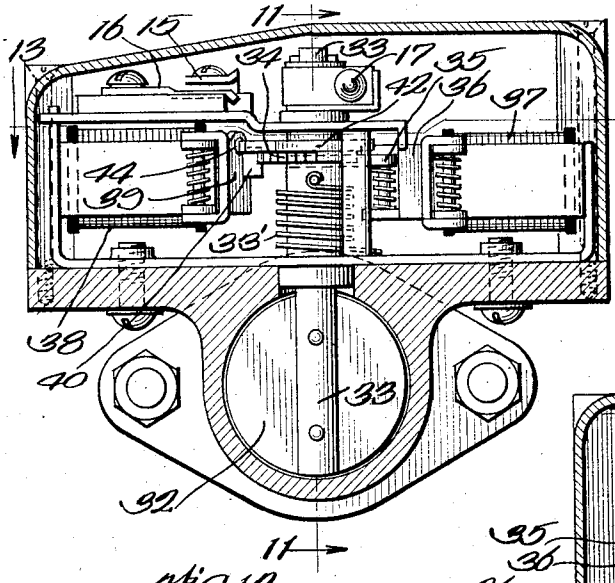


Fig. 11

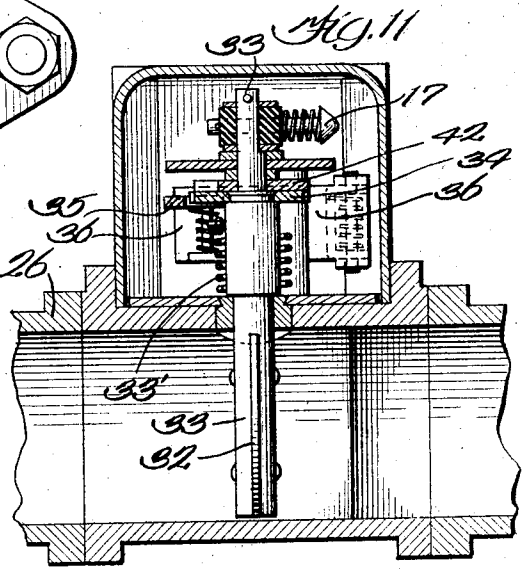


Fig. 12.

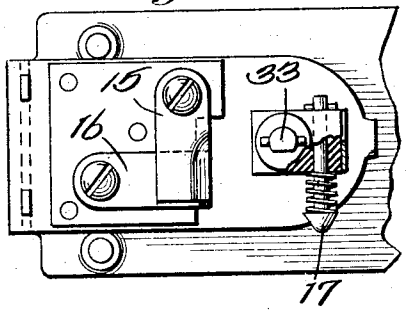


Fig. 13.

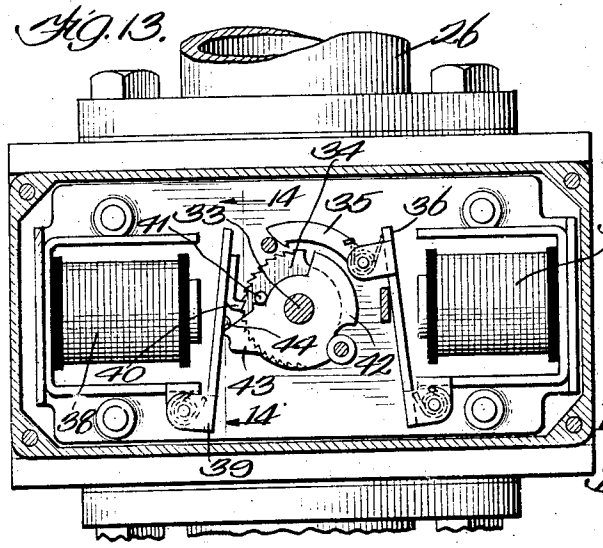
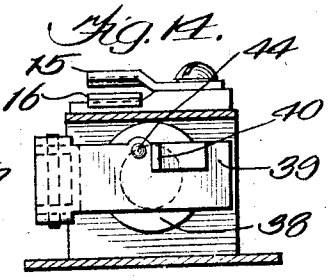


Fig. 14.



Inventor:
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By G. L. Bragg Atty.

Patented Jan. 11, 1927. 1,613,875

UNITED STATES PATENT OFFICE.

HARRY A. DOUGLAS, OF BRONSON, MICHIGAN.

LOCKING MECHANISM FOR INTERNAL-COMBUSTION ENGINES.

Application filed June 27, 1925. Serial No. 40,081.

