

# UNITED STATES PATENT OFFICE.

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## ANODE FOR ELECTROLYTICAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 546,328, dated September 17, 1895.

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*To all whom it may concern:*

Be it known that I, CARL HOEPFNER, a subject of the German Emperor, residing at Gies-  
sen, in the German Empire, have invented cer-  
tain new and useful Improvements in Anodes  
for Electrolytical Apparatus; and I do hereby  
declare the following to be a full, clear, and  
exact description of the invention, such as will  
enable others skilled in the art to which it ap-  
10 pertains to make and use the same.

My invention has relation to anodes for elec-  
trolytical apparatus, and more especially to  
anodes used in the electrolytical production  
of chlorine or in the electrolytical decomposi-  
15 tion of the halogen salts of the heavier and  
lighter metals or metal radicals, such as am-  
monium, and in the direct production of cop-  
per by electrolysis, as well as in the electro-  
lytical treatment of acids and alkalies, as so-  
dium or potassium chlorid, and in the electro-  
lytical treatment of cyanogen combinations—  
in fact, in all cases where it has heretofore been  
found necessary to use carbon anodes exclu-  
sively. It is well known that the carbon an-  
25 odes when artificially produced are of short  
duration, while anodes constructed of retort  
carbon are very costly, so that the use of either  
kind of anodes materially increases the ex-  
pense of the electrolytical production or treat-  
30 ment of such substances or bodies as above  
referred to.

The object of my invention is to provide an  
anode of greater durability than an artificial  
carbon anode, and even cheaper than the lat-  
ter, and hence considerably cheaper than an  
anode made of retort carbon, by constructing  
the anode of a conductive substance the sur-  
face of which contains a great proportion of  
silicium (practically not less than ten per  
40 cent.)—as, for instance, ferro-silicium, with  
about ten per cent. silicium or more. Such  
anodes not only possess the required power or  
property of resistance and conductivity, but  
are also extremely cheap and adapted to re-  
45 ceive any desired shape or form.

I am aware that ferro-silicium has been used  
for the cathodes of Bunsen elements where  
nitric acid was employed as an active or ex-  
citing agent or for the purpose of obtaining a  
50 conserving or preserving action of the electric

current. It is well known that pure or con-  
centrated nitric acid does not appreciably at-  
tack iron and does not attack aluminium, yet  
neither metal can resist the action of chlorine  
or hydrochloric acid, while either of the com- 55  
pounds above referred to is proof against  
both. Furthermore, in the electrolytical pro-  
duction of chlorine a metallic anode at which  
chlorine is set free is readily destroyed, and  
more readily than an anode in the nitric acid 60  
of a galvanic element.

In carrying out my invention I make the  
anode either wholly or partially of ferro-si-  
licium. When made wholly of ferro-silicium,  
it may be cast or otherwise formed to the de- 65  
sired shape, or a suitable conductive metal or  
other conductive substance, as carbon, may  
be coated or plated with ferro-silicium, either  
electrolytically or otherwise, or the electrode  
may be constructed of a compound contain- 70  
ing ferro-silicium as a compound of the lat-  
ter metal and carbon intimately mixed and  
reduced to a plastic condition, from which  
the electrode is made by molding or other-  
wise. On the other hand, a suitable conduct- 75  
ive metal may be combined with silicium,  
and the proportion of the latter so regulated  
as to impart to the compound the required  
property of resistance. Thus, for instance,  
iron may be reduced to a pulverulent condition 80  
by dissolution and precipitation in any well-  
known manner, and then intimately mixed  
with silicium in sufficient quantity to render  
the compound proof against the action of  
chlorine or acids or other substances or bodies 85  
liable to act injuriously upon the iron. The  
conversion of the iron and silicium into a  
plastic body or the conversion into such a body  
of a mixture of ferro-silicium and carbon may  
be, and preferably is, effected by means of par- 90  
affin or a similar substance. Pure silicium  
may be deposited upon an iron or nickel an-  
ode—for instance, for the purpose of provid-  
ing a protective coating to the surfaces of the  
anode exposed to the action of chlorine or 95  
other agent that would otherwise destroy the  
said anode. In either case I obtain an anode  
that contains on its surface *in minimo* about  
ten per cent. silicium, and is not only very  
cheap, but has the required property of re- 100



sisting the action of the bodies hereinabove referred to.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. An anode for electrolytical apparatuses, consisting of a conductive substance, the surface of which anode contains *in minimo* about ten per cent. silicium, so as to render such anode proof against the action of liquids or gases to which it may be exposed, particularly against the action of chlorine.

2. An anode for electrolytical apparatuses, consisting on its surface of a compound of silicium and another conductive metal in such

proportions (*i. e. in minimo* ten per cent. silicium) so as to render such anode proof against the action of liquids or gases to which it may be exposed, particularly against the action of chlorine.

3. The herein described plastic composition, consisting of a conductive substance, ferro-silicium, with ten per cent. silicium *in minimo*, and paraffine, for the purpose set forth.

In testimony whereof I have hereto signed my name in the presence of two witnesses.

CARL HOEPFNER.

Witnesses:

HENRY ORTH,

HENRY ORTH, Jr.