P. R. WERNER.

IGNITION SYSTEM FOR EXPLOSION ENGINES.

APPLICATION FILED OCT. 5, 1908.

940,376. Patented Nov. 16, 1909.

4 SHEETS—SHEET 1.

Fig. 5.

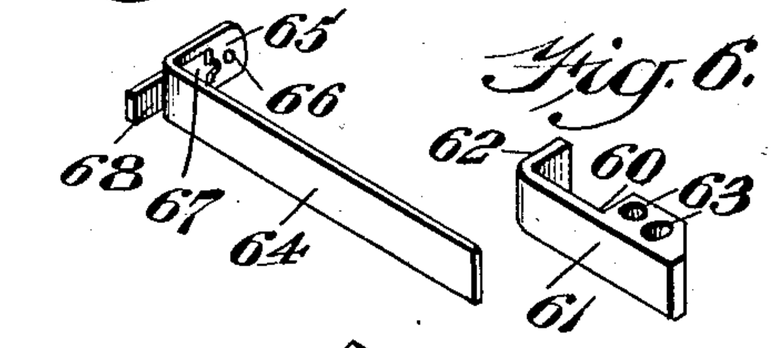


Fig. 6.

Fig. 4.

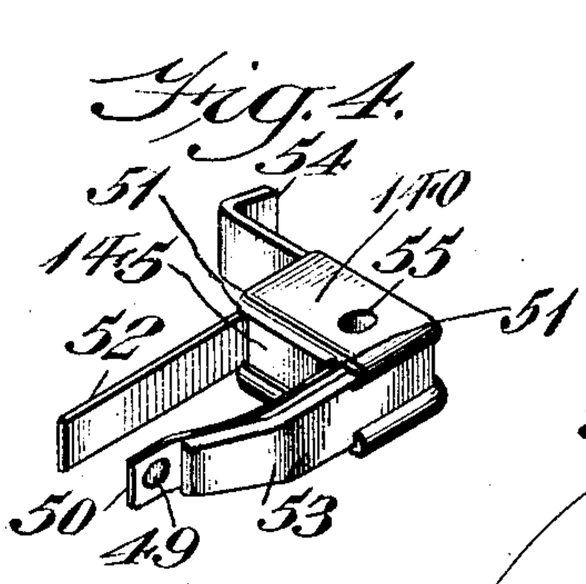


Fig. 1.

Fig. 10.

Fig. 7.

Fig. 8.

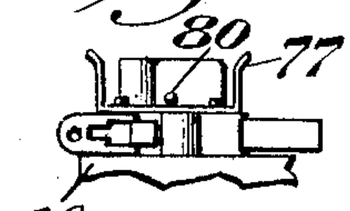


Fig. 9.

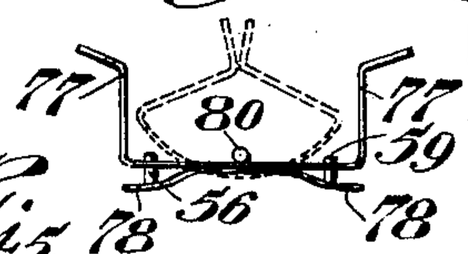


Fig. 2.

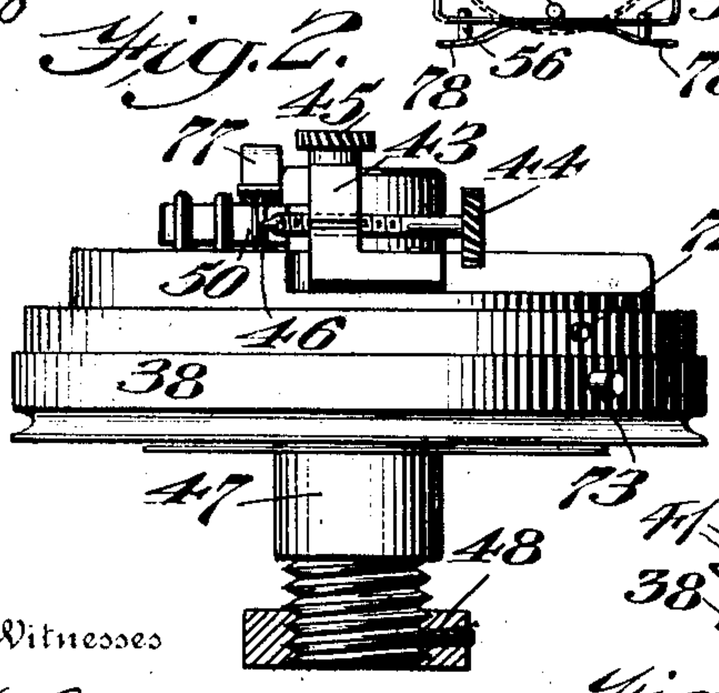


Fig. 3.

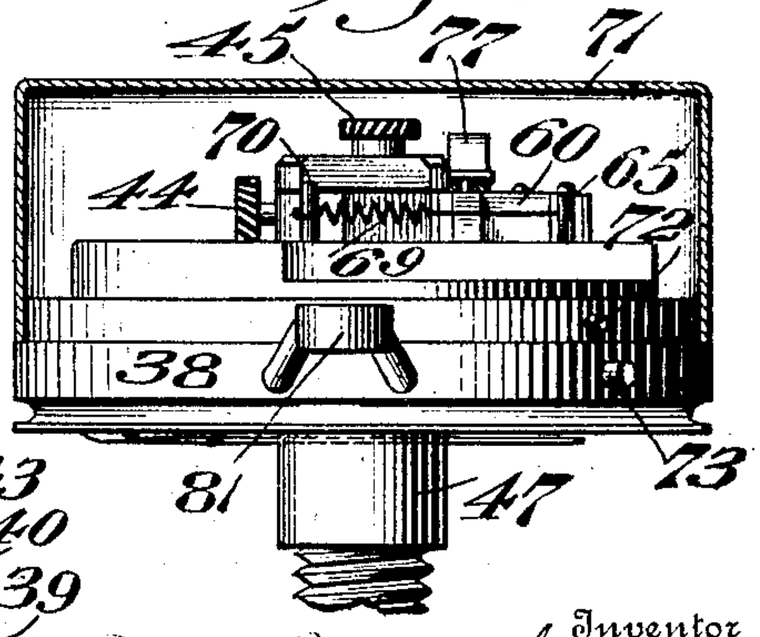
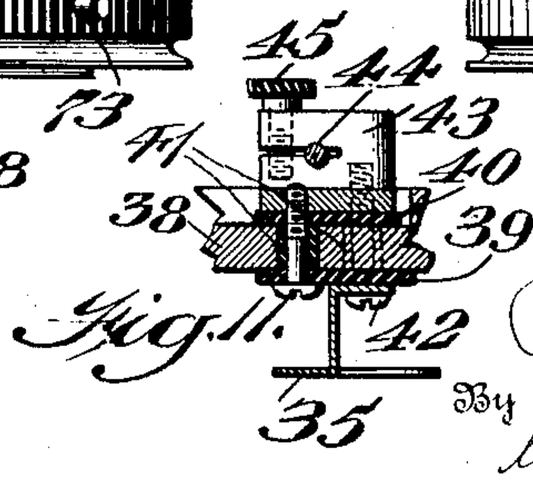


Fig. 11.



Witnesses

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4 SHEETS—SHEET 2.

Fig. 12.

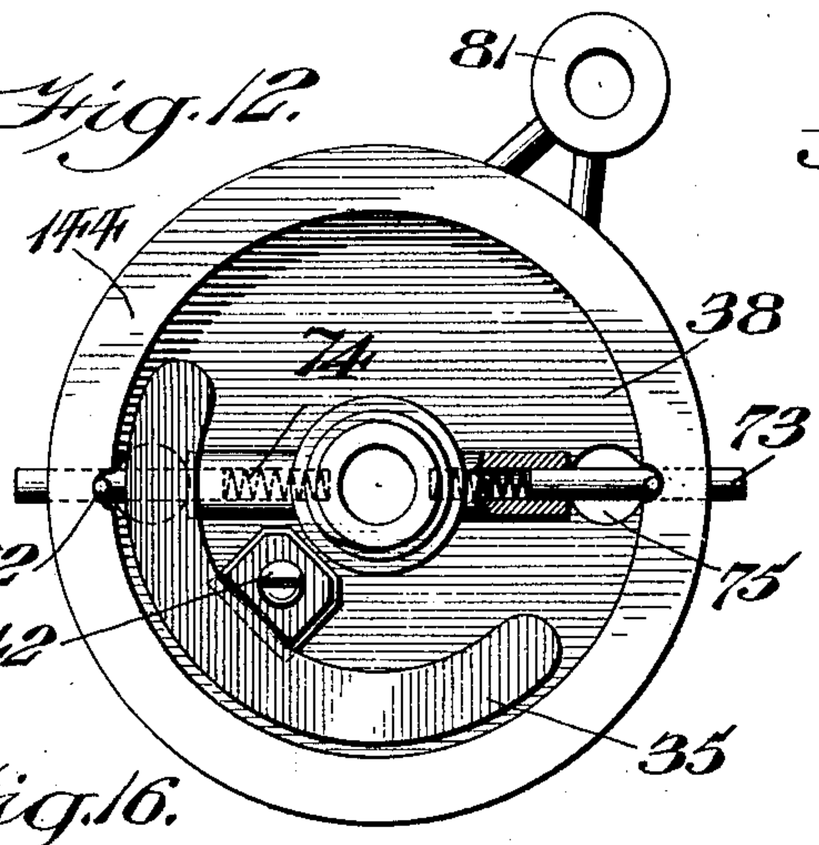


Fig. 15.

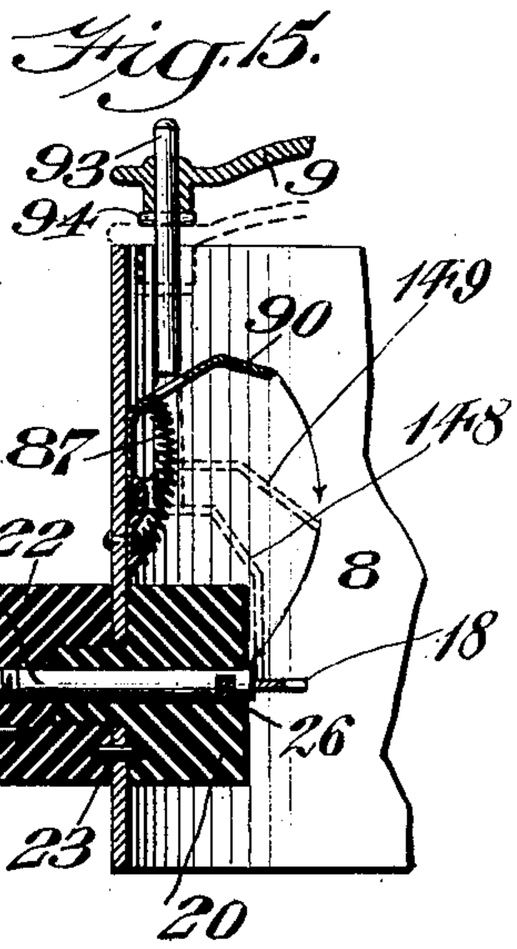


Fig. 14.

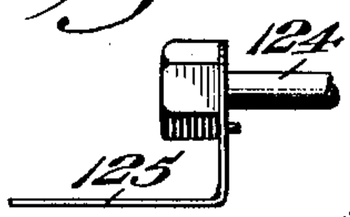


Fig. 16.

Fig. 13.

