Sept. 10, 1946. H. BENIOFF 2,407,245

ELECTRICAL APPARATUS

Filed April 30, 1941 2 Sheets-Sheet 1

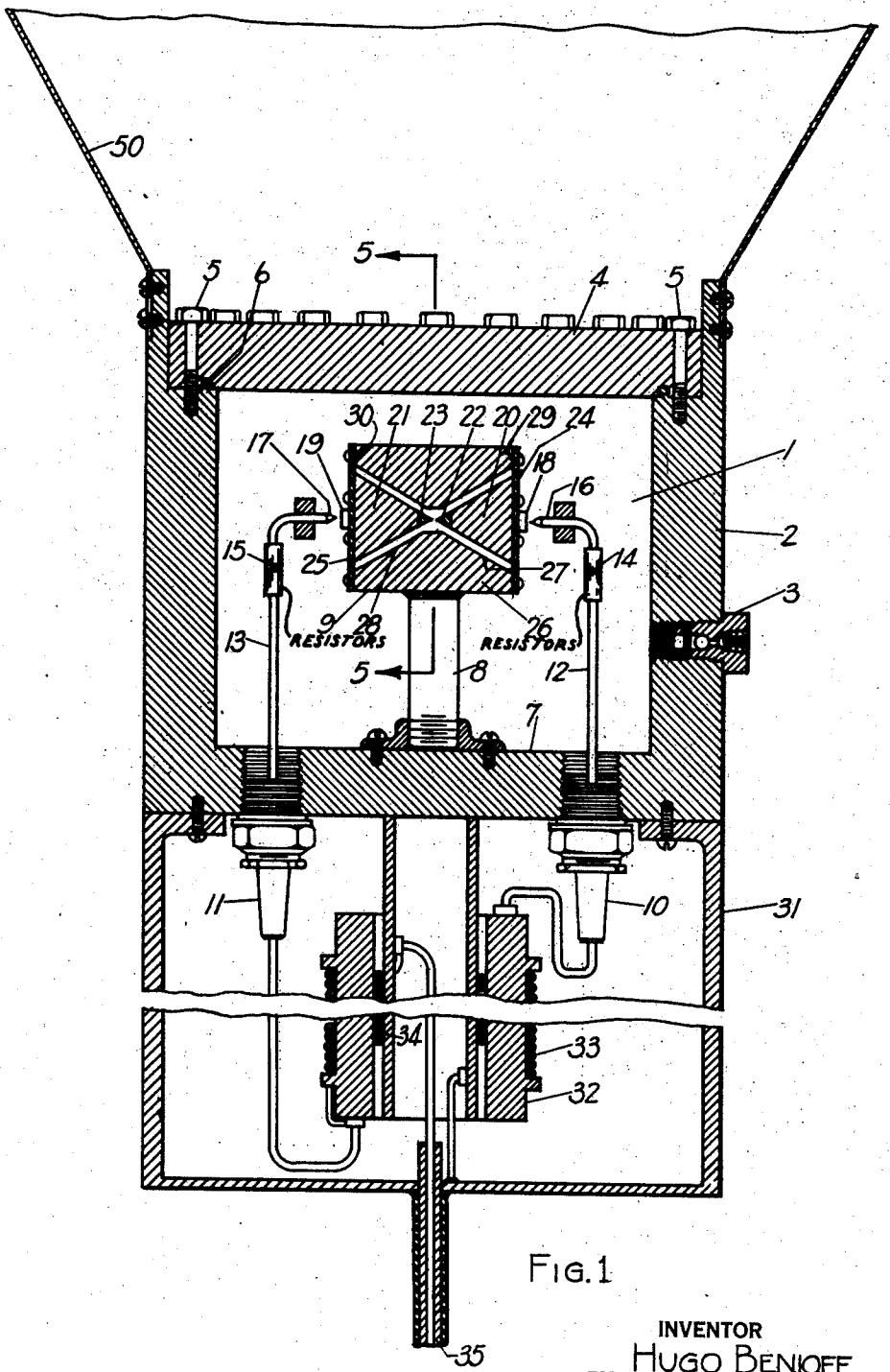


FIG. 1

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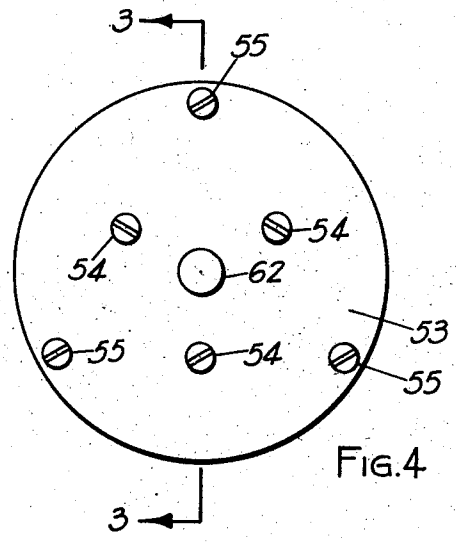


