No. 861,006. PATENTED JULY 23, 1907.

F. R. WICKWIRE.

CIRCUIT CLOSER.

APPLICATION FILED JUNE 23, 1906.

2 SHEETS—SHEET 1.

Fig. 2.

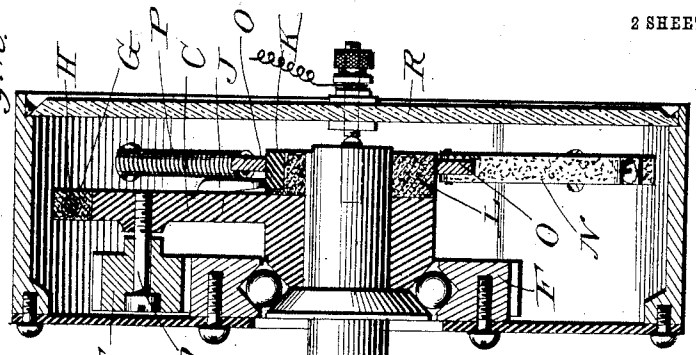


Fig. 4.

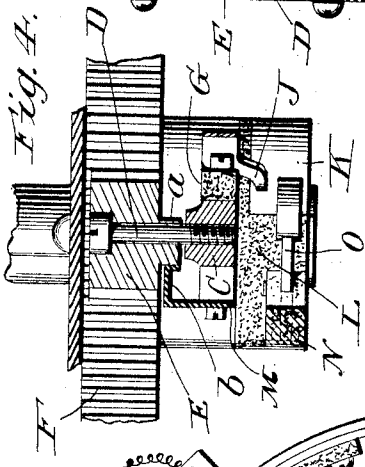


Fig. 3.

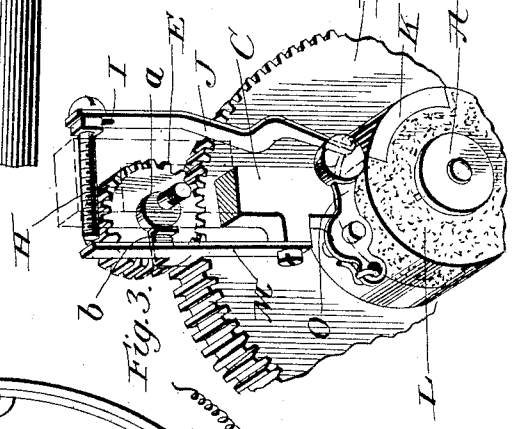
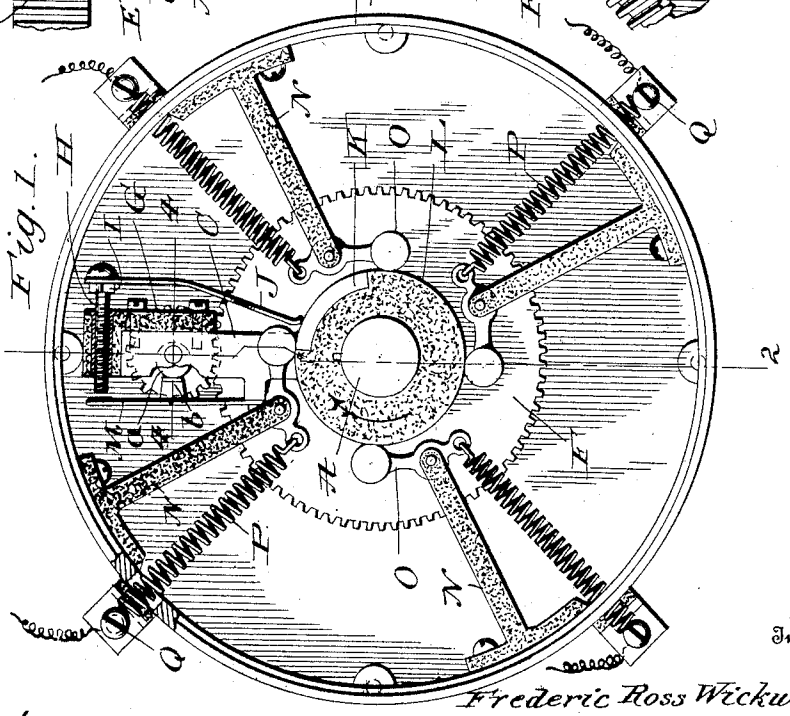


Fig. 1.



