

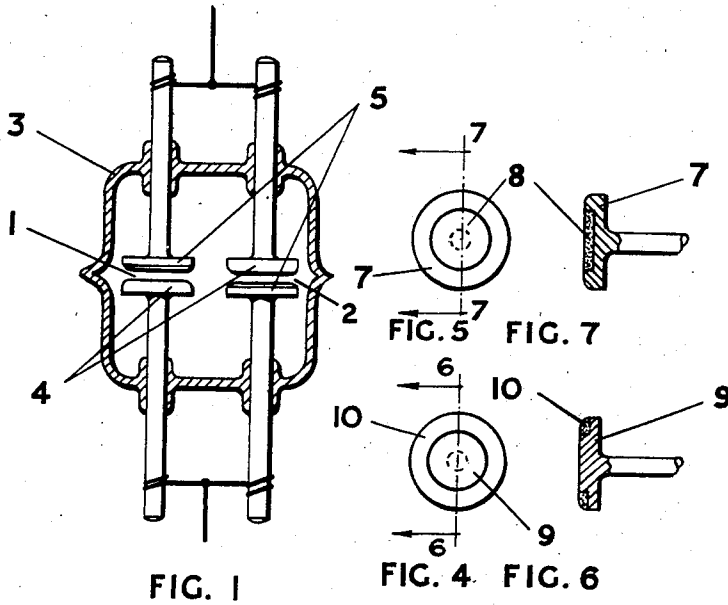
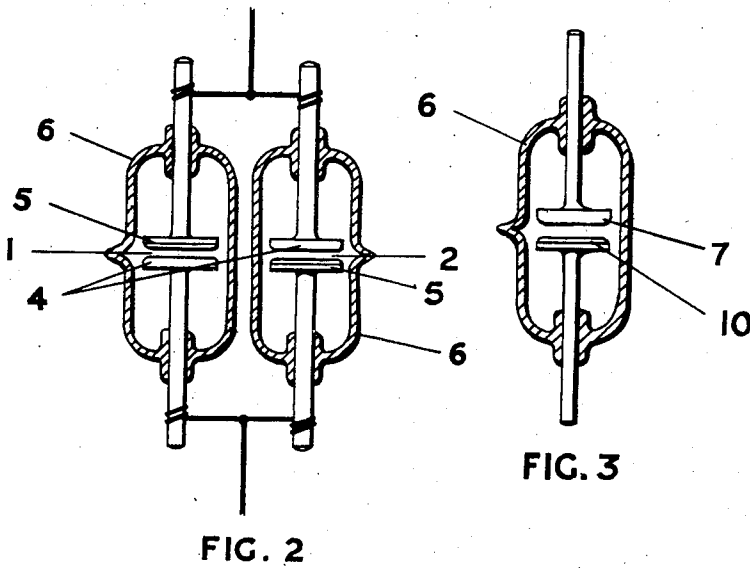
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SPARK GAP

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SPARK GAP

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5 Claims. (Cl. 250—27.5)

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This invention relates to improvements in spark gaps operating in an enclosed envelope of the type which is required to operate on pulses of electromotive force of alternate polarity for prolonged periods at a high sparking rate and at high peak spark currents as, for example, when used in high frequency ignition systems for internal combustion engines or in radio circuits employing rapid spark discharges.

When spark gaps are used for this purpose in which high peak spark currents at high sparking rates are passed, operating difficulties occur which may be due to damage done to the electrodes under the conditions of working; for example, when the peak current in the spark is high (in excess of about 100 amperes) damage may be caused to the electrodes at high sparking rates (in excess of about 250 sparks per second).

In my prior specification Serial 585,165, filed March 27, 1945, spark gaps are described in which the electrodes are arranged in a sealed envelope filled with an inert gas with a substantially uniform electric field created between the electrodes or in which a pair of such gaps are arranged in parallel electric circuits to distribute the sparking between the two pairs of electrodes in order that the rate of sparking in each gap may be reduced.

It has been found, however, that with two similar gaps arranged in parallel the sparking is not evenly distributed between the two and that overloading of one gap is liable to occur and that after the failure, e. g. increase of impulse ratio of one gap due to overloading, the remaining gap being forced to carry the full sparking rate may also fail.

Further in such spark gaps it is necessary to "form" the electrodes in order to provide a substantially steady or constant breakdown potential of the gap before sealing off the envelope which entails operating the gap for a considerable period in air.

The object of the present invention is to obtain a polarity sensitive spark gap, i. e., one which has a lower statistical lag when an electrode or a particular portion of the electrode is the cathode than when that electrode or portion is the anode, whereby the rate of sparking across the gap or across the particular portion of the gap when operating on pulses of alternating electromotive force may be reduced to one half by a positive control of the sparking across the gap.

The invention comprises a spark gap so conditioned or disposed that two paths for electrical impulses are provided, one path sensitive to elec-

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trical impulses of one polarity and the other path sensitive to electrical impulses of the opposite polarity, the sparking potential of both paths being substantially equal.

