May 17, 1932. H. RÜHLEMANN 1,858,969

ELECTRIC FUSE FOR PROJECTILES

Original Filed June 22, 1927

Fig.1.

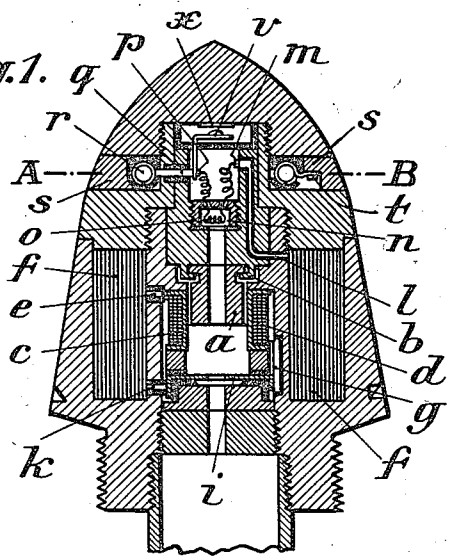


Fig.2.

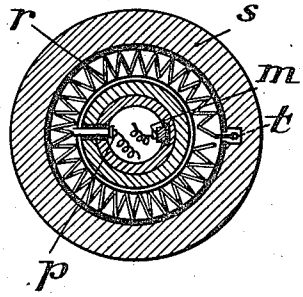


Fig.3.

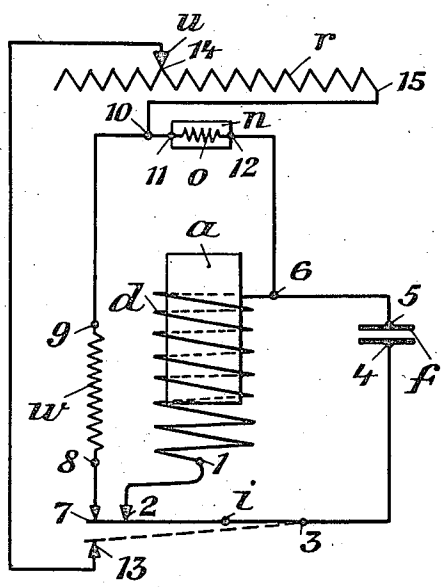
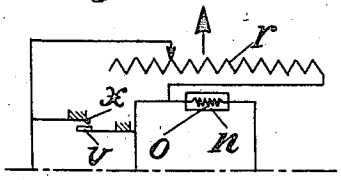


Fig.4.



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UNITED STATES PATENT OFFICE

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ELECTRIC FUSE FOR PROJECTILES

Original application filed June 22, 1927, Serial No. 200,683, and in Germany June 26, 1926. Divided and this application filed March 3, 1930. Serial No. 432,865.

The present application is a division of applicant's prior application Serial No. 200,683, filed June 22, 1927, now Patent No. 1,755,023, dated April 15, 1930, and relates to an electric fuse in which a condenser acts as a storage means from an electric source to supply the ignition current for an electrical igniting device.

The invention makes possible, by the use of such a condenser as an ignition current storage means, to produce an electric impact fuse, which is extremely sensitive and quick to operate, having a simple compact construction for projectiles, mines, etc. Such condenser arrangement in an electric time fuse also permits the stored current to be used at the same time for an impact ignition so that a simple and electrically-operated double igniter is produced. For this purpose, a contact is connected in series with the electric ignition means and the condenser.

In the accompanying drawings, some modifications of electric fuses according to the invention are shown by way of example in connection with an impact-fuse.

Figure 1 shows a longitudinal section of a fuse according to the invention,

Fig. 2 is a cross section on the line A—B of Fig. 1,

Fig. 3 shows diagrammatically the electrical connections, and

Fig. 4 is a detail of the modification shown in Fig. 3.

In the longitudinal axis of the projectile, a permanent magnet *a* is arranged shiftable in the longitudinal direction. The magnet *a* is held in the head of the projectile in its front end position by means of a locking device of known construction, for instance, by the lock spring *b*. Around the magnet *a* is arranged a coil body *c* wound with several turns *d* of insulated copper-wire. The coil body *c* is fixed in the head of the projectile. The two ends of the turns *d* are connected to a condenser *f* which, for instance, may be formed as a paper condenser with two tin-foils isolated by insulating paper. The one end of the turns *d* is connected across the contact *e* to the one tin-foil of the condenser *f*, while the other end of the turns *d* is led over contact *g* to a metal strip *i* which is stretched across the path of the magnet *a* and over contact *k* to the other tin-foil of the condenser *f*. The conductors *e*, *g*, *i* and *k* are insulated from the body of the projectile.

The tin-foil of the condenser *f* connected to the contact *e* is also connected to the insulated conductor *l*. Connected to this conductor at *m* is the one end of a thin resistance wire *o* embedded in the priming-composition *n* and serving as heating or ignition wire. This wire may, in the manner of the filament of an incandescent lamp, be wound or bent in a spiral or coil or in zigzag. Instead of an ordinary resistance wire, a wire of silit or of a similar material may be used. The other end of the resistance wire is connected at *p* to the contact *q* which in turn slides upon the surface of a resistance *r* arranged in a circle. The resistance *r* is insulated and unmovably arranged in a ring *s* which is rotatably and adjustably mounted in the head of the projectile. The ring *s* has in this construction the function of the usual composition ring in burning-fuses. The one end of the resistance *r* which, in the example illustrated, forms an annularly bent, helically wound wire is free, whereas its other end is electrically connected to the head of the projectile by means of a screw *t*.

