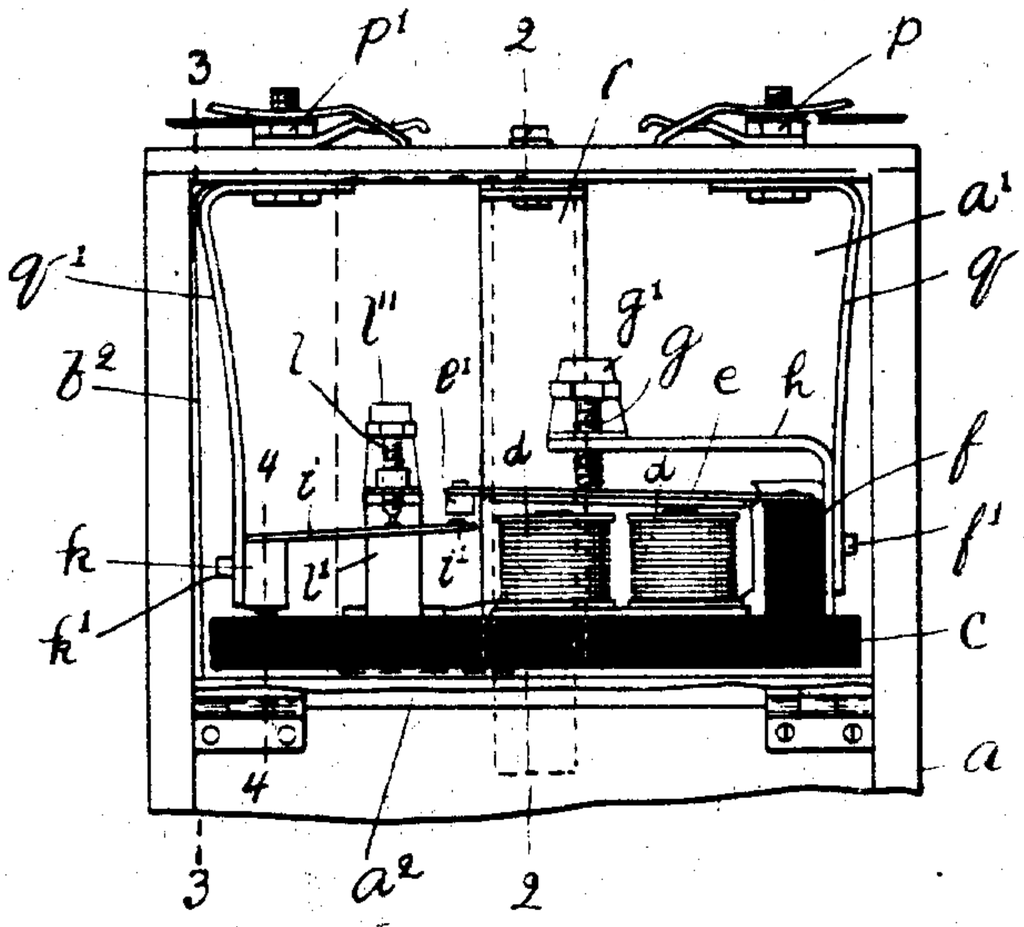
C. B. SNELL.

CIRCUIT INTERRUPTER.

APPLICATION FILED FEB. 18, 1907.

900,320. Patented Oct. 6, 1908.

Fig. 1.



