G. HONOLD.

ELECTRIC CONTACT DEVICE.

APPLICATION FILED JULY 21, 1917.

1,263,247. Patented Apr. 16, 1918.

Fig. 1.

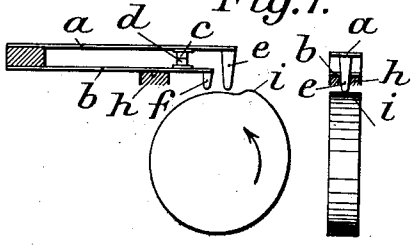


Fig. 4.

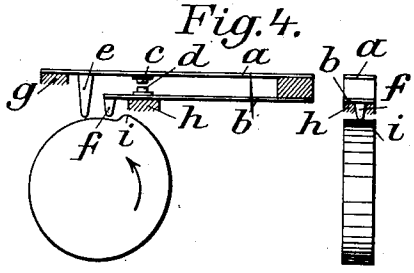


Fig. 2.

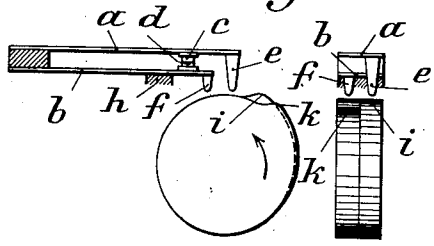


Fig. 5.

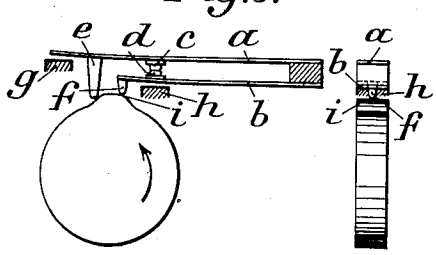


Fig. 3.

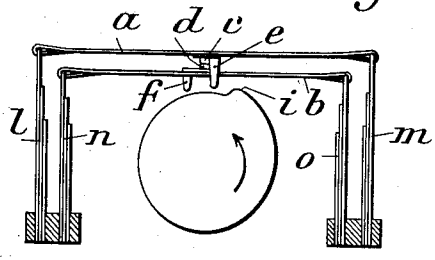
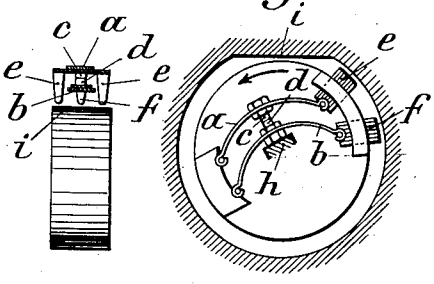


Fig. 6.



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ELECTRIC CONTACT DEVICE.

1,263,247. Specification of Letters Patent. **Patented Apr. 16, 1918.**

Application filed July 21, 1917. Serial No. 182,064.

To all whom it may concern:

Be it known that I, GOTTLOB HONOLD, a subject of the German Emperor, residing at and whose post-office address is Stuttgart, Hauptmannsreute No. 93, Germany, have invented certain new and useful Improvements in Electric Contact Devices; 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 refers to electric contact devices and more especially to mechanically controlled interrupters for use with the ignition devices of internal combustion motors. Its particular object is a contact device of this kind of superior efficiency and reliability.

In previous forms of interrupters the contacts are usually separated by means of a cam against the action of a spring, the interrupter elements being stationary and the coöperating cam being rotary, or else the interrupter elements rotate in front of a stationary cam. In this type of interrupters one of the contact pieces is usually fixed to a movable lever arm while the coöperative contact is relatively stationary. In order to operate such an interrupter in one sense the movable lever arm is lifted under control from its position of rest by a cam. The returning of the lever to its original position in order to actuate the interrupter in an inverse sense is effected by aid of spring action. Now in those cases where it is important that an interrupter be actuated in one or the other sense at a certain predetermined position of some rotating part of the machine, as is usually the case with the mechanically controlled interrupters of the ignition devices for internal combustion motors, the mere spring-controlled action does not give full satisfaction in quite a number of cases. For in order to impart to the mass of the lever arm the acceleration necessary for returning it to its initial position, the spring requires a certain time which is constant for a certain angle of displacement. With machines running at high speed, therefore, until the spring has been able to return the contact to its initial position, the angle of rotation of the rotary part in question, such as for instance the armature of the ignition device, will become unduly great. This drawback is still further increased by the circumstance that the cam in engaging the movable lever arm will accelerate it to such an extent that the arm in rising will pass beyond the lift determined by the height of the cam. In consequence thereof the spring is still less able to carry the contact back within the proper time. In other words, at high speed the returning of the lever arm takes place after a considerably flatter curve than the lifting under control. On the other hand it is important in many cases that the interrupter be actuated exactly at a predetermined period of the engine cycle and that the interval of time between the actuation of the interrupter in one and the other sense, that is, in opening or closing the coöperative contacts, vary in inverse proportion to the speed of rotation, the time of short-circuit of the generating winding controlled by the interrupter and the time of interruption thereof at double the speed being for instance reduced to one half.

