F. R. HOYT.

PERIODIC INTERRUPTER FOR IGNITION SYSTEMS OF INTERNAL COMBUSTION ENGINES.

APPLICATION FILED JAN. 29, 1915.

1,168,638.

Patented Jan. 18, 1916.

Fig. 1

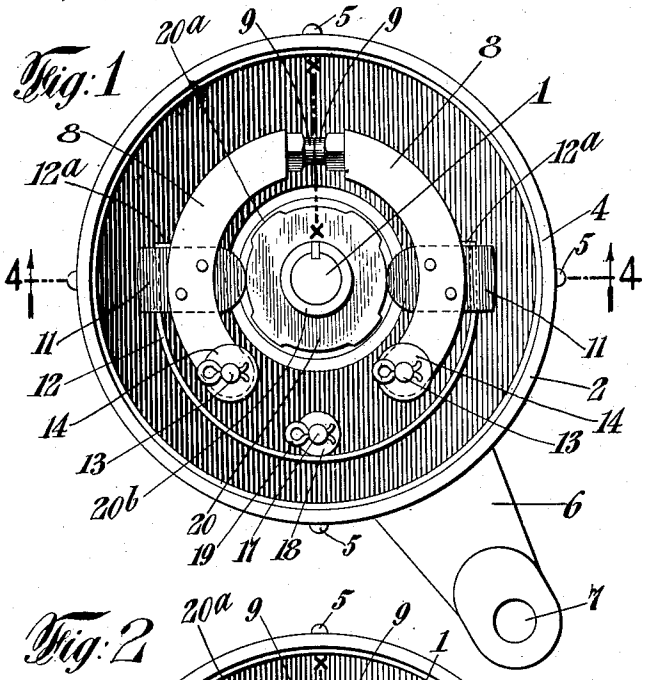


Fig. 3

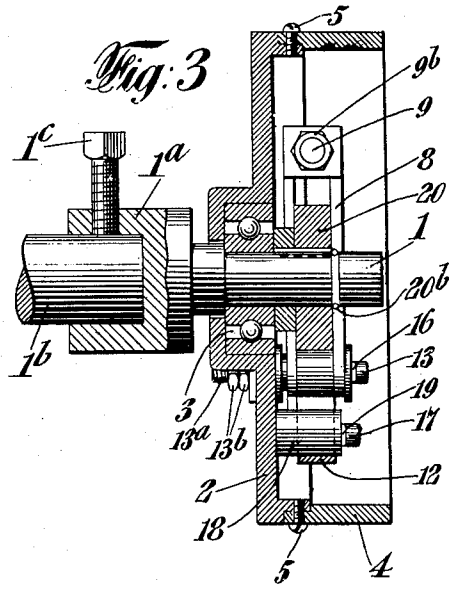


Fig. 2

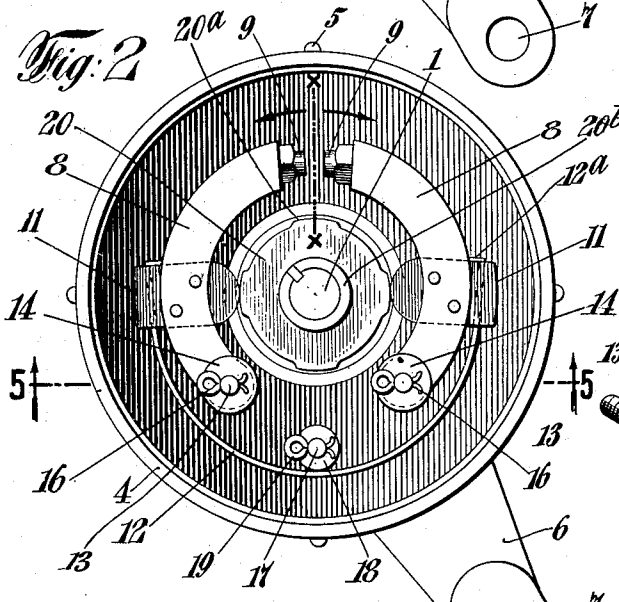


Fig. 6

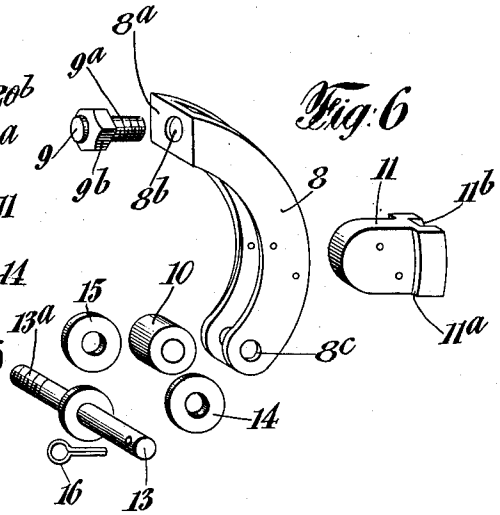


Fig. 4

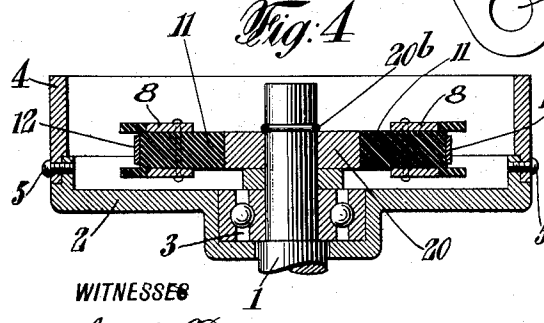
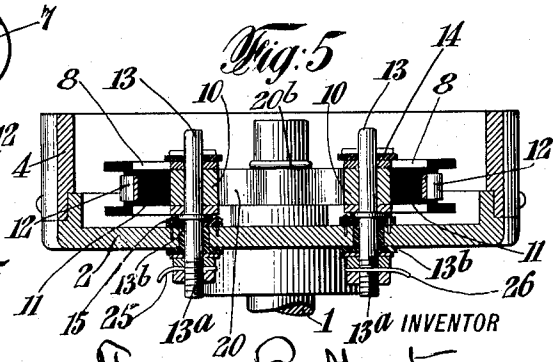


Fig. 5



WITNESSES

John E. Prager

A. Worden Gibbs.

INVENTOR

Francis R. Hoyt

BY

Whitehead Moore

ATTORNEYS.

UNITED STATES PATENT OFFICE.

FRANCIS R. HOYT, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO SIMMS MAGNETO COMPANY, OF EAST ORANGE, NEW JERSEY, A CORPORATION OF NEW YORK.

PERIODIC INTERRUPTER FOR IGNITION SYSTEMS OF INTERNAL-COMBUSTION ENGINES.

1,168,638. Specification of Letters Patent. Patented Jan. 18, 1916.

Application filed January 29, 1915. Serial No. 4,980.

To all whom it may concern:

Be it known that I, FRANCIS R. HOYT, a citizen of the United States, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Periodic Interrupters for Ignition Systems of Internal-Combustion Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention consists in the novel features hereinafter described, reference being had to the accompanying drawing in which is shown one embodiment of my invention selected by me for the purpose of illustrating the same, and the said invention is fully disclosed in the following description and claims.

Referring to the said drawings, Figure 1 represents a front view of a periodic interrupter or contact breaker embodying my invention and particularly designed for periodically interrupting the primary circuit of a high tension ignition system for internal combustion engines, the contacts being shown in closed relation. Fig. 2 is a view similar to Fig. 1 showing the contacts in separated relation. Fig. 3 is a vertical sectional view through the interrupter or contact breaker. Fig. 4 represents a sectional view through the contact breaker on line 4—4 of Fig. 1. Fig. 5 represents a similar section on line 5—5 of Fig. 2. Fig. 6 is a detail perspective view showing one of the pivoted contact arms detached, together with the various parts associated therewith.