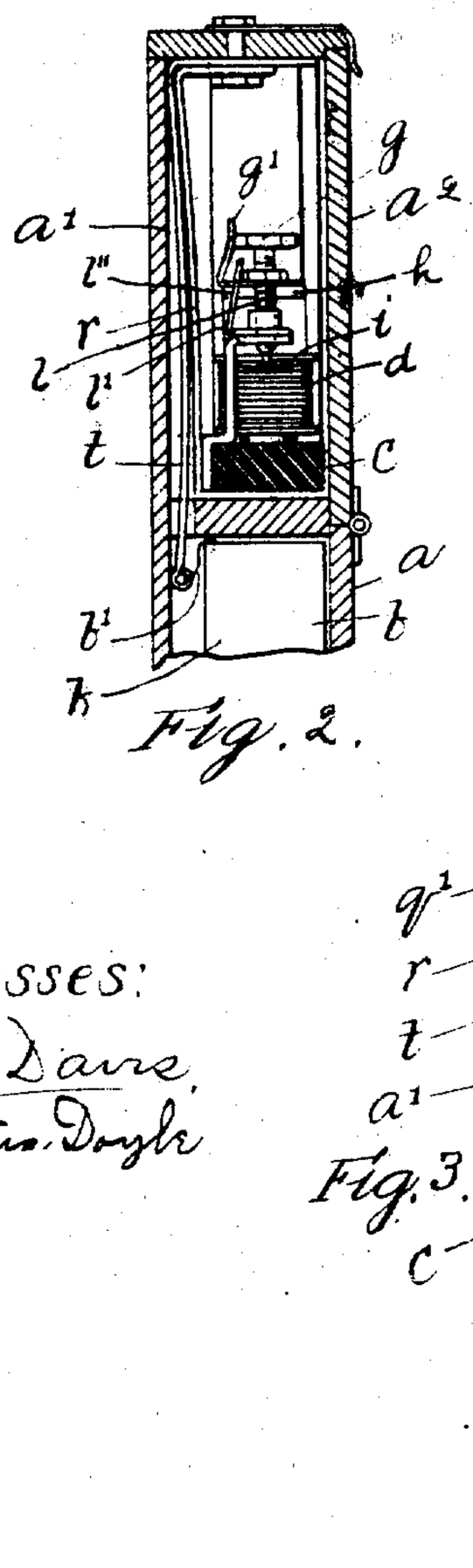


Fig. 2.

Fig. 4

Fig 5.

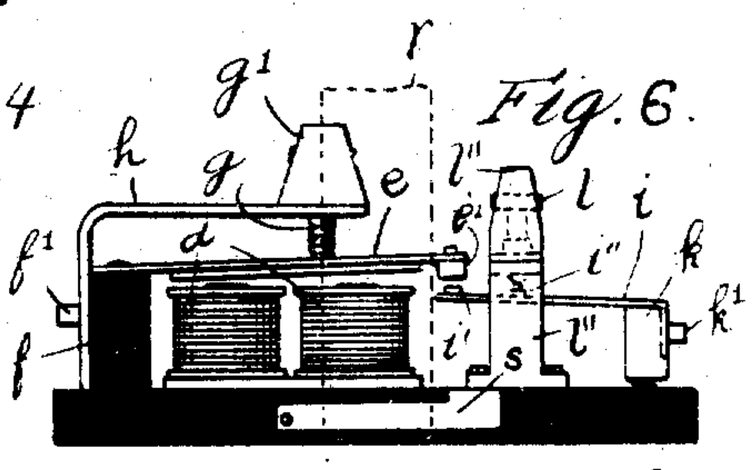


Fig. 6.

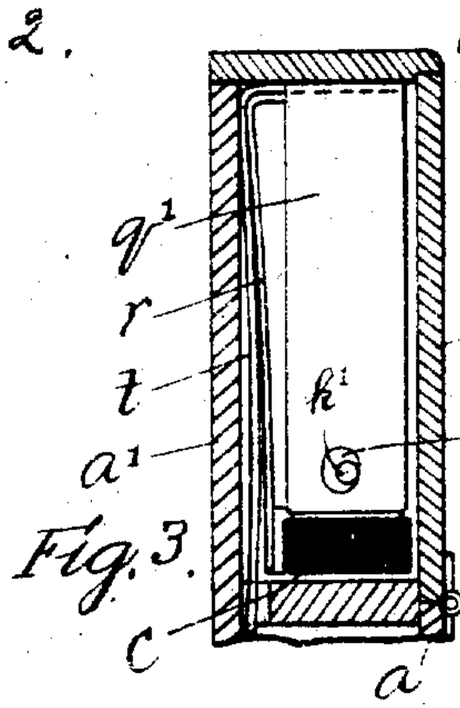


Fig. 3.