The drawback of retardation in the operation of the interrupter occurs for instance in magneto electric ignition devices and in single spark battery igniters by the igniting spark next following being weakened or being left out altogether, too little time being left to the armature field and to the field of the transformer coil respectively to be restored owing to the primary circuit being closed too late.

In the interrupter according to the present invention this drawback has been obviated by actuating the interrupter under control in one and the other sense so that any retardation, such as that caused by spring action, is rendered thereby impossible. In other words, the two contact pieces of the interrupter are displaced in succession by suitable means in such a manner that their position relatively to each other is first changed and then restored. To this end in the preferred form of the device in accordance with this invention the two contact pieces are arranged on movable lever arms and means are provided for lifting these arms one after the other in such a manner that the interrupter is actuated in one sense by lifting one arm and in the other sense by lifting the other arm. Preferably a cam or a plurality of cams are employed for operating the lever arms carrying the contact pieces.

According to the particular use for which

the interrupter is designed, its contacts are either closed in their position of rest so as to be first opened by the cam and then closed again, or they are open in the position of rest and are first closed and then opened again by the cam acting upon them. Electric ignition devices for internal combustion motors require one or the other type of interrupters according to the kind of ignition employed. With magnetos and with single spark battery igniters the first mentioned type of interrupter is used as in these cases the igniting spark is produced by opening the circuit, whereas with buzzer igniters, where ignition is started by closing the circuit, the type of interrupter mentioned in the second place is made use of.

In the first type of interrupters in accordance with the present invention the cam first lifts one lever arm carrying the upper contact piece, thus causing the contacts to be separated. While this movement is progressing, the same or another cam causes the other lever arm carrying the lower contact piece to be lifted also, the coöperative contacts being thus closed again.

In the second type of interrupters the contacts are first closed under control by the cam or cams, whereupon they are opened again under control by moving the second lever arm, the arms being thus restored to their position of rest with the contacts open.

A controlled movement of a movable lever arm in one or the other sense is impossible in interrupters having only a single movable lever arm for the reason that a safe closing of the contacts can be effected only by aid of the elastic uncontrolled action of a spring. In trying to move the movable contact under strict control, unless an elastic intermediate piece is provided, the contacts would not be closed or else would be broken in closing up. Owing to the inevitable imperfection of work it is impossible to secure an absolutely exact fitting of the contacts and even the usual wear will not bring such exact fitting about. It is true that there are interrupters where the counter-cam is under absolute control, for instance with a curved guiding slot, but in such a case a spring must be provided between the counter-cam and the interrupter contact, and at the same time the previously mentioned drawback that, in the beginning of the movement, the interrupter is sometimes retarded by this spring has to be taken into account. In contradistinction to this the interrupters according to the present invention having one lever arm lifted in order to operate the interrupter in one sense and the second arm lifted in order to operate the interrupter in the other sense, present an elastic spring action for both lever arms in the direction opposite to the movements aforementioned.

In the accompanying drawings illustrating several embodiments within my invention, Figure 1 shows in front elevation, and also in side elevation, an interrupter having a single rotatable cam; Fig. 2 shows in front elevation, and also in side elevation, an interrupter having two rotatable cams; Fig. 3 shows in front elevation, and also in side elevation, an interrupter in which the contacts are mounted on elastic bands held under tension by supporting springs; Figs. 4 and 5 show in front elevation, and also in side elevation, two forms of interrupters in which the coöperative contacts are normally open instead of normally closed; and Fig. 6 shows an arrangement in which the interrupter contacts rotate, whereas the actuating cam is normally stationary.

In all the modifications shown in the drawings the interrupter is actuated during each rotation only once in one or the other sense, but by providing a greater number of cams on the disk the number of interruptions during one rotation may be increased accordingly.

