W. F. DAVIS.

IGNITING MECHANISM FOR EXPLOSIVE ENGINES.

APPLICATION FILED MAR. 3, 1910.

1,065,923.

Patented July 1, 1913.

3 SHEETS—SHEET 1.

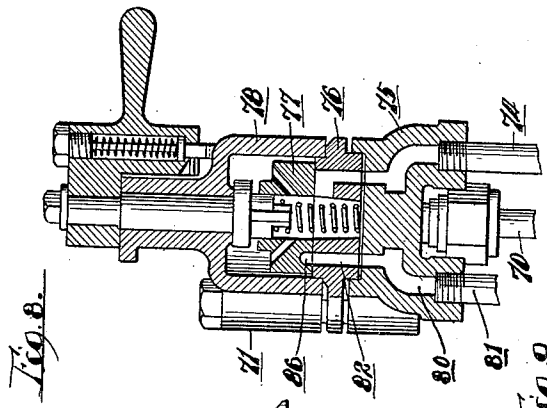


Fig. 8.

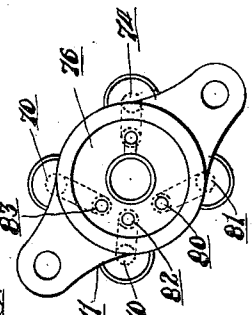


Fig. 9.

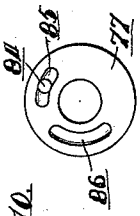


Fig. 10.