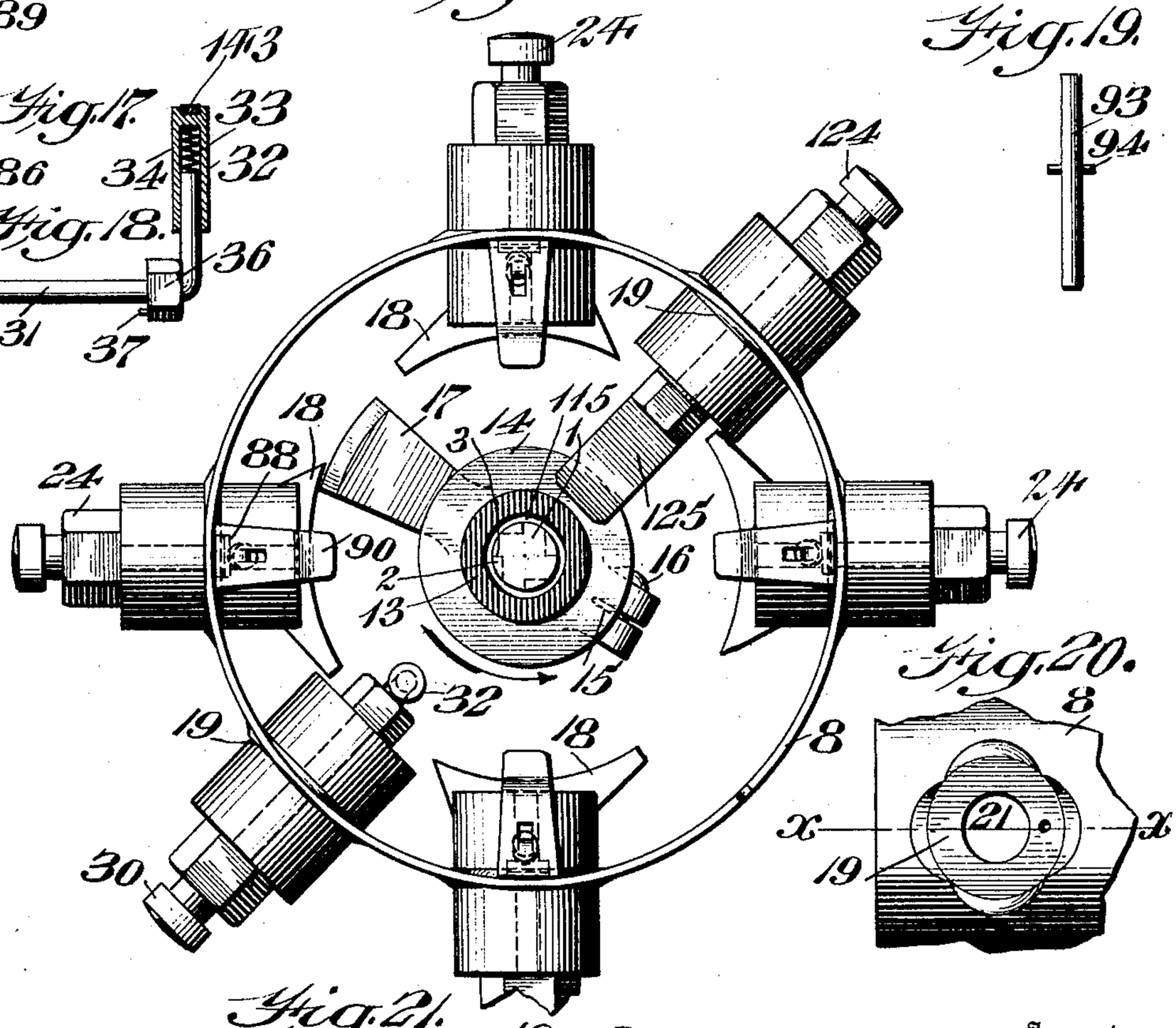


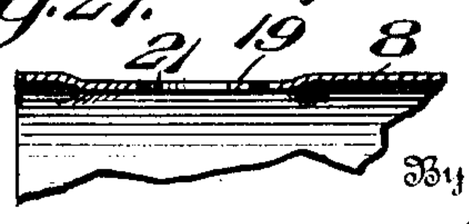
Fig. 19.

Fig. 17.

Fig. 18.

Fig. 20.

Fig. 21.



Witnesses

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4 SHEETS—SHEET 3.

Fig. 24.

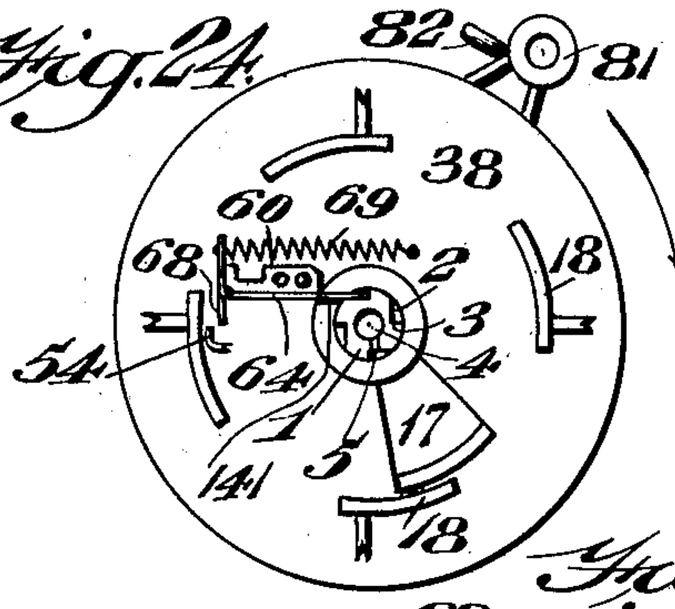


Fig. 23.

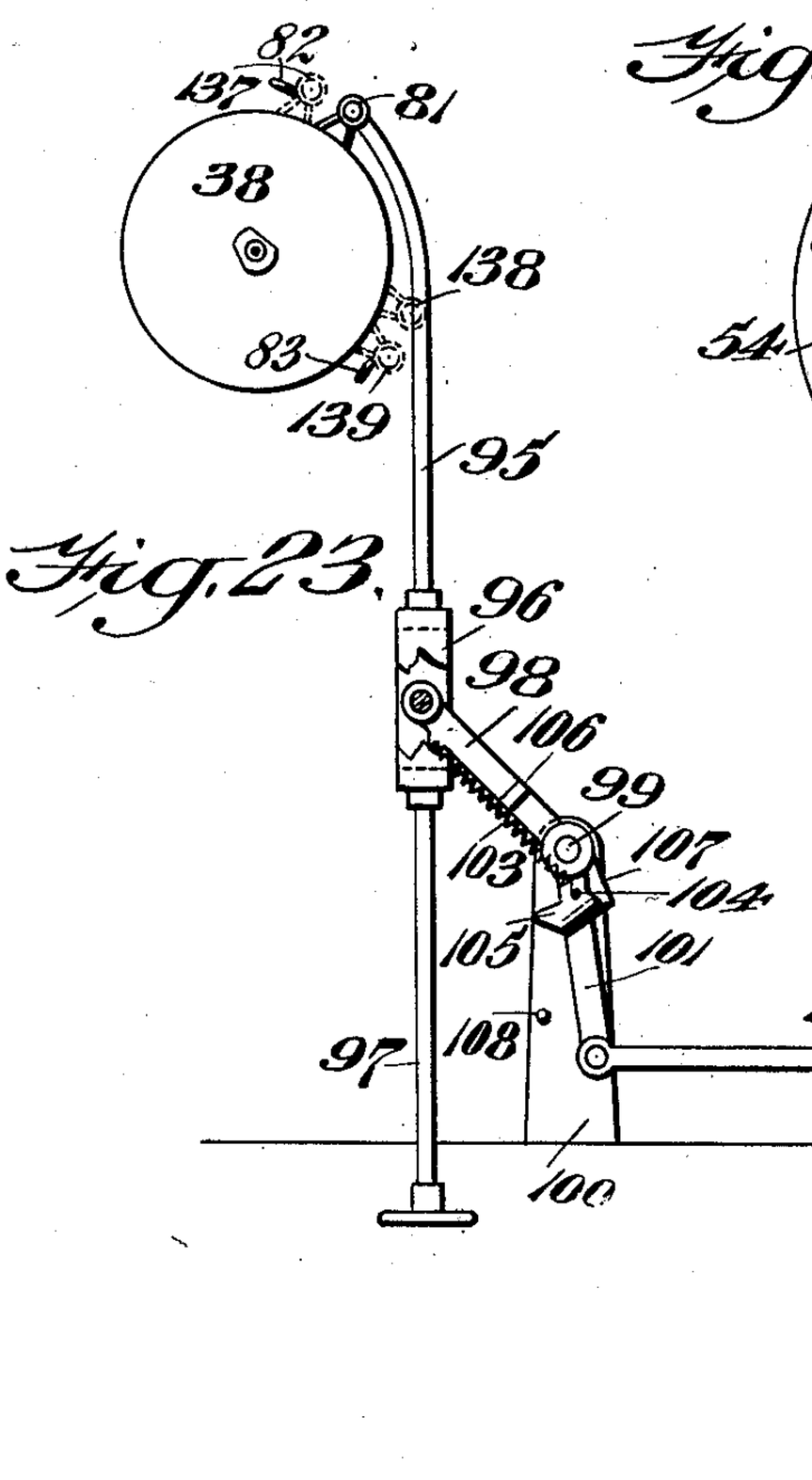


Fig. 22.

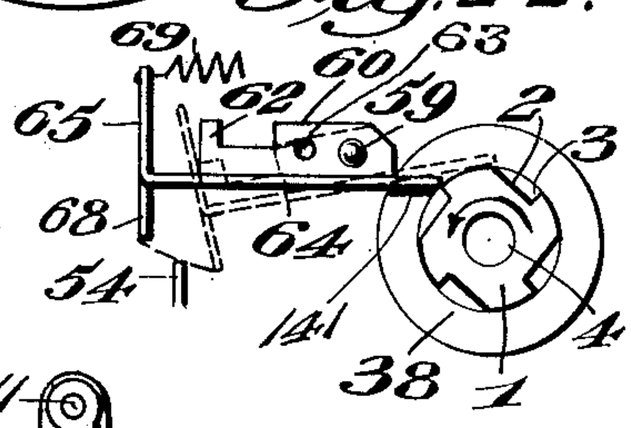


Fig. 25.

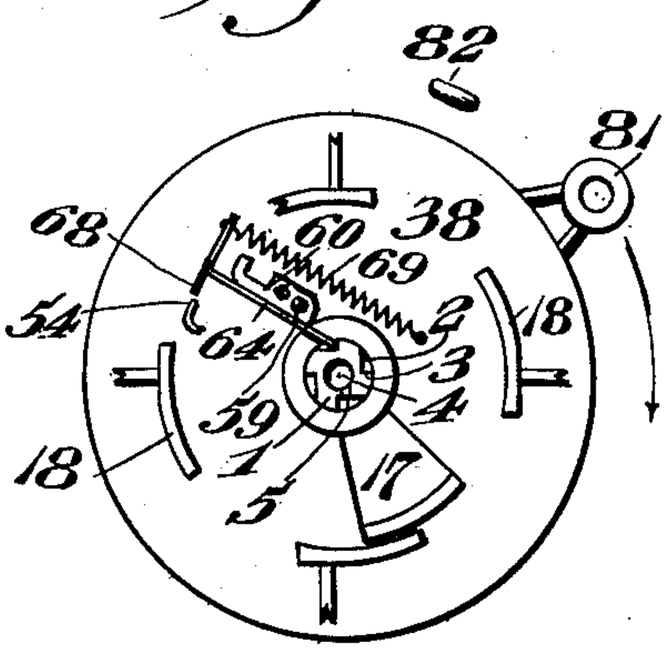


Fig. 26.

