

Nov. 19, 1940.

W. SCHÖNFELD

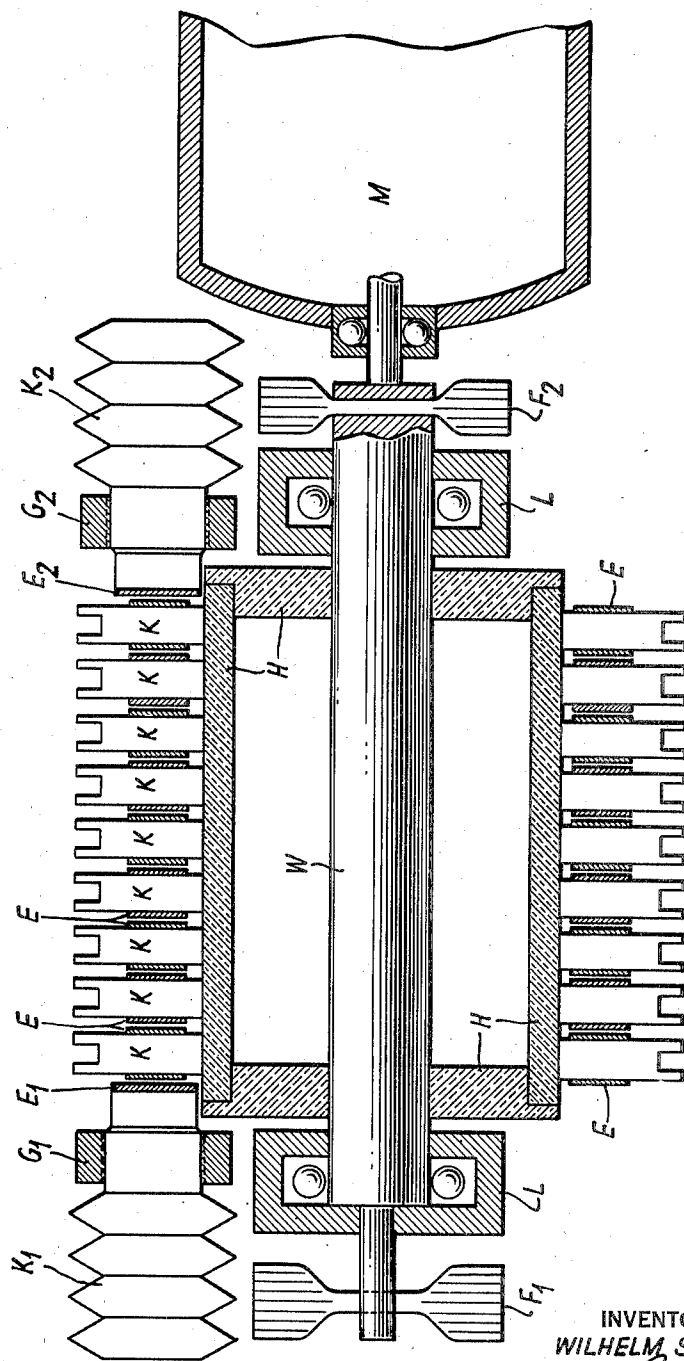
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QUENCHED SPARK GAP