My invention relates to power plants and has for its object the provision of apparatus whereby the source of energy that is employed for operating the engines or motors of such plants may be locked out of connection with such engines or motors. My invention is of particular utility in connection with those power plants which are employed to operate automotive vehicles and which include internal combustion hydrocarbon engines. In practicing my invention in connection with such engines I employ a spring for turning the throttle valve to a closed position. Step by step mechanism is employed for turning this throttle valve to an open position, the number of steps required for this purpose being known to the operator and those in confidence with him to guard against the unauthorized use of the automotive vehicle equipped with the apparatus. The step by step mechanism for placing the throttle in open position is desirably operated by an electromagnet. A second electromagnet is employed for removing the first magnet from its association with the step by step mechanism to permit the aforesaid spring to function. I also desirably couple a master ignition switch contact with the mechanism that governs the operation of the aforesaid throttle valve whereby, when this throttle valve is closed the master ignition switch is opened, and when this throttle valve is opened the master ignition switch is closed.

The invention will be more fully explained in connection with the accompanying drawings in which Fig. 1 is a diagrammatic illustration of the preferred embodiment of the invention as employed in connection with an automobile; Fig. 2 is a rear view of the preferred form of switch which controls the circuits of the magnets; Fig. 3 is the front view of the switch with parts broken away; Fig. 4 is a sectional view on line 4—4 of Fig. 6, of the switch; Fig. 5 is a sectional view on line 5—5 of Fig. 6; Fig. 6 is a sectional view of the switch on line 6—6 of Fig. 4; Fig. 7 is a detail view of a part of the switch structure taken on line 7—7 of Fig. 4; Fig. 8 is another axial sectional view of the switch on line 8—8 of Fig. 4; Fig. 9 is a sectional view of a part of the switch structure taken on line 9—9 of Fig. 6; Fig. 10 is a view partially in elevation and partially in section illustrative of the self operating mechanical means which serves when free to function to close the added throttle valve, the locking and releasing magnets and associated mechanism being also illustrated; Fig. 11 is a sectional view on line 11—11 of Fig. 10; Fig. 12 is an end view, with a small portion in section, illustrating the ignition switch; Fig. 13 is a sectional view on line 13—13 of Fig. 10; and Fig. 14 is a sectional view on line 14—14 of Fig. 13.

The power plant illustrated includes an internal combustion engine having four cylinders, 1, 2, 3 and 4, each cylinder having an ignition circuit inclusive of the sparking terminals 5, included in a conductor grounded at one end and connected with a contact 6 at its other end. The four contacts 6 of the four ignition circuits are arranged in a circular row which is concentric with a revoluble switching arm 7 adapted to engage the contacts 6 in succession. The switch arm 7 is carried upon a shaft 8 which is driven by the engine through the intermediation of an engine driven pulley 9 and a pulley 10 driven by the pulley 9 through the intermediation of the bolt 11. The shaft 8 also carries a circuit interrupting cam wheel 12 that serves to vibrate the circuit interrupting switch 13 which is included in an inducing ignition circuit arranged to be supplied with current from the battery or generator 14 of direct current. This inducing circuit may be traced from the battery 14, which is grounded, through the contacts 15 and 16, when these contacts are bridged by the switch member 17, the inducing winding 18, the switch 13, to the grounded contact of this switch. The switch 13 and its contact are desirably shunted by a grounded condenser 19 in accordance with common practice. The switch 7 is in the induced circuit which may be traced from the switch 13 and its grounded contact through the induced coil 20, the switch arm 7, the particular contact button 6 which happens to be engaged by the switch arm 7 to the sparking terminals 5 pertaining to the engaged contact 6.

The liquid fuel, usually gasoline, is supplied from the tank 21 through the pipe 22 to the fluid chamber 23 of the carburetor, the admission of the liquid gasoline to this fluid chamber being governed by a needle valve 24 that is controlled by a float 25 in said chamber, in accordance with common practice. The fluid chamber 23 communicates with the intake piping 26 that is con-

nected with the intake manifold 27 of the engine, a needle valve 28 controlling the effective size of the core 29 through which the fluid chamber 23 communicates with the piping 26. The usual air throttle valve 30 governs the amount of air admitted to the piping 26 for purpose of carburetion. The usual throttle valve 31 serves to regulate the amount of carbureted air passing from the carbureter through the piping 26 to the intake manifold. I preferably add another throttle valve 32 within the piping 26 and control this valve in accordance with the purpose of my invention. This valve is mounted to turn upon and turns with a shaft 33. The piping 26 is notched where the valve 32 is located so that this valve may remain closed during a part of its revolution. A coiled spring 33′ serves to place the valve in its closed position. When this valve is to be opened it is moved step by step throughout the portion of its range of movement in which it remains closed, the step by step movement of the valve being continued to place it in its fully opened position. This step by step mechanism operates in opposition to the coiled spring 33′.

