

July 9, 1935.

C. H. BRASELTON

2,007,939

RECTIFYING APPARATUS

Filed Dec. 4, 1931

Fig. 1.

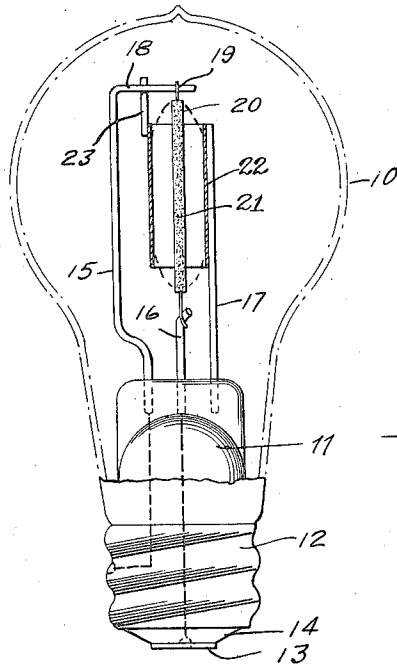


Fig. 2.

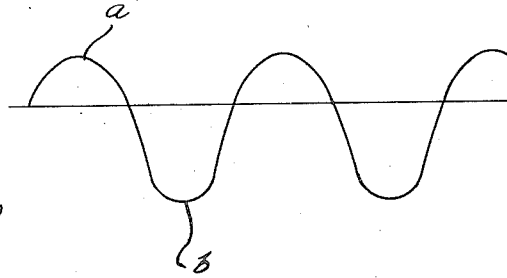


Fig. 4.

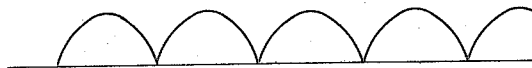
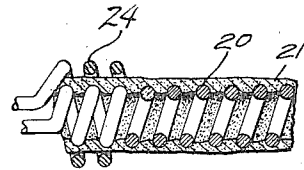


Fig. 6.

Fig. 3.

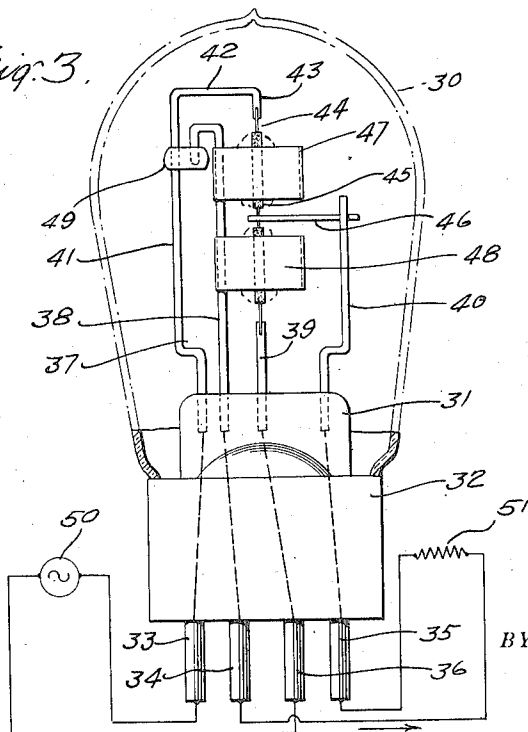
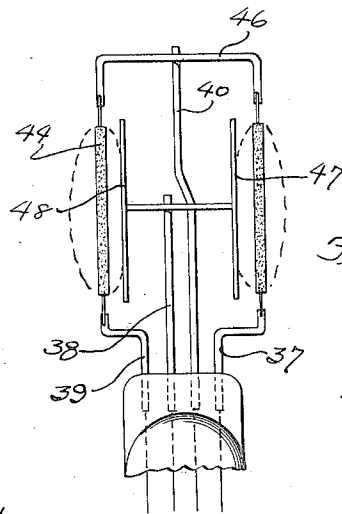


Fig. 5.

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UNITED STATES PATENT OFFICE

2,007,939

RECTIFYING APPARATUS

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Application December 4, 1931, Serial No. 578,938

2 Claims. (Cl. 250—27.5)

This invention relates to rectifying devices for alternating electric currents.

One of the objects of the present invention is to provide a rectifier which is simple in its construction.

Another object is to provide a rectifying device which is capable of use without any accessory appliances, but which may be installed directly and in series with the alternating power circuit and with the appliances which are adapted for use in connection with a rectifying current.

Another object of the invention is to provide a rectifier having a simple two outlet connection so that it may be used with an ordinary screw socket, such as are employed for electric lamps.

Still another object is to provide an improved structure of a two-way rectifying device, all of the elements of which are included in a single container or envelope.

