April 7, 1931. L. LEVY 1,799,854

CURRENT RECTIFIER

Filed Sept. 1, 1927 2 Sheets-Sheet 1

Fig. 1

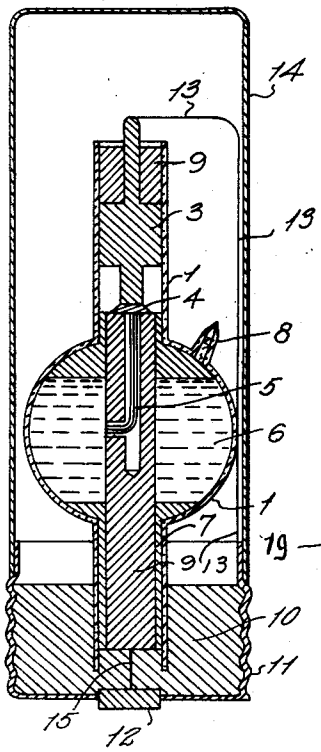
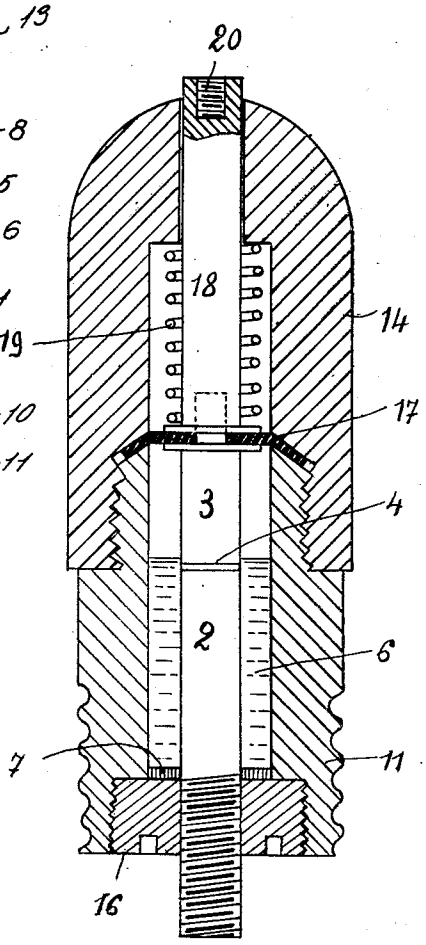


Fig. 2



Inventor
Lucien Levy.
By Hemp Orth & V Atty.

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Filed Sept. 1, 1927 2 Sheets-Sheet 2

Fig. 3

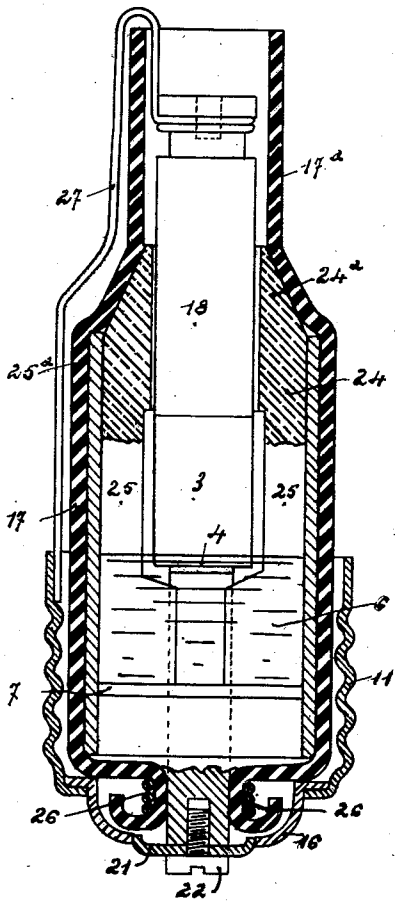
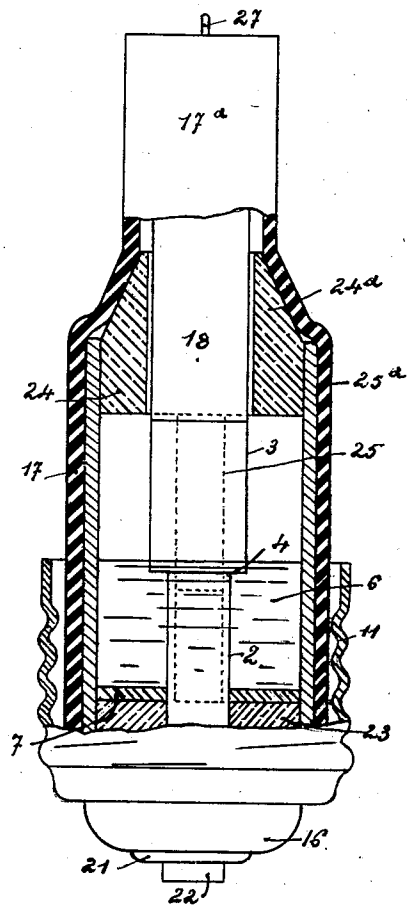