FIG. 4

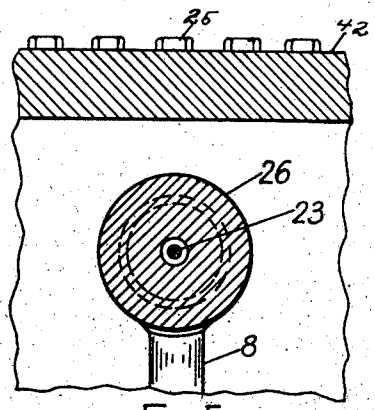


FIG. 5

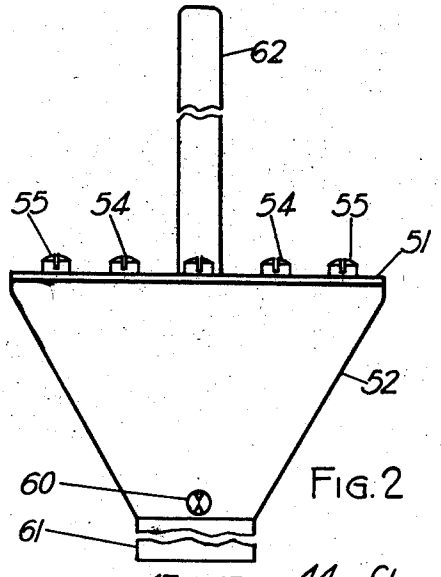


FIG. 2

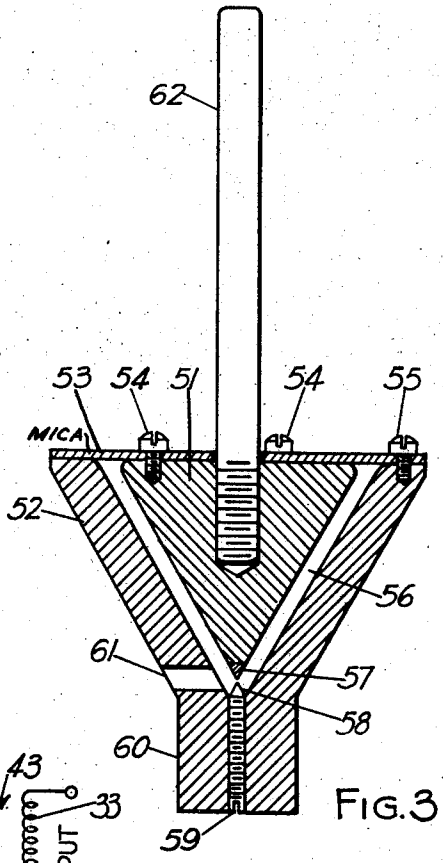


FIG. 3

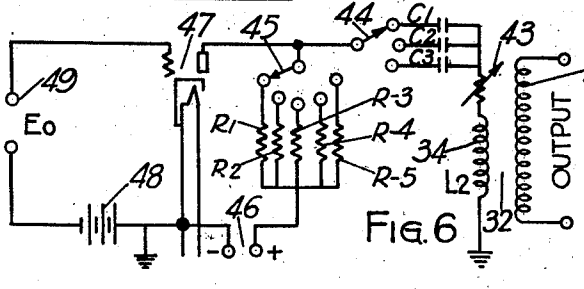


FIG. 6

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UNITED STATES PATENT OFFICE

2,407,245

ELECTRICAL APPARATUS

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Application April 30, 1941, Serial No. 391,153

4 Claims. (Cl. 250—17)

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The present invention relates to short wave transmitting apparatus and particularly to spark transmission of very high frequency electromagnetic waves.

The present invention further relates to a method and apparatus for accurately controlling the time of emission of electromagnetic wave trains at ultra-high frequencies in the range approximately of 300 megacycles and producing very short signal impulses for the purposes of directive radiation with the use of a radiating horn if desired.

The present invention further is concerned with the production and radiation of increased power at these very high frequencies and to this end employs a special type of high frequency tank oscillator in which increased power may be developed. This oscillator preferably contains in series a main spark gap and two auxiliary spark gaps although the auxiliary spark gaps may be eliminated in the operation of the system. The power is supplied to this series circuit through the secondary of an air core transformer the primary of which is operated by a condenser discharge tube controlled or triggered periodically by means of a control tube, preferably a thyratron. The circuit formed by the discharging condenser, the tube and transformer are arranged to have sufficient resistance to provide a highly damped type of oscillation so that only the initial oscillation will operate the circuit.

Further advantages and features of the present invention will be understood from the specification below taken in connection with the drawings in which Fig. 1 shows a vertical section through the apparatus; Fig. 2 shows a modified detail of an element shown in Fig. 1; Fig. 3 shows a section on the line 3—3 of Fig. 4; Fig. 4 shows a top view of the detail shown in Fig. 2; Fig. 5 shows a section on the line 5—5 of Fig. 1; and Fig. 6 shows a circuit diagram which may be used in connection with any of the figures.

