

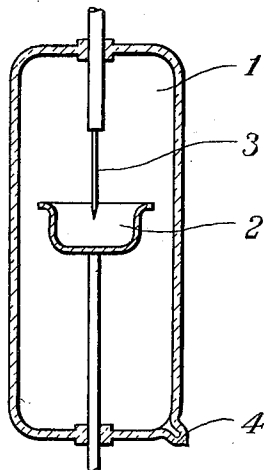
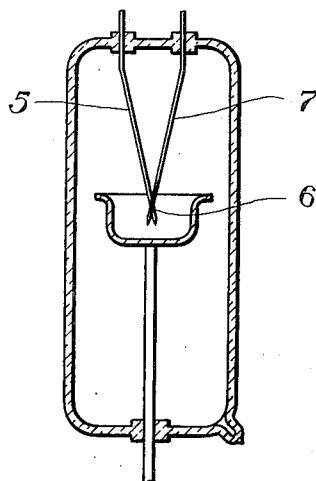
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CATHODE

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*Fig. 1.**Fig. 2.*

WITNESSES:

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## UNITED STATES PATENT OFFICE

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## CATHODE

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2 Claims. (Cl. 250—27.5)

The invention relates to cathodes and particu-  
larly pointed cathodes for high vacuum tubes.

An object of the invention is to provide a cath-  
ode whereby the value of the necessary anode  
5 potential to create a discharge is decreased.

Other objects and advantages of the invention  
will be apparent from the following description  
and drawing, in which

10 Figures 1 and 2 are views partly in cross sec-  
tion and partly in elevation of tubes embodying  
the invention.

The invention concerns the utilization of a  
cold cathode and especially a pointed cathode  
since in such a case, by reason of the inhomo-  
15 geneity of the electric field, a discharge is pos-  
sible at low potentials, and also without an ex-  
ternal source of energy providing a heating cur-  
rent for the cathode. The invention also includes  
a cathode, preferably constructed as a point, be-  
20 ing sub-divided by means of cathode disintegra-  
tion in an electric discharge into a large number  
of individual sub-microscopic fine points. A great  
decrease in the necessary operating potential is  
possible by this multiple sub-division of the cath-  
25 ode surface. It is desirable, of course, not to  
operate the cathode with too high current  
strengths because a too great specific current  
loading at the fine cathode points will ruin the  
points. The invention particularly concerns high  
30 vacuum tubes because the points are apt to be  
destroyed by the ion bombardment which takes  
place in the gas or vapor.

In Figure 1 is disclosed the discharge vessel 1  
with an anode 2 and a pointed cathode 3. The  
35 vacuum-tight envelope has a tubulation indicated  
at 4 for the application of the pump or gas supply  
utilized in the formation of the tube. This tubu-  
lation 4 is preferably sealed off when the tube is  
ready for operation. The discharge vessel is  
40 preferably first filled with a gas, for example,  
argon, the pressure of which is preferably below  
 $10^{-4}$  millimeters. A discharge is then passed  
between the cathode and anode for a relatively  
long time and the surface of the cathode points  
45 is coarsened by the rebound of ions. When this  
process is finished, the vessel is evacuated through  
the tubulation 4 which is sealed off and the tube  
is ready for operation.

As materials for the cathode, high melting  
50 metals such, for example, as tungsten, tantalum  
or molybdenum are particularly suitable. Under

certain circumstances the coarsened cathode sur-  
face may be vaporized with a light metal increas-  
ing the electron emitting activity such as barium,  
for example. Furthermore, an activation with  
thorium may also take place or a thoriated tung-  
sten wire used for the cathode. By the activa-  
5 tion of the cathode, the necessary operating po-  
tential value is further decreased and this de-  
creased operating potential still further protects  
the very large number of tiny points on the cath-  
ode. The necessary operating anode potential 10  
may be 50 volts and lower.

A heating of the cathode may be necessary  
under certain circumstances, such as for the  
purpose of degasifying the cathode or other  
measures necessary in the protection of the cath-  
15 ode. For such purposes, at least two cathode  
points may be arranged as illustrated in Fig. 2.  
A heating current may be supplied through the  
conductor 5, the contact point of the two cathode  
parts 6 and the conductor 7.

It may be desirable to provide the cathode not  
only with one but with a plurality or even with  
a large number of individual points which are  
connected in parallel with reference to the anode  
25 current. With this arrangement, a higher op-  
erating current is obtained while at the same  
time the maximum advantage of the effect of the  
point in decreasing the necessary anode poten-  
tial is obtained.

It is apparent that many modifications may be  
30 made in the form, arrangement and application  
of the invention. Accordingly, it is desired that  
only such limitations be placed on the following  
claims as is necessitated by the prior art.

I claim as my invention:

35 1. The method of preparing a pointed cathode  
which comprises causing an electrical discharge  
in a gas between said cathode and a less pointed  
electrode until said cathode is surfaced with a  
large number of sub-microscopic small points, said  
40 gas being of less than  $10^{-4}$  mm. pressure.

2. The method of preparing a pointed cathode  
which comprises causing an electrical discharge  
in a gas between said cathode and a less pointed  
electrode until said cathode is surfaced with a  
45 large number of sub-microscopic small points,  
said gas being argon of less than  $10^{-4}$  mm. pres-  
sure.

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