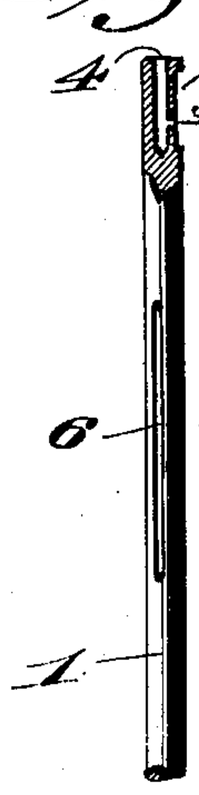
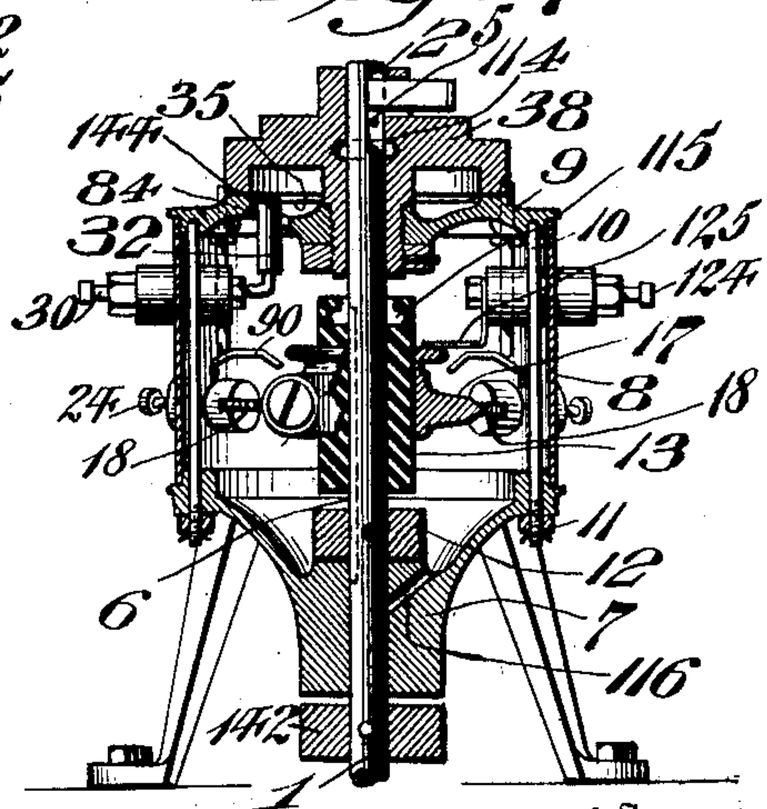


Fig. 27.



Witnesses

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IGNITION SYSTEM FOR EXPLOSION ENGINES.

APPLICATION FILED OCT. 5, 1908.

940,376. Patented Nov. 16, 1909.

4 SHEETS—SHEET 4.

Fig. 28.

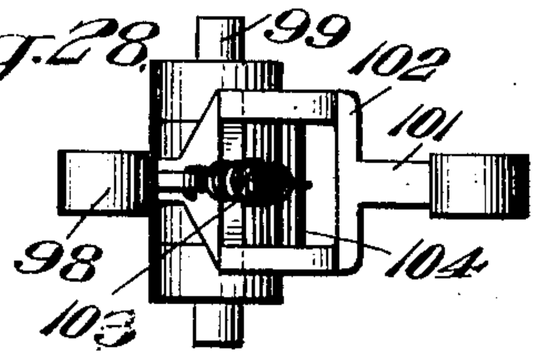


Fig. 29.

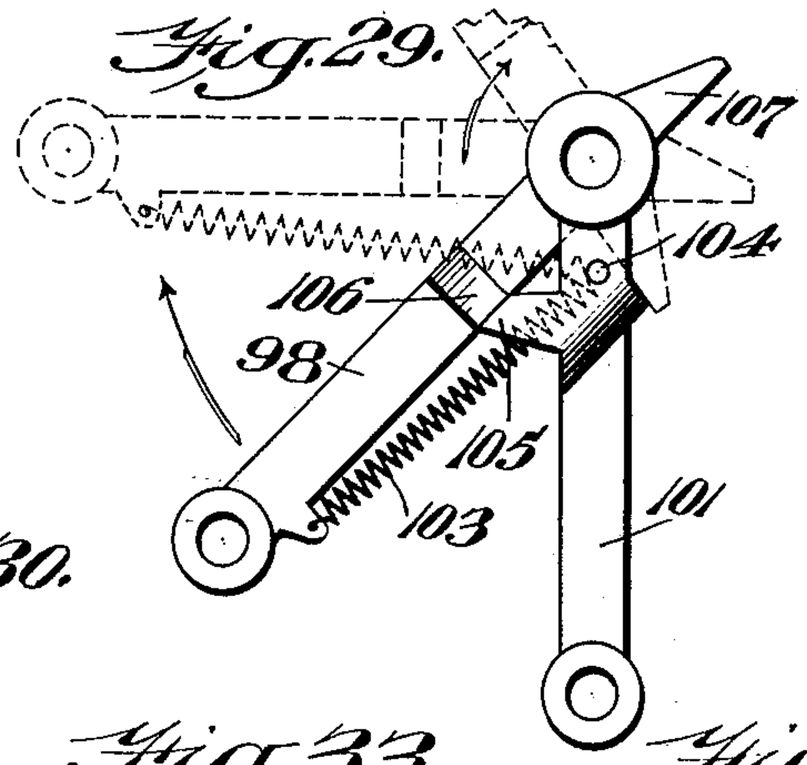


Fig. 30.

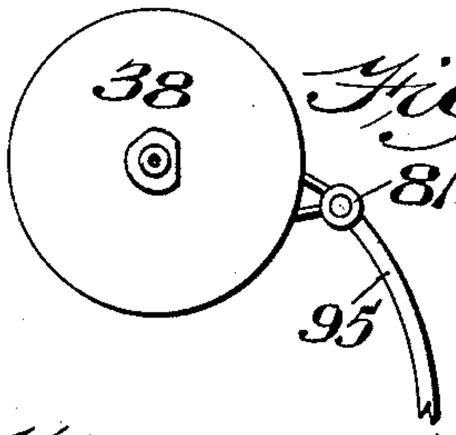


Fig. 32.

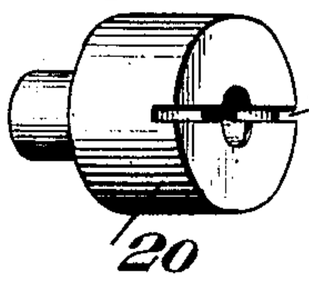


Fig. 33.

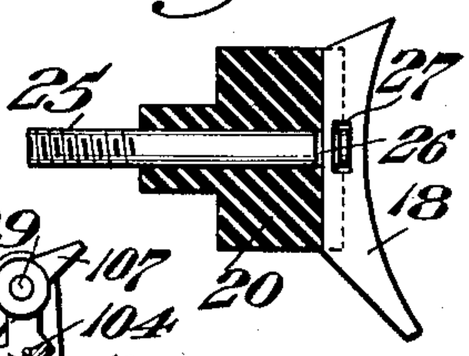
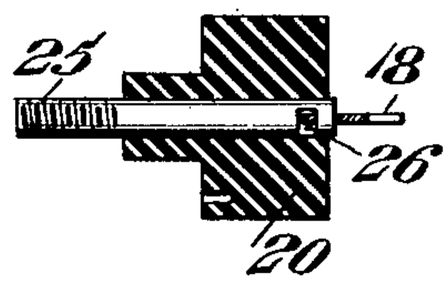


Fig. 34.



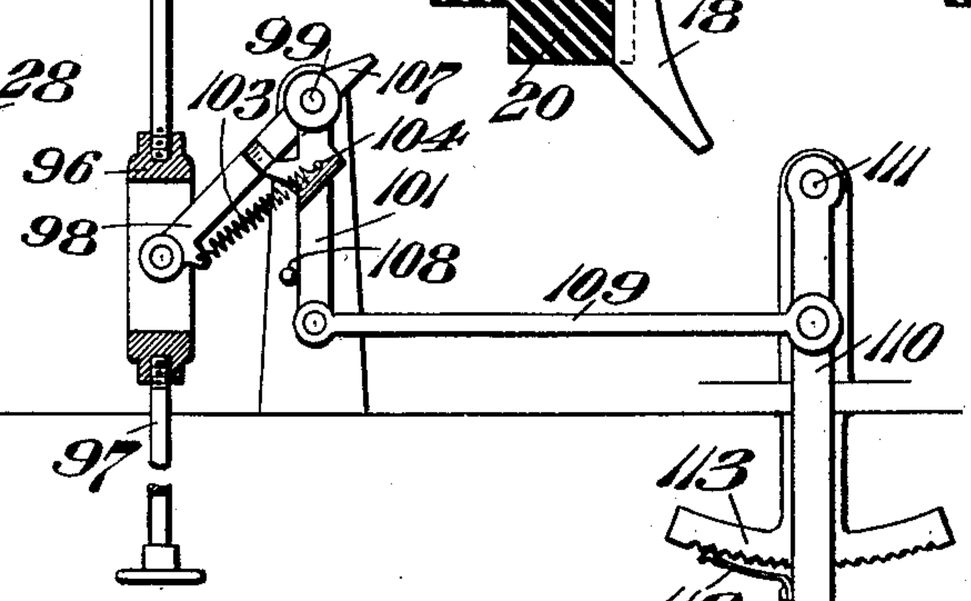


Fig. 35.

Fig. 36.

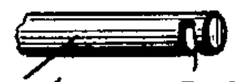
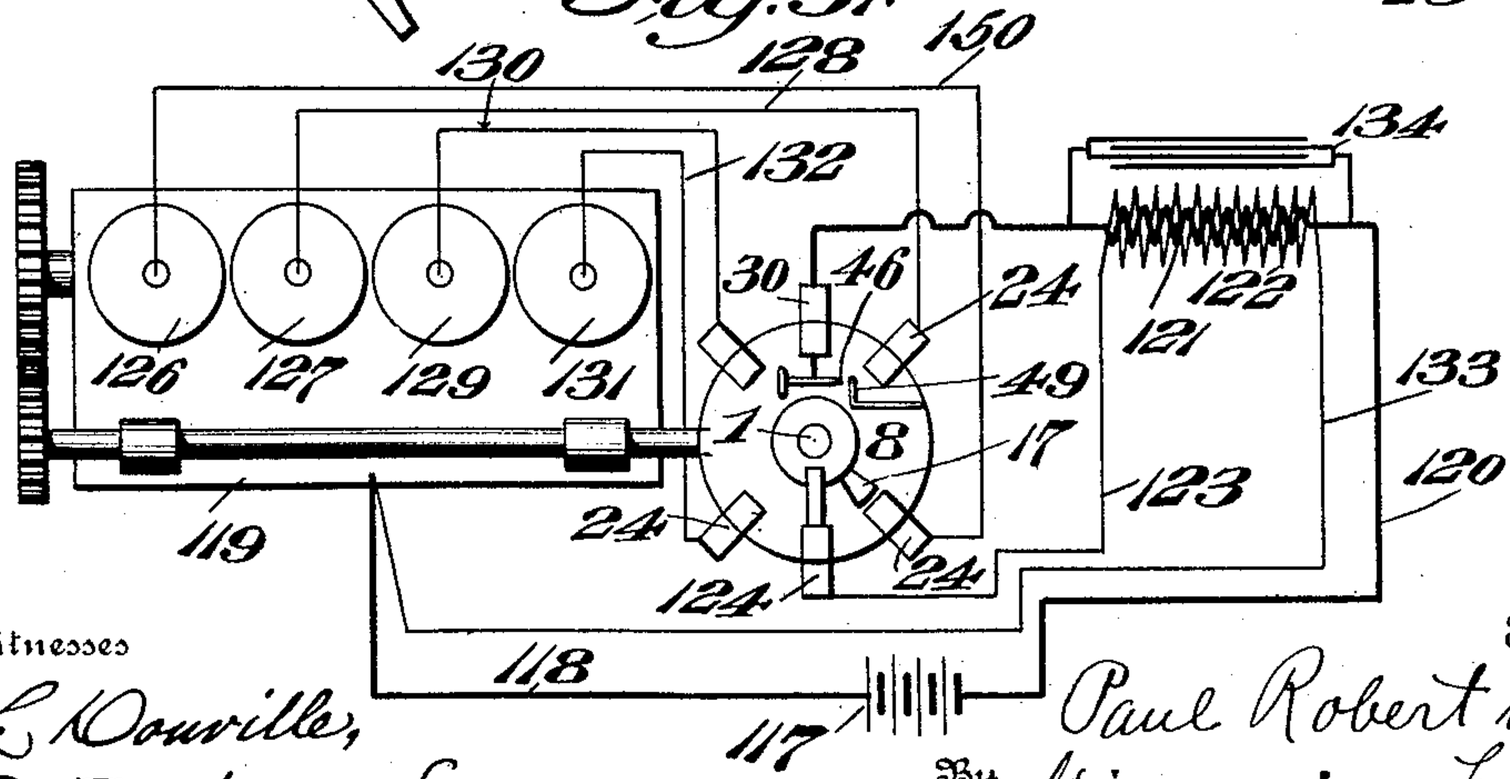


Fig. 31.