In connection with high tension ignition systems for internal combustion engines whether the source of current is a battery or accumulator, a magneto-electric machine, or dynamo, it is customary to periodically interrupt the primary circuit at intervals in the cycle of the engine for the purpose of inducing a current of high E. M. F. in the secondary circuit which passes through the spark plug and produces a spark in the engine cylinder. It is a known fact that the suddenness or rapidity with which the primary circuit is broken materially affects the voltage of the secondary current whether the same is induced in the secondary winding of an induction coil or in the secondary winding of a high tension magneto. In other words, the more rapidly the separable contacts of the interrupter or contact breaker are separated, the higher the voltage of the induced current in the secondary circuit. Further than this there is a considerable amount of sparking between the separable contacts of the interrupter or circuit breakers now in ordinary use, as they separate to break the primary circuit and this sparking tends to depreciate and injure the contacts which are ordinarily platinum, it being found in actual practice that particles of metal are carried from one contact to the other, frequently producing a pit in one contact and a growth or projection on the other. In the contact breakers ordinarily in use, one of the contacts is fixed and the other movable, being moved by means of cam mechanism, to separate the contacts at the desired intervals and at the desired points in the engine cycle.

One of the features of my present invention consists in making both of the separable contacts movable and simultaneously actuating each of them away from the other with the result that by imparting a minimum amount of movement to each contact, I nevertheless secure their separation to a given distance in one half of the time in which it can be accomplished where only one contact is movable, and further, I am enabled to separate the contacts with such extreme rapidity to a distance through which an arc, even though it may be established, will not be able to follow, so that the sparking across the separable contacts is greatly reduced, if not wholly eliminated, while at the same time, the more rapid separation of the contacts results in the production of a secondary current of greater E. M. F. than can be obtained where only one of the contacts is movable.

My invention also contemplates an improved arrangement of the movable contacts and the actuating means therefor, whereby perfect accuracy of operation is secured without the necessity of such nicety in the machine work for constructing the parts, as the opposed movable contacts adjust themselves automatically to any slight variations in the actuating mechanism, and my invention further contemplates the employment of wearing surfaces for the cam engaging portions of the movable contacts of more easily friable material than the con-

tacts themselves, so that the wear of said cam engaging portions will always keep pace with the contacting surfaces of the contacts, while the engagement of the harder contact surfaces acts as a stop to limit the movement of the cam engaging portions toward the actuating faces of the cam, so that there can be no wear upon said actuating faces beyond that necessary to compensate for the wear of the contact faces.

My invention also contemplates certain details of construction and combination of parts hereinafter fully described.

Referring to the drawing which illustrates one embodiment of my invention selected by me for purposes of illustration, 1 represents a rotary shaft which is driven by any suitable means from the internal combustion engine and at a predetermined speed in relation to the crank shaft or cam shaft thereof. In this instance the shaft 1 is shown as provided with socket 1^a adapted to fit over the end of a shaft, as 1^b, forming part of the engine structure or separated by the engine, and secured in position thereon by a set screw 1^c. Ordinarily the shaft 1 will be so timed as to produce a separation of the contacts for each cylinder of the engine in each cycle thereof.

In the present embodiment of my invention I have shown a shell or casing supported on the shaft 1 by a suitable bearing 3, in this instance, a ball bearing being shown, the said casing comprising a disk portion 2 and an annular shell 4 secured to the disk portion by means of screws 5, or otherwise, said disk portion carrying the separable contact members, and the casing is provided with the usual timing lever 6 provided with means, as the aperture 7 therein, for connecting it with a suitable timing lever (not shown) by means of which the casing may be adjusted in a rotary direction with respect to the shaft 1 for the purpose of advancing or retarding the spark in a well-known way.

Upon the disk 2 are mounted a pair of curved contact arms 8—8 each of which is pivoted at one end to the disk, and at the other end carries a contact 9. I prefer to form these contact levers, as shown in detail in Fig. 6, of sheet metal in the form of two curved portions connected by a central portion 8^a having an aperture 8^b therein, to receive a contact screw 9^a provided with a set nut 9^b, the contact 9, which is preferably of platinum, being secured to the outer end of the screw 9^a. The free ends of the curved sheet metal portions of the contact arms are provided with apertures 8^c which are separated by a spacing washer 10.

11 represents the cam engaging block, the main portion of which extends between the sheet metal curved portions of the arm 8 and is riveted or otherwise secured thereto, so that it forms a spacing block between the opposite ends of the arm, and said block 11 is also provided with a wider portion on the outer side of the arm 8 forming shoulders 11^a to engage the rear edges of the curved portions of the arm 8 and assist in holding the block rigidly in position, and said wider portion of the block is provided on its outer end face with an exterior recess 11^b which receives one end of the spring 12 hereinafter referred to.

