April 29, 1941. W. H. BENNETT 2,239,695

CAPACITIVE TARGET-EMITTER FOR ELECTRIC DISCHARGE DEVICES

Filed Feb. 6, 1939

FIG. 1

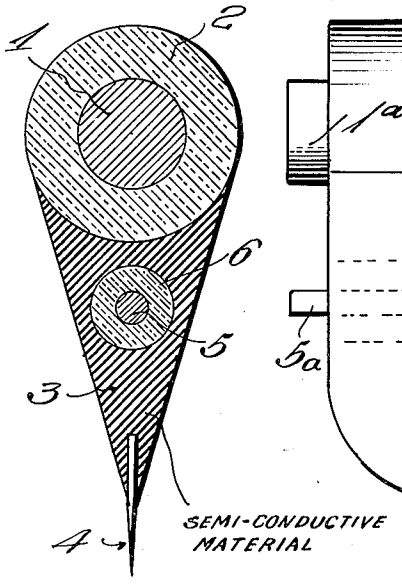


FIG. 2

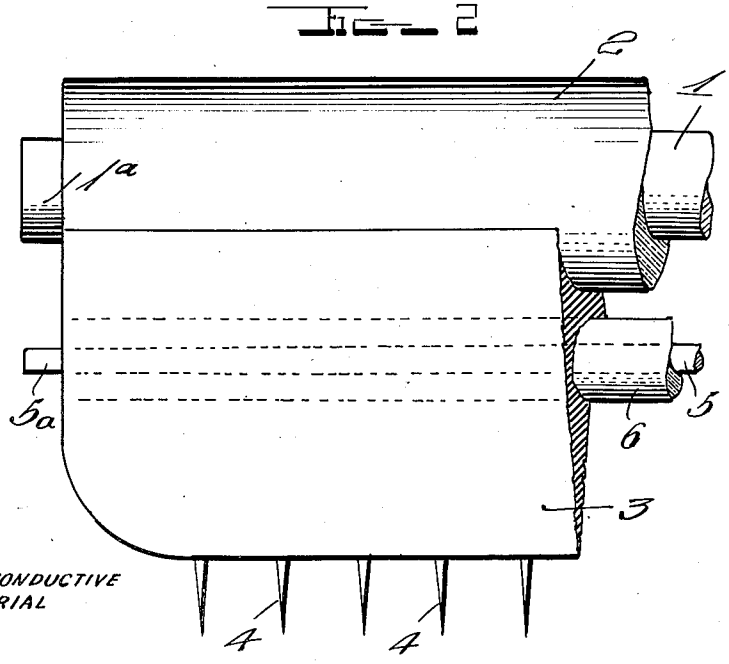


FIG. 3

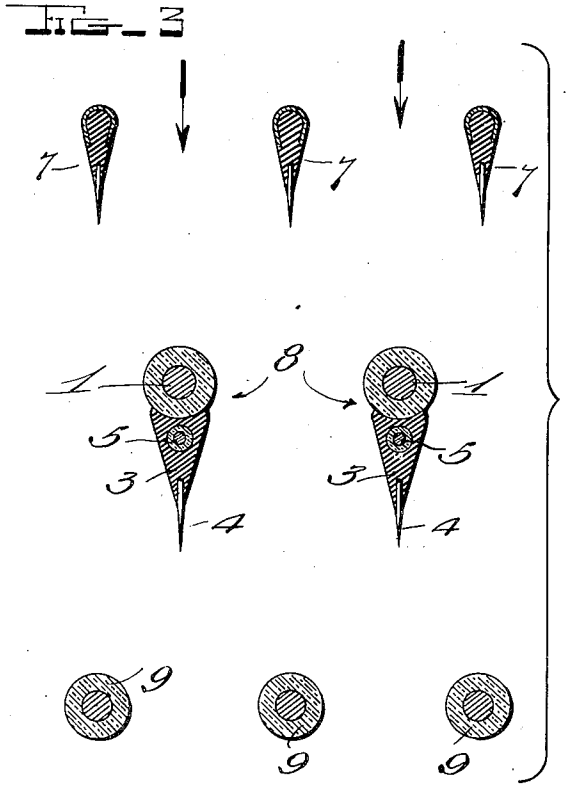
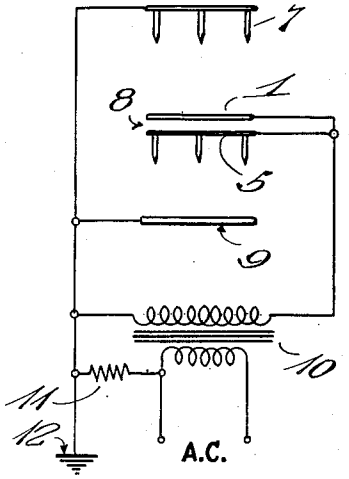


FIG. 4



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CAPACITIVE TARGET-EMITTER FOR ELECTRIC DISCHARGE DEVICES

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Application February 6, 1939, Serial No. 254,934

10 Claims. (Cl. 230—69)

My invention relates broadly to apparatus for effecting electric discharge under high voltage conditions between emitter and target electrodes, and more particularly to a construction of combination target-emitter for use in tandem arrangements in such apparatus.