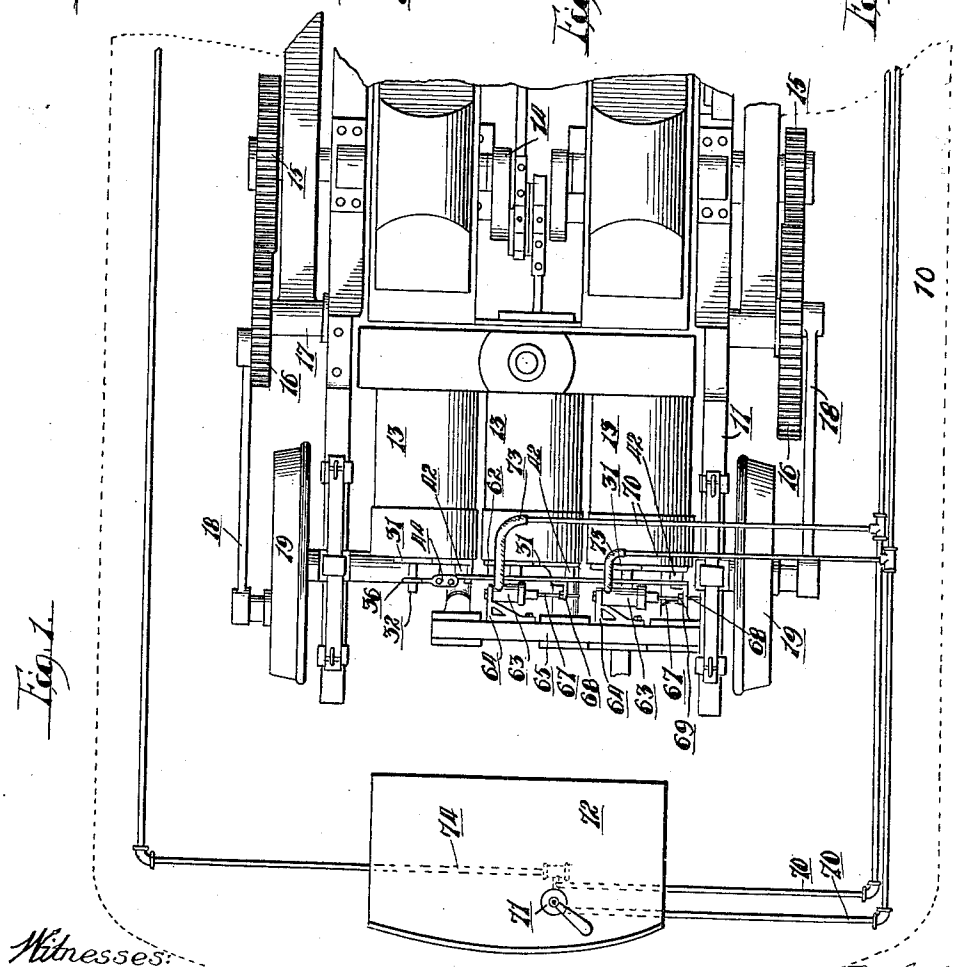


Fig. 1.

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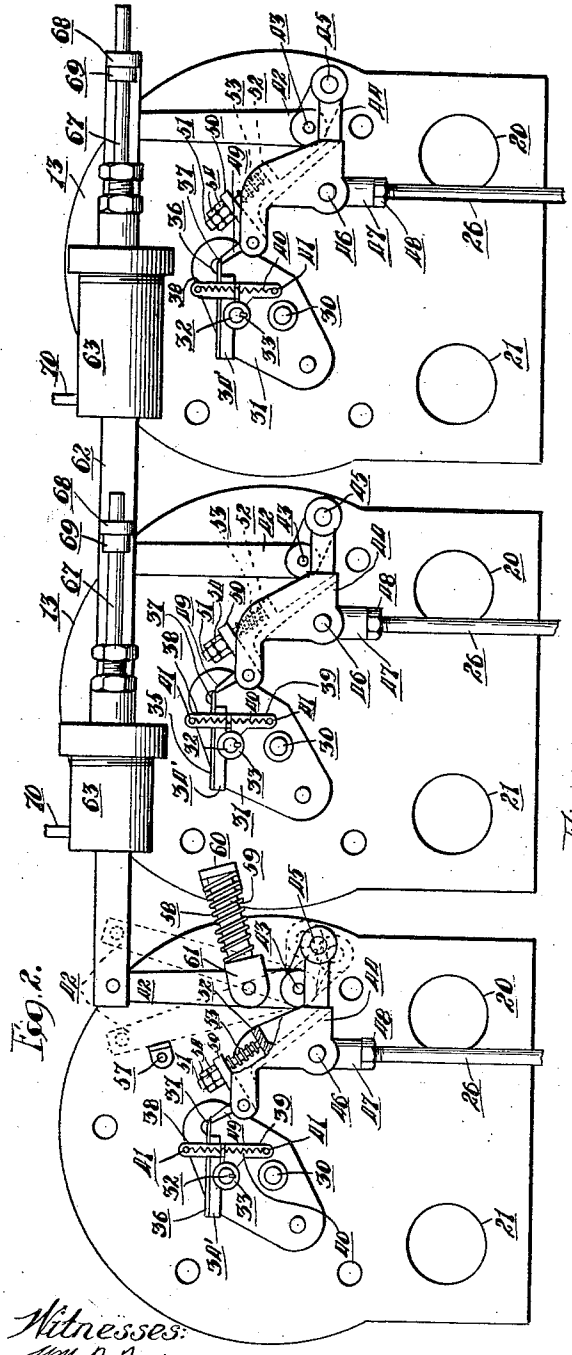


Fig. 2.