The disk 2 is provided with a pair of studs 13—13 for pivotally supporting the contact arms 8, and in assembling the parts, of the spacing washer, 10, is placed between the plate portions of each arm 8 and the apertures 8^c are slipped over the stud 13, washers 14 and 15 being preferably placed on the stud above and below the arm 8, and the parts are preferably held in relation by a cotter pin 16, thus making a construction of extreme simplicity which can be readily assembled, and when once in position cannot get out of operative relation.

The arms 8 are normally pressed toward each other by a spring or springs, and I have shown for this purpose, the spring 12, the ends of which lie in the recess 11^b of the cam engaging blocks 11 of the contact members, the extreme end portion of the springs being bent inward, as at 12^a, to prevent their accidental disengagement, and the central portion of the spring is held in position, in this instance, by a stud 17 secured to the disk 2 and preferably provided with an insulated bushing or block 18 held thereon by cotter pin 19. In this instance since the part supporting the contact arms 8 is stationary except for its range of adjustment to advance or retard the spark, the actuating means for the oppositely movable contacts is in the form of a rotating cam, indicated in the drawings at 20. This cam is keyed on the shaft 1, and in this instance held in position thereon by split ring 20^b, engaging a groove in the shaft, and is provided with four raised actuating portions 20^a, disposed in this instance at 90° with respect to each other around the axis of rotation of the cam, the said actuating portions being obviously so arranged as to simultaneously actuate the contact arms, normally held in closed position by the spring 12, whenever a spark is desired. In this instance the contact arms have their cam engaging portions disposed diametrically opposite each other with respect to the axis of the cam shaft 1, and the cam engaging portions are therefore arranged diametrically opposed to each other.

By referring to Fig. 1, it will be noted that the contacts are closed and engage each other, the plane of engagement being indicated by the dotted line x—x.

In Fig. 2 which represents the position of the parts after the cam engaging portions

11 of the arms have been actuated by the actuating portions 20[a] of the cam, it will be seen that each of said contact arms has moved away from the plane of contact, an equal distance and in a direction opposite to that in which the opposing contact is made as indicated by the arrows. Obviously the contacts 9—9 in my improved construction are separated from each other twice as fast as either of said contacts is separated from the dotted line *x*—*x*. In other words, twice as rapidly as they would be separated were one of the contacts stationary. This results, as before stated, in such an abrupt breaking of the primary circuit of the ignition system, that a secondary circuit of great intensity of voltage is produced in the secondary circuit. Moreover, the contacts 9 are separated so quickly to a distance through which the arc cannot follow, that sparking between the contacts 9 is reduced to a minimum, if not entirely obviated, and the consequent depreciation of the contacts by transfer of metal will be obviated under any conditions of use.

I prefer to make the bearing blocks 11 of the contact arms of a material which wears more readily than the opposed faces of the contacts 9 and for this purpose I prefer to use fiber or other similar material. It will be noted by reference to Figs. 1 and 2 that if the meeting faces of the contacts 9 wear, which would necessitate the contact arms coming slightly closer together to insure contact, the wear of the bearing blocks 11 will obviously keep pace with the wear of the contacts and maintain the parts in the same relative relation. It is also obvious that when the contacts 9 are together as in Fig. 1, they act as a stop to prevent the contact 11 from being forced against the cam and will thus relieve the said blocks from wear during a considerable portion of the revolution of the cam, so that the said blocks will not be permitted to wear away any faster than is required to have them keep pace with the more slight wear upon the meeting surface of the contacts 9.

The circuit will ordinarily pass through the studs 13 to the respective contacts 8—8 with which they are in electrical connection at the apertures 8[c]. The current may be completed to the studs 13 in any desired manner. In the present instance I have shown each stud 13 provided with a binding post extension 13[a] extending through an insulating 13[b] and provided with the usual nuts and washers, for securing it to the disk 2 and enabling a wire or other electric connection to be secured thereto, the circuit wires being indicated in this instance at 25 and 26. Obviously the circuit in which the contact breaker is located can be established in other ways in accordance with the particular situation in which it is used.

