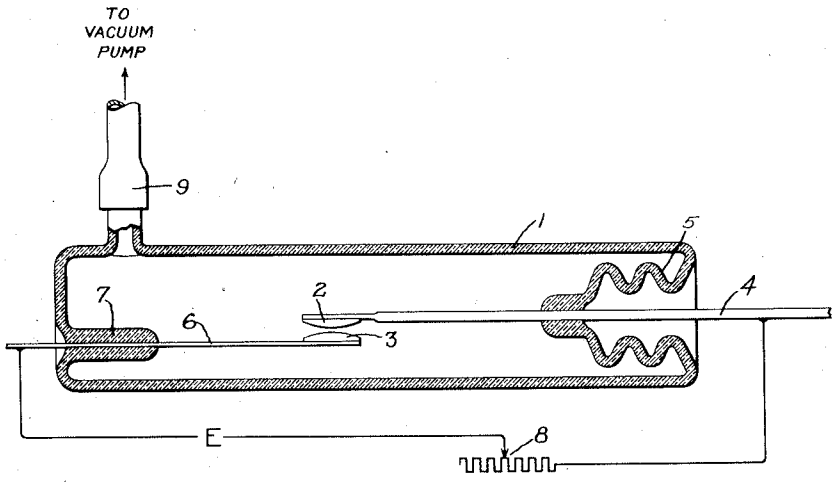
Sept. 27, 1932. G. DOBKE 1,879,131

METHOD OF DEGASSING VACUUM APPARATUS

Filed Dec. 17, 1931



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Patented Sept. 27, 1932 1,879,131

UNITED STATES PATENT OFFICE

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METHOD OF DEGASSING VACUUM APPARATUS

Application filed December 17, 1931, Serial No. 581,558, and in Germany December 24, 1930.

My invention relates to a method of degassing vacuum apparatus, more particularly to the degassing of vacuum switch contacts, and has for its principal object the provision of an improved method of relieving metallic elements within a vacuum vessel of occluded and other gases.

My invention will be more fully set forth in the following description referring to the accompanying drawing, and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Referring to the drawing, the single figure thereof is a partly diagrammatic view in section of a vacuum switch and means associated therewith for carrying out the process embodying my invention.

The preparation and conditioning of high vacuum apparatus, as switches for example, for service involves as is well known the technique of removing occluded and other gases from the elements within the switch so that heat generated by normal operation of the switch does not liberate gas from the switch elements causing impairment of the vacuum and consequent failure of the apparatus. A method of degassing vacuum switch contacts subsequent to assembly thereof with respect to the vacuum switch unit is disclosed and claimed in Letters Patent of the United States No. 1,784,302 granted to Milliken and Sorensen on December 9, 1930 for process for conditioning electric switches. This method includes the repeated closing and opening of the switch contacts by applied mechanical forces while an electric potential is applied across the contacts so that the heat generated by arcing during separation expels gases therefrom and so conditions the contacts for service. During this degassing operation the switch envelope is connected to the vacuum pump for evacuating the switch envelope in a manner well known in the art.

My invention involves certain improvements on the above degassing method which include rapid vibratory operation of the contacts at such separation that arcs of unexpected intensity, due to the sudden liberation of gas from the contacts, are not drawn. Excessive arcing may cause damage to or destruction of the contact structure in the case where the applied voltage is quite large. A further improvement is the appreciable reduction in the time required to complete degassing of the contacts.

In accordance with my invention the degassing process is effected by repeated and rapid short arcing between the contacts or equivalent elements. To this end at least one element or contact is capable of vibratory movement, as by means of a resilient support or spring. The contacts are positioned so that they are normally separated a small distance, and an electric potential is impressed across the same of such magnitude that the electrostatic forces between the contacts attract them against the bias of said resilient support into engagement. Immediately upon engagement the circuit is completed and the electrostatic forces attracting the contacts together are no longer present. The contact having vibratory characteristics thereupon moves out of engagement with its coacting contact drawing a short arc and the above cycle is immediately repeated. The result is rapid vibratory engagement of the contacts and liberation of gas by the heat generated by arcing.

