J. R. KELLEY.

ELECTROLYTIC INTERRUPTER.

APPLICATION FILED APR. 21, 1911.

1,020,698.

Patented Mar. 19, 1912.

2 SHEETS—SHEET 1.

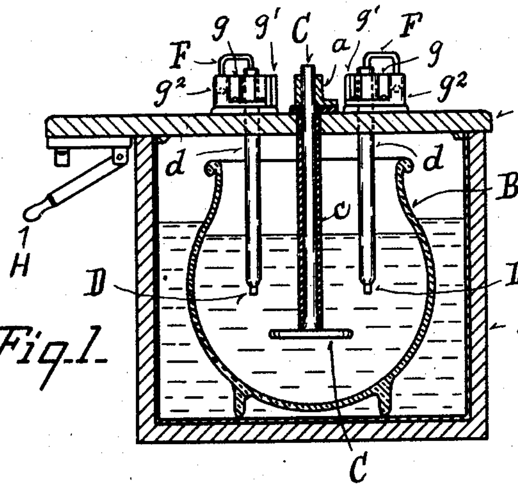

Fig.1.

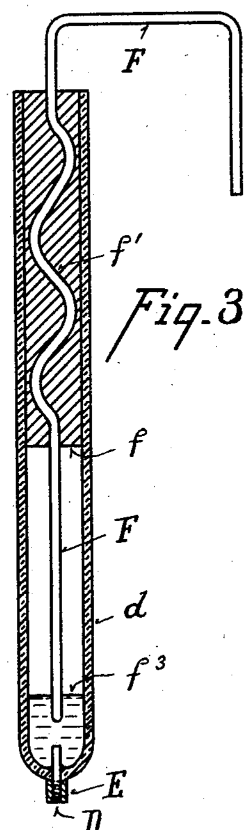

Fig.3.

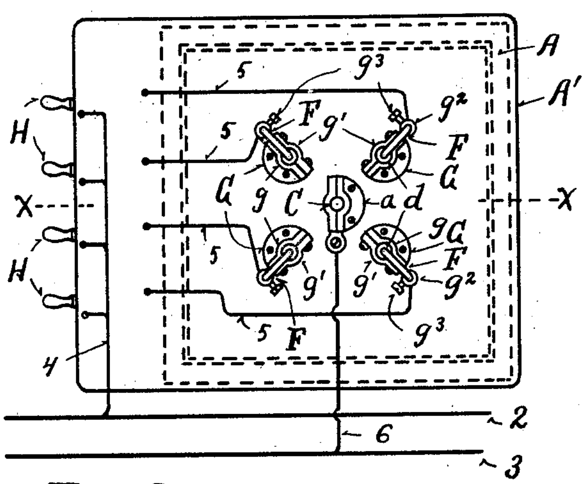

Fig.2.

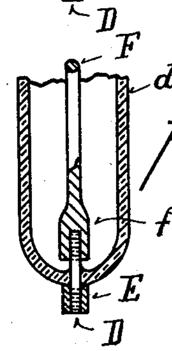

Fig.4.

Fig.6.

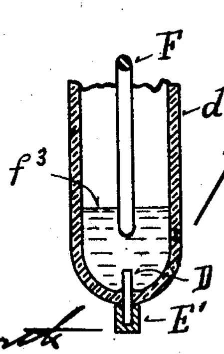

Fig.5.

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2 SHEETS—SHEET 2.