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UNITED STATES PATENT OFFICE.

CULLEN B. SNELL, OF BRADFORD, MASSACHUSETTS.

CIRCUIT-INTERRUPTER.

No. 900,820. Specification of Letters Patent. Patented Oct. 6, 1908.

Application filed February 18, 1907. Serial No. 357,794.

To all whom it may concern:

Be it known that I, CULLEN B. SNELL, of Bradford, county of Essex, State of Massachusetts, have invented an Improvement in Circuit-Interrupters, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to a form of circuit operating device or circuit interrupter, which comprises an electro-magnet having a vibrating armature adapted to make and break the circuit therethrough, such devices being commonly known as vibrators, and being especially adapted to be used in connection with spark coils or igniters for explosive engines. Devices of this character require accurate adjustment, according to the varying strength of the batteries and other varying conditions, hereafter described, and it becomes at times necessary to substitute one interrupting device for another, so that it is desirable that these devices may be accurately and easily adjusted and may be readily removed and replaced. I have further observed that the jar and vibration ordinarily caused by the rapidly vibrating armature, will, if not absorbed, often cause the armature spring to crystallize and the life thereof and of certain other parts to be shortened.

The objects of my invention are to provide a device of the above character with means whereby it may be readily removed from or inserted in its case, so that it may be readily inspected, adjusted, or exchanged, and so that the act of inserting the device makes the necessary electrical connections; to provide means for supporting the device so that the vibrations caused by the circuit interrupting armature will be absorbed, and to provide a device of this character with means whereby it may be adjusted so that the best results may be secured under different conditions. I accomplish these objects by employing the means shown in the accompanying drawings, in which,

Figure 1 is a front elevation of a circuit interrupter and box therefor made according to my invention. Figs. 2 and 3 are cross sections on the line 2—2 and 3—3 of Fig. 1, respectively. Fig. 4 is an enlarged detail sectional view on the line 4—4 of Fig. 1. Fig. 5 is a detail view of one of the spring holding arms. Fig. 6 is a detail rear view of the interrupting device removed from the case.

The box or casing *a* is provided with a condenser *b* in its lower portion, and said casing *a* is provided with a chamber *a'* in its upper portion which is closed on one side with a lid a^2.

The vibrator or interrupter comprises an insulating base piece *c* having the usual magnet coils *d* thereon and the armature spring *e* which is mounted on an insulating support *f* fixed on said base *c*. The usual stop screw *g* for limiting the upward movement of the armature spring is supported upon an angular arm *h* connected to the outer side of said support *f*, a spring *g'* being provided which locks said screw from rotation by engaging one of the sides of its head. The angular arm *h* is made flexible, instead of rigid, as is usual in other apparatus, and cushions the up-throw of the armature spring, and thus aids in prolonging the life of said spring. The circuit breaker comprises a spring arm *i*, mounted on a metal support *k*, said arm having a contact point *i''* thereon, and an end portion *i'* adapted to be engaged by the hammer *e'* on the end of the arm *e*. Said contact point *i''* is held closely adjacent the end of the contact screw *l*, mounted on a metal bracket *l'* secured to base *c* and to which one end of the magnet coils *d* are connected, the opposite end of said coils being connected to bracket *h*, as a matter of convenience in making the connections, as will hereafter appear. A locking spring *l''* is provided for locking screw *l* in different positions of adjustment.

The support *k* is vertically adjusted upon the base *c* by the means shown in detail in Fig. 4, which comprise a pair of guide pins *m*, adapted to enter recesses *c'* in the base *c*, in which are located coil springs *n* adapted to bear against the bottom of said recesses and the under side of the support *k*. A screw *o* is mounted in the base piece *c* and is threaded in the support *k*, so that when said screw is turned in one direction said support will be drawn down against said springs *n* and when it is turned in the other direction said springs will be permitted to lift it. Said springs *n* also act to provide a spring support for said support *k*.

