

UNITED STATES PATENT OFFICE.

RALPH BAGGALEY, OF PITTSBURG, PENNSYLVANIA, AND CHARLES M. ALLEN, OF LO LO, MONTANA; SAID ALLEN ASSIGNOR TO SAID BAGGALEY.

METHOD OF MELTING PRIMARY BATHS FOR DISSOLVING ORES.

No. 822,712.

Specification of Letters Patent.

Patented June 5, 1906.

Application filed December 19, 1904. Serial No. 237,467.

To all whom it may concern:

Be it known that we, RALPH BAGGALEY, of
Pittsburg, Allegheny county, Pennsylvania,
and CHARLES M. ALLEN, of Lo Lo, Missoula
5 county, Montana, have invented a new and
useful Method of Melting Primary Baths for
Dissolving Ores, of which the following is a
full, clear, and exact description.

Our invention, as more fully described
10 hereinafter, is capable of being practiced in
any convenient form of melting-furnace, cu-
pola, or converter, and particularly such as
are now used in smelting copper ores.

The object of our invention is especially to
15 produce a primary bath, preferably from
sulfid ores, for use in subsequently dissolving
other ores rich in minerals and generally of a
more silicious nature, as well as concentrates,
carbonates, and oxids, and, indeed, all the va-
20 rious forms of ore in which copper, gold, sil-
ver, &c., are found in nature, as more fully
described in a patent granted to us on Au-
gust 2, 1904, No. 766,654, for a method of re-
covering values from ores by dissolving in a
25 molten bath.

The object of our present invention is also
to produce such primary bath either with a
very small proportion of carbonaceous fuel—
say, for instance, two per centum of coke or
30 even less—or when conditions are right after
the ores have been once thoroughly ignited
the melting process may be carried on suc-
cessfully entirely without the use of carbona-
ceous fuel. It is thus possible to melt pyr-
35 rhotite ores and some forms of sulfid ores en-
tirely without the use of coke, providing such
ore be charged into the furnace exclusively
in large lumps that will provide air-passages
for the blast, and provided, further, that a
40 large volume of blast be used, and provided,
further, that such ores contain suitable per-
centages of sulfur.

In present smelting practice from fifteen
to twenty-five per centum of coke is found
45 necessary, particularly where the ores under
treatment are of a silicious nature. As coke
is usually very expensive at points where
copper ores are produced, the expenses for
fuel constitute an important proportion of
50 the total cost of treating ores. In present
practice this heavy consumption of coke is
due to the constant effort to calcine the ores
in the blast-furnace itself before the actual
zone of fusion has been reached in order that

such ores after fusion will produce a fifty-per- 55
cent. matte for subsequent treatment in the
converter. In all prior practice the aim has
been to concentrate matte as quickly as pos-
sible and at every stage of the process. Some-
times this has been accomplished by calcin- 60
ing the ore, either in roast heaps or by stall-
roasting. An effort has also been made to
calcine, and thus to concentrate, the ore in
the blast-furnace through the medium of an
oxidizing-blast. The same result is some- 65
times produced by scorifying the charge, as
is done in reverberatory-furnace practice. It
has also been produced by calcining the matte
and thereafter resmelting it. One of the
strongest advantages claimed for pyritic 70
smelting is that a great degree of concentra-
tion is possible in the matte through the use
of a hot blast. In short, all methods of re-
duction that are now in use for treating sulfid
ores aim at high concentration, whether the 75
same be accomplished by water, by calcina-
tion, by smelting, or by converting. In all
prior methods every unit of sulfur thus elimi-
nated is lost for fuel purposes in subse-
quent treatment. This loss of sulfur has 80
been peculiarly aggravated in prior methods
of smelting, for the reason that calcination as
a means of enrichment is always desired. If
instead of present practice a simple melting
operation is resorted to, much greater fuel 85
values can be retained in the matte. These
fuel values are of the greatest importance
where the intention—as, for instance, in the
process described in the application above re-
ferred to—is to subsequently smelt other 90
ores, and particularly silicious mineral-bear-
ing ores, through the oxidation of the sulfur,
iron, and other elements and compounds con-
tained in this matte. For the purpose stated
a simple melting of the ore is ideal practice. 95
In our present invention our aim is in the
first melting operation to separate the matte-
making materials of the ore from those that
are silicious and aluminous and to accom-
plish this separation with as little loss of sul- 100
fur as possible. The inevitable result of this
practice is the production of a very low grade
matte—that is to say, a matte that is low in
mineral values and high in fuel values. In
the subsequent process we thereafter reduce 105
ores that are higher in silica or in copper,
gold, silver, &c.