Fig-7-

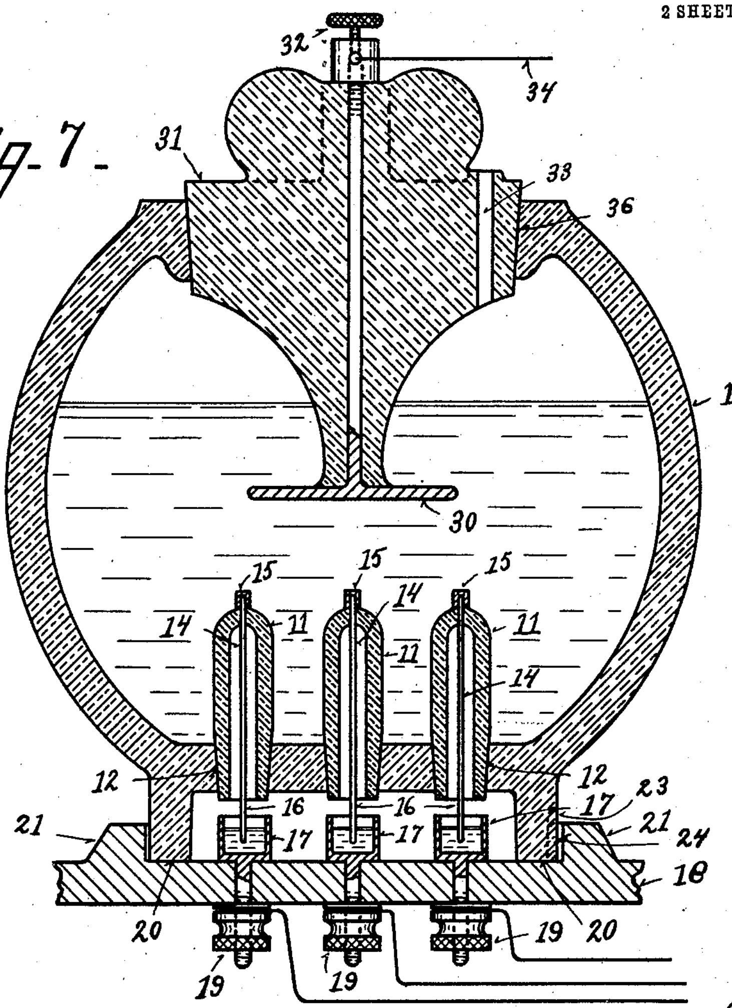
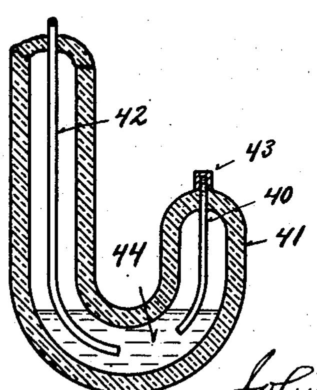


Fig-8-



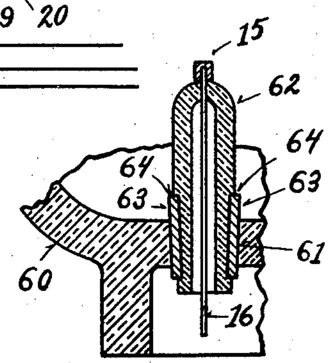


Fig-9-

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UNITED STATES PATENT OFFICE.

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ELECTROLYTIC INTERRUPTER.

1,020,698. Specification of Letters Patent. Patented Mar. 19, 1912.

Application filed April 21, 1911. Serial No. 622,447.

To all whom it may concern:

Be it known that I, JOHN ROBERT KELLEY, a citizen of the United States, residing at Covington, in the county of Kenton and State of Kentucky, have invented certain new and useful Improvements in Electrolytic Interrupters, of which the following is a specification.

My invention relates to improvements in electrical interrupters.

One of its objects is to provide an improved cell for electrolytic interrupters.

Another object is to provide an improved electrode for electrolytic interrupters in which the parts are arranged and combined to prevent rapid deterioration, and to provide for renewal of parts subject to wear.

Another object is to provide an improved form of electrode adapted to be conveniently adjusted to or removed from operative position.

It further consists in certain details of form, combination and arrangement, all of which will be more fully set forth in the description of the accompanying drawings, in which;

Figure 1 is a central vertical section through one form of electrolytic interrupter cell employing my improved electrodes, section being on line *x x* of Fig. 2. Fig. 2 is a top plan view of the same. Fig. 3 is an enlarged central sectional view through one of the interrupter electrodes detached. Fig. 4 is an enlarged detail sectional view of the lower portion of an electrode illustrating a modification. Fig. 5 is a view similar to Fig. 4 illustrating a modification. Fig. 6 is a perspective view of one of the caps or sleeves detached. Fig. 7 is a central vertical section through another form of cell embodying my invention. Fig. 8 is a sectional detail of a modification of the interrupter electrode. Fig. 9 is a sectional detail illustrating a modification of Fig. 7.