One of the objects of my invention is to provide a capacitive target electrode in conjunction with an emitter for high voltage operation.

Another object of my invention is to provide a capacitive target for electric discharge apparatus in physical combination with an emitter device but operative independent of the emitter in respect to an advance discharge in a tandem arrangement of electric discharge apparatus, the physical combination of target and emitter providing a streamlined unit.

A further object of my invention is to provide an emitter for electric discharge having a narrow discharge portion and a blunt head portion recessed to receive a capacitive target operatively related to an advance discharge in a tandem arrangement of electric discharge apparatus.

Still another object of my invention is to provide a capacitive target and a capacitive emitter in a unitary streamlined member for independent operation with respect to successive discharges in a tandem arrangement of electric discharge apparatus, for alternating current operation.

A still further object of my invention is to provide a construction of target-emitter for alternating current operation in a tandem arrangement of electric discharge apparatus wherein both target and emitter are capacitively related to the respective discharges, the one incident to the target and the other emanating from the emitter, and wherein the target and the emitter are electrically connected together in the apparatus and operative at the same potential.

Other and further objects of my invention reside in the construction and operation of the target-emitter of my invention hereinafter more fully described with reference to the accompanying drawing, in which:

Figure 1 is a cross sectional view of the target-emitter of my invention; Fig. 2 is a partial side elevation thereof; Fig. 3 is a diagrammatic showing of a tandem arrangement of elements in electric discharge apparatus employing the target-emitter of my invention; and Fig. 4 is a schematic diagram of the connections of the elements of Fig. 4 to an alternating current source.

Alternating current operation of electric discharge apparatus takes place with certain inequalities of discharge during the alternate phases of the applied voltage, being generally of greater extent when the emitter is negative than when the emitter is positive with respect to a target in the field of the discharge. One manner of overcoming this inequality involves the use of a capacitive target such as is shown and described in a copending application of Games Slayter entitled Capacitive target for electric discharge devices, Serial No. 254,933, filed February 6, 1939. When the apparatus includes further discharge stages in tandem, the target-emitter of my invention, which embodies the capacitive target features of the Slayter application, may be employed to effect equalization of the discharge in an advance stage of the apparatus and to preserve stability in the discharge from the adjacent emitter which constitutes a subsequent stage.

The target-emitter electrode of my invention may be used in various forms of electric discharge apparatus employing tandem arrangements of emitters and targets, such as blowers, rectifiers, precipitators, apparatus for chemical reactions, inverters, or like apparatus wherein tandem electric discharge operations are employed to advantage in producing electrical, mechanical or chemical functions.

Referring to the drawing in detail, the structure shown in Figs. 1 and 2 comprises the capacitive target which includes a metallic target electrode 1 and a dielectric sheath 2 on the electrode, and the emitter which consists of a semi-conductive body member 3 and emitter electrodes 4, bus 5 and dielectric 6 mounted in the semi-conductive body member 3.

The target and emitter portions of the structure are securely bound together, preferably in the same operation by which the emitter portion is formed. The body member 3 is composed of a plastic substance, semi-conductive, which is molded about the dielectric 6 and the emitter electrodes 4 to support the same, and may at the same time be molded in contact with the dielectric 2 whereby the target and emitter portions of the structure can be united. The electrodes 1 and 5 with the respective dielectric sheaths 2 and 6 are preformed for assembly in the unit structure shown in Figs. 1 and 2. Ends of the electrodes 1 and 5 project beyond the edge of the device for supporting the structure and providing electrical connections therefor, as shown at 1a and 5a, Fig. 2.

One arrangement of emitter and target electrodes for operation in tandem is shown in Fig. 3 wherein the forward emitter elements 7 may be of any type now in use, the intermediate target-

emitter devices 8 are of the form of my invention as shown in Figs. 1 and 2, and the target elements 9 may be of any type now in use, those shown being of the capacitive type disclosed in the Slayter application hereinbefore noted. Fig. 4 shows the connections of the elements of Fig. 3 to an alternating current source; a transformer 10 is employed to step-up the voltage, and a ballast resistor 11 and ground connection 12 are provided as shown to stabilize the operation of the apparatus.