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Fig. 1



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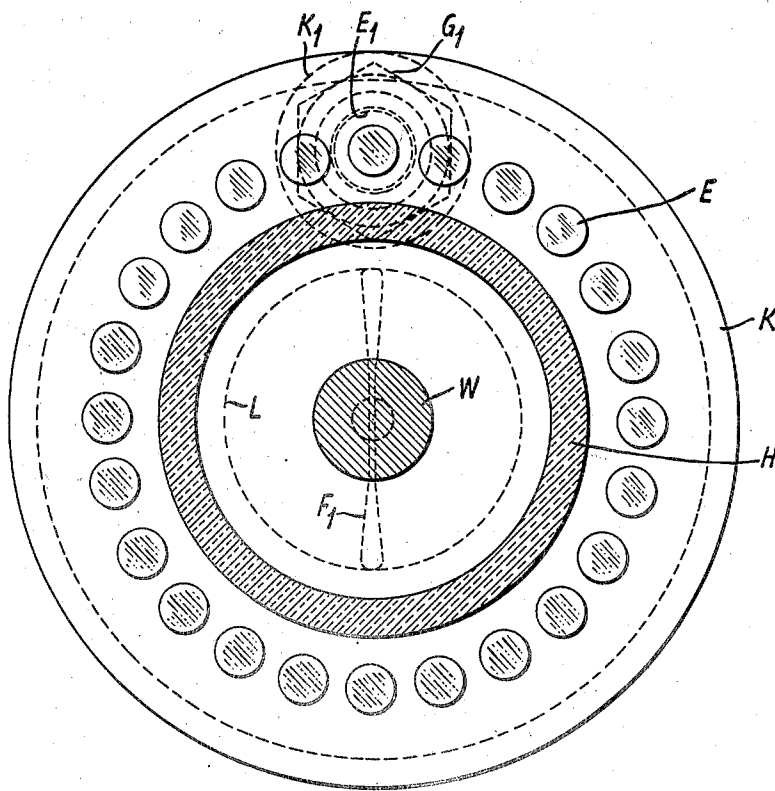
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Fig. 2



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QUENCHED SPARK GAP

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An object of this invention is to provide a quenched spark gap possessing a high quenching effect with very low self-capacitance and very low self-inductance.

5 The present invention is related to a new and novel series quenched spark gap which offers substantial advantages over similar arrange-
ments known in the prior art. Fundamentally speaking, it is known to use rotating spark gaps
10 for the generation of high frequency currents. For the production of short waves, in order that the ensuing oscillations may be of low damping and cooling of the discharge gaps, the inter-electrode distances must be extremely small.
15 Most favorable are distances of, say, an order of a few hundredths of 1 mm. Rotating the electrodes in reference to one another in the revolving series spark gaps known in the art, it will be found very difficult to observe or maintain
20 such small distances or gaps, and the consequence is that even slight alterations will cause serious variations in operation. Another fact is that the spark gaps known in the art, of the rotary type, inhere considerable self-capacitance
25 which represents a substantial shunt where ultra-short waves are dealt with.

According to the invention a quenched spark gap is designed in such a way that a series or row of juxtaposed series spark gaps is periodically passed between two stationary end or terminating electrodes upon which the discharge potential is impressed.

30 An exemplified embodiment of a spark gap as here disclosed consists of a rotatable hollow cylinder upon the shell or circumference of which the series spark gaps are disposed in the form of several adjacent rows covering the circumference of the cylinder parallel to the axis of rotation of the hollow cylinder, in such a way that
40 upon rotation of the cylinder the various series of spark gaps are positioned between the two fixed electrodes at the beginning and the end.

The invention shall now be explained more fully by reference to the appended drawings which
45 show this exemplified embodiment. Fig. 1 is a longitudinal section of the object of the invention; Fig. 2 is a cross-section. W denotes a steel shaft or spindle journaled in the ball bearings L, said shaft W being rotated by a motor M.
50 The said shaft W supports a hollow cylinder H made of insulation material upon the circumference of which, being separated from one another by a thin layer of asbestos, are secured the copper radiator or cooling elements K.
55 Welded onto the latter are the electrodes E, the

latter preferably being made of tungsten or electrolytic iron. E1 and E2 represent the two electrodes mounted at the beginning and at the end which are welded on the radiator or chilling bodies K1 and K2, respectively. These fixed
5 cooling elements may be adjusted in distance relative to the spark gap by screw-threads G1 and G2, and they are cooled by the aid of vanes F1 and F2 attached to the shaft. As can be seen from the cross-sectional view Fig. 2 of the
10 revolving part of the assembly, 24 series spark gaps are arranged on the circumference of the hollow cylinder in the particular exemplified embodiment here shown, which, upon rotation, are sequentially placed in a position between the
15 electrodes E1 and E2. The cooling of the spark gap is insured by blasting a current of air against the same from below.