The accompanying drawings illustrate the preferred embodiments of my invention. As illustrated in Figs. 1 to 4 A represents a metal lined box or container within which is located an electrolytic cell B of glass or other suitable material. Within the cell and supported from above preferably by means of a clamp *a* on the lid A′ of the container A is an electrode C of lead, carbon, or other chemically inert material. The upwardly projecting supporting stem of said electrode is preferably protected from the electrolyte in the cell by means of an insulating covering *c*, leaving only the lower portion of the electrode C exposed to the electrolyte. Within the cell B are also one or more, preferably a plurality of interrupter electrodes, each comprising a supporting and insulating shell or hollow stem *d* of glass, porcelain, or similar material from which projects and is exposed to the electrolyte an electrode D of limited area and preferably of metal which is not readily attacked or corroded, such as platinum or gold. The electrode D is fused or sealed into the wall of the stem *d* so as to project at opposite sides of the stem wall. On the outside of the stem wall the electrode D is fitted with a cap or sleeve E preferably of the same metal as the electrode, which cap is made to closely fit against the stem wall surrounding the point where the electrode passes through the wall. In Figs. 3 and 4 the member E is illustrated as a sleeve or tube threaded onto the electrode D, while in Fig. 5 the corresponding member E′ is illustrated as a cap closed at the outer end and held in place by frictional engagement with the electrode.

Leading upward within the stem *d* and in electrical contact at its lower end with the inner end of the electrode D is a lead wire or conductor F, which is sealed into position within the stem *d* by means of a sealing cement or material *f*, and is preferably bent at *f′* to insure a firm joint between the conductor and the cement. The upper end of the stem *d* is adapted to be detachably clamped in position between the jaws *g g′* of the bracket G mounted upon the lid A′. The upper end of the conductor F is bent into loop shape so that when the stem *d* is adjusted and clamped to position, the free end of the conductor will enter a socket in a binding post g^2 where it is adapted to be clamped by a binding screw g^3. As illustrated in Figs. 3 and 5 electrical contact is maintained between the electrode D and the lower end of conductor F by means of a body of mercury f^3 in the lower end of stem *d*, while as illustrated in Fig. 4 the lower end of the conductor is provided with a threaded socket f^4 which is screwed onto the threaded inner end of the electrode D.

A series of interrupter electrodes D supported in independent stems or insulators *d* are preferably employed connected in parallel and the exposed area of the electrodes

D and their caps E varied in separate or independent stems to provide for convenient variation of the current volume to be passed through the cell. A series of electrical switches H serve to control the electrical current from the lead wires 2, 3, through branch conductors 4, 5, and 6 and the electrodes to the electrolyte of the cell B, and so as to permit employing one or more of the electrodes D, or any one of said electrodes D according to the volume of current desired to be passed through the cell.

My improved interrupter is adapted to be employed to excite X-ray coils, and wherever an interrupted current is desired. In practice a body of cooling water is contained in or circulated through the container A and surrounding the cell B to prevent excessive heating of the electrolyte of cell B. The electrolyte *i* in cell B may be of varied composition, a dilute sulfuric acid may be employed, and upon the passage of a current through the cell, due to the limited area of electrode D exposed to the electrolyte and the liberation of gases at the surface of the electrode or electrodes D, a rapid interruption of the current takes place, thus producing a rapidly interrupted unidirectional current through a circuuit in which said cell is included.

Heretofore electrodes of limited area employed to interrupt the current, and also the material of the insulating stem through which they were loosely passed, in the neighborhood of the electrode, have both been subject to rapid deterioration due to local heat, chemical, electrical, or mechanical action, and consequently such apparatus has been of short life. With my improvements whereby the electrode is fused or sealed into the stem and the electrolyte kept out of the interior of the stem, and the cap or sleeve employed to protect the face of the electrode exposed to the electrolyte, and to protect the joint where the electrode passes through the stem wall, the disintegrating action is confined to the surface of the cap or sleeve E and electrode D exposed to the electrolyte, and is reduced to a minimum, while the cap or sleeve E being detachable is readily renewable when required, thus enabling the apparatus to be maintained in operative condition for long periods of time.