Witnesses

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UNITED STATES PATENT OFFICE.

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IGNITION SYSTEM FOR EXPLOSION-ENGINES.

940,376. Specification of Letters Patent. Patented Nov. 16, 1909.

Application filed October 5, 1908. Serial No. 456,227.

To all whom it may concern:

Be it known that I, PAUL R. WERNER, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Ignition System for Explosive-Engines, of which the following is a specification.

My present invention relates to an ignition system wherein but one transformer (*i. e.* induction coil without vibrator) is employed, the secondary or high potential current of which is conducted to the proper cylinders in consecutive order by the use of a rotating switch or selector; the primary current being produced by the proper action of the contact points.

It further consists of a novel construction of an ignition system wherein I obtain a making and breaking of the primary circuit, the contact being produced for a particular time interval to allow the complete saturation of the coil, and a quick, sharp break, such contact being always performed in the same time and in the same manner regardless of the engine speed.

It further consists of means for causing the above mentioned operations to take place in different phases with operation of engine.

My invention further consists of a novel construction of an ignition system wherein the manual labor commonly known as the cranking or turning over of the engine in order to start the same is entirely dispensed with, since in my present construction by simply rotating the contact support I am enabled to produce a spark, the same as is produced when the engine is running.

It further consists of a novel construction of an ignition system wherein means are provided whereby the secondary current may be short circuited through any particular cylinder or cylinders in case the operation of one or more of the cylinders becomes defective.

It further consists of means for causing the making and breaking of the primary current to occur at such times as may be necessary to operate the engine regardless of its speed, thus acting as a timer.

It further consists of means for bringing the spark lever to normal position, *i. e.* lever in extreme retarded position, the spark occurring when the piston has reached the highest point in its stroke and the crank is starting on its downward travel, thereby allowing the engine to rotate in the proper direction and thus preventing the engine from stopping or running in a reverse direction. Furthermore, on failure of engine to properly operate through lack of combustible charge, the temporary failure of fuel supply or other causes, such means will prevent the engine on being started by cranking or turning over, from kicking back due to the spark taking place prematurely as happens when the engine is running high speed.

It further consists of a novel construction of an ignition system wherein all the moving parts may be readily removed without the use of tools, and which while reliable and efficient in action may be cheaply manufactured.

It further consists of a novel system of oiling requiring but one oil hole and a minimum amount of oil and attention, the system acting automatically to lubricate all bearings.

It further consists of means for causing the engine to become automatically inoperative should the engine for any reason tend to run backward such as slowing down under a load.

It further consists of other novel features of construction, all as will be hereinafter fully set forth.

For the purpose of illustrating my invention I have shown in the accompanying drawings a preferred embodiment thereof, which has been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangement and organization of these instrumentalities as herein set forth.

Figure 1 represents a top plan view of an ignition system embodying my invention, certain parts thereof being removed for the sake of clearness of illustration. Fig. 2 represents a side elevation of Fig. 1, certain parts thereof being removed. Fig. 3 represents a side elevation of Fig. 1, showing in addition a sectional view of the casing, certain parts having been removed. Fig. 4 represents a perspective view of the movable contact member on an enlarged scale. Fig. 5 represents a perspective view on an enlarged scale, of the removable actuating member for the contact member. Fig. 6

represents a perspective view on an enlarged scale, of a removable guide, stop, and bearing member for the movable contact actuating member. Fig. 7 represents a perspective view of a spring clip employed to prevent improper movement of the movable contact member, contact actuating member, guide stop and bearing member. Fig. 8 represents a side elevation of a portion of my device showing the spring seen in Fig. 7 in assembled position. Fig. 9 represents a side elevation of the spring seen in Fig. 7, showing in full lines more clearly the manner in which the same is assembled and in dotted lines the position it assumes when the spring is compressed manually to remove or replace same. Fig. 10 represents a sectional view of a portion of my device showing more particularly the manner in which the cover is secured to the rotatable support. Fig. 11 represents a sectional view of a portion of the device showing more clearly the insulation for the stationary contact, and certain of its adjuncts. Fig. 12 represents a bottom plan view of the rotatable contact support in detached position. Fig. 13 represents a transverse section of Fig. 1 showing more particularly the terminals for the different cylinders, the selector and its terminal and the primary terminal and its contact member. Fig. 14 represents a side elevation of a portion of Fig. 13. Fig. 15 represents a sectional elevation of a portion of Fig. 13, showing more particularly the manner in which one of the cylinders is short circuited. Figs. 16 and 17 represent perspective views of a portion of the mechanism seen in Fig. 15. Fig. 18 represents a sectional view in detached position, of one of the contact members seen also in Fig. 27. Fig. 19 represents a side elevation of one of the pins which co-act with the member seen in Fig. 16, and seen in position about to be assembled in full lines in Fig. 15. Fig. 20 represents a plan view of a portion of the shell showing the manner in which the same is flattened at certain points thereof. Fig. 21 represents a section on dotted lines *x*—*x*, Fig. 20. Fig. 22 represents a plan view of a portion of my device showing in dotted lines the path in which the actuating member travels to co-act with the movable contact carrying member. Fig. 23 represents a diagrammatical view showing the manner in which the contact carrying support is actuated. Fig. 24 represents a plan view of a portion of the device, certain parts thereof having been removed in order to more clearly illustrate the manner in which the spark is produced in starting on spark. Fig. 25 represents a plan view similar to Fig. 24, but showing the parts in different relation to each other. Fig. 26 represents a plan view partly in section, of the actuating shaft. Fig. 27 represents on a reduced scale, a sectional elevation of my device, certain parts thereof having been removed. Fig. 28 represents a side elevation of certain portions of the controlling mechanism. Fig. 29 represents a plan view of Fig. 28, certain of the parts being shown in dotted lines in the position they assume at certain times. Fig. 30 represents a diagrammatical view showing the parts in Fig. 23 in different relation to each other. Fig. 31 represents a diagrammatical view showing the wiring and the manner in which the different circuits are formed. Fig. 32 represents a perspective view of one of the insulating members, in detached position. Fig. 33 represents a sectional view of an insulating member and showing in addition a contact and its fastening device. Fig. 34 represents a sectional view of the device seen in Fig. 33. Fig. 35 represents a plan view of one of the contacts. Fig. 36 represents a perspective view of a portion of the fastening device seen in Figs. 33 and 34.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings. In order to clearly set forth my invention I will first describe in detail my preferred construction and then the operation of the various parts.

1 designates a driven shaft which is operatively connected with the engine in any suitable or desired manner. The shaft 1 is angularly recessed as indicated at 2 thereby forming a shoulder 3, the purpose of which will hereinafter appear, it being understood that the number of such shoulders preferably correspond to the number of cylinders in the engine. The shaft 1 is provided with an oil aperture 4 at its outer end from which the oil may pass through a port 5 to the recessed portions, it being noted that the intermediate portion of the shaft 1 is provided with a suitable oil groove 6.

7 designates a casing member rotatably mounted on the shaft 1 and having its upper end preferably suitably recessed thereby adapting the same to receive the shell 8 which is preferably constructed of steel tubing. This casing member 7 if desired may have suitable lugs or standards as seen in Fig. 27.

9 designates a top member for the shell 8 which is suitably recessed in order to receive the upper end of the shell 8, said top member 9, shell 8 and bottom member 7 being rigidly secured together by means of rods 10 secured to the top member 9 and passing through the member 7 it being noted that such rods are provided with nuts whereby the parts are secured rigidly in assembled position. The shaft 1 has rigidly secured thereto by any suitable means set collars 12 and 142 which prevent improper longitudinal movement of the shaft 1.

13 designates an insulated bushing non-

rotatably mounted on the shaft 1 in any suitable manner and having mounted thereon a collar 14 which is split a certain distance as is indicated at 15, the parts being suitably secured together by means of a fastening device 16 whereby the collar 14 is non-rotatably mounted on the bushing 13, it being seen, as most clearly illustrated in Fig. 13 that the collar 14 is provided with a selector or arm 17 which is adapted to engage with the contacts 18 of the different cylinders. Instead of providing the contacts 18 of the different cylinders, with a comparatively small operative contact face as has heretofore been the custom in prior devices with which I am familiar, I provide an elongated contact surface, the length of which varies in accordance with the requirements met with in practice.

In order to save the expense of shaping the insulation provided for the terminals on the shell which leads to the different cylinders as well as the primary and secondary terminals I have in the present instance, by means of suitable dies flattened that portion of the shell 8 with which the insulation engages as will be clearly understood from Figs. 20 and 21, reference being also had to Fig. 13. It will be seen as indicated in Fig. 20 that by such means I obtain a flat surface 19 on both sides of the shell. The inner insulating block 20 is provided with an extension which projects through the aperture 21 and interlocks with the outer insulated block 22, it being understood by reference to Fig. 15 that a pin 23 passes through the shell 8 and engages the blocks 20 and 22 to prevent their rotation.

24 designates one of the terminals to which is adapted to be connected the wire leading to a desired cylinder. The terminal 24 is internally threaded as seen in Fig. 15 in order to engage with the threaded end of the connecting rod 25 which latter passes through the interlocking insulator members 20 and 22, it being noted that the inner end of the rod 25 is provided with a slot 26 thereby permitting the end of the rod 25 to interlock with the contact 18 which latter is provided with an aperture 27. In order to prevent improper movement of the contact 18 the insulator block 20 is provided with a slot 28 in which said contact is seated when the parts are in assembled position. In order to prevent improper movement of the terminal 24 a pin 29 passes therethrough and into the insulator block 22.

30 designates a primary terminal which is insulated from the shell 8 in a similar manner to the terminal 24, but instead of employing a rod such as 25 I employ a rod 31, as seen most clearly in Fig. 18, one end of said rod being adapted to engage with the terminal 30, while the other end thereof is deflected thereby forming a support on which a contact member 32 is movably mounted, said member 32 being provided with an aperture 33 and closed at one end. A spring 34 is located in the aperture 33 whereby when the parts are assembled as seen in Fig. 27 the contact member 32 will be maintained in engagement with the plate 35, it being seen that the contact portion of member 32 is suitably recessed in order to receive the lubricating material 143 which would preferably be graphite or other current conducting material.

36 designates an abutment for maintaining the terminal 30 and its adjuncts in position, said abutment being prevented from improper movement after being once adjusted owing to the provision of the pin 37 which engages said abutment and the adjacent insulating material. The contact plate 35, seen in Fig. 11 is insulated from the rotatable support or head 38 by means of the strips of insulation 39 and 40 and the bushings 41 through one of which the fastening device 42 passes the latter being connected with the contact block 43.

44 designates a contact carrying membe which has preferably threaded engagement with the stationary block 43 and is adapted to be maintained in its adjusted position by means of the set screw 45, it being noted that the end of the member 44 is provided with a contact point 46. The head 38 is provided in the present instance with a hollow shaft 47 which has a bearing in the stationary top member 9 of the casing, the lower end of said shaft 47 being threaded and with this threaded portion a set collar 48 is adapted to engage in order to maintain the rotatable member 38 in assembled position with respect to the stationary top member 9 of the casing and its adjuncts, it being most clearly seen in Fig. 27 that the top member 9 has a raised portion thereby forming a bearing for the under side 144 of the rotatable member 38 as will be clearly understood by reference to Figs. 12 and 27. The movable contact 49 is secured to a resilient arm 50 which latter is bent inwardly as indicated at 51 and then outwardly as indicated at 52, the portion 51 of said member being secured to the block 140 which forms with its adjuncts a rocker arm by deflecting or swaging the outer edges thereof over the portion 51 of the member 50 thereby rigidly securing the same to the block 140. It is in some cases desirable to use a plate 145 in order to prevent the distortion or buckling of the member 50 due to the swaging operation.