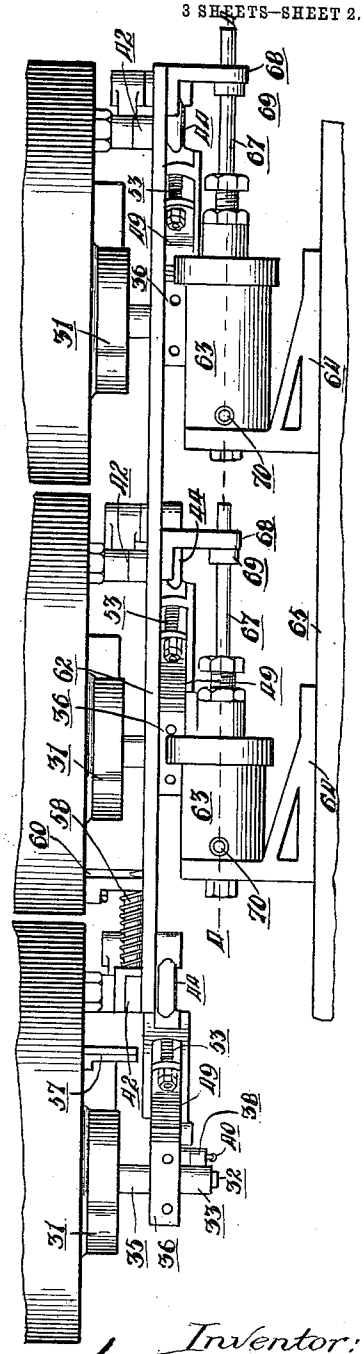


Fig. 3.

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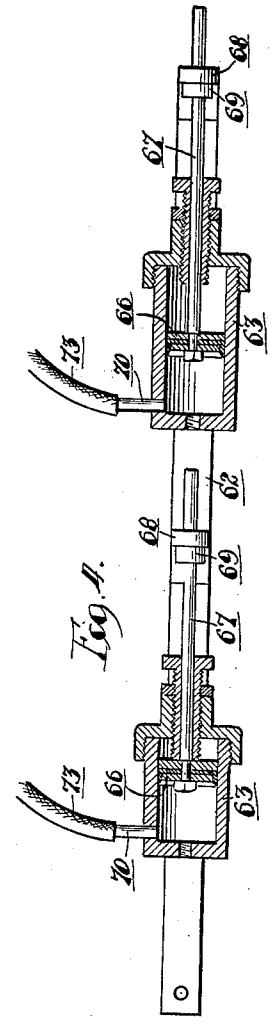


Fig. 4.

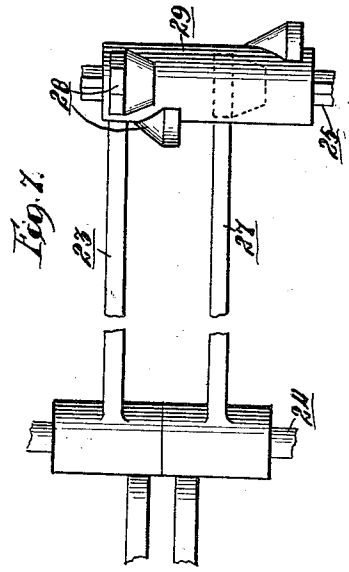
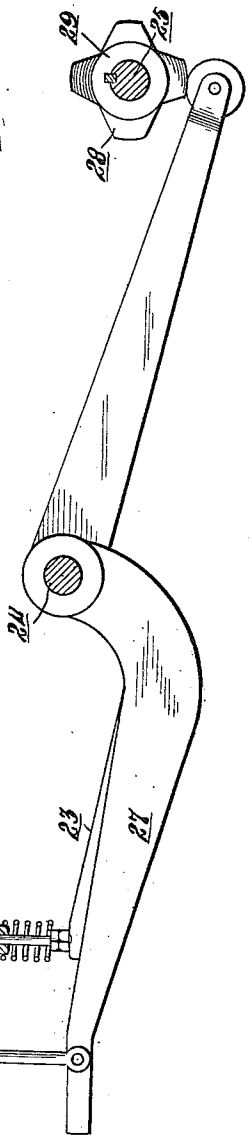


Fig. 7.



