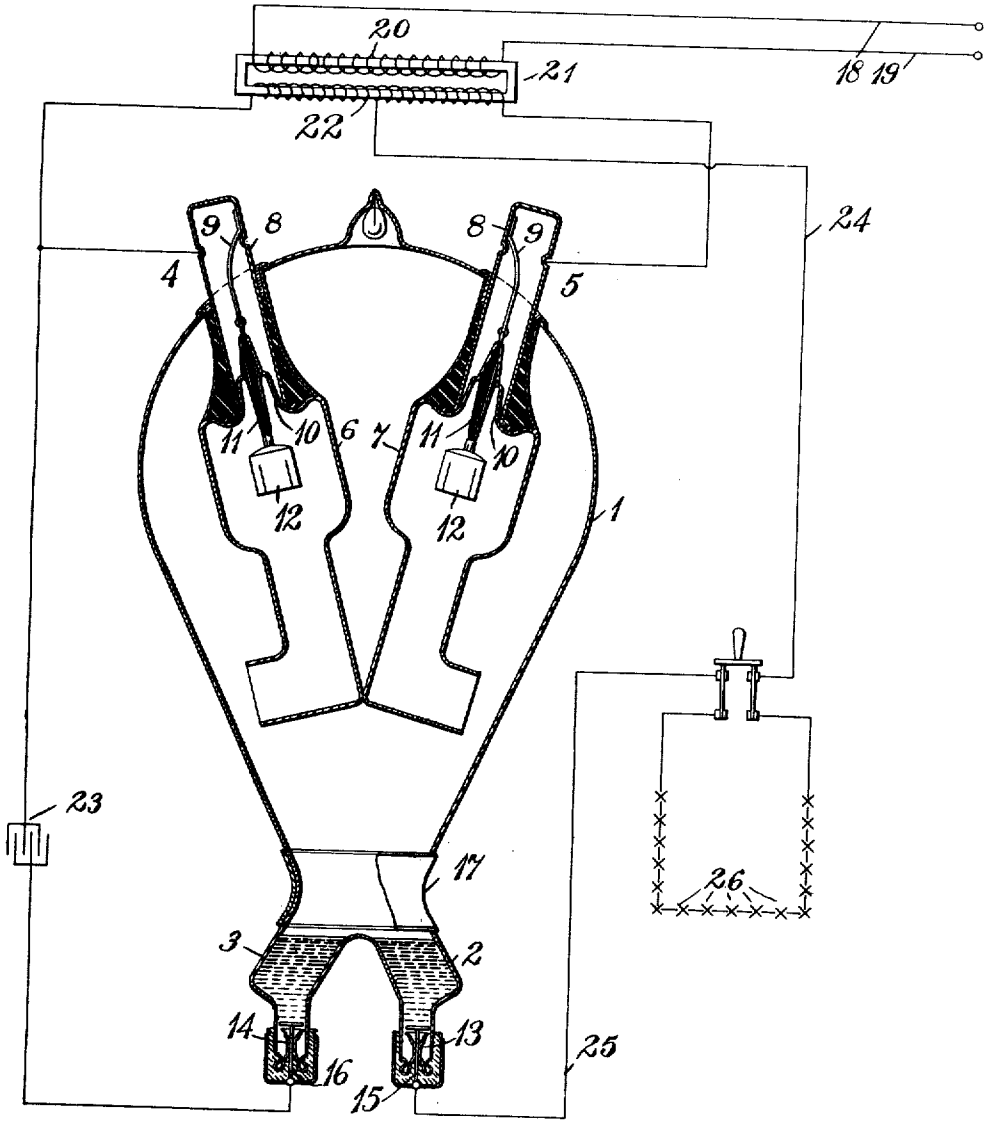
R. B. INGRAM.

MERCURY CONVERTER.

APPLICATION FILED JAN. 10, 1908.

1,015,958.

Patented Jan. 30, 1912.



WITNESSES:

Fred H. Miller

R. J. Dearborn

INVENTOR

Ralph B. Ingram

BY

Insley & Clarke

ATTORNEY

UNITED STATES PATENT OFFICE.

RALPH B. INGRAM, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, OF EAST PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

MERCURY-CONVERTER.