53 designates a rigid member one end of which is deflected in order to engage with the member 50 and prevent the improper vibration thereof. The member 53 is deflected in order that it may conform to the contour of the block 140 it being noted that

said member 53 is rigidly secured to the block owing to the manner in which the sides of said block are recessed and the edges are deflected over said member as will be clearly understood from Fig. 4. The opposite end of the member 53 is deflected outwardly as indicated at 54 in order to form a bearing surface, the purpose of which will hereinafter appear. The block 140 is apertured as is indicated at 55 thereby adapting the same to be removably mounted on the pin 56, it being noted that when the parts are in assembled position the resilient member 52 normally engages with stop 146, the movement of said member 52 in the opposite direction being limited by the stop pin 147. The rocking of the block 140 in one direction is limited by the stop pin 57 while its movement in the opposite direction is limited by the stop pin 58, it being noted that the pins 146, 147, 56, 57 and 58 are carried by the rotatably mounted head 38. The stop 146 prevents distortion of the member 50 while the stop 147 prevents the distortion of the member 52.

59 designates a pin or stud also carried by the head 38 and on which is rotatably mounted a combined bearing and stop member 60, said member being provided with a bearing surface 61 and having its free end deflected as indicated at 62 the purpose of which will hereinafter appear. The member 60 is apertured as indicated at 63 in order that it may be removably and rotatably mounted on stud 59.

64 designates a movable member one end of which is deflected as indicated at 65, the latter portion being provided with an aperture 66 and a slot 67 which latter is formed by stamping out a portion of the material such portion being deflected as indicated at 68 in Fig. 5, the end of said deflected portion 68 being adapted to engage with, at certain times the deflected portion 54 of the member 53 as will be more fully explained in connection with the operation of the device.

69 designates a spring one end of which is secured to a stud 70 carried by the rotatable head 38, the other end of said spring being secured to the portion 65 whereby the deflected portion 65 is normally in engagement with the deflected end 62 of the movable member 60 it being understood as seen in Fig. 1 that one end of the movable member 64 is adapted to co-act with the shoulders 3 on the shaft 1. In order that the spring 69 may be readily and quickly removed when desired, I cut away a desired amount of the member 65 as indicated in Fig. 5 in order that the spring 69 may be the more quickly secured to such member as will be apparent from Figs. 1 and 5.

71 designates a cover which is adapted to be seated on the head 38 as is indicated most clearly in Figs. 3 and 10, said cover being retained in position owing to the engagement therewith of the pins 72 which latter are carried by the rod 73 which is normally maintained in the position seen in Fig. 10 by means of the spring 74. In order that the pin 72 may be readily secured to the rod 73 I provide a differential aperture in the head 38 as is indicated at 75, thereby forming a bearing or abutment for that portion of the pin 72 extending on opposite sides of the rod 73.

76 designates a yielding retaining device which is most clearly seen in Figs. 7, 8 and 9, see also Figs. 2 and 3. This retaining device consists of a spring having the upwardly deflected sides 77 and provided with the downwardly turned members 78 it being seen that the bottom of the device is provided with apertures 79.

80 designates a pin or stud carried by the rotatable head 38 and extending preferably horizontally therefrom to prevent the retaining device becoming accidentally removed. The object of the retaining device 76 is to prevent any improper movement of the member 140 and its adjuncts, the member 64 or the member 60. It will be noted that the ends 77 are bent toward each other until they assume the position shown in dotted lines in Fig. 9, whereupon the member 76 can be slipped under the pin 80 and when the ends 77 are released the apertures 79 will engage with the pivot pins 56 and 59 respectively. Since any upward movement of the device is positively prevented by the pin 80 it will be apparent that no upward movement of the block 140 and its adjuncts or the parts 64 and 60 can take place. Owing to the pressure of the resilient members 78 a slight tension will always be placed on the member 140 and also a desired amount of tension on member 64 and member 60. I wish to call particular attention to the fact that the ends 77 are deflected in such manner that any permanent distortion of the bottom portion of the resilient retaining device is prevented.

81 designates an apertured arm preferably integral with the head 38, the movement of said arm being limited by the stops 82 and 83 carried by the casing 9. The stops are located in such a manner that the spring actuated contact plunger 32, which when the parts are assembled passes through the aperture 84 as seen in Fig. 27, will be prevented from disengagement with the contact plate 35, seen most clearly in Fig. 12.

I will next describe the mechanism employed for short-circuiting one or more of the cylinders when it is desired to test the working of any one or more of such cylinders, reference now being had more particularly to Figs. 15, 16 and 17. 85 designates a plate which is secured by rivets or equiva-

lent fastening devices to the shell 8, said plate having a portion 86 thereof deflected outwardly and to this deflected portion one end of a spring 87 is secured. The upper portion of the plate 85 is deflected to form a lip or tongue 88 which is adapted to pass through the aperture 89 in a short-circuiting member 90 which has a portion thereof deflected as indicated at 91 and to such portion the other end of the spring 87 is secured, whereby the plate 90 is normally maintained in the position indicated in full lines in Fig. 15 until the parts are assembled. The tongue 88 and aperture 89 form a hinge connection for the plates 85 and 90. 92 designates apertures in the casing member 9 through which the ends of rods 93 extend, one of said rods being shown in detached position in Fig. 19, said rods being provided with a cross pin 94 or other suitable abutment in order to prevent the same from passing through the apertures 92, it being understood that the lower end of the rods 93 bear upon the plate 90 and the rods are held against casing member 9 by springs 87 and when such rods are depressed the plates 90 assume the positions indicated in dotted lines at 148 in Fig. 15 when the parts are assembled in order to cut out or short circuit a desired cylinder. When the parts are assembled, the plate 90 assumes its normal position as indicated by dotted lines at 149. It will be understood that in Fig. 15 I have shown in full lines the position the plate 90 assumes before the top casing member is assembled with respect to the other parts. When the parts are assembled the tension of the spring 87 maintains the plate 90 in engagement with the lower end of the rod 93 as shown by dotted lines 149, Fig. 15. The apertured arm 81 has connected therewith a connecting rod 95 to which is secured the coupling 96 having also connected therewith an actuating rod or lever 97. 98 designates an arm, one end of which is pivoted to the coupling 96, the other end thereof being pivoted at 99 to a suitable fixed part such as the standard 100, which would be carried by the car body or engine frame or other suitable rigid part. 101 designates a lever provided at one end with a fork 102 the ends of which are pivoted on the rod 99. 103 designates a spring one end of which is secured to the arm 98 the other end thereof being secured to a rod 104, carried by the fork 102. The fork 102 is provided with the lugs 105 which engage with the lugs 106 thereby limiting the extent to which the arm 101 can approach the arm 98. The arm 98 is provided with an extension 107 which at certain times is adapted to abut against the fork 102, the purpose of all of which will hereinafter more fully appear. 108 designates a stop for limiting the movement of the arm 101 in one direction. The arm 101 has pivoted thereto a connecting lever 109 one end of which is pivoted to the lever 101, the other end thereof being pivoted to a lever 110 which latter is pivoted at 111 to a suitable fixed point, said lever 110 being provided with a resilient locking member 112 which is in sliding engagement with the stationary rack 113.

In order that the device will be suitably lubricated at all times the rotatable head 38 is provided with an annular groove 114, see Fig. 27, it being seen that the oil passing through the apertures 4 and the apertures 5 will pass down one of the faced off portions 2 and collect in the annular groove 114 in the head 38 and gradually work its way along shaft 1 and collect in the annular groove 115 formed in the insulating block 13 and pass through the channel 6 in the shaft 1, down to the bearing in the bottom member 7. Any surplus oil which collects within the casing will pass through the apertures 116 and thence to the shaft 1.

In order to more clearly describe the operation of my device I have shown in Fig. 31 a diagrammatical view wherein is indicated the manner in which the current flows from the battery through the system. In this figure, 117 designates the battery or other current supply from which the line 118 extends, said line being grounded on the engine casing 119. 120 designates another line leading from the battery 117 or other terminal of the current supply, said line passing through the primary coil 121 to the terminal 30 and thence to the stationary contact 46, thence to the movable contact 49, then passing through the body of the device to the engine casing and thence through line 118 to the battery. The secondary current passes from the secondary coil 122 by the line 123 to the secondary terminal 124 which latter has secured thereto a contact plate 125 which bears on the upper face of the collar 14 and from thence it passes to the selector 17. In the present instance as shown by diagram, Fig. 31, the secondary current passes from selector 17 to terminal 24 to spark plug in cylinder 126 through the line 150. The spark plug in cylinder 127 is connected by line 128 with the terminal 24, the spark plug in cylinder 129 is connected by its line 130 with its terminal 24 and the spark plug in cylinder 131 is connected by the line 132 with its terminal 24. The current passes by lines 128, 130 and 132 only when the selector 17 is opposite their respective contact blocks 18. The secondary coil 122 is grounded with the casing 119 by the line 133 whereby the secondary current returns to the secondary winding of the coil. 134 designates a condenser which is connected across the primary coil 121. 135 designates lugs carried by the casing member 9 with fas-

tening devices 136 whereby connections may be secured thereto in order to maintain the casing of the entire device stationary and since any suitable connections may be employed for this purpose and since such connections will vary in accordance with the machine to which it is secured I have deemed it unnecessary to illustrate or describe in detail such a construction.

The operation of my novel construction of ignition system will now be readily apparent and is as follows: The shaft 1 is operatively connected in any suitable manner with the engine shaft and at any desired ratio to the engine speed. Assuming now that the shaft 1 rotates and the parts are in their normal position as seen in Fig. 1 the shoulder 3 will cause the movable member 64 to be moved outwardly from its normal position in substantially a straight line, it being understood that this movement brings spring 69 to a greater tension, it being noted that there is always a slight tension on the deflected end 65 of the member 64. As the member 64 moves forwardly it has a sliding bearing on the bearing surface 61 of the member 60 and on the bearing surface 141 of the support 38. As the shoulder 3 passes beyond the inner end of said member 64, the inner end of said member 64 will slide on the outer periphery of the shaft 1 and owing to the tension of the spring 69, the member 64 will be returned in a different manner from which it was advanced, as clearly shown in Fig. 22, and during its return movement the end of the member 68 will contact with the deflected end 54 of the member 53 which latter is secured to the block 140 thereby causing said block 140 to be moved on its pivot 56 and the contact 49 will engage with the stationary contact 46. When the end of the projection 68 engages with the deflected end 54 the block 140 will be oscillated on its pivot 56 against the tension of the spring 52 and as soon as the member 68 becomes disengaged from the deflected end 54 the spring 52 will cause the block 140 and its adjuncts to assume their normal position as indicated in Fig. 1. The stops 147 and 58 are provided in order to render the device fool proof so that the ends of the member 51 cannot be injured by the distortion of such members.

I wish to call particular attention to the novel movement of the movable member 64 which is best seen in Fig. 22. This member 64 travels in its forward movement in substantially a straight line and against the tension of spring 69. As soon, however, as the inner end of the member 64 engages the periphery of the shaft 1 the inner end slides laterally and longitudinally and the projection 68 is moved laterally in the opposite direction and longitudinally. The member 64 which on its return movement slides on the bearing face 61 of the member 60 will have substantially the same fulcrum as the guide block and stop 60 and by adjusting the relative location of the pivot pin 59 by locating the same in a different aperture as seen in Fig. 1 the arc through which the contact portion of the member 68 moves on its return movement may be varied as desired and by such a construction I am enabled to increase the strength of the spark since I am enabled to vary the length of contact between the members 68 and 54 and thereby vary the amount of contact between points 46 and 49. The movable member 64 has a bearing against the face 141 of the rotating head 38 so that it is accurately guided in its forward movement by the bearing 141 and the bearing 61. As the member 64 moves rearwardly toward its neutral position the arm 65 will abut against the stop formed by the projection 62 and the tension of the spring causes the portion 65 of the member 64 to be retained in engagement with the projection 62 so that the members 64 and 60 act as an integral lever except when the member 64 is advanced by the shoulder 3 or returning to its normal position, so that the inner end of the member 64 will freely follow the contour of the periphery of the shaft 1. As the shaft revolves the selector 17 in the manner already hereinbefore described, picks out the desired cylinder so that the current is conducted to the spark plug thereof at the proper time. When the shaft 1 is rotated in a reverse direction no contact will be made since the member 64 will simply be oscillated against the tension of spring 69 and the member 64 will not be advanced.