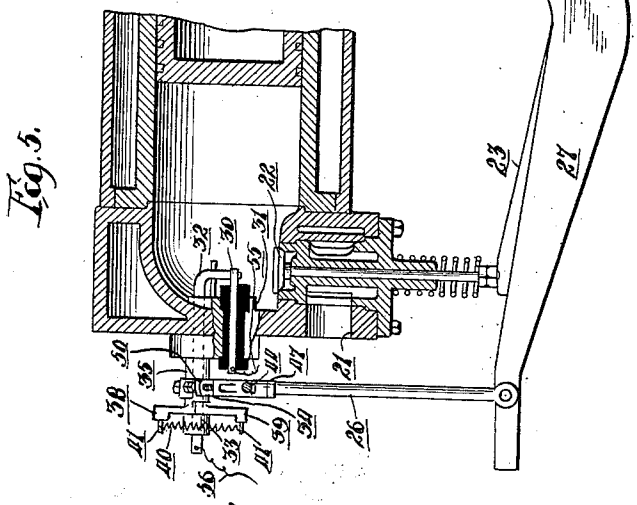


Fig. 5.

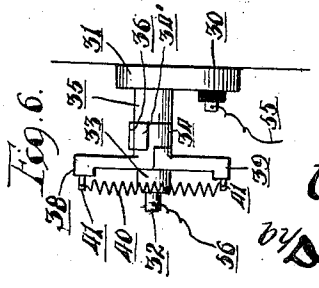


Fig. 6.

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UNITED STATES PATENT OFFICE.

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IGNITING MECHANISM FOR EXPLOSIVE-ENGINES.

1,065,923. Specification of Letters Patent. Patented July 1, 1913.

Application filed March 3, 1910. Serial No. 547,025.

To all whom it may concern:

Be it known that I, WILLIAM F. DAVIS, a citizen of the United States, residing at Kansas City, in the county of Wyandotte and State of Kansas, have invented certain new and useful Improvements in Igniting Mechanisms for Explosive-Engines, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to the igniting mechanism for explosive engines and particularly to that type of igniters in which the electrodes are brought together and then separated quickly to form the spark.

The improvement seeks to provide a simple and effective form of such an igniting mechanism, together with the simple and effective means by which the time of ignition may be changed.

With these objects in view the invention consists in the features of construction, combinations and arrangements of parts hereinafter set forth, illustrated in the accompanying drawings and more particularly pointed out in the appended claims.

The improved igniter mechanism is particularly applicable to motors for cars and the like, in which it is desired to vary the time at which the igniter operates in accordance with the speed of the motor.

In the drawings, the improvement is shown as applied to a motor mounted upon the truck of a car.

Figure 1 is a plan view of the car motor with the improved igniter mechanism applied thereto. Fig. 2 is a view of the end of the engine cylinders showing the igniter operating mechanism. Fig. 3 is a plan view of parts shown in Fig. 2. Fig. 4 is a detail section on line 4—4 of Fig. 3. Fig. 5 is a longitudinal section through the rear end of the cylinders. Fig. 6 is an enlarged detail view of parts shown in Fig. 5. Fig. 7 is a plan view of the operating cam and rocker shown in Fig. 5. Fig. 8 is a vertical section of the valve that controls the operation of the spark-timing devices. Fig. 9 is a plan view of the valve seat. Fig. 10 is an inverted plan view of the valve.

The car body 10 indicated in dotted lines, is swiveled to the truck 11 in the usual way. The engine cylinders 13 are mounted on the truck and the pistons in the cylinders are connected to a crank shaft 14 that is journaled on the truck. Gears 15 on the engine shaft, mesh with gears 16 on the countershaft and these gears are connected by pitman rods 18 with the wheels 19 of the truck.

