To all whom it may concern:

Be it known that I, SHERARD OSBORN
COWPER-COLES, a subject of the King of
Great Britain, residing at Grosvenor Man-
sions, 82 Victoria street, Westminster, Lon-
don, England, have invented new and useful
Improvements in the Electrodeposition of
Iron; and I do hereby declare that the follow-
ing is a full, clear, and exact description of
the invention, which will enable others skilled
in the art to which it appertains to make and
use the same.

My invention relates to the electro-depo-
sition of iron and has for its object to pro-
vide a process which renders it possible to
produce iron or steel articles such as tubes,
cylinders, sheets and the like in one operation
direct from crude iron or from iron ore.

It has hitherto been found impossible in
practice to obtain by electro-deposition iron
articles such as tubes, or sheets of a quality
to render them of commercial value and at
a cost which compares favorably with ordi-

The chief difficulties encountered have been
the slowness of the process due to the necessity
of employing a very low current density
and in obtaining iron of a quality suitable
for commercial purposes. Iron electro-de-

30 posited under ordinary conditions is porous
and spongy, is difficult to anneal and has a
tendency to flake off the cathode during
deposition unless deposited at a very low
current density, which makes the process

35 and the plant too costly for commercial pur-
poses. Now, I have discovered that iron
can be deposited in a form suitable for the
production of tubes, sheets and wire with a
bright smooth surface resembling that of

very highly polished iron by maintaining
the solution from which the iron is deposited
charged with iron oxid.

In a suitable way of carrying out the in-
vvention the iron oxid is kept in suspension
45 in the electrolyte by means of stirrers or by
moving one or both of the electrodes or by
any other suitable means, the effect of which
is to reduce the acidity and effect a burnishing
action on the iron deposited. I have ob-

50 tained excellent results from a solution con-
taining 20 per cent. of sulfo-cresylic acid
saturated with iron, the current density
being 100 amperes per square foot of cathode
surface, the voltage 3.25 at the terminals of

the iron electrodes, these being 3 inch apart
and the temperature of the electrolyte 70 C.

I find the temperature of the electrolyte
considerably affects the quality of the iron.
If it is much below 70° C. the iron becomes
laminated and flakes off; if it is much above
70° C. the surface becomes covered with
ridges or stream lines and cannot be used for
commercial purposes without further treat-

ment.

The sulfo-cresylic acid above mentioned
is a cresol-sulphonic acid containing approxi-
ately 10% parts cresol and 98 parts sulphuric
acid. The cresol contains ortho 35%, meta
49% and para 25%. This cresol is heated
with sulphuric acid, yielding isomeric cresol-
sulphonic acids.

It is important that none of the oxid in
suspension shall be deposited on the iron
otherwise it will be worthless for commercial
purposes. It is therefore advantageous in
producing sheets or tubes, to slowly revolve
the cathode which may be arranged longitudi-

nally or vertically. This also insures an
equal thickness of deposit by changing the
relative position of the anode and cathode.

I find that the iron produced from the sulfo-
cresylic solution is exceedingly hard and
when it is desired to produce soft tough iron,
ferrous sulfate solution should be employed,
I also find that it may be advantageous to
add small quantities of carbon bisulphid from
time to time to the electrolyte.

Iron articles produced as described above
do not pit or corrode like iron which has been
cast or wrought into the desired form, and
this is probably due to the purity and uni-
formity of the metal.

When requiring to produce steel articles
carbon is deposited with the iron and after
removal from the mandrel they are heated to

a high temperature to convert the iron into
steel.

In a modified process according to the in-
vention I make use of insoluble anodes such
as lead or graphite and I leach the iron out

100 of the ore by means of a suitable solvent.
For example, a carbonate or sulfid ore is
roasted and mixed with crushed coke so as to
form a filter bed and a solution of sulphuric
acid or other suitable solvent of iron oxid is

caused to pass through the filter bed which
is of a constitution to permit the solution
percolating freely through it. The coke and
iron oxid form an electric couple in the pres-
ence of the acid, thus facilitating the disso-
lution of the iron oxid. In some cases I find
it is advantageous to arrange a cathode in a

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porous cell above the filter bed which constitutes the anode and pass an electric current through the ore to assist its dissolution. After its passage through the filter bed the solution is pumped or allowed to circulate through an electro-depositing tank containing insoluble anodes arranged around a revolving mandrel forming the cathode upon which the iron is deposited in the form of a sheet, tube or the like.

It is possible, when using a carbon or graphite anode, to electro-deposit carbon with the iron which, when heated, forms a steel.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

1. The process of obtaining the electro-deposition of iron, which consists in forming an electrolyte from a substance containing iron and in maintaining the electrolyte charged with iron, substantially as described.

2. The process of obtaining the electro-deposition of iron, which consists in forming an electrolyte from a substance containing iron, in charging the electrolyte with iron oxid and maintaining the same in suspension by agitation of the electrolyte, substantially as described.

3. The process of obtaining the electro-deposition of iron, which consists in forming an electrolyte from iron ore, in circulating such solution through a tank containing insoluble anodes arranged around a mandrel forming the cathode, substantially as described.

4. In the electro-deposition of iron from the ore, the process consisting in mixing the roasted ore with coke so as to form a filter-bed through which an iron oxid solvent is caused to pass, the solution, after its passage through the filter bed, being caused to circulate through a tank containing insoluble anodes arranged around a revolving cathode, substantially as described.

5. The process of electro-deposition of iron, which consists in forming an electrolyte from sulfo-cresylic acid, and substances containing iron and depositing the iron upon a cathode in the usual manner, substantially as described.

6. The process of electro-deposition of iron, which consists in forming an electrolyte from sulfo-cresylic acid and substances containing iron and depositing the iron upon a cathode by an electric current of a density of 100 amperes per square foot of cathode surface, and maintaining the electrolyte at a temperature approximating 70° C., substantially as described.

SHERARD OSBORN COWPER-COLES.

Witnesses:
C. G. REDFERN,
A. ALNUTT.