In my present invention I have designed an ignition system wherein the engine may be started without the usual cranking of the engine, which has heretofore been deemed essential, and in my present construction I am enabled to start the engine by simply rotating the head 38, and I will now explain the manner of operation of the novel mechanism which I have devised to accomplish this purpose. In the present instance I have shown a construction wherein when the actuating lever 97 is pushed forwardly, the head 38 will be rotated from the position indicated at 138 until it assumes the position indicated by 137, in Fig. 23. As the actuating lever 97 is moved forwardly the lever 98 is brought from the normal position seen in Fig. 30 to the position indicated in Fig. 23 thereby increasing the tension of the spring 103, and if the lever 110 and its adjuncts are not in normal position the abutting of 107 against 102 will bring the parts to their normal position as indicated in Fig. 30, so that the lever 101 abuts against the stop 108. As soon as the operator releases the pressure on the actuating lever 97 the

tension of the spring 103 causes the actuating lever 97 to return to its normal position and the head 28 to be brought from the position indicated by 137 to the position indicated by 138. As the lever 97 returns to its normal position due to the tension of the spring 103, it will be apparent that owing to the pivoted members 98 and 101 which are connected by the spring 103 and since the spring 112 engages the rack 113 the parts 98 and 101 will be returned to their normal position as indicated in Fig. 30, leaving the lever 110 in its normal position seen in said Fig. 30. In Fig. 24 I have shown the position the parts assume when the head 38 is in such position that the arm 81 abuts against the stop 82 and in Fig. 25 I have shown the position the parts assume as the head 38 returns to its normal position. It will be apparent that as the head 38 is moved to the position indicated in Fig. 24 the inner end of the movable member 64 will be moved into the next corresponding slot or cut away portion 2, so that the inner end of the movable member 64 will abut against the next shoulder 3. Now as the head 38 returns to its normal position due to the tension of the spring 103 as above described, the member 64 will be moved outwardly in the same manner as has hereinbefore been described with reference to the natural operation of the device when the shaft 1 is rotating, and the movable member 64 will be advanced and as the head 38 rotates in the direction of the arrow seen in Fig. 25 it will be released as seen in Fig. 22 in dotted lines, and engage with the deflected end 54, thereby rocking the member 140 and causing the contact to be made between the movable contact 49 and the stationary contact 46.

In order to vary the time at which the spark takes place I employ the mechanism seen in Figs. 23 and 30. Referring now more particularly to these figures it will be seen that as the lever 110 is moved toward the right the lever 109 will be moved in unison therewith, thereby moving the lever 101 away from the stop 108, and since the spring 103 is of sufficient tension to move the rotatable head 38, it being understood that the members 101 and 98 are pivotally supported at 99, the connecting rod 95 will be moved rearwardly so that the rotatable head may be advanced as desired from the position seen in Fig. 23 and indicated by 138 to the position indicated by 139.

In order to retard the spark the lever 110 would be moved in a reverse direction and owing to the lugs 105 on lever 101 and lugs 106 on lever 98 the members 98 and 101 when moved in the direction of the arrow indicated in Fig. 29, move as if they were one integral lever and since the lever 98 is operatively connected with the connecting rod 95 the head 38 will be correspondingly moved and as soon as the lever 101 abuts against the stop 108 the parts will be brought back to their normal and neutral position. By their neutral position I mean the position the parts assume when the spark takes place at the extreme retarded position of ignition. The parts 98 and 101 act as an integral bell crank lever in all cases except when the lever 97 is manually actuated.

It is well known in the art that an engine does not always stop with its pistons upon their highest points but generally stops at a point slightly beyond the highest point of its throw, therefore, the selector 17 sometimes stops at such a point intermediate adjacent contacts 18 that the spark will take place in the wrong cylinder unless some means are present to produce an explosion in the cylinder desired. By employing an elongated contact I am enabled when the selector has slightly passed the neutral point of the contact member 18, to produce an explosion in the cylinder which has just been passed, when the actuating lever 97 is pushed forward and allowed to return.

When it is desired to test any one or more of the cylinders to determine whether they are operative or inoperative the operator presses down pins 93 which correspond to the cylinders which he desires to cut out or short circuit. The rod 93 on its downward movement causes the contact plate 90 to move on the hinge formed by the tongue 88 and aperture 89 until the plate 90 assumes the position indicated at 148 in dotted lines in Fig. 15, whereupon the cylinder connected with the terminal 24 shown in Fig. 15 will be short circuited. When it is desired, for purposes of adjusting, to remove the cover or casing, the operator presses inwardly the rods 73 thereby causing the pins 72 to become disengaged from the cover 71 whereupon such cover may be readily removed. When it is desired to remove the member 140 and its adjuncts 64 or 60 it is simply necessary to remove the retaining device 76 whereupon such parts, 140 and its adjuncts, and 64 and 60 may be readily removed without the use of any tools whatsoever.

I desire to call attention to the manner in which my device may be quickly taken apart and assembled since by simply removing the nuts 11, the casing member 9, casing 8 and the parts carried thereby and the rotatable head 38 may be separated for inspection or repair.

By varying the number of shoulders or notches on the shaft 1 and by locating them in different planes and by varying the number of contact devices carried by the head 38 and locating such devices in different planes or opposite each other and by suitably arranging the selector or selectors 17

and the secondary contacts or their terminals I can run a one, two, three or four cylinder engine or any multiple of such numbers. If six cylinders are used I employ two contact devices located diametrically opposite on the head 38 and employ three shoulders on the shaft 1 and six contact faces as 18 in different planes and with two selector brushes in different horizontal pianes. For a one, two or three cylinder engine a corresponding number of shoulders would be made on the shaft 1 with a corresponding number of secondary terminals. The contacts 18 are preferably elongated and the length of such contacts is only limited by the length of the periphery of the selector since the distance between adjacent contacts must be greater than the length of the periphery of the operative portion of the selector, otherwise the current would not be conducted to the single spark plug desired. An elongated contact 18 is not necessary unless it is desired to start on spark which it is understood is accomplished by actuating the lever 97. If it is not desired to start on spark a contact consisting of a single point is used instead of 18. I have preferred to show the contacts 18 as being located in the same plane in which case only one selector 17 is necessary. By moving forwardly the lever 97 to start the engine on spark, the head 38 is rotated to allow the contact making mechanism to be moved to such a position that on the release of the lever 97 and the return of the head 38 to its normal position a spark is produced, and the head 38 is left in the proper position for the operation of the engine with spark retarded preparatory to the operation of the lever 110 to increase the speed and power of the engine. By rotating the head first forwardly instead of rearwardly a spark is produced directly, but in such cases it is difficult to return the head to its normal position quick enough to cause the second spark to be produced at the right time to cause the next explosion, and I therefore prefer the method hereinbefore described, since the head 38 is, after producing the spark, in its neutral position ready for producing the next spark or explosion.

I desire to call particular attention to the fact that in my present construction I obtain a positive contact and the contact is not due to the inertia of the rocker arm 140 caused by the actuating member striking thereagainst, but in my present device the bearing face of the projection 68 slides against the bearing face of the projection 54 and causes the contact 49 to be positively held against the stationary contact 46 for a desired time, or in other words until the spring 69 has drawn the projection 68 out of engagement with the projection 54 and the contact is maintained during the time that the projection 68 has sliding contact with the projection 54.

In order to prevent any excess pressure and undue jamming or binding the projection 68 against the projection 64, the contact 49 is mounted on a resilient arm 50 so that undue wear of the parts and any jamming of the projection 68 will be positively prevented. It will of course, be understood that in conjunction with my novel construction I may employ any source of current supply either a battery, dynamo or any other suitable device.

It will be apparent to those skilled in the art that in my present invention I have so constructed the different parts that they may be stamped out of the metal so that the parts will be interchangeable, and since as is well known, it is much cheaper to stamp out the different parts than to machine them or to manually shape them, it will be apparent that an ignition system embodying my invention may be economically constructed without affecting the efficiency of the device. It will be apparent that the movable rock arm 140 is constructed in such a manner that there is no liability of any of the parts working or jamming loose since I dispense entirely with the use of screws or fastening devices which are liable to become loosened through the vibration, and I secure the parts in assembled position preferably by swaging a portion of the body of the rocker arm 140 over the other parts carried thereby. The only nuts or screws employed in my construction are the nuts 11 which are not liable to become loosened due to any vibration of the parts of the machine by which the device is carried.

By the employment of my novel construction of ignition system in conjunction with an automobile the same is so compact that it may be placed if desired within the body of the automobile in proximity to the engine whereby I am enabled to employ a short driving connection and very short secondary cylinder leads whereby I am enabled not only to prolong the life of the insulation but also prevent any material loss of the electric motive force.

By mounting the contact mechanism so that the spark may be advanced independently of the driving shaft I produce a device wherein I am enabled to dispense with a great many of the extra parts which have heretofore been deemed necessary in devices of this character and consequently prevent the lost motion which has heretofore been present in devices of this character.

It will now be apparent that I have devised a novel and useful ignition system which embodies all the features of advantage enumerated as desirable and while I have in the present instance shown and described a preferred embodiment thereof

which has been found in practice to give satisfactory and reliable results, it is to be understood that the same is susceptible of modification in various particulars without departing from the spirit or scope of the invention or sacrificing any of its advantages.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In an ignition system including primary and secondary circuits, the combination with a casing of terminals carried thereby and leading to the different cylinders and terminals leading to the primary and secondary circuits, a shaft rotatably mounted in said casing, a selector brush carried by said shaft and adapted to rotate in proximity to the cylinder terminals, a head rotatably carried by said casing, a contact producing mechanism carried by said head and controlled by said shaft, the relative movement of said contact mechanism and shaft producing but a single spark for each explosion and the circuit at the contact mechanism remaining open when the contact mechanism and shaft stop at any relative location to each other, and means for actuating said head to produce a contact in the primary circuit and a spark in the secondary circuit when said shaft is stationary.

2. In an ignition system including primary and secondary circuits, a casing, a head rotatably mounted thereon, a shaft rotatably mounted in said head, contact producing mechanism carried by said head and adapted to be actuated by said shaft on its rotation, cylinder terminals suitably supported, a selector mounted on said shaft and adapted to rotate in proximity to said terminals, a primary terminal adapted to lead the current to said contact mechanism, a secondary terminal suitably supported and operatively connected with said selector, means for rotating said head to advance or retard the spark, the relative movement of said contact mechanism and shaft producing but a single spark for each explosion and the circuit remaining open when the contact mechanism and shaft stop at any relative location to each other, and means for rotating said head to produce a contact in the primary circuit and a spark in the secondary circuit when said shaft is stationary.

3. In an ignition system, a stationary casing, a shaft rotatably mounted therein, a selector brush carried by said shaft, cylinder terminal leads suitably supported in the path of said selector, a secondary terminal lead suitably supported and electrically connected with said selector, a primary terminal lead suitably supported, a spring actuated plunger supported by said last named terminal, a head rotatably mounted on said casing, a stationary contact with which said plunger is at all times electrically connected, a contact producing mechanism carried by said head and adapted to be operated by said shaft, means for rotating said head in one direction, and means for causing said head to automatically return to its normal position and during such movement to cause said contact device to produce a spark while said shaft is stationary.