Each engine cylinder is provided with suitable inlet and exhaust channels 20 and 21 controlled by suitable valves. The exhaust valve 22 (see Fig. 5) is of a spring-held, puppet type and is actuated at proper intervals by a rocker 23. Rocker 23 is fulcrumed on a shaft 24 and is moved by a cam on the shaft 25. Shaft 25 is driven from the engine shaft by 2-to-1 gearing or in any other suitable manner. An igniter shifter-rod 26 is connected to the rear end of a second rocker 27 that is fulcrumed on the shaft 24 and arranged to be operated by cams on the shaft 25. The operating cam-points 28 for the rockers 23 and 27, are preferably mounted on a sleeve 29 splined to the shaft to rotate therewith, but movable longitudinally thereon. There are two cam-points 28 for each rocker and the engine may be reversed by sliding the cam sleeve upon the shaft 25 to bring one or the other of each pair of cam-points into operative relation with the rockers 23 and 27 respectively.

The igniter comprises a fixed electrode 30 mounted in, but insulated from a bushing 31 set in the head of the cylinder. A movable electrode 32 is journaled in the bushing and is provided with a laterally extended portion at its inner end that is arranged to engage the fixed electrode 30. A collar 33 is keyed or otherwise suitably fixed to the outer end of the movable electrode 32 and a collar 34 is loosely journaled on said electrode between the fixed collar 33 and a boss 35 on the bushing 31, through which the 32 electrode extends. The loose collar is provided with a horizontal cross-arm 34′ having a thin blade 36 of steel, fixed to its upper face. One end of the blade projects beyond the end of the arm 34′ and terminates in a beveled edge 37 as shown. The loose collar 34 and arm 34′ are also provided on one side of the center with an outwardly off-set lug or projection 38, the lower end of which is arranged to abut against the upper end of a corresponding inwardly off-set projection or lug 39 on the fixed collar 33. These lugs or projections extend in opposite directions from their point of contact and are normally held together by a

coiled spring 40 that extends between pins 41 on the ends of the lugs or projections 38 and 39.

An adjusting arm or bell crank lever 42 is carried by a pivot bolt 43 on the end of the cylinder and an igniter shifter-arm 44 is connected to the short arm of the bell crank lever 42 by a pivot bolt 45. The shifter-arm is connected by a pivot bolt 46 intermediate its ends to a coupling piece 47 that is adjustably threaded upon the upper end of the shifter rod 26. A set nut 48 locks the shifter-arm 44 and rod 26 together in adjusted position. The free end of the shifter-arm carries a pivoted dog 49 having an offset tail-portion 50 through which extends a bolt 51 that is threaded into a lug 52 on the shifter-arm. A spring 53 is coiled about the bolt 51 between the lug 52 and the tail-portion 50 of the dog. Nuts 54 upon the end of the bolt are arranged to engage the tail portion 50 so that the dog is held in adjusted position upon the shifter-arm 44 between the nuts 54 and the spring 53.

On the up-stroke of the rod 26 and shifter-arm 44, the dog 49 will engage the beveled end of the blade 36 on arm 34′, and through the medium of a spring 40 will turn the movable electrode 32 into engagement with the fixed electrode 30. When this engagement is effected, the movement of the electrode and parts connected thereto is arrested and the continued upward movement of the shifter-arm will stretch the spring 40 so that, when the end of the blade 36 trips from the dog 49, the lug 38 on the loose collar 34 will strike the lug 39 on the fixed collar 33 a sharp blow to quickly separate the electrodes. On the return movement of the shifter-arm, dog 49 will yield as it passes over the end of the blade 36 compressing the spring 53.

If the spring that holds the electrodes in contact and subsequently separates them is too heavy, the contacting points of the electrodes will rapidly wear. If it is too light, the points will not be properly brought together and separated. In the form shown, this spring tension may be very easily and nicely adjusted by lengthening and shortening the coiled spring 40 between the pins 41.

One of the conducting wires 55 from the battery or other source of current, is connected to the insulated electrode 30. The other conducting wire 56 is connected directly to the end of the movable electrode 32, as shown in Fig. 5, so that the presence of moisture, scale or dirt between the movable electrode and the bushing 31, will not affect the passage of the current.