In a vibrator or interrupter for ignition apparatus great accuracy of adjustment is necessary to secure the best results, and I have found that sufficient accuracy is not obtainable by any of the usual methods where one or two adjusting screws are employed and where the vibrating springs are all attached to rigid supports. The adjust-

ment of the armature spring or hammer should be changed according to the increase or decrease of the voltage employed, and the elevation of the armature above the magnet coils should depend upon the tension of the spring, the weight of the armature and hammer and the strength of the magnet. These factors vary somewhat in different instruments of the same design. For successful operation it is essential that the position of contact made by the two contact points should be in just the right relation to the up and down limits of the hammer's movement, as well as that the tension of contact be correct; for the shorter the duration of the "make" the less is the consumption of current, and, if the hammer, by magnetic pull and momentum, is made to travel a given distance, as much of that distance as possible should be employed in creating the "break" between contact points and as little as possible in creating the "make." If the position of contact is high with relation to the hammer's movement, the duration of the "make" is short as compared with duration of the "break", furthermore, the shorter the distance of travel of the hammer the higher the frequency of vibrations. For these reasons it is clear that a correct position of contact is quite as essential as a correct tension of contact. The tension of contact may be adjusted by means of the screw *l* in order that the position of contact may be adjusted, I also provide the above described means for vertically adjusting the support *k*. It will be apparent that by vertically adjusting both screw *l* and support *k* the position of contact with relation to the armature may be placed at the most desirable point. The provision of means for vertically adjusting the support makes it readily possible to compensate for variations in the tension of different springs or for variation in the shape or size of any parts which effect the adjustment when assembling the device or renewing parts. It also enables compensation for changing variations when in use, caused by lessening tension of the springs or shortening of contact points by wearing. By these means a saving in battery consumption is effected, a higher frequency of vibration is secured, and a reduction of arcing at the contact points is accomplished, with the consequent increased endurance of the spark points.

Binding posts *p*, *p'* are provided on the top of the casing *a* and a pair of oppositely disposed, flat holding springs *q*, *q'* are respectively connected to the lower ends of said posts. The springs *q*, *q'* are of angular form, one of said springs being illustrated in detail in Fig. 5, and comprising a bifurcated base portion o^0 adapted to be slipped onto the binding posts, and to be clamped flat against the inner side of the top of chamber *a'*, the arms of said springs extending somewhat convergently downward in position to engage respectively, the opposite sides of the support *f*, or arm *h* thereon, and the support *k*. The support *f* is provided with a projecting screw head *f'* and the support *k* with a projecting screw head *k'*, each of which is adapted to be passed through apertures q^2 formed in the lower ends of said springs *q*, *q'*. As these springs *q*, *q'* act towards each other, they act to clamp and support the whole vibrator device between them and at the same time the spring *q* makes an electrical connection with bracket *h*, to which one end of the magnet coil is connected, and the spring *q'* makes an electric connection with bracket *l*, to which the other end of the magnet coil is connected through circuit breaker *i* and support *k*.

A flat spring *r* is secured to the inner side of the rear wall of chamber *a'* midway between the spring arms *q* and *q'* and is adapted to press against the rear side of the base *c* in contact with a metal strip *s*, connected to the bracket *l'*. Said spring *r* is arranged in contact with a strip *t*, to which one terminal *b'* of the condenser *b* is connected, as shown in Fig. 2, the other terminal b^2 being shown as connected to post *p'*, so that the condenser coil is shunted about the circuit interrupter.

The spring *r* acts to press the base *c* outwardly so that, in order to remove the whole device, it is simply necessary to press the springs *q*, *q'* apart until they are free of the screw heads *f'*, *k'*, and then the spring *r* will force the device out of the chamber *a'*. To replace it, it is merely necessary to press back springs *q*, *q'* and press it in until the heads *f'*, *k'* may enter the holes q^2, all necessary electrical connections being made when springs *q*, *q'* are released.