Witnesses
C. H. Raider
Stewart Rice.

Inventor:
Frederic Ross Wickwire,
By Dodge and Sons,
Attorneys

THE NORRIS PETERS CO., WASHINGTON, D. C.

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2 SHEETS—SHEET 2.

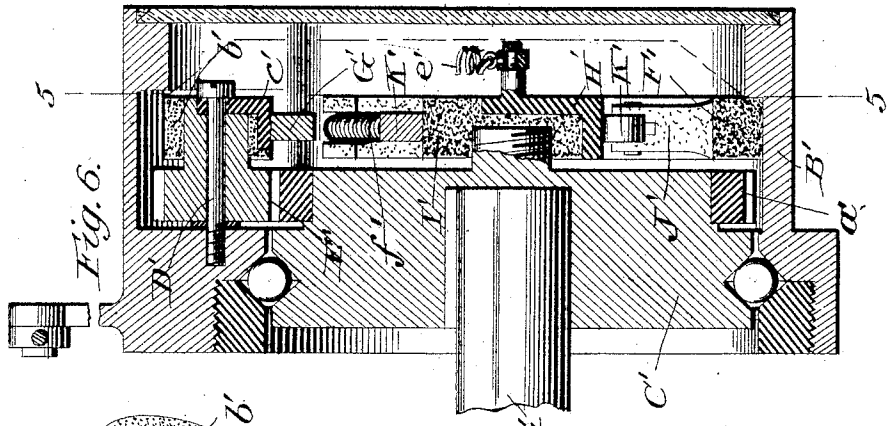


Fig. 6.

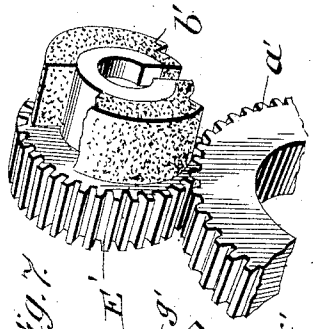


Fig. 7.



Fig. 8.