Referring more particularly to the drawing for an illustration of means carrying out the above method, a vacuum switch having an envelope or casing 1 of glass or other suitable insulating material has mounted therein a pair of coacting contacts 2 and 3. By way of example, the vacuum switch is of the type wherein the normally movable contact 2 is directly operated by a rod 4 sealed in and extending through a flexible bellows portion 5 of the envelope wall. In normal operation of the switch tilting movement of the operating rod 4 is effective to cause engagement and separation of the contacts 2 and 3 by reason of the flexible wall portion 5.

In order that one of the contacts, as the contact 3, shall be capable of vibratory movement it is resiliently supported, as by a leaf spring 6 sealed in and extending through the switch wall in any suitable manner as in-

dicated at 7. It will be apparent that the frequency of vibration of contact 3 depends upon the design of the spring 6 and may be chosen to suit the particular requirements of the switch.

The supporting members 4 and 6 for the contacts in the present instance are conducting and form a part of the electric circuit including an electric potential E and a variable resistance 8. With the contacts 2 and 3 closed the impressed voltage causes current to flow through the switch and resistance 8.

With an electric potential is applied across two conducting plates separated by a dielectric, the plates are attracted by electrostatic forces to an extent depending upon the magnitude of the potential and the thickness of the dielectric. The shape of the contacts 2 and 3 is preferably such that when normally separated a short distance by the vacuum dielectric, the same may be subjected to an attracting force at a potential commensurate with the voltage capacity of the switch.

The method of degassing is carried out as follows: The operating rod 4 is first adjusted by means (not shown) so that the contacts 2 and 3 are slightly spaced. This spacing, of course, will depend upon the size of switch, design of contacts, impressed voltage, and other factors. The contacts are thereupon connected in circuit with voltage E and variable resistance 8. Immediately upon appearance of the impressed voltage across the contacts they are attracted into engagement by the electrostatic action above described completing the circuit. The spring 6, which is slightly flexed during engagement of the contacts, immediately causes opening of the same due to the disappearance of the attracting forces. The resulting vibratory engagement of the contacts and rapid arcing is effective to heat the contacts so that they become incandescent within a short time notwithstanding the fact that the arc is very short. This causes complete degassing of the contacts in a comparatively short time and the liberated gases are drawn through the vacuum pump connection indicated at 9. After degassing of the contacts and evacuation of the switch to the desired extent has been accomplished the vacuum pump connection is suitably sealed off.

The variable resistance 8 is for the purpose of regulating the potential across the contacts so that the voltage may be effective to produce the required electrostatic forces while limiting the arcing current to a safe value.

It should be understood that my invention is not limited to specific details of construction and arrangement thereof herein illustrated, and that changes and modifications may occur to one skilled in the art without departing from the spirit of my invention.

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

1. A method of degassing the contact structure of a vacuum switch including an envelope, a pair of contacts mounted therein and means resiliently supporting one of said contacts, which comprises separating said contacts a predetermined distance, applying an electric potential across said contacts of such magnitude that the electrostatic forces between the same overcome the bias of said resilient support resulting in rapid vibratory engagement of said contacts and heating thereof by arcing, and evacuating the evolved gases from said envelope.

2. A method of degassing the contacts of a vacuum switch including a switch envelope, a pair of contacts mounted within said envelope and means resiliently supporting one of said contacts, which comprises positioning said contacts so that they are normally slightly spaced, applying a potential across said contacts of such magnitude as to cause attraction and engagement of the same by electrostatic forces, said resilient support immediately separating said contacts causing vibratory engagement and arcing, maintaining said potential until said contacts are thoroughly degassed by repeated arcing, and evacuating the evolved gases from said envelope.

3. A method of degassing conducting elements within a vacuum switch including an envelope and means supporting said elements within said envelope including a resilient support for one of said elements, which comprises separating said elements a predetermined distance, applying an electric potential across said elements, regulating said potential so that said elements are attracted into vibratory engagement by the resulting electrostatic forces and the arc resulting upon separation of said contacts is ineffective to cause injury to said switch, and evacuating the gases liberated from said elements.

4. In a vacuum switch including a pair of contacts one of which is capable of vibratory movement, the method of degassing said contacts which comprises impressing an electric potential across said contacts of such magnitude that said contacts are attracted into vibratory engagement, adjusting said potential so that the resulting arcing between said contacts is effective to heat and degas said contacts, and evacuating the gases liberated from said contacts.

In witness whereof, I have hereunto set my hand.

GÜNTHER DOBKE.