Referring to Fig. 1 of the drawings, *a* and *b* are a pair of flat springs forming lever arms, arm *a* carrying contact piece *c* and counter-cam *e*, arm *b* carrying contact piece *d* and counter-cam *f*. Both counter-cams *e* and *f* are located in the path of the rotary cam disk *i*. When the interrupter is at rest, the arm *b* is pressed by spring action upon the stationary stop *h*; the contact piece *c* is pressed against the contact piece *d*. When the cam *i* engages the counter-cam *e* lever arm *a* is lifted and contact piece *c* is separated from contact *d*. Thereafter the cam *i* lifts the counter-cam *f* and thereby causes the contact piece *d* to again engage contact *c* so as to close the circuit. At the same time the counter-cam *e* is lifted off the cam *i*. As soon as counter-cam *f* has left cam *i* the two lever arms *a* and *b* are restored to their position to rest without however the contact between pieces *c* and *d* being interrupted. The speed of interrupters of this kind is limited by the lift imparted to the lever arms by the rotary cam. This lift should not exceed a certain limit, although it is true that the time of interruption is not influenced substantially by a higher lifting of the lever arms for the reason that both arms are thrown upward in the same fashion one after the other within an interval corresponding to the distance of the counter-cams, and the contacts being brought together again at approximately the highest position of the arms provided that their own movement in passing from the upward movement to the downward movement is comparatively low. One need not be afraid either that the contacts on hitting one upon the other might rebound. On the other hand the mechanical stress exerted upon the spring, this stress increasing

with the velocity and the lift, is limited to a certain extent. On the other hand the velocity at which the counter-cams hit upon the face of the cam should not be too great. The rear surface of the cam can be made very flat in interrupters of this kind as it does not contribute to the duration of the interruption.

The arrangement and action of the interrupter represented in Fig. 2 are almost identical with those of the device described above, with the only exception that in this interrupter the counter-cams *e* and *f* are actuated by separate cams, counter-cam *e* by cam *i* and counter-cam *f* by cam *k*. To this end the cams and counter-cams may be displaced sidewise relatively to each other as shown at the right-hand part of Fig. 2. By making the disks carrying cams *i* and *k* movable relatively to each other the distance between the two cams may be varied at will and a means is thus afforded for varying also the duration of interruption.

In Fig. 3 the invention is shown as applied to an interrupter having its contacts *c* and *d* arranged on elastic bands *a* and *b* placed under tension by aid of springs *l*, *m*, *n*, *o*, the cam *i* serving for displacing the bands in a vertical direction. Interrupters of this kind offer the advantage that while the masses of the movable parts are very small the spring tension may be made very high, their natural vibration being almost suppressed by an effective damping. A counter-cam *e* is arranged on both sides of the band *b* so as to be lifted by the broad surface of cam *i* without counter-cam *f* being displaced simultaneously.

While in the interrupters shown in Figs. 1 to 3 the contacts are closed in the position of rest and are separated by lifting one contact carrier and closed again by lifting the other one, the interrupters shown in Figs. 4 and 5 have their contacts separated in the position of rest and closed by lifting one of the contact carriers in order to be opened again by the lifting of the other contact carrier.

In the interrupter shown in Fig. 4 arm *a* is pressed by spring action against stop *g*, arm *b* against stop *h*, while the interrupter is at rest, the contact pieces being thereby separated from each other. By the action of the rotary cam *i* the counter-cam *f* and lever arm *b* are lifted first, the contact *d* being thus carried against contact *c* so as to close the circuit. On the cam disk continuing its movement of rotation counter-cam *e* is lifted also, the contact *c* being caused thereby to be lifted off contact piece *d*. When the arms *a* and *b* are returning to their position of rest where the counter-cams *e* and *f* leave the surface of the cam disk, the contact pieces remain separated from each other.

The only difference between the interrupter just described and the one shown in Fig. 5 is that the cam *i* is made broad enough to cause counter-cam *e* to be engaged by the cam *i* at the moment where counter-cam *f* is set free again. This causes the arm *a*, when the contacts are separated, to be lifted under control by the cam *i*, while at the same time the arm *b* is returned from its lifted position into its position of rest under spring action. This position of the lever arm is shown in the drawings. As a movement of the contact pieces *c* and *d* in opposite direction is started at the same moment, they will get separated from each other in a very short time.

