Feb. 15, 1944. R. E. LLOYD 2,341,931

CIRCUIT MAKER AND BREAKER

Filed April 24, 1941

Fig. 1.

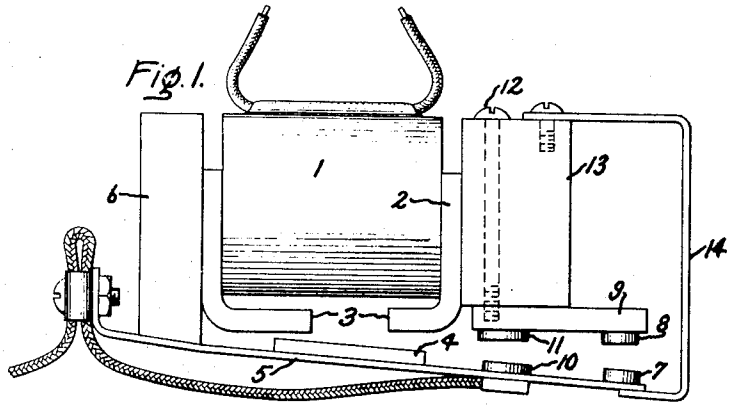


Fig. 2.

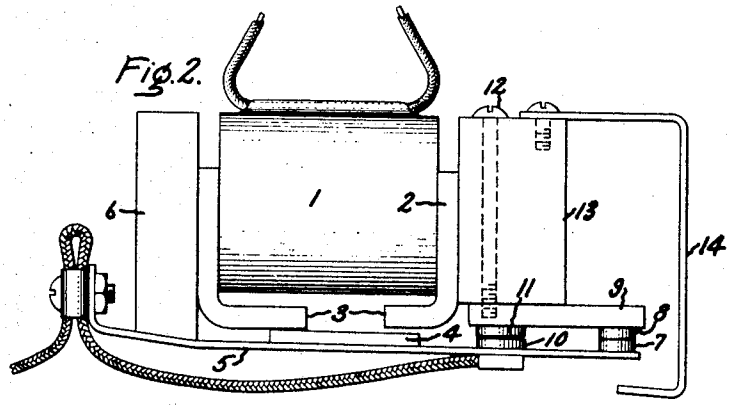
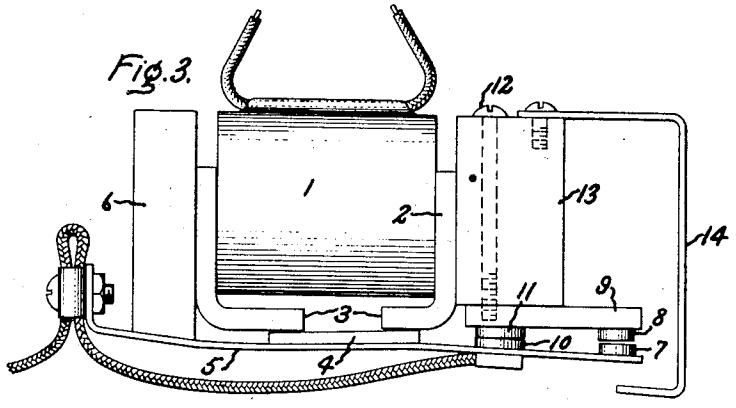


Fig. 3.



Inventor:
Randall E. Lloyd,
by Harry E. Dunham
His Attorney.

Patented Feb. 15, 1944

2,341,931

UNITED STATES PATENT OFFICE

2,341,931

CIRCUIT MAKER AND BREAKER

Randall E. Lloyd, Schnectady, N. Y., assignor to General Electric Company, a corporation of New York

Application April 24, 1941, Serial No. 390,125

2 Claims. (Cl. 200—146)

This invention relates to electric circuit makers and breakers and more particularly to improvements in electromagnetically-operated contactors or relays.

In certain places it is important that the weight of electrical apparatus be reduced to as low a value as possible consistent with reliability. For example, in aircraft the weight problem is always present and as the use of electricity on aircraft is increasing, the size and weight of the necessary apparatus for handling the increased amount of electrical energy is correspondingly increasing.

The present invention was developed primarily for airplane service in which it is used to connect a charging generator to a storage battery when conditions are such that charging can take place and for disconnecting the generator from the battery at other times, such as when the engines and the generator are shut down.

In accordance with this invention I provide a novel and simple contactor which has a relatively low weight in comparison with the amount of current which its contacts can reliably interrupt. It is characterized by the use of two sets of contacts, one of which performs the arcing duty on both the make and break of the circuit and the other of which conducts the current during normal or steady state conditions. In addition, means is provided for opening the arcing contacts after the current carrying contacts close so as to prevent the arcing contacts from freezing or sticking together. In this manner the arcing contacts may be very small and light and as the current carrying contacts are not called upon to perform any arcing duty their contact surfaces will remain clean and of low resistance, so that the size and weight of these contacts can be made considerably less than would be the case if they also had to perform the arcing duty.

An object of the invention is to provide a novel, simple and low weight electromagnetic contactor.

Another object of the invention is to provide a new and improved circuit making and breaking means.