Now, the operation of the spark gap is as follows:

20 By rotation of the central electrode, ever freshly cooled and deionized gaseous paths or gaps are shifted into the spark path. This path or gap is fixed by the stationary outer electrodes E1 and E2 and fixed and defined by the line
25 connecting the first and the last electrodes. In the instance here mentioned comprising 24 spark gaps around the circumference of the revolving hollow cylinder, as will thus be seen, a cold deionized gaseous path will enter the spark gap
30 twenty-four times for each revolution. Thus, if the hollow cylinder requires for a revolution, say, one second, this means that the gas path of a series of consecutively disposed electrodes stays just one-twenty-fourth of one second in the
35 spark path. In other words, the copper radiator elements K have $\frac{23}{24}$ of a second time to give off such heat as may have been generated. In the ten-unit spark gap as represented in the exemplified embodiment, the resultant thermal load
40 of the spark gap amounts to only 400 watts. This load, in the case of a stationary spark gap, would have to be divided between twenty electrodes, whence the heat dissipated and to be
45 carried away per electrode would amount to twenty watts. But in the rotary spark gap according to the present embodiment, the 400 watts are divided among a twenty-four times greater number of electrodes, whence a load of
50 less than two watts. Owing to such low heat load and to the movement of the electrodes, the tendency to form craters is avoided, combined with very effective cooling and deionization. Because of such low heat load, moreover, the radiator elements can be made comparatively small
55

in size. And this means very low self-capacitance of the entire assembly with the result that the shunt residing in this capacity and which for ultra-short waves is conducive to marked losses, is greatly reduced. The self-capacitance of the spark gap shown in the exemplified embodiment amounts, for instance, to only around 2 centimeters.

The abbreviation of the current path due to the compact and crowded arrangement of the electrodes, as contrasted with the conventional stationary spark gap, amounts to about eighty percent. As a result, the self-induction of the spark gap which constitutes part of the inductance of the oscillatory circuit is diminished considerably. The condenser of the oscillatory circuit, for the generation of waves of the same length, may therefore be made larger, and this means an appreciable raise in power.

Owing to the efficient cooling of the spark gap, it is possible to use extremely high spark frequencies, say, up to 10^6 per second, without the spark becoming inductive as a result of inadequate or imperfect de-ionization. Also, this fact raises the oscillatory power or performance of the arrangement considerably.

By mounting additional stationary electrodes at the beginning and at the end, further spark paths may be obtained which may be used either for impulsing other oscillatory circuits or as spare gaps. To insure equally good cooling conditions in this case, the number of electrodes distributed over the periphery and the speed of rotation must be increased correspondingly.

The invention is not restricted to the exemplified embodiment illustrated in the drawings,

but a great many modifications are conceivable which fall inside the scope and spirit of the invention.

What is claimed is:

1. A quenched spark gap comprising a rotatable shaft, a ventilation vane mounted on said shaft for cooling said spark gap, an insulating cylindrical member secured to said shaft, a plurality of metallic discs mounted on said insulating cylindrical member, a plurality of metallic electrode members secured to both surfaces of each disc and forming a row of juxtaposed series spark gaps, a pair of fixed terminal electrodes, said discs arranged in a row periodically between said fixed electrodes so that electrical discharge applied to one of said fixed terminal electrodes passes through said series spark gaps and is discharged at an opposite fixed terminal electrode.

2. A quenched spark gap comprising a rotatable device, a rotatable shaft secured to said rotatable device, a ventilation vane mounted on each end of said shaft for cooling said spark gap, an insulating cylindrical member secured to said shaft, a plurality of metallic discs mounted on said insulating cylindrical member, a plurality of metallic electrode members secured to both surfaces of each disc and forming a row of juxtaposed series spark gaps, a pair of fixed terminal electrodes located adjacent said ventilation vanes, said discs arranged in a row periodically between said fixed electrodes so that electrical discharge applied to one of said fixed terminal electrodes passes through said series spark gaps and is discharged at an opposite fixed terminal electrode.

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