1,015,958. Specification of Letters Patent. Patented Jan. 30, 1912.

Application filed January 10, 1908. Serial No. 410,225.

To all whom it may concern:

Be it known that I, RALPH B. INGRAM, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Mercury-Converters, of which the following is a specification.

My invention relates to mercury-vapor rectifying devices for electric currents, and it has for its object to provide simple, effective and reliable means for assisting the starting of the rectifying process when the circuits of the device are established.

It has heretofore been a common practice to start the rectifying process in mercury-vapor rectifiers or converters by so rocking the mercury receptacle that a starting terminal might be connected to the negative working terminal, a relatively high voltage starting current being impressed upon the auxiliary terminal to break down the negative electrode resistance which opposes the initial flow of current in the circuit. In order to produce an adequate starting current, a condenser of considerable size has been connected in series with the starting circuit, but I have succeeded in materially reducing the size and expense of the external condenser in such circuit.

According to my present invention, I provide, in adition to a main negative terminal which is disposed in a protuberance containing mercury, an auxiliary terminal disposed in a second protuberance which also contains mercury, the two terminals being located adjacent to each other near the lower and smaller end of the pear-shaped bulb which constitutes the mercury-vapor receptacle. Slightly above the mercury level, and on the outside of the bulb, I provide a band of conducting material which is not connected to any of the circuits of the device. The said band acts in conjunction with a small condenser, which is connected in series with the starting circuit, when the bulb is rocked for the purpose of spilling mercury from one protuberance to the other.

The single figure of the accompanying drawing comprises a sectional view of a mercury-vapor rectifier constructed in accordance with my invention and a diagram of the circuit connections for the same.

Referring to the drawing, the device here illustrated comprises a pear-shaped bulb or receptacle 1 which is constructed of glass or other suitable insulating material having two similar protuberances 2 and 3 containing mercury or other conducting liquid having similar characteristics and a pair of positive terminals 4 and 5 that are disposed in tubes 6 and 7 which project downwardly into the receptacle 1 and the lower ends of which project outwardly at substantially right angles to their body portions. The terminals 4 and 5 comprise metal tubes 8 to which external circuit conductors are connected and which are provided with platinum leads 9 secured to the interiors of the metal tubes at one end and sealed into partitions 10 in the glass tubes 6 at intermediate points by means of relatively small sleeves or coatings 11 of ruby glass, the inner extremities of the terminals having cup-shaped members 12. The protuberances 2 and 3 are provided with projections 13 and 14 into which terminals 15 and 16 are sealed and the receptacle 1 is provided with a band 17 of conducting material at the junction of the protuberances with the receptacle.

Alternating current energy is supplied to the primary winding 20 of a transformer 21 from any suitable source, through circuit conductors 18 and 19 and the secondary winding 22 of this transformer supplies energy to the rectifier, the transformer terminals being connected to the rectifier terminals 4 and 5. One of the transformer terminals is also connected to the rectifier terminal 16 through a condenser 23 and an intermediate point in the transformer winding is connected to a return circuit conductor 24 which forms one side of a direct current circuit 24—25. The said direct current circuit receives its energy from the rectifier and may include series arc lights 26, or other suitable translating devices, the conductor 25 being connected to the rectifier terminal 15.

The band 17 is not connected to any portion of the circuit or to any of the rectifier terminals, but it is so located relative to the mercury in the protuberances that when the bulb is rocked for the purpose of starting the rectifying process, a condenser is formed which acts in conjunction with the con-

denser 23 as hereinafter indicated and produces a sufficient static action to permit the starting current to break down the negative electrode resistance of the terminal 15.

The band 17 is not connected to any portion of the circuit or to any one of the rectifier terminals, but it is so located relative to the mercury in the protuberances that when the bulb is rocked for the purpose of starting the rectifying process, the band on the one side and the mercury on the other side of the glass, together constitute a condenser, the plates of which instead of being opposite each other, are only slightly overlapped. By reason of this arrangement the electric field existing between the two conductors is concentrated where it is most useful in breaking down the negative electrode resistance of the mercury. Since the action of the band breaks down the negative electrode resistance of the mercury, it is only necessary to provide an external condenser 23 of relatively small capacity in order to initiate the rectifying process.