Various other objects will become apparent on consideration of the following description and of the accompanying drawing, in which

Fig. 1 is a view in elevation of one of the forms of my invention which may be preferred;

Fig. 2 is a diagrammatic showing of the wave curve with current plotted against time;

Fig. 3 is a view of an improved two-way rectifying device;

Fig. 4 is a wave diagram of the device of Fig. 3;

Fig. 5 is a diagrammatic view indicating the operation of the rectifying device of Fig. 3; and

Fig. 6 is an enlarged detail of a section of the coated conducting filament.

Referring to Fig. 1, there is illustrated a container 10, of glass or similar material, to an end of which is sealed a stem or support 11. To this end is also mounted a base element having a screw-threaded wall 12 and contact base 13 separated by insulating material 14. Mounted on the support 11 are three standards 15, 16, and 17. Standards 15 and 16 are connected below the stem, the standard 15 to the screw wall 12, and the standard 16 to the contact plate 13 of the base. Standard 15 extends to a point above the center of the bulb or envelope 10, and has a section 18 transverse thereto either welded to the standard 15 or formed in continuation thereof. Between the end 19 of the section 18 and the standard 16 is connected a coiled conductor 20, preferably of tungsten, on which is a coating 21

of electron emitting material, such as oxides of barium, calcium, which are alkaline earth metals, or other alkaline substances. This coating may be applied either externally to the tung-

sten coil or internally as a coating within the coil, or as a rod of the oxide within the coil. Also, the oxide may be mixed with the conductor; that is, tungsten and calcium oxide or thorium oxide may be mixed together either physically or by a chemical means, such as the combination of tungstic acid and thorium nitrate.

The standard 17 forms a support for the tube 22 to which it is welded or otherwise attached, this tube being concentric to the coated filament 20. A conductor 23 extends between the tube 22 and cross bar 18, this conductor serving also as a steadying means for the tube.

Within the container 10 and immersing the various elements mentioned, is an atmosphere of gas or mixture of gases, which are preferably inert, chemically. These gases include neon, argon, nitrogen, helium and various metallic vapors, such as those of mercury, cesium, rubidium and calcium. Chemically pure gases should be employed to avoid reactions in the container. A purification being less than one percent, by volume is desirable.

The coating 21, hereinabove referred to, is preferably applied as a paste in the proportions approximately, for example, of 40 grams of barium carbonate, 40 grams of calcium carbonate, 8 grams of barium nitrate with a binder of sufficient nitrocellulose dissolved in amyl acetate to hold the coating on the wire. The filament with this paste applied is then sealed in the bulb, the contents evacuated by a vacuum pump, and the bulb and its contents heated by an oven placed over the same until the temperature of the bulb and contents is approximately 400° C. Electric current is also passed through the filament and heated up to red heat or about 600° C. The various gases evolved by this heating process are heated by a vacuum until the pressure drops to approximately one-half micron. The current is then increased through the filament to a bright red color, or about 800° C. The oven is then removed and the filament temperature increased to about 1200° C., pumping being continued until the pressure is again about one-half micron.

It has been found, as stated in my co-pending applications, when a coating such as described hereinabove is heated by the passage of an electric current, an atmosphere of inert and, in general, ionizable gases, such as those hereinabove described, that a layer of highly activated luminescent gases forms about the conductor and its coating. This layer is, of course, highly conductive for electric current and forms a by-pass for electric current between the conductor seg-

ment 18 and the standard 16; that is, alternatively, current flows directly through the conductor 20 or through the conductor 23, tube 22, conducting gas layer and conductor 20.

5 In the case of an alternating current, however, when the current flow from the conductor is positive with reference to the standard 16, the tube 22 is positive and electrons readily
10 emit from the coating 21 on the conductor 20, thus ionizing the gas and permitting the flow of current from the tube to the conductor. On the opposite alternation of the cycle, however, the tube 22 is negative with reference to the average value of the potential of the conductor 20,
15 and hence its effect is to restrain the electron emission from the coating so that there is a minimum or zero flow of current through the gases surrounding the coating 21, with most of the current passing from the conductor 21 and from the standard 16 to the conductor 18.
20 The wave form of such an alternating current is indicated in Fig. 2, the wave section *a* indicating a flow of current from standard 16 to conductor 18, and the wave section *b* indicating the reverse flow. The average effect of this dissimilarity of the current strength for different alternations in the current cycle is a rectification somewhat similar to that obtained by
25 crystal rectification.

30 A device such as described has but two current outlets which are adapted for engagement in the ordinary screw base fitting into an ordinary lamp socket. The device is immediately operated when current is passed therefrom, has
35 no moving parts, and meets a variety of needs where an incomplete rectification is sufficient for the purpose.

In Fig. 3 I have indicated a full wave rectifier in which all the various rectifying elements are
40 incorporated within a single container. Within the envelope container 30 is sealed a stem or support 31, to which a base element 32 is attached having terminal pins 33, 34, 35, and 36. Within the tube and mounted on the support 31
45 are standards 37, 38, 39, and 40. The standard 37 is connected to the terminal 33, standard 38 to the terminal 34, standard 39 to the terminal 35, and the standard 40 to the terminal 36. Standard 37 is continued as a straight section
50 41, having a bent-over section 42. Between the end 43 of the section 42 and the standard 39 is connected a coil 44, or plurality of coils, of tungsten, said coil having a coating 45 of alkaline oxides similar to that described in connection with the rectifier of Fig. 1. This coating
55 is applied in a similar manner and functions identically to form a layer of highly activated gases. The electric current passing through the conductor heats the coating.