The invention will be described with reference to the accompanying drawings which show alternative arrangements of the electrodes.

Fig. 1 shows a gap employing two pairs of electrodes arranged in the same envelope.

Fig. 2 shows two pairs of electrodes mounted in separate envelopes and electrically connected in parallel.

Fig. 3 shows a pair of composite electrodes arranged in an envelope.

Figs. 4 and 5 show face views (enlarged) of the two electrodes shown in Fig. 3.

Figs. 6 and 7 are sections on line 6—6, Fig. 4, and line 7—7, Fig. 5, respectively.

In one form of the invention two spark gaps 1 and 2 arranged in an envelope 3 are electrically connected in parallel, one electrode 4 of each pair being, for example, of tungsten and the other electrode 5 of each pair having an oxide sintered on to the tungsten, for example, titanium oxide (TiO_2), aluminium oxide (Al_2O_3), or magnesium oxide (MgO), which it has been found will provide polarity sensitive gaps, i. e., the statistical lag of the gap is less when the oxidized electrode is the cathode. Thus with the gaps arranged in parallel as shown in Figs. 1 and 2, when one pair of parallel electrodes 4 and 5 of gaps 1 and 2, respectively, are cathodes, gap 2 will operate and gap 1 will be inoperative since the statistical lag of gap 2 with electrode 5 as cathode is less than that of gap 1. Similarly on the next pulse of opposite polarity the statistical lag of gap 1 will be the lesser as its electrode 5 is then the cathode and gap 2 will be inoperative.

The electrodes, instead of being in a single envelope 3 as shown in Fig. 1, may be arranged in separate envelopes 6 as shown in Fig. 2, the two pair of electrodes being electrically connected in parallel outside the envelope.

In the arrangement shown in Figs. 3—6 a composite pair of electrodes are employed having two concentric portions, the outer portion 7 of one electrode being of tungsten with an oxidized portion 8 inset therein whilst the second electrode is formed with a central portion 9 of tungsten and an outer concentric oxidized portion 10.

Instead of providing the oxidized electrode by sintering the oxides with the tungsten, they may be embedded in or produced on the tungsten in any other suitable manner such as by "forming"

the electrode as described in my earlier specification Serial No. 585,165.

In all cases the object is to reduce the statistical lag for one path on negative polarity and to maintain a high statistical lag for the other path on the same polarity and vice versa.

The envelopes are preferably filled with a gas, for example, commercially obtainable nitrogen as it has been found that any impurities therein do not adversely affect the operation of the gaps and are advantageous for arc quenching.

By employing two pairs of gaps in parallel, i. e. two gaps in parallel sensitive to pulses of electromotive force of positive polarity and two gaps in parallel sensitive to pulses of electromotive force of negative polarity, the sparking rate in each pair of polarity sensitive gaps may be still further reduced but no positive control will be obtained as between the two gaps operating on the same polarity.

The electrodes have been described as being composed of tungsten as this metal has been found to have advantages, but the invention is not limited to the use of this particular metal.

I claim:

1. A spark gap of the type referred to for operation on pulses of electromotive force of alternate polarity comprising two plate electrodes disposed parallel to one another in an envelope containing gas, said electrodes providing two polarity sensitive conducting paths for the electrical impulses between said two parallel plate electrodes, one path being sensitive to electrical impulses of one polarity and the other path sensitive to electrical impulses of the opposite polarity, the sparking potential of both paths being substantially equal.

2. A spark gap of the type referred to for operation on pulses of electromotive force of alternate polarity comprising two plate electrodes disposed parallel to one another in an envelope containing gas, said electrodes providing a polarity sensitive conducting path through one portion of the electrodes sensitive to electrical impulses of one polarity and a second polarity sensitive conducting path through a further portion of said electrodes sensitive to electrical impulses of the opposite polarity, the sparking potential of both paths being substantially equal.

3. A spark gap of the type referred to for

operation on pulses of electromotive force of alternate polarity comprising two pairs of plate electrodes electrically connected in parallel, each plate electrode being disposed parallel to the other plate electrode of the pair in an envelope containing gas, one pair sensitive to electrical impulses of one polarity and the other pair sensitive to electrical impulses of the opposite polarity, the sparking potential of both pairs being substantially equal.

4. A spark gap of the type referred to for operation on pulses of electromotive force of alternate polarity comprising two pairs of plate electrodes electrically connected in parallel, each plate electrode being disposed parallel to the other plate electrode of the pair, one pair sensitive to electrical impulses of one polarity and the other pair sensitive to electrical impulses of the opposite polarity, the sparking potential of both pairs being substantially equal, and an envelope containing an inert gas by which the two pairs of electrodes are enclosed.

5. A spark gap of the type referred to for operation on pulses of electromotive force of alternate polarity in which a conducting path of low time of lag of spark under the applied electromotive force is provided by a cathode electrode of tungsten sintered with an oxide and a tungsten anode and a conducting path of higher time of lag of spark under the applied electromotive force is provided by a cathode electrode of tungsten and an anode of tungsten sintered with oxide.

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