In the manufacture of periodic interrupters or contact breakers of this character, it is extremely difficult to get the machine work produced with absolute accuracy and in the ordinary interrupters, very slight variations in the construction of the cams and other parts of the device, are productive of serious results, for example, should there be a slight inaccuracy in the boring of the cam so that its location is very slightly eccentric, the effect in an ordinary interrupter would be to vary the time in the cycle of certain cylinders at which the spark will be produced. In my improved interrupter, it will be seen that as both contacts are moved in opposite directions by cam actuating portions on opposite sides of the center, any slight variation in the centering of the cam would merely tend to slightly change the position of the plane of contact between the contacts 9, bringing it either to the right or left of the dotted line *x*—*x*, without affecting the operation of the device, the pivoted contact arms swinging together to one side or the other to compensate for any inaccuracies of workmanship, while separating and approaching each other at the same periods in the cycle. To make this entirely clear, let us suppose, with reference to Fig. 1, that the cam 20 is bored inaccurately so as to have its center to the left of the axis of the shaft 1. The effect of this would be to force the left hand contact lever 8 over a very slight amount while the right hand contact lever would be permitted to move a corresponding distance to the left and still engage the opposite contact. In other words, my improved construction greatly cheapens the cost of manufacture of these devices by obviating the necessity of the absolute technical accuracy and nicety of these parts, which has heretofore been required and without which the apparatus would not work commercially.

It will also be noted that by locating the cam engaging portion between the pivot of the contact arm and the contact itself, a greater degree of movement is imparted to the contact than is imparted to the cam engaging portion and as the simultaneous action of both arms separates the contacts twice the distance which either contact would move, and in half the time, a much smaller cam can be employed than would be necessary if only one contact was movable, thus reducing the wear and jar on the apparatus, while the extremely quick separation of the contacts produces a higher voltage in the secondary circuit, while at the same time diminishing the sparking across the contacts 9—9.

It will also be seen that various parts of the contact breaker can be made and assembled without any adjustment beyond the adjustment of the contact pins or screws 9[a]

and after the device is once assembled no further adjustment of the apparatus is necessary at any time, as it cannot get out of adjustment by wear of the apparatus, as before described.

In this instance I have shown the actuating cam provided with four raised actuating portions disposed at 90° apart around the axis of rotation of the cam, and this is the construction which I prefer to use with a four cylinder internal combustion engine, where the cam shaft is operated at one half the speed of the crank shaft. It will be understood, however, that the number of actuating portions will obviously depend upon the speed of rotation of the crank shaft and the number of cylinders with which the engine is provided.

What I claim and desire to secure by Letters Patent is:—

1. In a circuit breaker for ignition systems, the combination with a pair of opposed contact members, each movable toward and from the other and provided with a contact to engage the contact carried by the other member, means for moving said members to bring said contacts into engagement, and means for simultaneously moving said contact members in opposite directions to separate said contacts.

2. In a circuit breaker for ignition systems, the combination with a pair of opposed contact members, each movable toward and from the other and provided with a contact to engage the contact carried by the other member, yielding means engaging said members for normally forcing said contacts toward each other, and holding them in engagement, and means for simultaneously moving said members in opposite directions away from each other to separate said contacts.

3. In a circuit breaker for ignition systems, the combination with a pair of pivoted contact members, each provided with a contact, yielding means for normally forcing said contacts toward each other holding them normally in engagement, and means interposed between said contact members for engaging them simultaneously and moving them in opposite directions away from each other to separate said contacts.

4. In a circuit breaker for ignition systems, the combination with a pair of pivoted contact members, each provided with a contact, yielding means for normally forcing said contacts toward each other, and holding them in engagement, a cam for separating said contacts, said cam and said contact members being relatively rotatable one with respect to the other, and said cam being provided with actuating portions for engaging and simultaneously actuating both of said members in opposite directions to separate said contacts.

5. In a circuit breaker for ignition systems, the combination with a pair of pivoted contact members, each provided with a contact, yielding means for holding said contacts normally in engagement, a cam interposed between said members, said cam and said contact members being relatively rotatable one with respect to the other, and said cam being provided with oppositely disposed actuating portions for engaging and simultaneously moving said contact members away from each other to separate said contacts.