While in the modifications shown in Figs. 1 to 5 the interrupter is stationary and the cam or cams are rotating, the modification shown in Fig. 6 has a stationary cam and a rotary interrupter. Here two flat springs *a* and *b* have contact pieces *c* and *d* arranged at the middle thereof. One end of each of the springs *a* and *b* is linked to a pin fixed to the interrupter disk, while the other ends are linked to radially movable counter-cams *e* and *f*. The springs are placed under a tension causing spring *b* to be pressed against a fixed stop *h* and contact piece *c* to be pressed against contact piece *d* while the interrupter is at rest. When the interrupter rotates in the direction of the arrow, counter-cam *e* in meeting the stationary cam *i* is displaced in a radial direction toward the center of the disk. Spring *a* acting like a bent-lever is bent somewhat so as to lift the contact piece *c* from the contact piece *d*. Shortly thereafter the counter-cam *f* will meet also cam *i* and be displaced in an inward direction thus lifting contact piece *d* and carrying it against contact piece *c* so as to close the circuit and to disengage counter-cam *e* from cam *i*. On counter-cam *f* leaving cam *i* the two springs *a* and *b* are returned to their position of rest without the contact between pieces *c* and *d* being interrupted. This shows that the mode of action of this interrupter is identical with the one of the interrupter shown in Fig. 1.

It will easily be understood that the modifications shown in Figs. 1 to 6 of the drawings are merely intended as specimens of different kinds of interrupters arranged in accordance with the invention, such interrupters being provided up to this day with a movable and a stationary contact. However the invention may of course be applied with great advantage also to all other kinds of lever interrupters operated by cams, which allow of combining two movable lever arms carrying the contacts.

I claim:

1. In mechanical interrupters for electric ignition systems, two coöperative contact

pieces forming one element of the interrupter and being relatively movable to open or close a circuit, and mechanical means forming the other element of the interrupter and being operative at successive ignition periods to positively lift first one and then the other contact piece so as to first change and then restore their relative position, one of said elements being rotatable.

2. In mechanical interrupters for electric ignition systems, two coöperative contact pieces forming one element of the interrupter and being relatively movable to open or close a circuit, and cam-shaped means forming the other element of the interrupter and being operative at successive ignition periods to positively lift first one and then the other contact piece so as to first change and then restore their relative position, one of said elements being rotatable.

3. In mechanical interrupters for electric ignition systems, two coöperative spring-carried contact pieces forming one element of the interrupter and being relatively movable to open or close a circuit, and cam mechanism forming the other element of the interrupter and being arranged to periodically move first one and then the other of the contact pieces against the stress of their respective springs so as to first change and then restore their relative position, one of said elements being rotatable.

4. In mechanical interrupters for electric ignition systems, two contact levers forming one element of the interrupter, coöperative contact pieces arranged on said levers, and mechanical means forming the other element of the interrupter for positively lifting first one and then the other of said levers to first change and then restore the relative position of the coöperative contact pieces, one of said elements being rotatable.

5. In mechanical interrupters for electric ignition systems, two contact levers forming one element of the interrupter, coöperative contact pieces arranged on said levers, and cam shaped means forming the other element of the interrupter and being operative at successive ignition periods to positively lift first one and then the other of said levers to first change and then restore the relative position of the coöperative contact pieces, one of said elements being rotatable.

6. In mechanical interrupters for electric ignition systems, two spring-pressed levers forming one element of the interrupter, cooperative contact pieces arranged on said levers, and cam mechanism forming the other element of the interrupter and being arranged in the path of said levers to periodically move first one and then the other against the spring stress thereof so as to first change and then restore the relative position of the coöperative contact pieces, one of said elements being rotatable.

7. In mechanical interrupters for electric ignition systems, two coöperative contact pieces forming one element of the interrupter and being relatively movable to open or close a circuit, and a pair of cams forming the other element of the interrupter and being arranged to lift respective ones of said contact pieces successively to first change and then restore their relative position, one of said elements being rotatable.

8. In mechanical interrupters for electric ignition systems, two coöperative contact pieces forming one element of the interrupter and being relatively movable to open or close a circuit, and two angularly-displaced cams forming the other element of the interrupter and being arranged to lift respective ones of said contact pieces successively to first change and then restore their relative positions, one of said elements being rotatable.

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

GOTTLOB HONOLD.

Witnesses:
PAUL WOLFAST,
ADOLF LEBHERS.