In our invention the iron, sulfur, &c., con-

tained in the ore and the oxygen contained in the air when properly combined constitute the sole fuel on which we depend in order to produce effective results. Therefore the less
 5 matte concentration that we effect in our first fusion of the ore the more fuel we will have with which to conduct our subsequent operations. Our present method is diametrically opposite to all prior smelting methods,
 10 in all of which an especial effort is made at all points to concentrate and to increase the grade of the matte, and such concentration must have the effect of sacrificing the fuel values contained in the matte for the reasons
 15 stated.

In prior practice a great effort is made to keep the matte "up to grade," as it is called, which means up to fifty per cent. Cu, and the farther it falls below the fifty-per-cent. mark
 20 the stronger will be the effort to raise it. Where the ore primarily is of such low grade that very low-grade mattes must result from its fusion, it follows that not enough copper will be present in the matte to enable the op-
 25 erator to complete the blow. If an additional charge cannot be secured from the smelting-furnace, which is often the case in ordinary smelter plants, it then becomes nec-
 30 essary to blow up to a certain point in the converter and thereafter to transfer a supplementary charge from another converter, so as to provide a large enough body of con-
 35 verter-matte to bring the two charges when combined in a single converter up to blister-copper.

In our present invention we aim to keep the grade of the matte primarily as low as possible consistent with the mineral values contained in the ores under treatment. In-
 40 stead of attempting to increase the grade of our matte by calcination or otherwise in our first smelting operation, as is universally done in present practice, our constant aim is to lower its grade, for two reasons: First, by
 45 this practice we save sulfur and iron for use in the treatment of other more silicious ores on which we depend mainly for the copper, gold, and silver that we seek; second, as a means of adding to our productive capacity,
 50 and consequently the cheapening of the process in the first smelting operation. It is a well-known fact that an increase in the grade of the matte in a measure retards the free running of the furnace, everything else
 55 being equal.

In the light of the foregoing explanation it will be seen that our methods of procedure are the reverse of all prior practice. It is es-
 60 pecially adapted to utilize the natural fuel contained in the ore and to utilize it to the best advantage. The waste of these substances that prevails in all present practice is eliminated by our invention, and by this invention we practically eliminate the use of

carbonaceous fuels of all kinds, and thus 65 avoid this heavy expense.

In the practice of our invention we take copper or iron sulfid ore containing, preferably, sixty-five per cent. or more of metal sul-
 70 fids and charge it, preferably in large lumps, into a blast-furnace wherein we melt it either with the use of no carbonaceous fuel or with as little carbonaceous fuel as possible, a large volume of air being used. Care is taken to produce a matte which is only enriched to a
 75 slight degree by such operation. Thus the mere melting of the matte will usually add about four per cent. to its metal values, and sulfid ore which assays two per cent. of metal values will after melting produce a matte as-
 80 saying about six per cent., and we prefer to adhere as close to such enrichment as possible. The matte which we thus obtain, containing, say, three to fifteen per cent. of metal values,
 85 is used as a primary bath for dissolving ores in the manner described and claimed in our patent above mentioned. We find that it is desirable in melting the ore to charge it into the furnace in large lumps.

We claim— 90

1. The method of providing a primary bath for dissolving ores which consists in passing through an ore of high fuel value a large volume of blast, and melting the ore with only such concentration as results from
 95 a simple melting; substantially as described.

2. The method of providing a primary bath for dissolving ores which consists in passing through an ore of high fuel value in large lumps a large volume of blast, and
 100 melting the ore with only such concentration as results from a simple melting; substantially as described.

3. The method of providing a primary bath for dissolving ores which consists in
 105 passing through an ore of high fuel value a large volume of blast, and melting the ore and producing a matte which approximates as closely as possible to the original combinations of sulfur, iron, copper, silver, gold and
 110 the like in the original ore as is consistent with the removal of the gangue from the ore; substantially as described.

4. The method of dissolving ores, which consists in melting ore, separating the gangue
 115 therefrom without materially removing the sulfur, iron, copper, silver, gold and the like contained in the ore, whereby a primary bath is produced, and then dissolving ore in the primary bath, substantially as described. 120

In testimony whereof we have hereunto set our hands.

RALPH BAGGALEY.
 CHARLES M. ALLEN.

Witnesses:

A. E. HOBART,
 WILLIAM M. KIRKPATRICK.