Fig. 4



Inventor
Lucien Levy,
By Henry Orth & Co
Attys

Patented Apr. 7, 1931 1,799,854

UNITED STATES PATENT OFFICE

LUCIEN LEVY, OF PARIS, FRANCE

CURRENT RECTIFIER

Application filed September 1, 1927, Serial No. 216,941, and in France October 20, 1926.

My invention relates to a current rectifier in which the formation of the valve is obtained by disposing a contact placed between two metal parts, one of copper and the other of aluminium for example, directly in a sulphuretting liquid, and by creating between these two metal parts a progressively increasing continuous or alternating tension. In this manner there is formed a thin layer of conducting cuprous sulphide for instance, which allows of obtaining quickly the rectifying effect desired although it has a small resistance.

My invention may be executed in various manners without departing from the principle of same.

Fig. 1 of the appended drawing shows a first mode of execution of a valve according to the present system.

Fig. 2 is a vertical sectional view of a very simple modified form of construction.

Figs. 3 and 4 are two vertical sectional perpendicular views of another modification.

The device shown in Fig. 1 allows of the valve being capable of working a long time owing to the use of a provision of sulphuretting liquid, the arrangement being such on the other part that the liquid is fed by capillarity only so that the cuprous sulphide remains at the point where it has formed itself thus preventing the wear of the copper.

In this figure, 1 indicates a glass tube provided with a middle sphere containing an aluminium cylinder 2 and a copper cylinder 3.

The aluminium cylinder 2 is provided axially with a chimney 5 ending in a middle spherical body 6 which contains sulpho hydrate of ammonia and is provided with a cotton wick for example. In this manner the contact between the cylinders 2 and 3 is kept always moist and sulphuretted.

The passage of the current during the formation results in the production of a layer of cuprous sulphide 4 which after a certain time solders mechanically the copper with the aluminium. The aluminium cylinder and the glass tube are sealed at 10 for example with Colaz wax in a screwed cap 11 provided at the center with a contact 12 connected with the aluminium cylinder 2 by means of a connection 15, the outer screw being connected to the copper 3 by means of the connection 13. The valve is made air-tight by pouring paraffine at 7 before filling it with sulpho-hydrate of ammonia, the latter filling taking place through the opening 8 and being completed by pouring vaseline in order to steady the liquid through the orifice 8 which is then fused with a lamp, paraffine being finally poured in the opening 9. The whole of the valve is protected by means of an aluminium cover 14 secured to the threaded cap 11.

It may be remarked that tantalum or other similar metals producing with the metalloid (sulphur, selenium or tellurium) an insulating sulphur or an insulating layer of sulphur may be substituted to the aluminium, that selenium hydrates, tellurium hydrates, etc., may be substituted to sulpho-hydrate, and also that any metal capable of producing with the metalloid a good conducting compound may be substituted for the copper.