The action of the band 17 may be explained more in detail as follows: Since the band is not connected to any circuit, its charge is entirely induced by that of the mercury and is, of course, of opposite sign. Assuming that the bulb has been tilted so that the mercury overlaps the edge of the band, the condition is analogous to two adjacent conducting plates of a condenser which are offset so that they overlap only slightly. Under these conditions the electric field existing between the two plates is concentrated between the overlapping edges, producing what is known as a static fringe. In the case of the mercury and the band this concentration of stress occurs at the surface of the mercury and therefore serves to break down the negative electrode resistance which has usually been overcome electrically by applying a high voltage to the terminals of the mercury vapor device or mechanically by distributing the mercury. By extending the band downwardly to overlap the mercury level when the bulb is in its operative position, the rectifying process may be started without tilting the bulb, the device being thereby rendered self-starting. One of the advantages of the arrangement illustrated arises from the fact that the full charging or starting current is only taken from the alternating current circuit when the bulb is tilted.

In the prior art, a rectifying action has sometimes been established between the extremities of the positive electrodes and points farther out on the stems of the terminals; under such circumstances, the life of the rectifier is materially reduced if not immediately cut off, and in order to avoid the possibility of such action, I have provided the sleeve or jacket 11 of ruby glass, as hereinbefore described. This coating or jacket is applied by winding the plastic glass around the terminal in the form of a helix which obviates air holes and other imperfections. The ruby glass is found to be tougher than ordinary glass and is less apt to crack or break down in service so that the usefulness of the rectifier is enlarged and prolonged.

Modifications in the size and shape of the device may be made without departing from the spirit of my invention, and I desire that such modifications shall be included within its scope.

I claim as my invention:

1. A current-rectifying device comprising a mercury-containing receptacle of insulating material, and a band of conducting material on the exterior thereof, said band being independent of the circuits of the device.

2. A current-rectifying device comprising an insulating receptacle having mercury-containing protuberances at its lower end, and a continuous band of conducting material encircling the receptacle slightly above the level of the mercury, said band being independent of the circuits of the device.

3. A current-rectifying device comprising a pear-shaped receptacle or bulb having mercury-containing protuberances at its lower and smaller end, a starting circuit connected to one of the protuberances, a direct current-receiving circuit connected to the other protuberance, and a band of conducting material encircling the receptacle slightly above the mercury level, said band being independent of the circuits of the device.

4. A current-rectifying device comprising a pear-shaped glass receptacle or bulb having mercury-containing protuberances at its lower and smaller end, a starting circuit led into one of the protuberances, a uni-directional current-receiving circuit led into the other protuberance, alternating current supply circuits led into the receptacle near its larger end, and a metal band encircling the receptacle near its smaller end, slightly above the normal level of the mercury, and independent of the circuits of the device.

5. A current-rectifying device comprising a mercury-containing receptacle of glass having inwardly extending tubes that form indentations in the walls of the receptacle and are open at their inner extremities, said tubes having enlargements and cross partitions intermediate their ends, metal tubes cemented into the glass tubes outside of the partitions and extending out of the receptacle, and terminal leads of conducting material secured to the inside of the metal tubes provided with coatings or jackets of ruby glass and sealed into the partitions in the glass tubes.

6. A current-rectifying device comprising a substantially pear-shaped mercury-con-

taining receptacle of glass having inwardly extending tubes that form indentations in the walls of the receptacle and are open at their inner extremities, said tubes having enlargements and cross partitions intermediate their ends, and platinum terminal conductors having coatings of ruby glass sealed into the partitions, mercury-containing protuberances at the lower and smaller end of the receptacle, a starting circuit led into one of the protuberances, a uni-directional current-receiving circuit led into the other protuberance, alternating current supply circuits connected to terminals within the tubes, and a metal band encircling the receptacle near its smaller end and slightly above the normal level of the mercury.

In testimony whereof, I have hereunto subscribed my name this 26th day of December, 1907.

RALPH B. INGRAM.

Witnesses:
WM. BRADSHAW,
BIRNEY HINES.