With an igniter of this type it would be difficult to vary the time of ignition relative to the stroke of the engine by rotatably adjusting the igniter cam on its operating shaft. Indeed, with the preferred construction in which the cam is longitudinally shiftable on the shaft, it would be quite impracticable to also provide for a rotary adjustment of the cam. I therefore vary the time of ignition by adjusting the arm 42 upon which the shifter-arm 44 is pivoted. In Fig. 2 the adjusting arms 42 of the several igniting mechanisms are shown in mid-position. The extreme positions of one of the arms are shown in dotted lines. In one of the extreme positions, that for slow speed, the arm 42 is held against a stop 57 on the cylinder head by a spring 58. Spring 58 is coiled about a rod 59 that is pivoted to the adjusting-arm and the spring extends between abutment 60 on the adjacent cylinder head and an enlarged portion or head 61 on the rod 59. The arm 42 may be shifted by any suitable means, away from the stop 57 to its mid-position and to its extreme forward position. When released, spring 58 will return the arm to its initial position in engagement with the stop. As the arm 42 is thus shifted it will swing the shifter-arm 44 of the igniter about its pivotal connection 46 with the operating rod 26, and thus raise the dog 49 so that the dog will engage and operate the parts connected to the movable electrode at an earlier point in the stroke of the operating rod 26 and thus advance the time of ignition.

It will be observed that in the mid-position of the arm 42 the pivots 43 and 45 of the arms 42 and 44 are approximately in line with the end of the blade 36 with which the dog 49 engages, so that, in the extreme positions of the shifter-arm 42, the distance between the pivot 45 and the edge 37 of the blade 36 will be practically equal, and the parts too are so arranged that as the arm 42 is shifted through the short arc between the extreme positions, this distance will be at all times substantially the same. The rocking of the shifter-arm 44 upon its pivot 46, incident to the elevation and depression of the pivot 45, carries the point of the dog 49 slightly above or below the medial position in which it is represented, but as the shifter-arm 44 is also, and proportionately, moved toward or from the arm 34′, the point of the dog 49 will be carried a little farther or a little less far under the blade 36, and hence will be slightly delayed or slightly hastened in reaching the tip of the blade and riding off the same. Thus compensation will be made for the raising or lowering of the point of the dog 49 through the rocking of the shifter-arm 44, and the effect will be that contact of the dog 49 with the blade 36 will occur a little earlier or a little later under the lateral adjustments of the lever 42 than when the latter is in its normal position, and the spark will be accordingly advanced or retarded; but the extent of separation of the electrodes will remain practically constant. By this arrangement, dog 49 on the arm 44

will always engage the end of the blade 36 through substantially the same arc and will always place the spring 40 under the same tension to properly hold the electrodes in engagement, whatever may be the position of the adjusting-arm 42.

The arms 42 of the several igniting mechanisms are all connected at their upper ends to a common operating rod 62 that may be shifted in any suitable manner. With the engine located on a truck beneath the car, as shown, it is convenient to effect this shift by fluid pressure. For this purpose, a pair of motor cylinders 63 are carried by brackets 64 on a suitable header or support 65 (see Fig. 1). The pistons 66 in these cylinders (see Fig. 4) are provided with piston-rods 67 that extend loosely through the ends of offset arms 68 on the common shifter rod 62. Collars 69 fixed to the piston-rods 67, are arranged to engage one side of the offset arms 68 so that they are in one-way engagement with these arms. The first cylinder 63 has a short stroke and when air or other suitable motor fluid under pressure, is admitted thereto will operate the rod 62 to move the adjusting-arms 42 from initial to mid-position. The second cylinder 63 has a longer stroke and when air is admitted thereto, will further shift the arms 42 from mid-position to their extreme forward position. This further shift is, of course, permitted by reason of the one-way connection between the bar 62 and the piston-rod of the first cylinder. When the air is exhausted from the motor cylinders, the spring 58 will return the adjusting-arms to their normal position with the first adjusting-arm against the stop 57.