Oxygen may also be substituted for example for the sulphur metalloid and an aluminium oxide valve may be formed by substituting to the sulpho-hydrate an oxdizing agent or sodium phosphate or borate.

Finally it is to be noted that the devices as above described allow of obtaining relays having several electrodes the operation of which is based either upon the action of a grid placed near the cathode or upon the varying transverse conductivity of the cuprous sulphide layer when the tension applied to the valve is modified.

Fig. 2 represents a vertical section of a modified valve of simple construction.

The valve comprises a lower screwthreaded aluminimum cap 11 provided with a cylindrical bore closed at its lower end by a screwed aluminium insulating plug 16 and inside which is placed an aluminium cylinder 2 the lower end of which constitutes a central contact. A layer 7 of any appropriate insulating material, rubber solution for instance, is introduced in the bottom of the cap in order to ensure water tightness at the lower part.

An aluminium cover 14 in which the copper cylinder 3 is elastically disposed is screwed upon the upper screwthreaded part of the cap 11.

At its upper part the bore of the cap 11 containing the sulpho-hydrate of ammonia 6, the level of which is slightly above the top part of the aluminium cylinder 2, is closed by a disc or a watertight joint 17 preferably of vulcanized rubber, said disc being compressed at the center between the copper cylinder 3 and the upper aluminium cylinder 18 in line with it, and its edges are compressed between two conical portions of the aluminium elements 11 and 14.

A steel spring 19 bearing on the one part upon the joint 17 and on the other part upon the upper part of the bore of cap 14 is placed around the cylinder 18 guided by the upper part of the cover 14, said spring ensuring a predetermined pressure of the cylinder 3 upon the cylinder 2 and forming consequently an elastic connection guided in such a manner as to maintain both contact surfaces in parallel.

The aluminium cylinder 18 is threaded at its upper end 20 for securing any appropriate ring or hook used for lifting off the copper cylinder 3 during the formation of the valve. Owing to the passage of electric current during the formation of the valve, there is formed between the cylinders 2 and 3 a layer of cuprous sulphide 4 which after a certain time solders mechanically the copper with the aluminium. It will be noted that the whole valve is made of aluminium which is proof against sulpho-hydric acid. Moreover the lower threads of the cap 11 are formed as usual as right handed threads, whereas it is a left handed thread which is designed to join the parts 11 and 14 in order to prevent untimely unscrewing of one element or the other.

Figs. 3 and 4 represent a mode of execution of the valve which is both simple and cheap, it comprises a lower screw threaded relatively thin aluminum cap connected at its lower end with an insulating part 16 in the center of which is disposed an aluminum disc 21 provided with a hole for the bolt 22 which assembles together the aluminium cylinder 2 with the disc 21 in order to constitute the middle contact as well as to retain the whole of the valve in the cap 11.

The valve inside comprises an insulating part provided at its lower end with a cylindrical part 23 connected with the upper cylindrical part 24 by means of arms 25 in such a manner as to constitute an inner chamber.

The aluminium cylinder 2 is secured in the arms 25 and it passes completely through the cylindrical part 23 in which it is secured in such a manner as to end and project below it. A layer 7 of any appropriate insulating material is provided upon part 23 in order to obtain an air-tight closure at the lower part.

A cylindrical orifice is formed in the top 24 of the insulating element which ends in a conical portion 24^a, and the upper metal cylinder which consists of an upper aluminium element 18 and a lower copper portion 3 is engaged in said orifice.

The insulating part 23, 24, 25 is surrounded by a mica cylinder 25^a closing the chamber which contains the sulpho-hydrate of ammonia. This chamber is made perfectly air tight by means of a rubber tube 17 which is tied at its lower end upon the cylinder 2 under the portion 23 of the chamber, this tube surrounding also tightly the mica cylinder 25^a, and the conical part 24^a and ends in an upper narrower cylinder 17^a. A conducting wire 27 soldered with the cap 11 is connected on the other part with the top of the cylinder 18 in order to constitute the second contact.