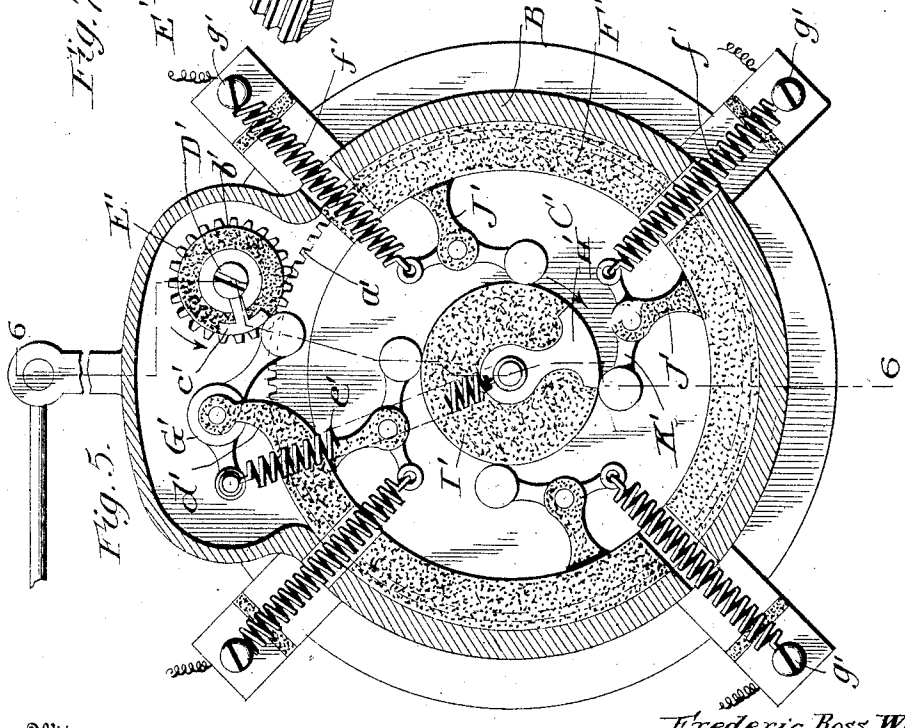


Fig. 5.

Witnesses

E. L. Raeder

J. Stewart Rice.

Inventor

Frederic Ross Wickwire

By Dodge and Sons,

Attorneys

THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FREDERIC ROSS WICKWIRE, OF CORTLAND, NEW YORK.

CIRCUIT-CLOSER.

No. 861,006. Specification of Letters Patent. Patented July 23, 1907.

Application filed June 23, 1906. Serial No. 323,079.

To all whom it may concern:

Be it known that I, FREDERIC ROSS WICKWIRE, a citizen of the United States, residing at Cortland, in the county of Cortland and State of New York, have invented certain new and useful Improvements in Circuit-Closers, of which the following is a specification.

This invention pertains to circuit-closing mechanism for successively closing and opening a plurality of circuits, and it consists primarily in means whereby sparking between the rotary or traveling member and the several relatively fixed contacts is prevented.

It further consists in novel features, details and combinations hereinafter set forth.

My invention is illustrated in its preferred form in the accompanying drawings, in which

Figure 1 is a face view or front elevation; Fig. 2, a transverse section on the line 2—2 of Fig. 1; Fig. 3, a perspective view of the main parts of the device with portions broken away; Fig. 4, a section on the line 4—4 of Fig. 1; Fig. 5, a face elevation of a modified form of the device, the case being shown in section on the line 5—5 of Fig. 6; Fig. 6, a section on the line 6—6 of Fig. 5; Fig. 7, a perspective view of the gear-driven revolving contact; and Fig. 8, a perspective view of the main contact segment.

Devices of the general character herein referred to are employed, among other places, in connection with sparking coils and spark-plugs or contacts of gas and vapor engines, particularly such as are provided with a plurality of sparking devices. In such circuit-closers there is usually employed a rotary or revolving member which makes and breaks contact with a plurality of contacts in succession, to ignite the charges of successive cylinders. It is found in practice that such rotating or revolving member becomes more or less ineffective by reason of the repeated sparking between it and the several contacts with which it co-operates, and as a result the operation of the engine becomes defective or irregular. It is also comparatively difficult to repair the damage thus occasioned.

To overcome these difficulties, I suppress the sparking at the points indicated, transfer it to a point where damage may be more readily repaired, and divide or distribute it between or over a series of contacts, so that the injury at any one of these points is greatly lessened, and the device is enabled to operate efficiently for a much greater length of time. Two embodiments of the same general plan will be explained, the essential principle or idea being the same in both.

Referring first to Figs. 1 to 4 inclusive, which illustrate a simple embodiment of the invention: A indicates a rotary shaft, which may conveniently be the half-speed shaft of a gasolene or other "explosive" engine. This shaft has one end extended into a shell or casing B, and preferably carried in an antifriction or ball bearing, as shown in Fig. 2. Carried by the shaft A, within the shell or casing B, and in electrical connection with said shaft, is a radial arm C, having at one side and near its outer end a fixed stem or screw D which serves as an axle for a pinion E, on the side of which pinion is formed or secured a cam or eccentric *a*. Pinion E meshes with the peripheral teeth of a fixed annular gear F, secured to shell or casing B, and as a consequence, said pinion E and cam or eccentric *a* are caused to rotate about the axle D as the shaft A rotates and the arm C revolves about the axis of said shaft, the number of rotations of the pinion and cam relatively to those of shaft A being determinable and variable at will, by varying the relative diameters of pinion E and gear F.