6. In a circuit breaker for ignition systems, the combination with a pair of pivoted contact members, each provided with a contact, yielding means for holding said contacts normally in engagement, a cam interposed between said members, said cam and said contact members being relatively rotatable one with respect to the other, and said cam being provided with oppositely disposed actuating portions for engaging and simultaneously moving said contact members away from each other to separate said contacts, said contact members being provided with cam engaging portions of softer material than the meeting portions of said contacts.

7. In a circuit breaker for ignition systems, the combination with two parts relatively rotatable one with respect to the other, a pair of contact arms pivotally mounted on one of said parts, and provided with meeting contacts, a cam carried by the other of said parts provided with actuating portions arranged concentrically with respect to the axis of said relative rotation for simultaneously engaging said arms, and moving them in opposite directions to separate said contacts, and yielding means for normally tending to force said arms in opposite directions to bring said contacts together.

8. In a circuit breaker for ignition systems, the combination with two parts relatively rotatable one with respect to the other, a pair of contact arms pivotally mounted on one of said parts, and provided with meeting contacts, said arms lying on opposite sides of the axis of relative rotation of said parts, a cam carried by the other of said parts having its axis substantially coincident with said axis of relative rotation and lying between said contact arms, said cam being provided with diametrically opposite actuating portions, and said arms being provided with oppositely disposed cam engaging portions, and yielding means for normally moving said arms in a direction to close said contacts.

9. In a circuit breaker for ignition systems, the combination with two parts relatively rotatable one with respect to the other, a pair of contact arms pivotally mounted

on one of said parts, and provided with meeting contacts, said arms lying on opposite sides of the axis of relative rotation of said parts, each arm being pivoted at one end and having its contact at the other end, a cam carried by the other of said parts having its axis substantially coincident with said axis of relative rotation and lying between said contact arms, said cam being provided with actuating portions on opposite sides of the same, and said arms being provided with cam engaging portions between its ends, whereby the movement of the contacts will be greater than the movement of said cam engaging arms in a direction to bring said contacts together.

10. In a circuit breaker for ignition systems, the combination with two parts relatively rotatable one with respect to the other, a pair of contact arms pivotally mounted on one of said parts and provided with meeting contacts, said arms lying on opposite sides of the axis of relative rotation of said parts, a cam carried by the other of said parts having its axis substantially coincident with said axis of relative rotation and lying between said contact arms, said cam being provided with diametrically opposite actuating portions, and said arms being provided with oppositely disposed cam engaging portions, and a single spring having its end portions connected with said arms and simultaneously forcing them in a direction to bring said contacts together.

11. In a circuit breaker, the combination with two parts relatively rotatable one with respect to the other, a pair of curved contact arms pivotally mounted upon one of said parts, each of said arms comprising parallel spaced plate portions, each of said arms being pivoted at one end and provided at the other end with a contact, a bearing block for each of said contact arms lying between the plate portions thereof and secured thereto, a cam carried by the other of said parts having its axis substantially coincident with the axis of said relative rotation, said cam being located between said bearing blocks and provided with diametrically opposite actuating portions for engaging said blocks and moving said arms simultaneously to separate the contacts carried thereby.

12. In a circuit breaker, the combination with two parts relatively rotatable one with respect to the other, a pair of curved contact arms pivotally mounted upon one of said parts, each of said arms comprising parallel spaced plate portions, each of said arms being pivoted at one end and provided at the other end with a contact, a bearing block for each of said contact arms lying between the plate portions thereof and secured thereto, a cam carried by the other of said parts having its axis substantially coincident with the axis of said relative rotation, said cam being located between said bearing blocks and provided with diametrically opposite actuating portions for engaging said blocks and moving said arms simultaneously to separate the contacts carried thereby, said blocks being provided with recessed portions on their outer faces, and a spring carried by the part to which said arms are connected and having its end portions engaging the recesses in said blocks.

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

FRANCIS R. HOYT.

Witnesses:
BERTHA B. ADELSON,
F. W. WYATT.