The invention will be better understood from the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

In the drawing, in which like reference characters designate the same parts in the several figures, Fig. 1 illustrates a side view of a preferred embodiment of the invention in its deactuated condition with both sets of contacts open. Figs. 2 and 3 illustrate successive positions of the armature and movable contacts of the contactor during a circuit closing operation.

Referring now to Fig. 1, the contactor has an operating winding 1 mounted on a magnetic field structure 2 having poles 3. Mounted in co-operative relation with these poles is an armature 4. The mounting comprises a strip of spring metal 5, such as steel, which has one end thereof fastened in any suitable manner to a support 6 of insulating material. Carried on the free or outer end of the spring 5 is a movable arcing contact 7 which co-operates with a fixed arcing contact 8 fastened in any suitable manner to a metal supporting plate 9.

The arcing contacts may be made of any suitable material. One such material is partially sintered tungsten impregnated with copper or silver in accordance with the teachings of Adams Patent 1,552,184, granted to the General Electric Company on September 1, 1925. This material is very resistant to burning and destruction by an electric arc and yet has a reasonably good conductivity.

Also attached to the spring 5 between the arcing contact 7 and the armature 4 is a movable current carrying contact 10 for co-operation with a fixed current carrying contact 11 also fastened to the plate 9. These current carrying contacts are preferably made of low resistance material, such as silver.

The plate 9 serves electrically to connect the fixed contacts permanently together and they have a common terminal or binding post in the form of a screw 12 passing through a block of insulating material 13 of any suitable kind mounted on the magnetic structure 2.

A bracket 14 fastened to the block 13 serves as a limit stop for the spring 5 when the magnet 1 is de-energized.

The operation of the invention can best be understood by referring to Figs. 2 and 3. When the magnet 1 is energized the upward motion of the armature 4 under the magnetic attraction of the poles 3 causes the spring 5 to bend at its left-hand end or point of support which therefore constitutes an effective pivot. The first result of this motion is the closure of the arcing contacts as shown in Fig. 2. As the armature continues to move toward the pole pieces the closed arcing contacts arrest the upward motion of the free end of the spring so that the spring is flexed at an intermediate point thereon and the arcing contacts constitute an effective pivot.

This permits the current carrying contacts to close. These contacts then in turn constitute an

effective pivot so that under the continued magnetic attraction of the armature the spring 5 is flexed still further, thus causing a reverse motion of the movable arcing contact and causing the arcing contacts to separate. This action takes place rapidly and insures that the arcing contacts cannot freeze or stick together due to any arc which may have been struck between them when the circuit is first closed by their engagement. It is accompanied by a wiping action of the contacts which also contributes to the prevention of sticking.

When the magnet is de-energized the downward motion of the armature under the combined influence of gravity and elasticity of the spring and the resulting straightening of the spring will first close the arcing contacts and will then open the current carrying contacts and will finally open the arcing contacts.

As the current carrying contacts always close after the arcing contacts have been closed and always open before the arcing contacts open practically no sparking or arcing will take place at their contact surfaces so that they remain clean and have low contact resistance.

While there has been shown and described a particular embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications can be made therein without departing from the invention and, therefore, it is aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a contactor of the type having a movable operating member, a strip of spring metal fixedly supported at one end and having its other end free, a movable arcing contact mounted on the free end of said strip, a fixed arcing contact mounted in co-operative relation with said movable contact, said member being attached to said strip adjacent the fixed end thereof, a movable current carrying contact mounted on said strip adjacent said movable arcing contact, and a fixed current carrying contact mounted in co-operative relation with said movable current carrying contact, said fixed contacts being permanently connected together by a low resistance conductor, said co-operating pairs of contacts being so arranged that when said strip effectively pivots about its fixed end under the influence of said operating member said arcing contacts first engage and form an effective pivot resulting in intermediate flexure of said strip whereby said current carrying contacts subsequently engage thereby in turn forming an effective pivot whereby further intermediate flexure of said strip causes said arcing contacts to separate, the straightening action of said strip upon the return movement of said member being such as to reclose said arcing contacts, then open said current carrying contacts, and finally open said arcing contacts.

2. In a contactor of the type having a movable operating member, a strip of spring metal fixedly supported at one end and having its other end free, a movable arcing contact of partially sintered tungsten impregnated with copper mounted on the free end of said strip, a fixed arcing contact of the same material mounted in cooperative relation with said movable contact, said operating member being attached to said strip adjacent the fixed end thereof, a movable current carrying silver contact mounted on said strip adjacent said movable arcing contact, and a fixed current carrying silver contact mounted in co-operative relation with said movable current carrying contact, said fixed contacts being permanently connected together by a low resistance conductor, said co-operating pairs of contacts being so arranged that when said strip effectively pivots about its fixed end under the influence of said operating member said arcing contacts first engage and form an effective pivot resulting in intermediate flexure of said strip whereby said current carrying contacts subsequently engage thereby in turn forming an effective pivot whereby further intermediate flexure of said strip causes said arcing contacts to separate, the straightening action of said strip upon the return movement of said member being such as to reclose said arcing contacts, then open said current carrying contacts, and finally open said arcing contacts.

RANDALL E. LLOYD.