

UNITED STATES PATENT OFFICE

2,603,423

METHOD FOR THE REMOVAL OF SULFUR
FROM SPONGE IRONRussell C. Buehl, Edgewood, Pa., assignor to the
United States of America as represented by the
Secretary of the InteriorNo Drawing. Application January 6, 1947,
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5 Claims. (Cl. 241-14)

(Granted under the act of March 3, 1883, as
amended April 30, 1928; 370 O. G. 757)

1 The invention described herein may be manu-
factured and used by or for the Government
of the United States for governmental purposes
without the payment to me of any royalty there-
on in accordance with the provisions of the act
of April 30, 1928 (Ch. 460, 45 Stat. L. 467).

This invention relates to the removal of sulfur
from metals reduced from their ores at tempera-
tures sufficiently low so that melting does not
occur and, in particular, to the removal of sulfur
from sponge iron.

In order to produce certain grades of steel,
especially tool steels, it is necessary to use iron
having a very low sulfur content, generally less
than 0.06 percent sulfur by weight. Sponge iron
has been found to be a desirable melting stock
for the production of steels, especially tool steels
in electric arc furnaces, but its sulfur content is
often undesirably high for this application.
Sponge iron can be produced economically and
the sulfur content can be controlled by the use
of lime, limestone, or dolomite as described in
U. S. Patent 2,380,406 and in the co-pending
application of Buehl et al. Serial No. 778,452,
filed October 7, 1947, now United States Patent
No. 2,495,225. However, these sulfur control
agents increase the cost of production of the
material and do not always yield sponge iron
with as low a sulfur content as is desired. The
process herein described may be employed to ad-
vantage to further lower the sulfur content of
sponge iron made with the use of sulfur control
agents.

Accordingly, it is an object of this invention
to provide an easy and economical method for
the removal of sulfur from sponge iron. It is
another object of the invention to provide a good
cheap melting stock of low sulfur iron for the
production of tool steels and other special alloys.
Other objects and advantages will be obvious or
will appear hereinafter.

These objects and advantages are accom-
plished in accordance with this invention by
abrading the surface of sulfur bearing sponge
iron and separating therefrom the fines thereby
broken from said surface, whereby a low sulfur
bearing sponge iron product is produced.

The method accordingly comprises a means of
removing sulfur from sponge iron or other metals
reduced from their ores at temperatures below
the melting point of the constituents.

In operation, a sulfur bearing sponge iron
product is subjected to suitable abrading treat-
ment such as selective grinding, roll crushing,
tumbling, and the like. By this action the brittle

2 surface layer is broken off as powdered fines
without appreciably decreasing the size of the
malleable sponge iron particles. Grinding equip-
ment that involves the impact of the iron par-
ticles at high velocities has been found to accom-
plish the abrading in a satisfactory manner and
is presently preferred. Thereafter, the fines or
the broken surface particles, are separated from
the sponge iron particles by suitable particle
classifying means such as sieving, magnetic sepa-
ration, sink and float separation, air classifica-
tion, and the like. The more massive particles
so obtained are found to have a considerably
lower sulfur content than the initial sponge iron
product.

The following examples show how the inven-
tion may be carried out, but it is not limited
thereto. Percentages are by weight unless speci-
fied to the contrary.

Example I

A sample of sponge iron containing 0.061 per-
cent sulfur was mechanically sieved to remove
the minus 200 mesh particles. This sieving low-
ered the sulfur content of the sponge iron to
0.051 percent with a loss of only 1.9 percent of
the iron content of the sample.

Example II

A sponge iron containing 0.061 sulfur was ball
milled for 10 minutes then sieved. The removal
of the minus 325 mesh particles lowered the
sulfur content of the sponge iron to 0.053 percent
with a loss of 3.1 percent of the iron; and the
removal of the minus 200 mesh particles lowered
the sulfur content of the sponge iron to 0.045
percent with a loss of 8.2 percent of the iron.

Example III

A sample of magnetically concentrated sponge
iron containing 0.148 percent sulfur was passed
through roll crushers which flattened the par-
ticles somewhat without much grinding action.
The roll crushed product was re-separated on a
magnetic separator. This lowered the sulfur con-
tent to 0.075 percent.

As shown in the foregoing description and
examples, the sulfur content of sponge iron can
easily and economically be decreased by abrad-
ing the surface of the sponge iron product and
removing the fines which have been broken from
the surface.

While the invention has been particularly de-
scribed employing specific abrading means, it is
not limited thereto.

While the invention has been particularly described employing specific separating or classifying means, it is not limited thereto.

Since many apparently widely differing embodiments of the invention will occur to one skilled in the art, the invention is not limited to the specific details illustrated and described, and various changes may be made therein without departing from the spirit and scope thereof.

What is claimed is:

1. The method of producing low sulfur content sponge iron which comprises treating the iron ore at a temperature below the melting point of the constituents of said ore in the presence of a solid carbonaceous material as the reducing agent and a desulfurizing agent selected from the group consisting of dolomite, lime and limestone to produce sponge iron particles having a closely adhering, brittle surface coating of high sulfur content basic slag, then abrading the surface of the so produced sponge iron particles to remove the brittle surface layer, and then separating from the abraded sponge iron particles the fines of high sulfur content slag which have been broken from the surface of said particles.

2. The method of claim 1 wherein the abrading is accomplished by ball mill grinding.

3. The method of claim 1 wherein the abrading is accomplished by high velocity impact grinding.

4. The method of claim 1 wherein the abrading is accomplished by roll crushing.

5. The method of claim 1 wherein the abrading is accomplished by ball mill grinding and the separating is accomplished by sieving to remove the fines.

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10 The following references are of record in the file of this patent:

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