4. In an ignition system including primary and secondary circuits, a stationary casing, a shaft rotatably mounted therein, a selector carried by said shaft and insulated therefrom, selector lead terminals suitably supported and in the path of said selector, a primary and a secondary terminal, one of which is connected with said selector, a head rotatably mounted on said casing, a contact mechanism with which the other of said terminals is always electrically connected, said shaft having means thereon for actuating said contact mechanism on the rotation of said shaft, the relative movement of said contact mechanism and shaft producing but a single spark for each explosion and the circuit remaining open when the contact mechanism and shaft stop at any relative location to each other, and means for rotating said head to produce a contact in the primary circuit and a spark in the secondary circuit while said shaft is stationary.

5. In an ignition system dispensing with a vibrating coil, a stationary casing, a shaft rotatably mounted therein, a selector carried by said shaft and insulated therefrom, cylinder lead terminals in the path of said selector, a primary and a secondary lead terminal, one of which is electrically connected with said selector, a rotatably mounted contact mechanism with which said primary terminal is connected, a secondary coil, a primary coil, a condenser bridging said primary coil, and said shaft having means thereon for actuating said contact mechanism on the rotation of the shaft, the relative movement of said contact mechanism and shaft producing but a single spark for each explosion and the circuit at the contact mechanism remaining open when the contact mechanism and shaft stop at any relative location to each other.

6. In an ignition system dispensing with a vibrating coil, a stationary casing, a shaft rotatably mounted therein, a selector on said shaft and insulated therefrom, cylinder lead terminals in the path of said selector, a primary and a secondary lead terminal one of which is connected with said selector, a contact mechanism rotatably mounted and always in connection with said primary lead terminal, said contact mechanism being adapted to be actuated by said shaft on its rotation, the relative movement of said con-

tact mechanism and shaft producing but a single spark for each explosive and the circuit at the contact mechanism remaining open when the contact mechanism and shaft stop at any relative location to each other, a secondary coil, a primary coil and a condenser bridging said primary coil.

7. In an ignition system, a stationary casing, a shaft rotatably mounted therein and recessed at its outer end to form a plurality of shoulders and having an aperture in its end communicating with one of said recessed portions and having an oil groove, insulation non-rotatably mounted on said shaft and having a recess communicating with said groove, a selector mounted on said insulation, cylinder lead terminals in the path of said selector, a primary and a secondary terminal, one of which is operatively connected with said selector, a head rotatably mounted on said casing, and through which said shaft extends, a contact mechanism carried by said head and at all times in connection with said primary lead terminal, the contact mechanism being adapted to be actuated by said shaft, a tension device for said head, and means for partially rotating said head against the tension of said device.

8. In an ignition system, a casing, a shaft rotatably mounted therein, a selector carried by said shaft and insulated therefrom, cylinder lead terminals suitably supported and in the path of said selector, spark producing mechanism actuated by said shaft, and means for short-circuiting any of the said cylinder lead terminals, said means including members movably carried by the casing and devices for moving said members into engagement with said terminals.

9. In an ignition system, a casing, a shaft rotatably mounted therein, a selector carried by said shaft and insulated therefrom, cylinder lead terminals in the path of said selector, a primary and a secondary terminal one of which communicates with said selector, a contact mechanism including a stationary contact which is electrically connected with the primary lead terminal, said mechanism being actuated by said shaft, a movable member carried by said casing, yielding means for maintaining said member in normal position, and means for causing said member to engage the adjacent cylinder lead terminal to short-circuit the same.

10. In an ignition system, a stationary casing, a shaft rotatably mounted therein, contact mechanism actuated by said shaft, a selector mounted on said shaft, a primary and a secondary lead terminal leading to said contact mechanism, and said selector cylinder lead terminals in the path of said selector, a plate secured to said casing in proximity to each cylinder lead terminal, a second plate pivoted to said first plate, push rods carried by said casing and normally engaging said second plate, a spring secured to said first and second plates for causing the latter to normally maintain said push rod in elevated position, said push rod when depressed causing said plate to contact with its adjacent cylinder lead terminal to short-circuit the same, and means for rotating said head.

11. In an ignition system, a casing comprising a shell and a bottom and top casing member removably secured thereto, said shell having cylinder lead terminals thereon, a shaft rotatably mounted in said bottom and top members, a selector fixed on said shaft and insulated therefrom and adapted to move in the path of said cylinder lead terminals, contact producing mechanism carried by said top member and into which said shaft passes, a primary and a secondary lead terminal carried by said shell, the secondary of which communicates with said selector, the primary of which communicates at all times with said contact mechanism, and means for rotating said contact mechanism to produce a spark when said shaft is stationary.

12. In an ignition system, a casing comprising a shell and a bottom and top casing member removably secured thereto, cylinder lead terminals suitably supported, a shaft rotatably mounted in said bottom and top members, a selector fixed on said shaft and insulated therefrom and adapted to move in the path of said cylinder lead terminals, contact producing mechanism carried by said top member and into which said shaft passes, a primary and a secondary lead terminal suitably supported, the secondary of which communicates with said selector, the primary of which communicates at all times with said contact mechanism, means for rotating said contact mechanism to produce a spark when said shaft is stationary, and a device operatively connected with said means for varying the time of the spark.

13. In an ignition system, a casing comprising a shell and a bottom and top casing member removably secured thereto, cylinder lead terminals suitably supported, a shaft rotatably mounted in said bottom and top members, a selector fixed on said shaft and insulated therefrom and adapted to move in the path of said cylinder lead terminals, contact producing mechanism carried by said top member and into which said shaft passes, a primary and a secondary lead terminal carried by said shell, the secondary of which communicates with said selector, the primary of which communicates at all times with said contact mechanism, means for rotating said contact mechanism to produce a spark when said shaft is stationary, a device operatively connected with said means for varying the time of the spark, and manually

actuated means for short-circuiting any of the cylinders.

14. In an ignition system, a casing, comprising a shell and top and bottom members, means for securing said shell and members in assembled position, said shell having portions thereof flattened on its inner and outer periphery, insulation engaging said shell, a rod extending through said insulation and having an elongated contact member secured thereto, a terminal connected with said rod, a shaft rotatably carried by said casing, a selector thereon adapted to move in the path of said elongated contact, primary and secondary lead terminals, the secondary of which is connected with said selector, and a contact mechanism rotatably mounted and connected with the said primary lead terminal and adapted to be actuated by said shaft, said contact device including means for preventing the producing of a spark when the contact device is rotated in a reverse direction.

15. In an ignition system, a casing, comprising a shell and top and bottom members, means for securing said shell and members in assembled position, said shell having portions thereof flattened on its inner and outer periphery, insulation engaging said flattened portions and passing through said shell, a rod extending through said insulation and having an elongated contact member removably secured thereto, a terminal removably connected with said rod, a shaft rotatably carried by said casing, a selector thereon adapted to move in the path of said elongated contact, primary and secondary lead terminals, the secondary of which is connected with said selector, a contact mechanism rotatably mounted and connected with the said primary lead terminal and adapted to be actuated by said shaft, and means for varying the position of said contact mechanism, said contact device including means for preventing the producing of a spark when the contact device is rotated in a reverse direction.

16. As a new article of manufacture, a lead terminal comprising a rod, a contact adapted to interlock therewith, insulation mounted on said rod and having a groove in which said contact is seated, and a terminal nut having engagement with said rod.

17. In a contact mechanism, a rocker arm pivotally supported, a contact resiliently carried thereby, a stationary contact, means for normally maintaining said contacts out of engagement, a movable member, a tension device therefor, means for actuating said movable member to cause the latter to coact with said rocker arm on its return movement and produce a contact, and a combined guide and stop for said movable member, said combined guide and stop being movably mounted.

18. In a contact mechanism, a rocker arm, a contact resiliently carried thereby, a stationary contact, means for normally maintaining said contacts out of engagement, a movable member, a tension device therefor, and means for advancing and releasing said movable member and for causing it to return in a different path from that in which it was advanced, said member engaging said rocker arm to produce a contact on its return movement, and a combined bearing and stop member movably mounted and with which said movable member is always in engagement.

19. In a contact mechanism, a stationary contact, a rocker arm comprising a block, a resilient contact carrying member secured thereto by deflecting the edges of said block over said member, a rigid member secured to said block by deflecting the edges of the latter thereover, one end of said rigid member being deflected to maintain the contact carrying member from vibration, the other end of said rigid member being deflected outwardly to form a bearing face, said resilient member having an arm extending therefrom, stops for said arm and rigid member, and means coacting with said bearing face for actuating said rocker arm to produce a contact.

20. As a new article of manufacture, a circuit closing member comprising a block adapted to be movably supported and having recesses in its sides, a resilient contact carrying member located in one of said side recesses and secured to said block by deflecting the edges of the latter thereover, a rigid member located in the other of said recesses and secured to said block by deflecting the edges of the latter thereover, one end of said rigid member engaging said resilient member to maintain the same from vibrating, the other end of said rigid member being deflected to form a bearing face, and said resilient member having an arm extending outwardly from said block.

21. In a contact mechanism, a movable support, a stationary contact thereon, a movable circuit closing member provided with a contact, means for actuating said member to cause said contacts to alternately engage and separate, a pin on said support on which said member is mounted and from which it can be removed without the use of tools, a second pin carried by said support, and a resilient retaining device engaging said second pin and having an aperture in which said first pin is seated to prevent accidental displacement of said member.

22. In a contact mechanism, a movable member, yielding means for maintaining said member in normal position, means for advancing said member and effecting the release thereof, means positively engaged by said member on its return movement and

intermediate the ends of its travel to open and close a circuit, and a movable bearing and stop member with which said movable member at all times coacts.

23. In a contact mechanism, a movable member, a tension device therefor, means for advancing said member in a substantially straight path and for effecting the release and return of said member in a different path from that in which it was advanced, and devices coacting with said member on its return movement to both make and break a circuit, said means for advancing said member in a straight path including a movable bearing and stop member movably mounted and with which said movable member at all times engages.

24. In a contact mechanism, a movable member, a tension device therefor, means for advancing said member and effecting the release and return thereof, a second movable member coacting with the return of said first movable member, a contact carried by said second member, a stationary contact coacting therewith to make and break the circuit, means for preventing a contact being made when said advancing means moves in a reverse direction, and a combined bearing and stop member movably mounted and with which said movable member engages during its advance and return movement and against which it normally abuts to maintain a tension on said movable member.

25. In a contact mechanism, a movable support having a bearing face thereon, a combined bearing and stop having a bearing face and movably mounted on said support, a movable member adapted to engage said faces, a tension device for said movable member, means for causing said movable member to be advanced in substantially a straight path and for effecting the release of said movable member, and means coacting with said movable member on its return movement to make and break a circuit.

26. In a contact mechanism, a movable support having a bearing face thereon, a combined bearing and stop having a bearing face and movably mounted on said support, a movable member adapted to engage said faces, a tension device for said movable member, means for causing said movable member to be advanced in substantially a straight path and for effecting the release of said movable member, means coacting with said movable member on its return movement to make and break a circuit, and means for preventing a contact being made if the means for advancing said movable member travels in a reverse direction.

27. In a contact mechanism, a movable support having a bearing face, a pin on said support, a combined bearing and stop member mounted on said pin and having a bearing face, a movable member adapted to engage said faces, a tension device for said movable member, means for advancing said movable member in substantially a straight path and for effecting the return of said member in a different path, separate means coacting with said member on its return movement to make and break a circuit, and resilient means for preventing accidental displacement of said separate means, said movable member and said combined guide and stop member.

28. In a contact mechanism, an apertured support movably mounted and having a bearing face, a pin carried by said support, a combined guide and stop member rotatably mounted on said pin and having a bearing face, a movable member engaging said faces, a tension device for normally maintaining said movable member against said stop, a shaft having a shoulder thereon for effecting the advance and release of said member on the rotation of said shaft, and means coacting with said movable member on its return movement to make and break a circuit.

29. In a contact mechanism, an apertured support movably mounted and having a bearing face, a pin carried by said support, a combined guide and stop member rotatably mounted on said pin and having a bearing face, a movable member engaging said faces, a tension device for normally maintaining said movable member against said stop, a shaft having a shoulder thereon for effecting the advance and release of said member on the rotation of said shaft, means coacting with said movable member on its return movement to make and break a circuit, and means for moving said support to advance or retard a spark.