As illustrated in Fig. 7 the cell 10 is preferably composed of lead glass, which is impervious to X-rays, and with thick walls. A series of hollow porcelain stems or supports 11 are seated by means of ground joints 12 in perforations through the bottom of the cell. The interrupter electrodes 14 are fused or sealed into the wall of the stems 11 at their upper ends so as to project upwardly into the electrolyte from said stems, and are provided with caps or sleeves 15 corresponding to the members E, E′ of Figs. 1 to 6, and which may be threaded or otherwise secured to said electrodes and adapted to protect the projecting portion of said electrodes and the joint between said electrodes and their stems from deteriorating influences. Lead wires 16 either connected to or integral with the electrodes 15 project downwardly through the central opening of the stems 11, and at their lower ends are adapted to dip into mercury cups 17 secured to the base or support 18 by means of binding screws 19, from which circuit wires lead to a series of switches similar to the switches H of Figs. 1 and 2. The cell is preferably provided with an annular foot or support 20 having a notch 23 to support the cell a sufficient distance above the mercury cups, and a ring or ledge 21 on the base 18 and having a projection 24 serves to center the cell so that the lead wires 16 will register with the mercury cups when the cell is placed in position. The opposite electrode 30, corresponding to the electrode C of Figs. 1 and 2 is mounted in and supported by a glass stopper 31 seating by means of a ground joint in an opening 36 at the top of the cell. The stopper 31 carries a binding screw 32 connected to the electrode 30 and by a lead wire 34, corresponding to the wire 6 of Fig. 2, to the line wire 3. A vent 33 through the stopper 31 permits the escape of any gases generated in the cell.

As illustrated in Fig. 7 the electrodes 14 being beneath the electrode 30 and opposite its under face, the most energetic action occurs between the electrode faces nearest to each other, and therefore has less injurious effect on the joint where the electrode passes through the stem wall, and the heat and generation of gases at the interrupter electrodes tend to establish upward currents in the electrolyte in the neighborhood of said interrupter electrodes, which carry away the corrosive elements and bring fresh quantities of cool electrolyte from below into contact with the interrupter electrodes, thereby greatly reducing the deteriorating action on said electrodes and the joints where they pass through the stem walls, and also enable an increased current efficiency to be attained.

In the modification Fig. 9 tight joints between the perforations 61 of the cell 60 and the electrode stems 62 are made by means of sleeves 63 of rubber or other suitable material of similar nature, which sleeves are preferably fitted into annular recesses 64 in the outer face of said stems, said recesses serving to retain the sleeves in place with reference to said stems, said sleeves enabling said stems to be interchangeably inserted into different perforations in the bottom of the cells, and to make tight joints therewith.

In Fig. 8 is illustrated an interrupter

electrode 40 and stem 41 adapted to be supported from above as in Figs. 1 and 2 and having the portion immersed in the electrolyte curved or crooked so that the portion of the electrode exposed to the electrolyte may be located beneath or at the side of the opposite or lead electrolyte and will project upwardly so that an upward current of electrolyte will be created when in use as heretofore described in connection with Fig. 7. A lead wire 42 through the stem 41 and a body of mercury 44 serve to connect the electrode 40 with the line wire, and a cap 43 serves to protect the projecting portion of the electrode and its joint with the stem wall from deteriorating influences.

The apparatus herein illustrated and described is capable of considerable modification without departing from the principle of my invention.

Having described my invention, what I claim is:

1. In an electrolytic interrupter, an interrupting electrode comprising a stem of non-conducting material, an electrode sealed into said stem and exposing a limited surface to an electrolyte, and means to protect the material of said stem from disintegration due to the passage of a current.

2. In an electrolytic interrupter, an interrupting electrode comprising a stem of non-conducting material, an electrode sealed into said stem and exposing a limited surface to an electrolyte, and means to protect said stem in close proximity to said electrode from disintegration due to the passage of a current.

3. In an electrolytic interrupter, an interrupter electrode comprising a hollow supporting member of non-conducting material, an electrode sealed into the wall of said supporting member and exposing a limited surface to an electrolyte, an electrical conductor leading through said supporting member and in electrical contact with said electrode within said supporting member, and a cap encircling said electrode outside of said supporting member to protect said supporting member from disintegration due to the passage of a current.

4. In an electrolytic interrupter, an interrupter electrode comprising a hollow supporting member of non-conducting material, an electrode sealed into the wall of said supporting member and projecting at opposite sides of said wall, means to pass a current to the end of said electrode within said supporting member, and a detachable member of conducting material encircling said electrode outside of said supporting member and closely fitting the outer face of said supporting member.