In the embodiment of the invention illustrated, the step by step mechanism is inclusive of an arcuate ratchet 34 which is fixed upon the shaft 33. This ratchet is engaged by a pawl 35 carried upon the armature 36 of an unlocking magnet 37.

The switch, to be hereinafter described, which governs the magnet 37, furnishes eight impulses in turning the shaft 33 against the force of the spring 33′ to open the valve 32, this valve remaining closed during several of these impulses and being brought to its fully open position by the remainder of the impulses. The switching mechanism that governs the unlocking magnet 37 also governs the locking magnet 38, the switch rendering the circuit of the magnet 37 ineffective when it renders the circuit of the magnet 38 effective. When the magnet 38 is energized it attracts its armature 39 to withdraw the holding dog 40 upon this armature from engagement with the ratchet 34. The spring 33′, against the force of which the magnet 37 turns the shaft 33, is then free to unwind to place the valve 32 in its closed position. If the magnet 37 should be given more than the predetermined number of impulses, the pin 41 upon the ratchet would engage the plate 42 which is journaled upon the shaft 33, the plate being thereby turned to bring the arm 43 thereon into engagement with the detent 44 upon the armature 39, the arm 43 then depressing the armature 39 to disengage the dog 40 from the ratchet 34, whereupon the spring 33 will unwind and place the valve 32 in closed position. When the valve 32 is placed in its fully open position, the shaft 33 engages the contact 17 with the two contacts 15 and 16 to close the ignition circuit, the engine of the power plant thus not being operable even though the valve 32 may be partially open, until the ignition circuit is thus closed.

The switching mechanism for governing the circuits of the unlocking magnet 37 and the locking magnet 38 is diagrammatically illustrated in Fig. 1, and is desirably constructed as illustrated in Figs. 2 to 9 inclusive. The switch shown is inclusive of a cylindrical casing 46 closed at one end by a disc of insulation 46′ and assembled at its other end with a mounting plate 47 which may be attached, for example, to the dashboard of an automobile. The disc 46′ also constitutes a contact carrier, as will appear, and is preferably assembled with the casing by means of bayonet pins 48 provided thereon that are received in bayonet slots 49 provided in the casing. A lock is provided which has an enclosing casing 50 that is in fixed relation with the casing 46. A plurality of inwardly spring pressed locking plungers 51 are carried by the shell 52 of the lock, this shell and the lock casing 50 being in fixed relation. A lock barrel 53 carries tumblers 54 that are respectively aligned with the plungers 51. When the key 55 is inserted said tumblers and plungers meet where the barrel 53 engages the shell 52, permitting the key to turn said barrel. This barrel is received within the central opening of an insulating disc 56 which constitutes a contact actuator, as will appear. A metallic contact ring 57 is assembled with the disc 56 by means of the spring barrels 58 which are in fixed relation with said ring 57 and which are in sliding engagement with the disc 56. These spring barrels contain spring pressed plungers 58′, which are thrust forwardly to engage the disc 56. The springs 58^2 that press upon said plungers forwardly, also press upon the rear ends of the barrels, these barrel ends constituting contacts 59, 60, 61 and 62, diagrammatically indicated in Fig. 1 as fingers projecting radially from the ring but in practice desirably projecting from the rear flat face of the ring.

A triangular metallic plate 63 is formed with a contact 64 that is located upon the common axis of the lock barrel 53, the disc 56 and ring 57, this contact 64 being in constant engagement with the terminal contact 65 carried by the insulating disc 46′, which not only serves to close the casing 46 but also serves as a contact carrier. The metallic contact plate 63 also carries another contact 66 which is brought into and out of engagement with the segmental metallic contact 67 that is coaxial with the barrel 53, the plate 63 being also assembled with the disc 56 by means of the spring barrels 68 carried by the plate 63, these spring barrels entering openings in the disc 56 and having

sliding engagement with this disc. Forwardly spring pressed plungers 69 are contained in the barrels 68, these plungers pressing upon the disc 66 and forcing the contacts 64 and 66 into engagement with their complements. The contacts 64 and 66 desirably project from the rear face of the plate 63. For clearness of illustration the contact 66 is shown in Fig. 1 as being in the form of a finger projecting radially from the plate 63. The contact carrier 46′ has a group of contacts 70, 71, 72 and 73 located in the circle of rotation of the contacts 59, 60, 61 and 62, the contacts 70 to 73 being accessible for engagement upon the inner face of the contact carrier 46′ and being electrically connected by a segmental metallic strap 74 upon the rear face of said contact carrier. Another group of contacts 75, 76, 77 and 78 are also in the circle of rotation of the contacts 59 to 62, these contacts 75 to 78 being also accessible for engagement upon the inner face of the contact carrier and being electrically connected by a metallic strap 79 on the rear face of said contact carrier.