It will be seen from Fig. 5 that the heads *q'*, *k'* are circular and that the lower ends of the holes q^2 are curved correspondingly, but are of somewhat greater width than the diameter of said heads, so that the action of spring *r* in pressing base *c* outwardly causes the latter to be lifted slightly. The result is that the whole vibrator is spring supported against both horizontal and downward movement, so that much of the jar or vibration, which is ordinarily caused by the vibrating armature, will be absorbed by the spring supports thereof.

The shock of the very rapid vibrations of the armature spring and contact spring tend to crystallize these springs and cause them to break at the point of greatest strain. The spring supports for base *c* and the independent spring supports for support *k* described above absorb much of this shock of vibration and prevent spring-crystallization and consequently prolong the life of said springs.

Having thus described my invention, what

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

1. A circuit operating device comprising an electro-magnet having a vibrating armature and means for yieldingly supporting said operating device, substantially as described.

2. A circuit operating device comprising an electro-magnet having a vibrating armature and means for yieldingly supporting said operating device composed of a plurality of contact springs, substantially as described.

3. A circuit interrupter comprising an electro-magnet having a vibrating armature, a base on which said interrupter is mounted having oppositely disposed contact terminals thereon, a pair of contact springs for said base disposed to engage said terminals, to support said base and absorb the shock of vibration caused by the vibrating parts, substantially as described.

4. In combination with a casing having a chamber open at one side, a base, an electromagnetic circuit operating device mounted on said base having circuit terminals at opposite ends thereof, contact devices at opposite ends of said chamber, consisting of a pair of springs disposed to engage said terminals and to act in opposite directions to clamp said operating device therebetween, said springs having apertures and said terminals having projections disposed to enter said apertures and to lock said operating device in position, substantially as described.

5. A circuit interrupter comprising an electro-magnet having a vibrating armature, a base on which said interrupter is mounted having oppositely disposed contact terminals thereon, a pair of supporting contact springs for said base disposed to engage said terminals and having apertures therein, the lower ends of said apertures having upwardly inclined faces, projections on said base arranged to fit loosely in said apertures when said springs are in engagement with said terminals, and a third spring disposed to engage said base between said contact springs to lift the same by causing it to slide upwardly upon the inclined faces of said apertures, substantially as described.

6. In combination with a casing having a chamber open at one side, a base, an electromagnetic circuit operating device mounted on said base having circuit terminals at opposite ends thereof, contact devices at opposite ends of said chamber, consisting of a pair of springs disposed to engage said terminals and to act in opposite directions to clamp said operating device therebetween, means on said operating device for engaging said springs to prevent transverse movement thereof with relation to said springs, and a spring disposed to engage the rear side of said base and to press said operating device from said chamber when the other springs are moved out of engagement with said terminals, substantially as described.

7. A circuit interrupter comprising a base, a contact point and an electro-magnet having a vibrating armature mounted on said base, and a support yieldingly mounted on said base and having a spring actuating arm thereon disposed to engage said contact point to make the circuit and to be engaged by said armature to break the circuit through said magnet, substantially as described.

8. A circuit interrupter comprising an electro-magnet having a vibrating armature, a contact point, a spring arm normally acting to engage said contact point and disposed to be engaged by said armature and alternately to make and break the circuit through the magnet coils, and means for adjusting said contact point and said arm in the direction of the path of the armature to vary the position of contact therebetween, substantially as described.

9. A circuit interrupter comprising an electro-magnet having a vibrating armature, a contact point, a support having a spring contact arm thereon disposed to engage said contact point and to be engaged by said armature to move it out of engagement with said contact point alternately to make and break the magnet circuit, and means permitting adjustment of said support and said contact in the direction of the path of said armature to vary their position of contact, substantially as described.

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

CULLEN B. SNELL.

Witnesses:
L. H. HARRIMAN,
H. B. DAVIS.