When firing the projectile, the magnet *a* by the inertia of its mass comes free from the locking springs *b* and moves to the rear in the head of the projectile. During this movement, the lines of force of the magnet intersect the turns of the coil *d* and generate in the latter an induction current by which the condenser *f* is loaded, as this coil *d*, as stated above, is connected to both coatings of the condenser *f*. Shortly before reaching its rear end position the magnet *a* impacts upon the metal strip *i* and bends same in the middle. Hereby the one end of the metal strip is withdrawn from the contact *g*. The circuit of the coil *d* across the condenser *f* is opened and the loaded condenser *f* is disconnected from the coil *d*.

At the same time the circuit of the condenser *f* across the heating wire *o* of the priming-composition *n* is closed by the metal

strip *i* bent in its middle by the magnet to such an extent as to make contact with the rear closing nut of the head of the projectile. Thereby the current flows from the one tin-foil of the condenser *f* through the conductor *l* and the screw *m* to the heating wire *o* from which the current passes through the screw *p* and the contact *q* to the resistance *r*. According to the angular position of the ring *s* in the head of the projectile, the current flows therethrough a greater or smaller number of wire turns, i. e. a greater or smaller length of the resistance wire itself until it passes at the end at *t* into the body of the projectile and returns through the latter to the metal strip *i* and from there to the contact *k* and the other tin-foil of the condenser *f*. According to the height of the resistance in form of the wire windings adjusted in the resistance *r* more or less current will flow in the circuit and therefore also through the heating wire *o* of the priming-composition *n*.

The heating wire *o* furnishes an amount of heat according to the Joule-law of $Q=0.24\ I^2rt-g$. cal., that is to say, the amount of heat generated depends upon the strength of the current.

As a quite definite degree of heat is required for igniting the priming-composition, the ignition will be effected with a current of low strength after a longer period of action only, whereas with a high strength of current ignition takes place after a short period of time already. By means of the regulating resistance *r*, the strength of the current and thereby the desired time necessary for causing ignition may be adjusted. The ring *s* is for this purpose, as the priming-composition of burning-fuses, provided with a scale indicating the ignition time points after firing which together with a mark at the head of the projectile permits to read off the ignition time adjusted.

In the construction shown in Fig. 3, the magnet *a*, as in the construction above described, on firing of the projectile moves through the coil *d* and generates in the latter an induction current which loads the condenser *f*. The current in this case flows from the one end 1 of the coil *d* through the points 2, 3, 4, 5 to the other end 6 of the coil *d*. During loading of the condenser *f*, however, a part of the induction current flows in a second circuit 1, 2, 7, 8, 9, 10, 11, 12, 6 through the priming-composition *n* and an exactly adjusted constant resistance *w*.

This second circuit causes a preheating of the ignition wire *o*. If, for instance, the detonation point is at 400° C., the ignition wire is preheated by this circuit to a temperature of about 350° C. At the end of the movement of the magnet *a* with regard to the coil *d*, the latter is disconnected from the condenser *f* and, moreover, the circuit for preheating the ignition wire is opened. The metal strip *i* then comes into the position shown in dotted lines and hereby closes the condenser *f* over the ignition wire *o* and the resistance *r* adjustable by the moving contact *u*. The discharge of the condenser *f* then takes place from the one tin-foil 4 through the points 3, 13, 14, 15, 10, 11, 12, 6 to its second coating 5. This current furnished by the condenser *f* during the flight of the projectile is proportioned by the resistance *r* in such a manner that it effects the remaining heating of the ignition wire from 350° C. to the temperature of 450° C. which corresponds to the detonation point of the priming-composition and therefore the ignition of the latter after the lapse of the time adjusted at the indicating device of the resistance *r*.

Fig. 4 illustrates a device which makes the electric time-fuse described above also suitable as an impact-fuse. If during the flight of the projectile the priming-composition will not be caused to ignite at the adjusted ignition time point, the resiliently mounted contact piece *v* will, when the projectile impacts upon an aim, be thrown forward by the inertia of its mass. Hereby the contact piece *v* is pressed against a fixed contact *x* and short-circuits resistance *r*. The rest of the condenser load may hereby at once discharge without resistance through the priming-composition which effects the ignition of the latter.

According to another arrangement not shown an automatically acting contact device may be used by means of which, when the projectile impacts upon an aim, the electric energy generated by the movement of the magnet *a* in the induction coil is passed through the ignition wire *o*, so that the ignition of the priming-composition is caused.

The present invention is a division of application Serial No. 200,683, filed June 22, 1927, Patent No. 1,755,023.

What I claim as my invention is:—

An electric impact-fuse for projectiles comprising a source of current, a condenser for storing current furnished by said source of current and an electric igniting means and a contact adapted to be closed on impact, said igniting means and said contact being connected in series with the discharge circuit of said condenser.

In testimony whereof I affix my signature.

HERBERT RÜHLEMANN.