5. In an electrolytic interrupter, a cell having an opening at the top and an opening through the bottom, a depending electrode having electrical connection through the top opening of said cell, a supporting member of non-conducting material seated in and closing the opening through the bottom of said cell and projecting into the electrolyte of said cell, and an interrupter electrode projecting through the wall of said supporting member at its upper end and exposing a limited area to the electrolyte of said cell.

6. In an electrolytic interrupter, a cell having an opening at the top and an opening through the bottom, a depending electrode having electrical connection through the top opening of said cell, a supporting member of non-conducting material seated in and closing the opening through the bottom of said cell and projecting into the electrolyte of said cell, an interrupter electrode projecting through the wall of said supporting member at its upper end and exposing a limited area to the electrolyte of said cell, and a cap protecting said electrode and its joint with said supporting member from deteriorating influences.

7. In an electrolytic interrupter, a cell having an opening through the bottom, a supporting member of non-conducting material seated in and closing the opening through the bottom of said cell and projecting into the electrolyte of said cell, an interrupter electrode projecting through the wall of said supporting member at its upper end and exposing a limited area to the electrolyte of said cell, and an electrode immersed in the electrolyte of said cell and adapted to co-act with said interrupter electrode.

8. In an electrolytic interrupter, a cell having a plurality of openings through the bottom, a plurality of supporting members of non-conducting material seated in and closing said openings through the bottom of the cell and projecting into the electrolyte of said cell, a plurality of interrupter electrodes projected through and sealed into the wall of said supporting members at their upper ends and exposing a limited area to the electrolyte of said cell, and an electrode immersed in the electrolyte of said cell and adapted to co-act with said interrupter electrodes.

9. In an electrolytic interrupter, a cell having a plurality of openings through the bottom, a plurality of supporting members of non-conducting material seated in and closing said openings through the bottom of the cell and projecting into the electrolyte of said cell, a plurality of interrupter electrodes projecting through and sealed into the wall of said supporting members at their upper ends and exposing a limited area of the electrolyte of said cell, a plurality of protecting caps seated upon the projecting portions of said electrodes, and an

electrode immersed in the electrolyte of said cell and adapted to co-act with said interrupter electrodes.

10. In an electrolytic interrupter, a cell having a plurality of openings through the bottom, a plurality of supporting members of non-conducting material seated in and closing said openings through the bottom of the cell and projecting into the electrolyte of said cell, a plurality of interrupter electrodes projecting through and sealed into the wall of said supporting members at their upper ends and exposing a limited area to the electrolyte of said cell, a plurality of protecting caps seated upon the projecting portions of said electrodes and exposed to the electrolyte, an electrode immersed in the electrolyte of said cell and adapted to co-act with said interrupter electrodes, and independent switches controlling the current through said respective interrupter electrodes.

11. In an electrolytic interrupter, a cell having an opening at the top and an opening through the bottom, a stopper seated in the opening at the top of said cell, an electrode carried by said stopper and projecting into the electrolyte of said cell, a hollow supporting member of non-conducting material seated in and closing the opening through the bottom of said cell, an interrupter electrode sealed into said supporting member and projecting from the upper end of said supporting member into the electrolyte of said cell, so as to expose a limited area to said electrolyte.

12. In an electrolytic interrupter, a cell having an opening at the top and an opening through the bottom, a stopper seated in the opening at the top of said cell, an electrode carried by said stopper and projecting into the electrolyte of said cell, a hollow supporting member of non-conducting material seated in and closing the opening through the bottom of said cell, an interrupter electrode sealed into said supporting member and projecting from the upper end of said supporting member into the electrolyte of said cell, so as to expose a limited area to said electrolyte, and a cap seated upon the projecting portion of said electrode and adapted to protect said electrode and its joint with said supporting member from deteriorating influences.

13. In an electrolytic interrupter, a cell having a plurality of openings through the bottom, a plurality of supporting members of non-conducting material seated in and closing said openings through the bottom of the cell, a plurality of interrupter electrodes sealed into said supporting members with a limited area projecting into the electrolyte of said cell and a portion projecting below the bottom of said cell, a plurality of cups containing liquid conductors of electricity located beneath said cell in position to establish separate electrical connections with said interrupter electrodes, and an electrode immersed in the electrolyte of said cell and adapted to co-act with said interrupter electrodes.

In testimony whereof I have hereunto affixed my signature in presence of two witnesses.

JOHN ROBERT KELLEY.

Witnesses:
C. W. Miles,
W. Thornton Bogert.