60 To the approximate mid-point of the conductor 44 a wire 46 is welded or otherwise attached, which wire is electrically connected to the standard 40. Above the point of connection of the wire 46 a tube 47 is supported by means of
65 welded engagement with the standard 38. Similarly, below the point of engagement of the wire 46 with the conductor 44 is the tube 48 which similarly is attached to the standard 39. The standard 38, at its upper end above the tube 47,
70 is anchored in a glass bead 49 mounted on the upper length 41 of the standard 37. As illustrated in the figure, the terminals 33 and 36 are adapted to be connected to the alternating current power source 50, and the terminals 34
75 and 35 to the load 51, which is designed for use

in a rectified or direct current. On inspection of the figure it will be obvious that the power circuit traverses the conductor 44 and the rectified current, standard 40, wire 46, conductor 44, and either of tubes 47 or 48 and lead-in wire 5 38.

In the operation of this form of rectifier, when the activated layer of gases is formed about the conductor 20, for one value of the voltage of the alternation of the current cycle, the tube 43 10 is positive with reference to the conductor 20, while the tube 47 is negative to the same conductor. At such an instant the current flow between the tube 47 and the conductor will be practically zero, whereas current flow from the conductor 15 and the tube 48 will be maximum. This causes current flow in the load circuit, including the load 51, in the direction as indicated by the arrow. On the reverse alternation of voltage the current flow from the conductor to the tube 48 20 will be zero, while that from the conductor to the tube 47 will be maximum, this current flow through the load 51 being in the same direction as in the prior alternation. There is thus obtained a rectified current of the type indicated 25 in Fig. 4 where current value is plotted against time.

In Fig. 5 I have indicated diagrammatically the arrangement of Fig. 3, similar numerals referring to similar parts, and the layer of activated gases 30 being indicated for one of the segments of the conductor.

Fig. 6 illustrates in detail the section of the conductor showing the coating applied externally, although, as hereinabove mentioned, it should 35 be understood that other means of applying the coating may be utilized. The coating material may be applied in the shape of a core rod which may have angular cross-section, such as that of a triangle in which there would be three lines of 40 contact against the interior of the coil. Other forms of the core could be used, each modifying the amount of ionization which would be imparted by the electron emitting material. It also appears that the coating material acts as a second 45 class conductor, and hence, because of its refractibility, permits higher conductivity than would otherwise be possible.

As shown in Fig. 6, the conductor is in coiled form, but I have found that a straight conductor 50 operates advantageously for certain uses. I have indicated, also, an auxiliary connection at the ends of the conductor. This auxiliary conductor is in the shape of a coil 24 of one or two turns enclosing the ends of the conductor coil and having 55 one end welded to the support. When the coating is ionized and a layer of conducting gases forms about the coating, this auxiliary conductor serves to carry a portion of the current and thus prevent overheating and possibly breaking or fusion of the end connections of the primary coil. I have also found it desirable, in some cases, to 60 completely insulate the supporting standards so that there may not be any leakage of the current in the container. This insulation may be by means of glass tubing or by coating the conductors with insulating substances, such, for example, as described in my co-pending case, Serial No. 578, 65 940, filed Dec. 4, 1931.

Various other modifications of the invention may be utilized, and I therefore do not desire to be limited to the modifications shown and described, other than such modifications as are disclosed by the claims hereto appended. 70 75

I claim as my invention:

1. In a rectifying device for full wave rectification a container; a support mounted therein; a plurality of standards mounted on said support; 5 a conductor mounted between two of said standards; a connection from the mid-point of said conductor to another of said standards; two tubular elements surrounding said conductor but displaced from each other and mounted on another 10 of said standards; an atmosphere of ionizable gas within the container; a coating of electron material on said conductor; and terminal elements connecting said standards to points external of the envelope, the breakdown potential of 15 said gas being less than that necessary to bring the coating on said conductor to electron emitting temperature.

2. In a rectifying device for full wave rectifica-

tion, a container, a support therein, a conductor mounted on the support, plural interconnected conducting elements adjacent the conductor but displaced from each other along the conductor, 5 external terminals, electrical connections between the ends of the conductor and to the said terminals, additional connections between the approximate midpoint of the conductor and another of said terminals, a connection between the 10 conducting element and another of said terminals, a coating of electron emitting material containing oxides of the alkaline earth metals on said conductor, and an inert ionizable gas within the container, the breakdown potential of said 15 gas being less than that necessary to bring the coating on said conductor to electron emitting temperature.

CHESTER H. BRASELTON.