When the key 55 is inserted the contact actuator 56 may be turned thereby in a uniform direction so that the contacts 59 to 62 inclusive may each sweep over and engage each of the contacts 70 to 73 inclusive and each of the contacts 75 to 78 inclusive, this movement being clockwise as viewed from the front of the switch and counterclockwise as viewed from Fig. 1. When the key 55 is withdrawn the plungers 51 enter the lock barrel 53 to hold this lock barrel from rotation and, through the medium of the lock barrel, to hold the contact actuator 56 from rotation. In this adjustment the circuit is opened at 66, 67, as diagrammatically illustrated in Fig. 1. When the key is inserted the lock barrel 53 is released whereupon the key is turned clockwise as viewed in Figs. 3 and 6, to turn the contact actuator 56 and the contact plate 63 clockwise as viewed in these figures, but counterclockwise as viewed in Fig. 1. The first result is to connect the contacts 66 and 67, whereby a circuit section is established tracing from the ground to the contact 67, the contact 66, the body of the plate 63, the contact 64, the contact 65, and the conductor 80. A conductor 81 connects conductor 80 with the metallic strap 79, the unlocking magnet 37 being included in the conductor 81. A conductor 112 is connected with the conductor 80, this conductor 82 being grounded through the locking magnet 38. When the contacts 66 and 67 are initially engaged no circuit is entirely complete, but when the key is moved further, the contacts 71 and 59 are engaged and contacts 61 and 78 are engaged, whereupon the grounded battery 14 is connected with the conductor 81, this battery being connected with the metallic strap 74 by the conductor 83 to complete the circuit of the unlocking magnet 37. This unlocking magnet is energized to move the segmental ratchet 34 one tooth space to turn the shaft 33 to a corresponding extent against the force of the valve closing spring 33′. When the key 55 is moved further the circuit thus established is broken to restore the pawl 35. The ratchet 34, however, is held by the dog 40. When the key 55 is moved a little further the contacts 59 and 72 are connected, contacts 60 and 70 are connected, and contacts 61 and 77 are connected, whereupon the unlocking magnet 37 is again energized to move the ratchet 34 another tooth space. In like manner, as the key 55 is continued to be turned, the contacts 59 and 73 are connected, contacts 60 and 71 are connected, contacts 61 and 76 are connected, and contacts 62 and 78 are connected, again to energize the magnet 37; the contacts 60 and 72 are connected, the contacts 61 and 75 are connected, and contacts 62 and 77 are connected again to energize the magnet 37; the contacts 60 and 73 are connected, and contacts 62 and 76 are connected to again energize the magnet 37; the contacts 61 and 70 are connected, and contacts 62 and 75 are connected, again to energize the magnet 37; contacts 61 and 71 are connected and contacts 59 and 78 are connected again to energize the magnet 37; and contacts 61 and 72 are connected, contacts 62 and 70 are connected, and contacts 59 and 77 are connected, whereupon the magnet 37 is given its final energization. The contact 66 is now at the upper end of the contact 67. A slight further movement of the key 55 will bring the contact 66 out of engagement with the contact 67 to open the circuit between the ground that is connected, with the contact 67 and the conductor 80. The magnet 37 is thereupon released but the dog 40 still continues to hold the ratchet 34. As a consequence of the intermittent movements of the shaft 33 effected by the magnet 37, the valve 31 is moved to fully open position. This condition is manifested to the operator of the automobile by means of the spring pressed plunger 84 upon the actuator 56 which clicks in its pocket 86 formed in the front end wall of the casing 46. Whenever the circuit of the unlocking magnet 37 was closed, a conductively continuous connection between the magnet 38 and the battery 14 was also established, but the magnet 38 was prevented from being energized due to the shunted ground connection extending from the contact 67. In order that the locking magnet 38 will not be energized when the circuit of the unlocking magnet 37 is finally broken by the separation of the contacts 66 and 67, the ring 57 should be disconnected from the battery 14 before the contact 66

leaves the contact 67, the ring 57 being so physically related to the contact plate 63 that this result will occur.

