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1,493,033

D. GREGG
 METHOD AND MEANS FOR AUTOMATICALLY REGULATING
 THE RESISTANCE OF A MAGNETO SAFETY GAP
 Filed Oct. 7, 1922

Fig. 1.

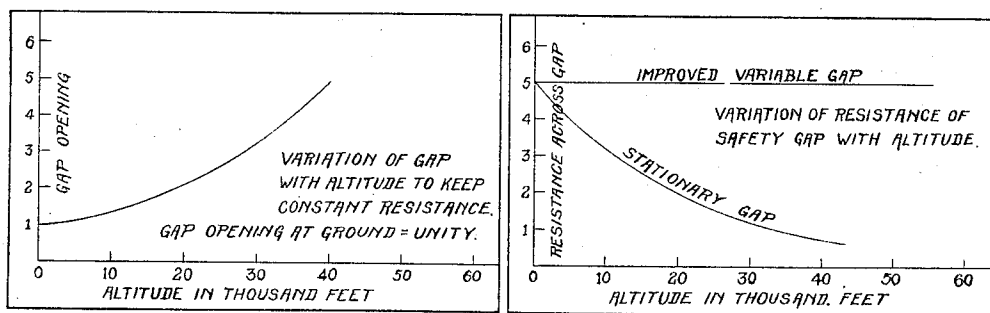
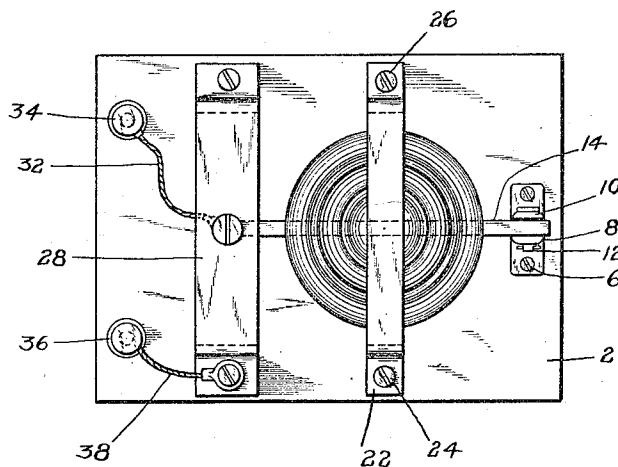


Fig. 3.

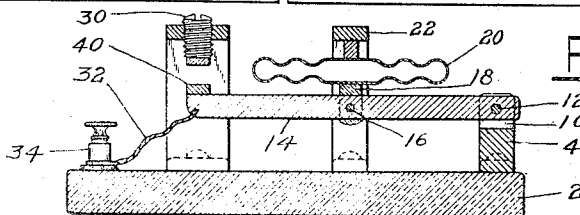


Fig. 4.

Fig. 2.

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UNITED STATES PATENT OFFICE.

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METHOD AND MEANS FOR AUTOMATICALLY REGULATING THE RESISTANCE OF A MAGNETO SAFETY GAP.

Application filed October 7, 1922. Serial No. 593,133.

To all whom it may concern:

Be it known that I, DAVID GREGG, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Methods and Means for Automatically Regulating the Resistance of a Magneto Safety Gap, of which the following is a specification.

This invention relates to the automatic regulation of spark gaps or more particularly to the regulation of the resistance across a safety spark gap for airplane engine magnetos, in particular those magnetos used on overcompressed or supercharged engines.

It is well known that the dielectric strength of air decreases on rarefaction. The atmosphere above the earth's surface decreases in density as the altitude above the earth's surface is increased. Thus it is clear that as an airplane ascends, the dielectric strength of the air between the contact points of a safety spark gap of a magneto thereon decreases. On a standard airplane engine the compression pressure in the cylinder also decreases as the airplane ascends, as this pressure is equal to the compression ratio of the engine times the atmospheric pressure at whatever altitude the engine is. (This is neglecting the increment of pressure due to the heating of the incoming charge, and to the residual heat in the cylinder.) Thus there is practically a constant ratio between the atmospheric pressure at the safety spark gap, and at the points of the spark plugs, and as the resistance of the safety spark gap is initially set higher than the resistance at the spark plugs the spark will always jump at the plugs as their resistance will always be less than at the safety gap.

On an overcompressed or supercharged engine the conditions are altered, as the compression pressure will be practically constant at any altitude at which the airplane may be flying. This is because the engine is always supplied (by means of the supercharger or other device) with intake air at a constant pressure. Hence it is clear that as a supercharged engine ascends the resistance at the plugs remains constant (as the pressure is constant) while the resistance across the safety gap decreases (as the atmospheric pressure decreases), and a point will be reached where the voltage will break

down the safety gap, and a spark will jump there.

This sparking across the gap may increase to such an extent that it will seriously affect the engine for which the magneto supplies electrical energy and may cause misfiring or even stop the engine. Many other disadvantages of the system at present employed might be set forth here, but they are too well known to need discussion. The invention is based substantially on the statement that "the dielectric strength is nearly proportional to the pressure and the potential difference required to produce a spark between rounded metallic surfaces varies almost as the distance between them and as the pressure" in "The Principles of Electric Wave Telegraphy and Telephony—J. A. Fleming."

