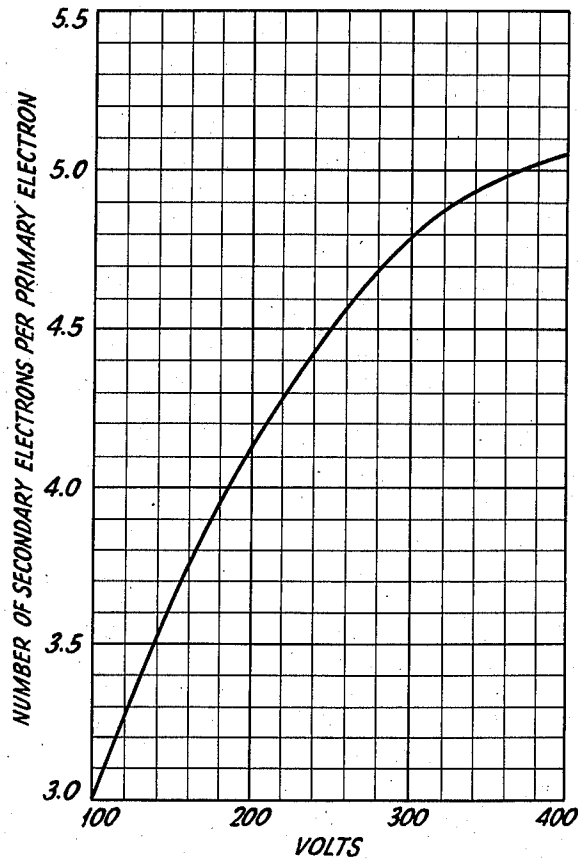


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SECONDARY ELECTRON EMITTER

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SECONDARY ELECTRON EMITTER

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4 Claims. (Cl. 250—174)

The present invention relates to materials hav-
ing a high secondary to primary electron emis-
sion ratio and primarily useful for electrodes for
electron multipliers and similar discharge devices
5 which utilize secondary electron emission.

It is known to coat secondary electron emit-
ters with layers having either an alkaline earth
oxide base or with complex layers having a
caesium base. The emitters with the oxide base
10 are stable and can be easily prepared, but have
a rather low coefficient of secondary electron
emission, which is the quotient or ratio obtained
by dividing the number of secondary electrons
by the number of primary electrons. The emit-
15 ters having the caesium base have a substan-
tially higher secondary electron emission coeffi-
cient, but are difficult to prepare and are sus-
ceptible to deterioration on rather slight in-
creases in temperature; furthermore, it is diffi-
20 cult to obtain several identical surfaces which
have the same coefficient of secondary electron
emission.

The principal object of our invention is to pro-
vide a secondary electron emitter which has a
25 greater coefficient of secondary electron emis-
sion and substantially as good stability as prior
emitters with alkaline earth oxide bases. An-
other object is to facilitate the making of such
emitters.

30 In accordance with our invention we make the
surfaces or electrodes of high secondary electron
emissivity of a base consisting of alloys of light
metals, such as aluminum and beryllium, with the
addition of a small amount of ferrous metal, such
35 as iron, and of a metalloid, preferably silicon.

We have found that by adding a small amount
of iron and silicon we can obtain alloys which
consist predominantly of aluminum and contain
up to 30% of beryllium. No prior alloys of this
40 kind which contain more than a small percent-
age of beryllium are known to us. The addition
of the iron and silicon to the alloys of aluminum
with beryllium produces a new material, as it
seems to modify the physical structure so that
45 it differs from that of the binary alloys, and
to impart to the surface a higher power of sec-
ondary electron emission than is obtainable from
the binary beryllium alloys alone.

The composition of the alloys of our invention
50 may vary within rather wide limits especially in
the proportions of beryllium to the other light
metal, such as aluminum. For example, the
beryllium may constitute from 10% to 30% of
the alloy, the iron and silicon addition about 1%
55 to 10%, with the remainder the other light metal,

such as aluminum. The ratio of iron to silicon
in the addition may vary widely, although in gen-
eral it is desirable that the silicon constitute at
least half or more of the addition. One spe-
cific alloy which we have found to be especially
5 suitable for secondary electron emitters is of the
following composition: aluminum 74%, beryllium
21%, iron 2%, silicon 3%.

The accompanying figure shows, as a func-
10 tion of the velocity of the primary electrons ex-
pressed in volts, the secondary electron emission
coefficient obtained with the above alloy. For a
velocity of 400 volts of the primary electrons,
the secondary emission coefficient exceeds the
15 value of 5, which is somewhat below the values
obtained with complex or caesiated surfaces hav-
ing a caesium base. On the other hand, emitters
made of this alloy in accordance with our inven-
tion have marked advantages over the caesiated
20 type because of facility in preparing the elec-
trodes, regularity of the results obtained, and the
very high stability; and our emitters also have
advantages, as the secondary electron emission
obtained from emitters of this alloy is substan-
25 tially greater than can be obtained from the
surfaces with alkaline earth oxide base ordi-
narily employed.

The preparation of electrodes made from the
alloy in accordance with our invention is sim-
30 ple. For instance, the electrode made from such
alloy is placed in a glass vessel in which is cre-
ated a high vacuum (of the order of 10^{-7} milli-
meter mercury), while the electrode is freed from
occluded gases by heating it with high frequency
35 inductive heating or electronic bombardment.
No treatment other than degassing in high vac-
uum is necessary to develop the high secondary
electron emissivity.

The electrodes or emitters thus obtained have
the advantage of a high thermic stability. They
40 are of particular use in tubes with multiplying
emitters or electrodes which dissipate through
radiation a rather large amount of energy and
which therefore should be able to stand relative-
ly high temperatures such as (300° C.) without
45 losing their emitting properties.

We claim:

1. A secondary electron emitting electrode for
electron multipliers and the like having a sur-
face of high secondary electron emissivity and
50 composed of an alloy consisting of 10% to 30%
beryllium, 1% to 10% of iron and silicon, and
the balance aluminum.
2. A secondary electron emitting electrode com-
posed of an alloy consisting of 15% to 25% beryl-
55

lium, 1% to 10% of an addition consisting of iron and silicon in which the silicon equals or exceeds the iron, and the balance aluminum.

5 3. A secondary electron emitting electrode composed of 74% aluminum, 21% beryllium, 2% iron and 3% silicon.

4. A secondary electron emitting electrode composed of an alloy consisting of a base constitut-

ing at least 90% of the alloy and composed of aluminum and beryllium and containing at least twice as much aluminum as beryllium, and added metals consisting of silicon and iron, the silicon constituting at least half of the added metals. 5

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