A valve of any suitable sort may be employed for controlling the flow of motor fluid to and from the motor cylinders 63. In the form shown, pipes 70 lead from the cylinders 63 to a suitable controlling valve 71 that is arranged upon a board 72 in the front end of the car. These pipes are secured to the bottom of the car and include flexible portions 73 to permit a relative movement between the body of the car and the truck whereon the cylinders 63 are mounted. As stated, any suitable form of controlling valve may be employed. One form of valve is illustrated in Figs. 8, 9 and 10. In this form, air under pressure from a supply pipe 74 is led by suitable ports through the lower portion 75 of the valve casing, through the valve seat 76 and rotary disk valve 77 into the upper portion 78 of the valve casing and to the upper side of the valve. The valve seat is also provided with an exhaust port 80 leading to an exhaust pipe 81 and ports 82 and 83 communicating with the pipes 70 that lead to the fluid pressure devices 63. The disk valve 77 is provided with an admission port 84 which extends therethrough and which communicates with an arc-shaped channel 85 on the under side of the valve. The valve is also provided on its under side with an arc-shaped exhaust channel 86. By turning the valve in one direction the cylinders 63 may be placed successively in communication with the source of air or other suitable fluid under pressure, and by turning the valve in the opposite direction the cylinders may be connected suitably to the exhaust. In this way, the adjusting arms 42 are shifted to vary the time of ignition.

It is obvious that numerous changes may be made in the details of construction and arrangement of parts without departure from the essentials of the invention and that parts of the invention may be taken without its adoption in entirety. It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

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

1. In an apparatus of the character described, in combination, a fixed electrode; a movable electrode provided with a rigid and with a loose arm; a tension spring connecting said arms; a shifter adapted to strike the movable arm, and thereby first to move the rigid arm and the electrode, through said spring connection, to carry the movable electrode into contact with the fixed electrode, and thereafter to further tension said spring; and means for adjusting said shifter to vary the time of its engagement with the movable arm while preserving a substantially constant throw of the shifter.

2. In an apparatus of the character described, in combination, a fixed electrode; a movable electrode; a striker mounted to oscillate on the movable electrode; a spring adapted to hold the striker and the movable electrode in contact; reciprocatory means to separate the striker and the movable electrode a substantially constant amount; and means to vary the normal elevation of the reciprocatory device and its consequent relation to the striker without substantially varying the ultimate amount of movement of said striker and separation of the electrodes.

3. In an apparatus of the character described, in combination, a fixed electrode, a movable electrode, an oscillatory striker pivoted on the latter and held thereagainst by a spring, a pivoted adjusting-arm, a shifter rod, a shifter pivoted at one end to the adjusting-arm and intermediate its ends to the shifter rod, the free end of the shifter adapt-

ed to contact the striker and the point of contact being in line with the supporting pivot of the adjusting-arm and the pivot between the shifter and the adjusting-arm in the mid position of the latter.

4. In igniter mechanism for explosive engines, the combination with fixed and movable electrodes, of tight and loose collars on the outer end of said movable electrode, said collars having engaging lugs, a tension spring extending between said lugs, a blade having a projecting beveled edge fixed to said loose collar, a pivoted shifter and a spring-held pivoted dog on the end of said shifter arranged to engage the edge of said blade, substantially as described.

5. In igniter mechanism for explosive engines, the combination with fixed and movable electrodes, of tight and loose collars on the end of said movable electrode having engaging lugs, a tension spring extending between said lugs, a pivoted shifter, a coupling member pivoted to said shifter intermediate its ends, an operating-rod adjustably connected to said coupling member, a spring-held pivoted dog on the free end of said shifter arranged to engage and operate said loose collar and means for adjusting the position of said dog on said shifter, substantially as described.