The aluminum cylinder is provided at its upper end with a threaded hole designed to retain a ring or hook used for lifting off the copper cylinder 3 during the formation of the valve. The passage of the current during the formation of the valve produces between the cylinders 2 and 3 a layer of cuprous sulphide 4 which solders mechanically the copper with the aluminium. The rubber tube designed to ensure the compression of both parts upon each other allows also of the lifting during the formation of the valve of one of the electrodes relatively to the other in the case of short-circuiting.

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

1. A current rectifier valve which comprises an aluminum electrode, a copper electrode closely adjacent thereto and a sulphuretting liquid brought to the joining surface in order to form with one of the electrodes a conducting sulphide, and contact pieces connected with both electrodes.

2. A current rectifier valve which comprises a copper electrode, an aluminium electrode and means to carry them closely adjacent each other, sulpho-hydrate of ammonia, a water-tight container for same, means for bringing it to the adjacent surface of both electrodes, and contact pieces connected to both electrodes.

3. A current rectifier valve which comprises an aluminum electrode, a copper electrode closely adjacent thereto, a sulphuretting liquid covering over the adjacent electrode surfaces, means to carry and guide both electrodes, one of said electrodes being movable, means to urge them elastically one upon the other and contact pieces connected with both electrodes.

4. A current rectifier valve which comprises: an aluminium electrode, a copper electrode closely adjacent thereto, an aluminium outer cover made in two pieces one of

which constitutes a cap, an insulating plug closing the cap at its lower end, sulpho-hydrate of ammonia contained in the lower cap, a screwthread assembling both elements of the cover, an upper aluminium rod made in one piece with the copper cylinder, a rubber joint between the two elements of the cover, an orifice in the top part of the cover designed to guide the upper metal cylinder and a steel spring interposed between the joint and the bottom of the upper cover in order to ensure a predetermined compression between the two metal cylinders and constituting an elastic guided connection which keeps the contact surfaces in parallel with each other.

5. A current rectifier valve which comprises: a cylindrical aluminium electrode, a cylindrical copper electrode closely adjacent thereto, a hollow insulating part containing both metal cylinders, a mica cylindrical body placed outside the insulating part forming the chamber, sulpho-hydrate of ammonia contained in the chamber, a cylindrical base for the insulating part for securing the aluminium cylinder, a rubber cover enclosing both metal cylinders, the insulating part and the mica cylinder, tying means to secure the bottom of the rubber cover to the projecting part of the aluminum cylinder, and means to establish the necessary contacts.

6. A current rectifier valve which comprises: an aluminium cylinder, a copper cylinder closely adjacent thereto, an insulating part containing both metal cylinders and a sulpho-hydrate solution therein, a mica cylindrical body surrounding the insulating sulpho-hydrate container, a cylindrical base provided on the insulating part to secure the aluminium cylinder, a rubber cover covering both metal cylinders, the insulating part and the mica body, tying means to secure the bottom of the rubber cover to the projecting part of the aluminium cylinder, a screw-threaded cap to receive the whole device, an insulating part in the bottom of said cap, an aluminium disc in the axis of the insulating part and a bolt assembling the aluminium cylinder with the cap.

7. In a current rectifier valve, two closely adjacent electrodes of aluminum and of copper, respectively, and a liquid at the opposed surfaces of the electrodes capable of forming with one of the electrodes a rectifying compound cementing the electrodes together.

8. In a current rectifier valve, two closely adjacent electrodes of aluminum and of copper, respectively, and a liquid at the opposed surfaces substantially inert to aluminum and forming with the copper of the other electrode a rectifying compound cementing the electrodes together.

9. A current rectifier valve which comprises an aluminium electrode, a copper electrode closely adjacent thereto, a sulphuretting liquid covering the adjacent electrode surfaces, means to carry and guide both electrodes, both electrodes being movable, means to urge them elastically one upon the other and contact pieces connected with both electrodes.

In testimony that I claim the foregoing as my invention, I have signed my name.

LUCIEN LEVY.