30. In a contact mechanism, an apertured support movably mounted and having a bearing face, a pin carried by said support, a combined guide and stop member rotatably mounted on said pin and having a bearing face, a movable member engaging said faces, a tension device for normally maintaining said movable member against said stop, a shaft having shoulders thereon for effecting the advance and release of said member on the rotation of said shaft, means coacting with said movable member on its return movement to make and break a circuit, means for moving said support to advance or retard a spark, and means for moving said support to cause a spark to be made when said shaft is stationary.

31. In a contact mechanism, a movable member, a tension device therefor, a pivotally supported bearing and stop for limiting the movement of said member in one direction and for guiding said movable member in its travel, means for advancing said member to increase the tension thereon and for effecting the release of said member, means coacting with said movable member during

its travel in one direction to cause the contact to be both made and broken, and means for preventing said movable member coacting with said contact producing means when the advancing means travel in reverse direction.

32. In a contact mechanism, a support movably mounted, a combined bearing and stop pivotally supported, a movable member engaging therewith and always bearing thereagainst, a tension device for maintaining said member in normal position thereagainst, means for advancing said member and effecting the release thereof, and means positively engaged by said member on its movement in one direction to make and break the circuit, the travel of said member in one direction being in substantially a straight path.

33. In a contact mechanism, a support movably mounted, a movable member thereon and normally under tension, a combined guide and stop for said member pivotally supported and with which said movable member always engages, means for advancing said member and effecting the return thereof, and a mechanism engaged by said member on its return movement and intermediate the end of its travel to make and break a circuit.

34. In a contact mechanism, a support movably mounted, a movable member thereon and normally under tension, a combined guide and stop for said member pivotally supported and with which said movable member always engages, means for advancing said member and effecting the return thereof, a mechanism engaged by said member on its return movement and intermediate the end of its travel to make and break a circuit, and means for moving said support to advance or retard a spark.

35. In a contact mechanism, an apertured support rotatably mounted and having a bearing face, a pin carried by said support, a combined guide and stop mounted on said pin and having a deflected end and provided with a bearing face, a movable member normally engaging said bearing faces and having a deflected end engaging the deflected end of said stop, a spring for normally maintaining the deflected end of said movable member against the deflected end of said stop member, means for advancing said movable member in substantially a straight path and for effecting the release and return of said member in a different path, said movable member being always in engagement with the bearing face of said guide and stop member, and means coacting with said movable member on its return movement to make and break the circuit.

36. In a contact mechanism, an apertured support rotatably mounted and having a bearing face, a pin carried by said support, a combined guide and stop mounted on said pin and having one end provided with a bearing face, a movable member normally engaging said bearing faces and having a deflected end engaging the end of said stop, a spring for normally maintaining the deflected end of said movable member against the end of said stop member, means for advancing said movable member in substantially a straight path and for effecting the release and return of said member in a different path, said movable member being always in engagement with the bearing face of said guide and stop member, means coacting with said movable member on its return movement to make and break the circuit, and said means for making and breaking the circuit being inoperative when said advancing means travels in a reverse direction.

37. In a contact mechanism, a support movably mounted and having a bearing face, a pin carried by said support, a combined bearing and stop rotatably mounted on said pin and having a bearing face, a movable member engaging both of said bearing faces when moving in one direction and having a deflected end engaging the end of said stop, a tension device for maintaining said ends normally in engagement, means for advancing said movable member and effecting the release and return thereof in a different path from the path in which it is advanced, means coacting with said member on its return movement to make and break a circuit, and means for moving said support to cause a circuit to be made and broken when said advancing means are stationary.

38. In a contact mechanism, a movable support, a movable member thereon, a combined guide and stop for said member movably mounted on said support, yielding means for maintaining said movable member normally in position, means for advancing said member, means positively engaged by said member on its return movement and intermediate the ends of its travel to make and break a circuit, and means for moving said support to cause a circuit to be made and broken when said advancing means are stationary.

39. In a contact mechanism, a support rotatably mounted, a stationary contact thereon, a circuit closing member rotatably mounted on said support, a contact carried thereby, means for maintaining said contacts normally out of engagement, a movable member normally under tension, a movable guide and stop coacting therewith, means for advancing said movable member in substantially a straight path and effecting the release and return of said member in a different path, said member engaging with said circuit closing member to produce a contact during such return movement, a lever operatively connected with said support, and a

tension device connected with said lever for maintaining said support in normal position whereby when said lever is actuated a spark will be produced when the advancing means for said movable member are stationary.

40. In a contact mechanism, a support rotatably mounted, a stationary contact thereon, a movable member, a tension device therefor, means for advancing said member and effecting the return thereof in a different path from that in which it is advanced, separate means coacting with said movable member on its return movement for causing the circuit to be closed, and opened, a lever operatively connected with said support for moving same in one direction, and yielding means for automatically causing the return of said lever and the support connected therewith to normal position, whereby a spark will be produced when said advancing means is stationary.

41. In a contact mechanism, a support rotatably mounted, a stationary contact thereon, a movable member, means for advancing and effecting the return thereof in a different path from that in which it is advanced, separate means coacting with said movable member on its return movement for causing a circuit to be closed, and opened, a lever operatively connected with said support for moving same in one direction, and yielding means for automatically causing the return of said lever and the support connected therewith to normal position, whereby a spark will be produced when said advancing means is stationary, and a second lever operatively connected with said yielding means for causing the rotation of said support to advance or retard the spark.

42. In a contact mechanism, a support movably mounted, a movable member carried thereby, a tension device for said member, means for advancing said member and causing the return thereof in a different path from that in which it was advanced, separate means coacting with said member during its return movement to both make and break the circuit, an actuating lever operatively connected with said support for moving the latter, a sectional bell crank lever pivotally supported, one section of which is pivotally connected with said lever, a spring for causing said bell crank lever to normally act as a single lever except when said actuating lever is actuated, a stop for limiting the movement of the other section of said bell crank lever in one direction, and a second lever operatively connected with said last mentioned section for rotating said support to advance or retard the spark.

43. In a contact mechanism, a support rotatably mounted, means for limiting the movement of said support in both directions, a movable member carried by said support, a combined guide and stop having a bearing face with which said member engages, a tension device for said member, means for advancing said member in substantially a straight path and causing the return thereof in a different path, separate means coacting with said member during its return movement to make and break a circuit, a tension device for maintaining said support in normal position, and means for moving said support against said tension device to cause a spark to be produced when said advancing means is stationary.

44. In a contact mechanism, a support rotatably mounted, means for limiting the movement of said support in both directions, a movable member carried by said support, a combined guide and stop having a bearing face with which said member engages, a tension device for said member, means for advancing said member in substantially a straight path and causing the return thereof in a different path, separate means coacting with said member during its return movement to make and break a circuit, a tension device for maintaining said support in normal position, means for moving said support against said tension device to cause a spark to be produced when said advancing means is stationary, and means for moving said support to advance or retard the spark.

45. In a contact mechanism, a support movably mounted, stops for limiting the movement of said support in both directions, a movable member carried by said support, and normally under tension, means for advancing said member and causing it to return in a different path from that in which it was advanced, means coacting with said member during its return movement to make and break a circuit, a lever operatively connected with said support, a sectional bell crank lever pivotally supported one section of which is operatively connected with said lever, a spring for maintaining the sections of said bell crank lever in normal position, said sections having lugs for limiting the movement of said sections toward each other, one of said sections having a projection adapted to engage the other of said sections when moved in one direction, a stop for the section moving in said direction, and actuating means for said last named section.

46. In a contact mechanism, a support movably mounted, stops for limiting the movement of said support in both directions, a movable member carried by said support, and normally under tension, means for advancing said member and causing it to return in a different path from that in which it was advanced, means coacting with said member during its return movement to make and break a circuit, a lever operatively connected with said support, a sectional bell crank lever pivotally supported one section of which is operatively connected with said

lever, a spring for maintaining the sections of said bell crank lever in normal position, said sections having lugs for limiting the movement of said sections toward each other, one of said sections having a projection adapted to engage the other of said sections when moved in one direction, a stop for the section moving in said direction, an actuating lever operatively connected with said last named section and movably supported, a stationary rack and a retaining device carried by said last named lever and coacting with said rack.

47. In a contact mechanism, a support movably mounted, a movable member normally under tension carried by said support, means for advancing said member and causing it to return in a path different from that in which it was advanced, means coacting with said member on its return movement to cause a circuit to be made and broken, a cover having apertures therein, and spring pressed plungers carried by said support and having deflected portions engaging said apertures to maintain said cover in assembled position.

48. In a contact mechanism, a support movably mounted, a movable member carried thereby, a combined guide and stop member pivotally supported and coacting with said member, a tension device for said movable member the tension of which acts in a plane parallel to the longitudinal movement of said member, means for advancing said member and causing the return thereof in a path different from that in which it was advanced, means coacting with said movable member during its return movement and intermediate the ends of its travel for causing a circuit to be made and broken, and means for controlling the movement of said support.

49. In a contact mechanism, a movable member, a tension device therefor, a movably supported bearing and stop for limiting the movement of said member in one direction and for guiding said movable member in its travel, means for advancing said movable member and effecting the release of said member, means coacting with said movable member during its travel in one direction to cause the contact to be both made and broken, and means for varying the pivotal point of said bearing and stop.

50. In a contact mechanism, a movable member, a tension device therefor, a pivotally supported bearing and stop for limiting the movement of said member in one direction and for guiding said movable member in its forward travel, the pivot of said bearing and stop forming a fulcrum for said movable member, means for advancing said member and causing the return thereof in a different path, said member rocking on its fulcrum during its return movement, and means coacting with said movable member during its travel in one direction to cause the contact to be both made and broken.

51. In a contact mechanism, a stationary contact, a movable rocker arm, a contact carried thereby, a movable member, a combined bearing and stop pivotally supported, means for varying the position of the pivot of said bearing and stop, a tension device for said movable member, and means for advancing said member and causing it in its return movement to actuate said rocker arm to produce a contact, the duration of said contact depending directly upon the location of the pivot of said bearing and stop and directly upon the strength of said tension device.

52. In a contact mechanism, a support movably mounted, stops for limiting the movement of said support in both directions, a movable member carried by said support, and normally under tension, means for advancing said member and causing it to return in a different path from that in which it was advanced, means coacting with said member during its return movement to make and break a circuit, a lever operatively connected with said support, a sectional bell crank lever pivotally supported one section of which is operatively connected with said lever, a spring for maintaining the sections of said bell crank lever in normal position, said sections having lugs for limiting the movement of said sections toward each other, one of said sections having a projection adapted to engage the other of said sections when moved in one direction, a stop for the section moving in said direction, and actuating means for said last named section, whereby when said lever is operatively actuated said actuating means will be returned to normal position.

53. In a device of the character described, a support, having apertures therethrough, spring pressed plungers mounted in said support at an angle to said apertures, pins carried by said plungers and having their ends deflected at an angle to said apertures and passing through said support, and a cover seated on said support and adapted to interlock with said pins.

54. In a device of the character described, a cylindrical shell having apertures therethrough, a portion of said shell in close proximity to said apertures being depressed and the contiguous portion being pressed outwardly to form a flat surface of a desired extent on the outer and inner peripheries of such cylinder in proximity to said apertures.

55. In an ignition system, a casing, comprising a cylindrical shell and bottom and top members, fastening devices for securing the parts in assembled position, a support rotatably mounted on said top member, a cover removably secured to said support, con-

tact mechanism carried by said support, means mounted within said cylinder for selecting the cylinder to which the current is to be led, said means including operative means for said contact mechanism, and means for securing said casing in position.

56. As a new article of manufacture, a cylindrical shell consisting of a tube of uniform thickness having apertures therethrough, the inner and outer surface surrounding the apertures being flattened, in combination with inner and outer insulating blocks engaging the inner and outer flattened surfaces of the shell, and means for securing said blocks in assembled position with respect to said shell.

PAUL ROBT. WERNER.

Witnesses:
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