When it is desired to lock the valve 32 in closed position, the locking magnet 38 is energized to permit the spring 33' to turn the shaft 33 to an extent sufficient to place this valve in its closed position. This result is secured by turning the key 55 in its previous direction a sufficient distance to connect the contact 61 with the contact 73, contact 62 with contact 71, to connect contact 59 with 76, and contact 60 with contact 78, whereupon the circuit for the locking magnet 38 is established. The circuit for the unlocking magnet 37 is also established but this magnet is not affected when magnet 38 is energized, the latter magnet being of sufficiently less resistance than magnet 37 as to shunt magnet 37. Rotation of the key 55 is desirably thereafter continued until the spring pressed plunger 84 clicks into the pocket 87 upon the front end wall of the casing 46. During this further movement of the key 55 the locking magnet 38 is incidentally intermittently energized with no effect.

I claim—

1. The combination with an internal combustion engine including a fuel supply conduit and a valve movable to control the flow of fuel through said conduit; of electro-magnetic means operable to move said valve step by step, and a switch controlling the operation of said electro-magnetic means.

2. The combination with an internal combustion engine including a fuel supply conduit and a valve movable to control the flow of fuel through said conduit; of an electro-magnetically operated pawl and ratchet mechanism for moving said valve, and means controlling the operation of said mechanism.

3. The combination with an internal combustion engine including an ignition circuit and a switch movable to control said circuit; of electro-magnetic means operable to move said switch step by step, and means controlling the operation of said electro-magnetic means.

4. The combination with an internal combustion engine including an ignition circuit and a switch movable to control said circuit; of an electro-magnetically operated pawl and ratchet mechanism for moving said switch, and means controlling the operation of said mechanism.

5. The combination with an internal combustion engine including a fuel supply conduit and a valve movable to control the flow of fuel through said conduit; of yieldable means constantly urging said valve towards a closed position, electro-magnetic means for moving said valve step by step to open position against the influence of said yieldable closing means, and means controlling the operation of said electro-magnetic means.

6. The combination with an internal combustion engine including a fuel supply conduit and a valve movable to open and closed positions to control the flow of fuel through said conduit; of an electro-magnetically operated pawl and ratchet mechanism for moving said valve to one of its positions, yieldable means for moving said valve to the other of its positions, releasable means for holding said valve against movement during the intervals between the intermittent operations of said pawl and ratchet mechanism, electro-magnetic means controlling the operation of said holding means, and a switch controlling the operation of said pawl and ratchet mechanism and said holding means.

7. The combination with an internal combustion engine including an ignition circuit and a switch movable to control said circuit; yieldable means constantly urging said switch towards an open position, electro-magnetic means for moving said switch step by step to closed position against the influence of said yieldable switch opening means, and means controlling the operation of said electro-magnetic means.

8. The combination with an internal combustion engine including a fuel supply conduit and a valve movable to control the flow of fuel through said conduit; of electro-magnetic means operable when intermittently energized to move said valve step by step, and a switch controlling the operation of said electro-magnetic means, said switch including a rotatable part and means whereby continuous rotation of said part intermittently energizes said electrical means.

9. The combination with an internal combustion engine including a fuel supply conduit and a valve movable to control the flow of fuel through said conduit; of a spring constantly urging said valve towards closed position, a ratchet fixed to said valve, an electro-magnet including an armature, a pawl carried by said armature cooperating with said ratchet, means for intermittently energizing said magnet whereby said pawl and ratchet serves to move said valve step by step towards open position, and a releasable dog for holding said valve against closing movement during the intervals between the intermittent operations of said magnet.

10. The combination with an internal combustion engine including a fuel supply conduit and a valve movable to control the flow of fuel through said conduit; of a spring constantly urging said valve towards closed position, a ratchet fixed to said valve, an electro-magnet including an armature, a pawl carried by said armature cooperating with said ratchet, means for intermittently energizing said magnet whereby said pawl and ratchet serves to move said valve

step by step towards open position, a releasable dog for holding said valve against closing movement during the intervals between the intermittent operations of said magnet, and means whereby said dog is released to permit said spring to close said valve in the event said magnet is intermittently energized more than a predetermined number of times.

11. The combination with an internal combustion engine including a member movable between two positions in one of which it permits operation of the engine and in the other of which it prevents operation of the engine; of mechanism operable intermittently to move said member step-by-step to a position in which it permits operation of the engine, and means controlling the operation of said mechanism.

In witness whereof, I hereunto subscribe my name.

HARRY A. DOUGLAS.