As will be seen by reference to Fig. 4, the target electrode 1 and the bus 5 are connected together and maintained at the same potential. With respect to the discharge from the emitters 7, however, the electrode 1 has a capacitive effect due to the dielectric 2; and with respect to the discharge from the emitter electrodes 4 the bus 5 is capacitively connected across the dielectric 6 through the semi-conductive body member 3. The operation of the capacitive target 1—2 is essentially the same as described in the Slayter application aforementioned. The capacitive emitter 3—6 functions substantially as set forth in my copending application Serial No. 256,183, filed February 13, 1939, entitled Electrical discharge system.

The component elements of capacitive target and capacitive emitter, embodied in my invention, have been proved especially advantageous in the alternating current operation of electric discharge apparatus as will be understood from the other disclosures cross referenced herein. The application of these features to apparatus of tandem arrangement is made possible by the structure of my invention in which these elements are combined in a unitary device streamlined in form for most efficient operation in the wind stream attending the discharge phenomenon. Because of the connection of the electrode 1 and the bus 5 at the same potential there is no interaction between the target and emitter elements and greater stability is thus achieved together with a simplification of the structure required.

While I have described my invention in a preferred embodiment, I desire it understood that modifications may be made therein and that no limitations upon my invention are intended except as are imposed by the scope of the appended claims.

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

1. In combination, in electric discharge apparatus, a capacitive target element and a capacitive emitter element united in a stream-lined structure with said target element forming the leading edge and said emitter element the trailing edge.

2. In combination, in electric discharge apparatus, a capacitive target element of cylindrical form, and a capacitive emitter element mechanically connected with said target element and shaped to form a stream-lined structure with said cylindrical target element at the leading edge.

3. In electric discharge apparatus, a tandem electrode arrangement for providing a plurality of discharge stages, each intermediate stage including a target-emitter device comprising a target element disposed in the discharge field of an advance stage and an emitter element for producing the discharge in the succeeding stage in the tandem electrode arrangement, and a dielectric sheath about said target element for producing a capacitive effect between the discharge in said advance stage and said target element, said target and emitter elements being united with said dielectric sheath in said target-emitter device.

4. In electric discharge apparatus for alternating current operation, a tandem electrode arrangement for providing a plurality of discharge stages, each intermediate stage including a target-emitter device comprising a target element disposed in the discharge field of an advance stage and an emitter element for producing the electrode in the succeeding stage in the tandem discharge arrangement, said target and emitter elements being united in said target-emitter device, and means for producing capacitive effect in each of said elements in relation to the respective discharge.

5. In electric discharge apparatus for alternating current operation, a tandem electrode arrangement for providing a plurality of discharge stages, each intermediate stage including a target-emitter device comprising a target element disposed in the field of the alternating electric discharge in an advance stage, said target element having a dielectric sheath effective to produce a substantial balance of the alternate phases of said discharge, and an emitter element for producing the discharge in the succeeding stage in the tandem discharge arrangement, said target and emitter elements being united with said dielectric sheath in said target-emitter device.

6. In electric discharge apparatus for alternating current operation, a tandem electrode arrangement for providing a plurality of discharge stages, each intermediate stage including a target-emitter device comprising a target element disposed in the discharge field of an advance stage and an emitter element for producing the discharge in the succeeding stage in the tandem electrode arrangement, said target and emitter elements being united in said target-emitter device, means for producing capacitive effect in each of said elements in relation to the respective discharge, and means for impressing the same alternating potential on both said target and said emitter elements.

7. In combination, a target element for electric discharge apparatus comprising a metallic core having a sheath of dielectric material; and an emitter element comprising a bus connector having a sheath of dielectric material, emitter electrodes, and a body of semi-conductive material embodying said bus and the sheath thereon and supporting said emitter electrodes; said target and said emitter elements being united with the first said dielectric sheath and said body of semi-conductive material mechanically connected together.

8. In combination, a stream-lined electric discharge emitter device having the forward edge portion thereof recessed, and an electric discharge target device mounted in said recess with the exposed surface thereof forming a continuation of the surface of said stream-lined emitter device; said target device comprising a tubular dielectric member and a core member of conductive material within said tubular member.

9. In combination, a stream-lined electric discharge emitter device having a body of semi-conductive material recessed at the forward edge, and an electric discharge target device mounted in said recess with the exposed surface thereof forming a continuation of the surface of said stream-lined emitter device; said target device comprising a metallic core having a dielectric

sheath, said emitter device having means for electrical connection thereto, and an external shunt across said metallic core and said means whereby the same electric potential may be applied to said target and said emitter elements.

10. In combination, a capacitive electric discharge emitter element and a capacitive electric discharge target element united in a streamlined structure with said target element at the leading edge, said emitter and target elements being electrically insulated from each other, and an external shunt interconnecting said elements whereby the same electric potential may be applied to said capacitive target element and said capacitive emitter element.

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