G indicates a block of insulating material, as fiber, vulcanite or the like, secured to the outer end and forward face of radial arm C. Passing through this block G is a screw H, which carries between its head and a clamping nut I a conducting spring or finger J, the inner extremity of which bears upon and makes electrical connection with a contact plate or block K seated in the peripheral face of a hub or collar L of fiber or other non-conducting material, made fast upon shaft A, close to the hub of radial arm C, the collar L serving to electrically insulate the contact plate K from shaft A and arm C, except through special connections, to be explained. The point or headless end of screw H protrudes beyond insulating block G, and forms a contact point for a spring finger M, carried by arm C, and tending normally to make contact with the screw and through it with spring or finger J and contact-block K. Spring finger M has a lateral ear or projection *b*, which is held by the force of the spring in constant contact with the periphery of cam or eccentric *a*. The relation of the parts and the throw or eccentricity of cam or eccentric *a* are such that at a given point in the rotation of the cam the spring finger M is forced away from and out of contact with the end of screw H, thus destroying electrical connection at that point, and breaking the circuit which at other times is established from arm C, through the spring finger M, screw H and spring or finger J with contact-block K.

N indicates one of a series of arms or brackets, which may be of fiber or other insulating material, or may be of conducting material but insulated from shell or casing B, to which they are secured and by which they are supported. There are as many of these arms or brackets N as there are sparking plugs or circuits to be closed and broken, four being shown in the drawings. These arms or brackets extend from the shell or casing inward to near the circumference of the hub or collar L, and each has pivoted in its inner end a contact lever O, one end of each lever being arranged to bear upon the periphery of hub L, while the other end is connected with a spring P, the opposite end of

which is made fast to a binding-screw Q. Each screw is electrically connected with one of the sparking coils of the series, under one mode of electrical wiring, and with the spark plug when used as a distributer for the secondary circuit.

The springs P are preferably made of copper wire, but may be of brass or other suitable material having good conducting capacity.

The contact levers O are arranged in plane with the hub L, and consequently as said hub rotates the contact plate K passes under said levers and makes contact therewith successively.

The parts being thus constructed and arranged and the cam or eccentric *a* being set with proper reference to positions of the levers O, the operation is as follows: The shaft A rotates in the direction indicated by the arrow in Fig. 1, in which figure the contact-block K is shown as just passing from beneath contact lever O above it. At this time the eccentric *a* is at its full throw to the left in said figure and is holding the spring finger M away from the contact screw H, hence is interrupting the circuit at that point, and the contact lever O will ride off from contact-block K without producing a spark between them. A spark will have been produced between the spring finger M and screw H at the instant of their separation, but by facing these parts with platinum or the like this sparking will be rendered harmless.

From the position indicated in Fig. 1, block K will be carried by rotation of the shaft toward and beneath the bearing end of the second lever O, that is, the one to the right of that which it is represented as leaving. This will occur at a time when the contact is still broken between the screw H and spring M, hence no spark will occur between the block K and the lever O as the block enters into contact with said lever, but shortly after the making of contact between plate K and lever O, contact will be re-made and the circuit closed between H and M through rotation of cam or eccentric *a*, whereupon the current will pass as before by shaft A, arm C, spring M, screw H, finger J, plate K, lever O and spring P to the binding-post Q, and thence to the spark-plug or other place to which the current is to be delivered. It will thus be seen that immediately before plate K makes contact with any one of the levers O, and again immediately before it passes out of contact therewith, the circuit is interrupted by the separation of the spring M and screw H, hence there will be no sparking between the levers O and plate K.