6. In igniter mechanism for explosive engines, the combination with fixed and movable electrodes, of rigid and loose members on the end of said movable electrode; a tension spring directly connecting said rigid and loose members; a shifter for said loose member; an operating rod connected to the shifter; and an adjusting elbow lever carrying on one of its arms, and at a distance from its fulcrum, a stud or fulcrum for said shifter, and adapted through movement of the lever to vary the position of the shifter and the consequent time of ignition, substantially as described.

7. In igniter mechanism for explosive engines, the combination of a fixed electrode; a movable electrode carried by a rocking shaft bearing two arms, one rigidly and the other loosely supported thereon; a spring connecting said loose and rigid arms; an operating shifter adapted to engage the loose arm, and through the spring connection, to move the rigid arm and rock the shaft; a shaft rotating in timed relation to the main shaft of the engine; a cam on said rotating shaft; connections between said cam and said shifter, said cam being longitudinally shiftable on said shaft to forward and reverse positions; and an adjusting lever carrying at a point eccentric to its fulcrum, a stud or fulcrum on which said shifter is supported, said lever serving, through its adjustment, to vary the time of engagement of the shifter with the arm of the rocking electrode shaft, and thereby to vary the time of ignition, substantially as described.

8. In igniter mechanism for explosive engines, the combination with fixed and movable electrodes, of rigid and loose members on said movable electrode; a tension spring directly connecting said members; an operating shifter for said loose member; an adjusting elbow lever carrying on one of its arms, and at a distance from its fulcrum, a stud or fulcrum for the shifter; and an operating rod connected to said shifter, substantially as described.

9. In igniter mechanism for explosive engines, the combination with fixed and movable electrodes, of tight and loose, spring-connected members on said movable electrode, a shifter-arm for said loose member, a pivoted adjusting bell-crank lever whereon said shifter-arm is pivotally mounted and an operating-rod pivotally connected to said shifter-arm intermediate its ends, substantially as described.

10. In igniter mechanism for explosive engines, the combination with fixed and movable electrodes of an operating shifter therefor; an adjusting arm connected to said shifter for changing the time of ignition; a fluid pressure device for operating said adjusting arm in one direction; a spring for moving said arm in the reverse direction; and a valve controlling the flow of pressure fluid to and from said fluid pressure device, substantially as described.

11. In igniter mechanism for explosive engines, the combination with fixed and movable electrodes, of an operating shifter-arm therefor, a spring-held adjusting arm whereon said shifter arm is mounted, a fluid pressure device for operating said adjusting-arm against the tension of its spring and a valve for controlling the flow of fluid under pressure to and from the fluid pressure device, substantially as described.

12. In igniter mechanism for explosive engines, the combination with fixed and movable electrodes, of an operating shifter therefor; an adjusting arm for said shifter; a plurality of fluid pressure devices of different throw, each having one-way connection with said adjusting arm; a spring acting upon said arm in opposition to the fluid pressure device; and means for controlling the flow of fluid to and from said pressure device, substantially as described.

13. In explosive engines, the combination with a plurality of cylinders, of igniters for each of said cylinders comprising fixed and movable electrodes; operating shifters for said movable electrode; adjusting-arms connected to said shifters for changing the time of ignition; a common operating-bar connected to all of said adjusting-arms; a fluid pressure device for moving said bar in one direction; and a spring serving to move said

bar in the opposite direction when freed from the action of the fluid pressure device.

14. The combination with a car body and its supporting truck, of an explosive engine mounted on the truck and connected to the truck wheels; igniter mechanism for said engine comprising fixed and movable electrodes; an operating shifter for said movable electrode; an adjusting arm for changing the time of ignition, connected to said shifter; a fluid pressure device for operating said adjusting arm in one direction; a spring for moving said arm in the opposite direction; a control valve on the car body; and pipe connections, including flexible portions, between said valve and said fluid pressure device.

In testimony whereof I affix my signature, in the presence of two witnesses.

WILLIAM F. DAVIS.

Witnesses:
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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."