In Fig. 1 there is provided an airtight chamber 1 within a casing 2 which may be made of metal or conducting material with a valve 3 at one side through which air or gas may be pumped under pressure. The top of the casing is covered by a plate 4 which hermetically seals the casing by means of the bolts 5, 5, etc., extending all the way around the periphery and clamping the cover to the casing with an airtight seal 6 in between the top and the clamping edge and composed of material transparent to waves such as Bakelite, glass or ceramic. Mounted on the base 7 of the

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casing is a supporting bracket 8 containing the spark-oscillating device 9 of the general type described in my copending application Serial No. 362,434, filed October 23, 1940, but differing in certain respects which will be described later. Two high-tension insulators 10 and 11 are mounted in the base 7 of the chamber 1 and provide a support respectively for the conductors 12 and 13 in series with each of which are resistors 14 and 15 and the spark gaps 16 and 17, respectively. The spark gaps 16 and 17 are opposed to the terminals 18 and 19, respectively, which, in turn, connect to the metallic cones 20 and 21 tapering to center points 22 and 23 which are preferably of some hard metal such as tungsten. The cones 20 and 21 are supported by mica insulating plates 24 and 25, respectively, which are mounted at the ends of the element 26 which is cylindrical in its outer shape with the interior hollowed out to the shape of cones so that the inner surfaces 27 and 28 are respectively spaced away from the sides of the cones 20 and 21.

The element 26 at its end has flat sections 29 and 30 against which the mica insulating sheets 24 and 25 are held fast. In back of the casing 2 in a second chamber 31, which need not be air tight, is mounted an air core transformer 32 whose secondary 33 supplies power to the spark tank circuit and the primary 34 of which is connected through the concentric cable 35 to the power supply source which is more completely described in Fig. 6.

In Fig. 6 the air core transformer 32 with the output secondary 33 and the input primary 34 may be operated and controlled through a circuit in which a thyratron tube 47 initiates the discharge through one of the condensers C_1, C_2 or C_3 through the proper connection of the switch 44. The condensers C_1, C_2 and C_3 are charged by the direct current high potential source indicated at 46 through one of the resistances R_1 to R_5 depending upon the position of the switch 45. The condensers are discharged by means of the thyratron tube 47 the grid of which is biased by the battery 48 in series with a triggering oscillating source 49 which may be sinusoidal peaked or saw-toothed in shape and may periodically furnish a sufficient potential to the grid to initiate the discharge of the condenser circuit between the cathode and anode of the thyratron tube 47, and thus control the time of spark discharge. When the thyratron 47 breaks down, the resistance R_1 to R_5 connected in circuit is substantially shorted, but the damping of the discharge is controlled by the adjust-

able resistance 43 to provide one major oscillation with only minor subsequent ones insufficient to cause a breakdown of the oscillator spark circuit.

In the operation of the system shown in Fig. 1, the tank circuit is charged across from the spark point 16 to the spark point 17 which, in turn, breaks down with the breakdown of the sparking points 22 and 23, thus causing an oscillation of electrical energy in the cones 20 and 21 and a radiation in the direction of the horn 50.

In the modification shown in Figs. 2, 3 and 4 an arrangement showing substantially half of the member 9 is illustrated. In this case the central conical element 51 is supported by the conical shell 52 by means of the mica disc 53 through the screws 54 holding the cone 51 to the mica and screws 55 holding the mica disc to the external cone 52. A uniform space 56 is provided between the elements 51 and 52. At the apex of the cone 51 there is attached a tungsten other sparking point 57 which is opposed by the point 58 adjustably positioned by means of the screw 59 on which the spark 58 is mounted. The screw 59 threads through the cylindrical end 60 of the element 52 and permits an adjustment by means of the screw 59 of the spark gap along the center axis of the cone. A window 61 is provided so that the adjustment of the gap may be properly viewed. Mounted in the cone element 51 may be the antenna 62 which may be of such a dimension as to provide the desired resonance in tuning of the system. This unit may be substituted for the unit 9 in Fig. 1.

Having now described my invention, I claim:

1. An ultra-high frequency electromagnetic spark oscillator comprising two opposed sparking points, a conical conductive member supporting one of said points and a conical conductor shell surrounding and having a surface parallel to and spaced from said conical member supporting the other of said points, said points being closer together than the shell and the conductive member whereby the spark takes place between the sparking points and an insulating disc supporting said conical member to said shell.

2. An ultra-high frequency electromagnetic spark oscillator comprising two opposed sparking points, a conical conductive member supporting one of said points and a conductor shell surrounding and spaced from said conical member supporting the other of said points and an insulating disc supporting said conical member to said shell and electromagnetic radiating means extending from said conical member.

3. An ultra-high frequency electromagnetic spark oscillator comprising two opposed sparking points, a conical conductive member supporting one of said points and a conical conductor shell surrounding and having a surface parallel to and spaced from said conical member supporting the other of said points, said points being closer together than the shell and the conductive member whereby the spark takes place between the sparking points and an insulating disc supporting said conical member to said shell and means for adjusting one of said sparking points along the central axis of the cone.

4. An ultra-high frequency electromagnetic spark oscillator comprising two opposed sparking points, a conical conductive member supporting one of said points and a conductor shell surrounding and spaced from said conical member supporting the other of said points and an insulating disc supporting said conical member to said shell and electromagnetic radiating means extending from said conical member and means for adjusting one of said sparking points along the central axis of the cone.

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