The contact surfaces of spring finger M and screw H may be made quite small and proportionately inexpensive, whereas the larger surfaces of lever O and block K, if made of platinum, would involve considerable expense, and by reason of the rubbing or sliding contact would be somewhat rapidly worn away.

It is, of course, understood that the mechanism here described may be included in the primary circuit of an induction or sparking coil, the secondary coil of which is included in the spark plug circuits; or it may be connected in the secondary circuit, and the contact-shoes be used as distributers for the secondary current, permitting said secondary current to pass from the coil, enter the insulated segment K through the binding-post in the glass cover plate R, and be distributed to the various spark plugs through the shoes and springs. In other words, any usual or approved arrangement of circuits may be adopted.

In Fig. 2 a binding-screw is shown carried through and secured in the glass plate or cover R and bearing upon a contact point on shaft A, but connection may be made with the shaft A or its arm C in any other convenient way. The spring contact member J is slotted to receive the screw H, and consequently may be adjusted lengthwise and swung sidewise to make proper contact with the block K.

When this device is used in connection with gasolene or other explosive engines the spark may be advanced or retarded at the spark plug by turning the outside case B a greater or less distance, so as to shift the contact levers O backward or forward.

Referring now to Figs. 5 to 8 inclusive, a modified embodiment of the invention will be explained, it being understood that the circuit connections may be as before.

In these figures, A′ indicates a shaft, which may conveniently be the half-speed shaft of the engine, as before, and which extends into a shell or casing B′. Upon the shaft A′ is secured a hub C′, the periphery of which is grooved, to receive antifriction balls or rollers, which are interposed between the hub and a raceway in the shell or casing B′. This permits the shaft to rotate freely without appreciable tendency to turn the shell or casing, yet enables the casing to be readily shifted or turned about the shaft to vary the lead or contacting points.

Hub or disk C′ is formed or furnished with peripheral gear teeth *a′*, which mesh with the teeth of a pinion E′, carried by an axle D′, bearing a fixed relation to the shell or casing, and conveniently made in the form of a screw which enters a threaded socket in said shell, as seen in Fig. 6. Pinion E′ is formed with a neck at one side, upon which is secured an insulating collar *b′*, bearing a peripheral contact segment *c′*, which makes electrical connection with the pinion through a radial arm, the form of the segment being shown in Figs. 5, 6 and 8 and its seat illustrated in Fig. 7. It will be seen that the segment is electrically connected with the shell or casing through axle D′. The relative diameters of pinion E′ and the toothed portion of hub or disk C′ are such that pinion E′ makes as many rotations for each rotation of shaft A′ as there are spark plugs or relatively fixed contacts, four to one being the relation here illustrated.

Within shell or casing B′ is a substantially annular insulating body F′, one end of which is bent outward to form, or is furnished with, a post *d′* to support a contact lever G′, one end of which is connected by a spring *e′* with a contact segment H′, carried by an insulating hub I′ on the shaft A′. Spring *e′* serves to hold the opposite end of lever G′ in contact with the periphery of collar *b′* or with its segment *c′* when the latter comes opposite the end of the lever. As the lever G′ and spring *e′* are included in the sparking circuit, it is obvious that the circuit can be completed only at such times as lever G′ and segment *c′* are in contact, which will be once in each rotation of pinion E′, and four times for each rotation of shaft A′ and its hub I′.

Projecting inward from the insulating body F′ are

four posts J′, in each of which is pivoted a contact lever K′, each bearing at one end upon the periphery of hub I′ and connected at its other end to a coiled spring *f′*, which in turn is carried to the outside of the shell or casing and made fast to an insulated binding-post or screw *g′*. From each post a wire or conductor is carried to a spark plug, either directly or indirectly, according to the mode of wiring adopted.