Heretofore no one to my knowledge has devised any means for accomplishing the purposes hereinafter described although in the use of the ordinary stationary spark gap many accidents have been caused. It is practically impossible to use magnetos for high altitude work if they have been constructed for low altitude work or should the spark gap of the magneto be adjusted for high altitude work the magneto will have substantially no regulation for low altitude work.

With the above and other facts in mind one object of my invention is to provide a means whereby to automatically control the resistance across the safety gap regardless of the surrounding atmospheric pressure and at all times. It is a further object of my invention to provide simple and expedient means for accomplishing this automatic control, which will be responsive in direct proportion or in any desired ratio to the pressure of the surrounding atmosphere at any altitude at which an aircraft upon which the magneto may be mounted is flying.

Other objects will become apparent as the description of my invention proceeds from the claims and from the drawing, in which:

Fig. 1 is a plan view of an embodiment of my invention.

Fig. 2 is a side sectional elevation thereof and;

Figs. 3 and 4 are graphic illustrations of gap variation with altitude and resistance variation with altitude, respectively.

As illustrated in Figs. 1 and 2 my inven-

tion as at present embodied consists of a base 2 of suitable insulating material upon which is mounted an upright fulcrum member 4 secured thereto as by screws 6. Between the
 5 forked ends 8, 10 on pivot 12 is mounted a lever contact arm 14 connected pivotally at 16 to a member 18 rigidly attached to one center of a bellows 20 which bellows is connected at a point diametrically opposite there-
 10 to through any suitable means to a bracket support 22 secured at 24, 26 to the insulating base 2. A second bracket 28 is secured to the base 2 and has mounted thereon an adjustable contact 30 which is in turn con-
 15 nected through wire 32 to a binding post 34 secured in the base 2. A similar binding post 38 secured to the base in a similar manner as binding post 34, connected through wire 38 to a contact member 40 mounted in
 20 cooperative relation to the contact 30 on the end of lever 14. The binding posts 34, 36 serve to connect the spark gap in the magneto circuit in the same manner as heretofore employed. Any suitable damping means
 25 for damping out vibrations or oscillations of the lever 14 may be utilized.

The bellows 20 is composed of thin metal and may be arranged in any position with respect to the fulcrum pivot 12. It may contain a gas at a pressure above atmospheric pressure, or the gas may be at or under atmospheric pressure. Corresponding corrections and detailing of the mechanism will be made in all such cases however.

35 The operation of the device shown will be obvious. As the aircraft ascends, the pressure surrounding the diaphragm or bellows decreases allowing the bellows to expand, moving the lever 14 down and widening the
 40 gap, thus keeping the resistance across the variable gap constant.

Fig. 3 is a graph with any gap opening (in the case shown the gap width is taken as unity at sea level), of my variable spark gap,
 45 showing how the gap opening increases with an increase of altitude. Fig. 4 is a graph illustrating (with legend) the variation in resistance across the stationary spark gap and how I secure constant resistance by com-
 50 pensating for such variation in resistance across my variable spark gap through wide pressure ranges. It will be noted that there is practically no variation in resistance across the variable gap under increasing or
 55 decreasing atmospheric pressures.

The objects accomplished by my variable gap may be accomplished by enclosing the gap or the magneto and gap within an air-tight closure and maintaining atmospheric pressure at sea level therein.

I claim:

1. A spark gap comprising spaced contacts and means adapted to maintain a constant resistance thereacross upon variation of a resistance factor in the medium between
 60 said spaced contacts.

2. A pair of spaced contacts and means adapted to automatically maintain a constant resistance thereacross upon variation of a resistance factor in the medium between
 70 said spaced contacts.

3. A pair of spaced electrical contacts adapted to be subjected to and dependent upon a medium having variable resistance characteristics and means responsive to said
 75 characteristics to maintain a constant resistance across said contacts.

4. In a safety spark gap for aircraft magnetos, contacts separated by a gap, means responsive to variations in atmospheric condi-
 80 tions to vary said gap.

5. In a spark gap for an electric distribution system for aircraft, contacts separated by a gap, means directly responsive to a variation in atmospheric pressure to vary said
 85 gap.

6. In a spark gap for an electric distribution system for aircraft, means directly responsive to atmospheric temperature and means cooperative with said first mentioned
 90 means to vary said gap.

7. In a spark gap for an electric distribution system for aircraft, contacts separated by a gap, means proportionately and automatically responsive to atmospheric pressure
 95 variations to maintain constant resistance across said gap.

8. In a device of the character described, a pair of contacts spaced by a spark gap, and means responsive in direct proportion to an
 100 atmospheric characteristic to vary the relative distance of said contacts.

9. In a device of the character described, a fixed contact, a movable contact, and a pressure-responsive element adapted to vary effective distance between said fixed contact
 105 and said movable contact.

In testimony whereof I affix my signature.

DAVID GREGG.