Pinion E′ is so set with reference to the gear teeth of hub or disk C′, and the segments *c′* and H′ are so positioned that segment H′ will make contact with one or another of the levers K′ just before segment *c′* makes contact with lever G′, and that lever G′ will break contact with segment *c′* just prior to the passage of segment H′ out of contact with each of the levers K′ in turn. From this it results that the spark incident to breaking the circuit will be removed from the rotating hub I′ and transferred to the small hub or collar *b′* and its segment *c′*. Segment *c′* and its coacting lever are readily accessible and can be easily renewed when necessary.

It will be noted that this arrangement makes use of a pinion carried on a fixed axle, whereas that first described uses a pinion which both revolves about the axis of the shaft and rotates upon its own axis.

It is obvious that the details of construction may be varied considerably without departing from the spirit or scope of my invention. Thus, for instance, any common and well known form of contact-arm, spring or finger may be employed in lieu of the pivoted arms or levers O, and in using the term levers in this connection, it is to be understood as including any such common and well known equivalent.

Having thus described my invention, what I claim is:

1. In combination with a revolving arm in electrical connection with a source of current, a contact plate or block arranged to revolve in unison with said arm; separable contact members in electrical connection respectively with the arm and block; a rotatable cam or eccentric carried by the arm and serving periodically to separate said contact members and to permit them to come into contact; and a plurality of relatively fixed contact members arranged in the path of and to bear upon the revolving contact block, the relation of the several parts being such that said separable contact members are separated just before the revolving contact block passes into and passes out of contact with the respective relatively fixed contact members, but are permitted to make contact during the intervening periods.

2. In a device for alternately closing and opening an electric circuit, the combination of a revolving contact block or member; a plurality of relatively fixed contact members with which the revolving contact member successively makes contact; electrical connections for the revolving and the fixed contacts; and a make-and-break device interposed between the source of current and the revolving contact block, adapted and arranged to open or break the circuit just before the revolving contact block reaches and just before it leaves the relatively fixed contact members and to restore or complete such circuit in the intervening periods.

3. In an electric circuit closing device, the combination of a traveling contact block; a series of relatively fixed contact members with which the traveling block makes contact successively; and an independent circuit closing device adapted to break the circuit just before the traveling contact reaches and just before it leaves each relatively fixed contact, and to close said circuit in the intervals between such reaching and leaving of the fixed contacts.

4. The herein-described circuit closer, comprising a rotatable shaft A, provided with an arm C, having a stud or axle D, provided with a pinion E, carrying a cam or eccentric *a;* a fixed gear F with which the pinion E meshes; a contact screw or stem H carried by but electrically insulated from the arm C; a spring contact member M carried by the arm C and tending normally to make contact with the screw or stem H, but arranged to be thrown out of contact therewith through the rotation of the cam or eccentric *a;* an insulating hub L carried by shaft A and provided with a contact block K; an electrical connection between said contact block K and the screw or stem H; and a plurality of contact members O fixed relatively to the shaft and its hub L and arranged to bear yieldingly upon the periphery of the latter, the parts being adjusted to destroy contact between the members H and M just before contact is made between the members K and O, then to restore contact between the members H and M, and again to interrupt the contact between the members H and M just before contact is destroyed between the members K and O.

5. In an electric circuit-maker and breaker, the combination of a series of contact levers; a rotary hub having a contact segment to make and break contact with said levers successively; and a second rotary member adapted to open the circuit just before it is broken at any of said contact levers, and to close it just after any one of the contact levers makes its electrical contact in said circuit.

6. In an electric circuit-maker and breaker, the combination of two rotary members geared to make unequal numbers of rotations; a plurality of coacting contact levers for making electrical contact with the rotary member making the fewer rotations; and a contact lever coacting with the other rotary member, the arrangement being such that the circuit is first closed between the member of fewer rotations and one of its levers, and then closed through the action of the other rotary member; and that the circuit is broken in the reverse order.

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

FREDERIC ROSS WICKWIRE.

Witnesses:
ORRA K. GEORGE,
A. C. WAERAD.