No. 844,452. PATENTED FEB. 19, 1907.

T. J. HESKETT.

PROCESS OF OBTAINING METALS FROM SULFIDS.

APPLICATION FILED JULY 16, 1906.

Fig. 1.

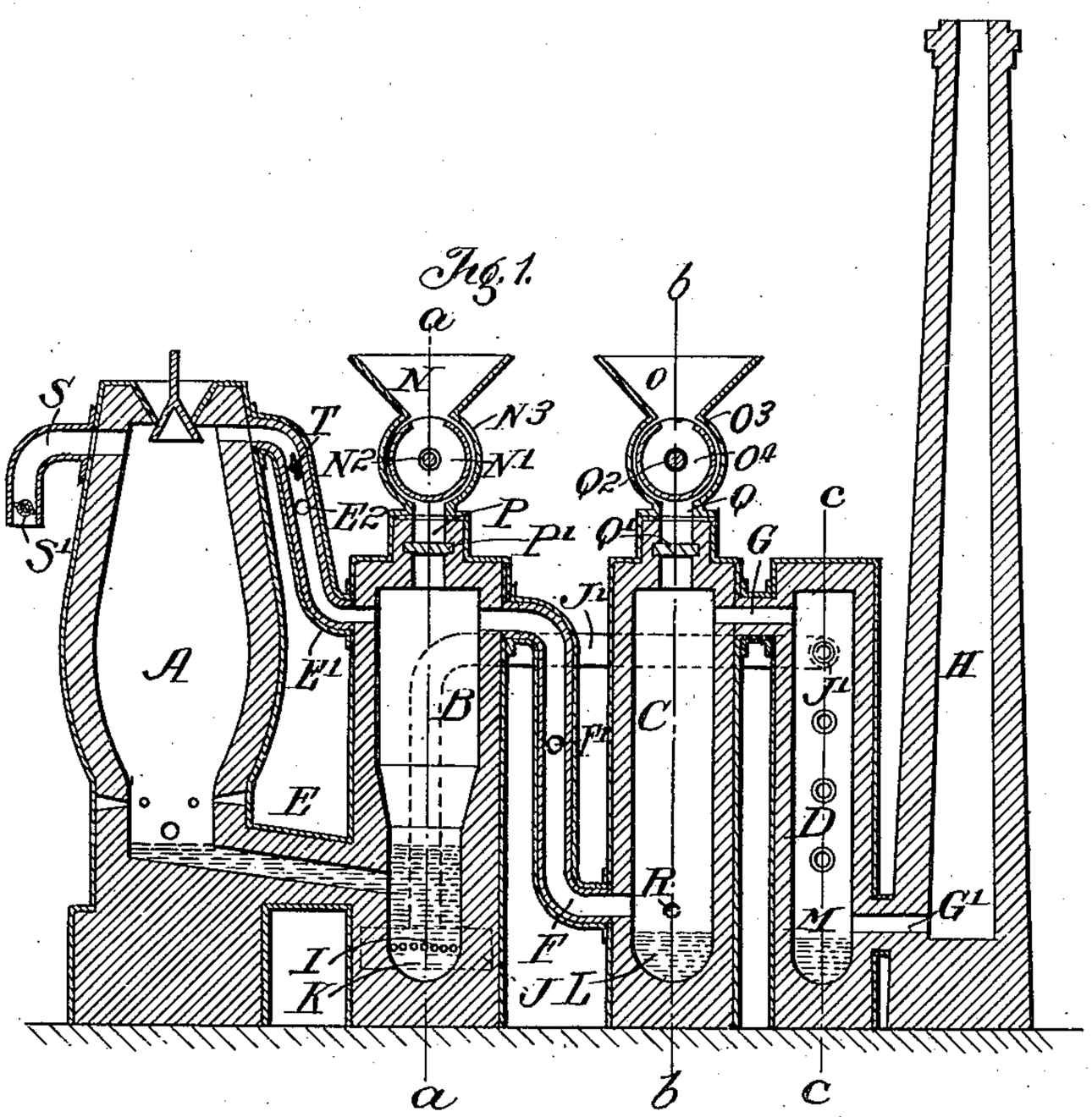


Fig. 2.

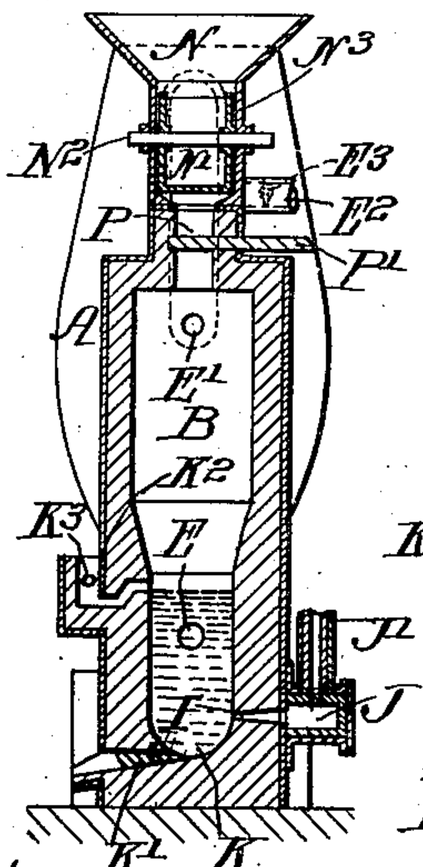


Fig. 3.

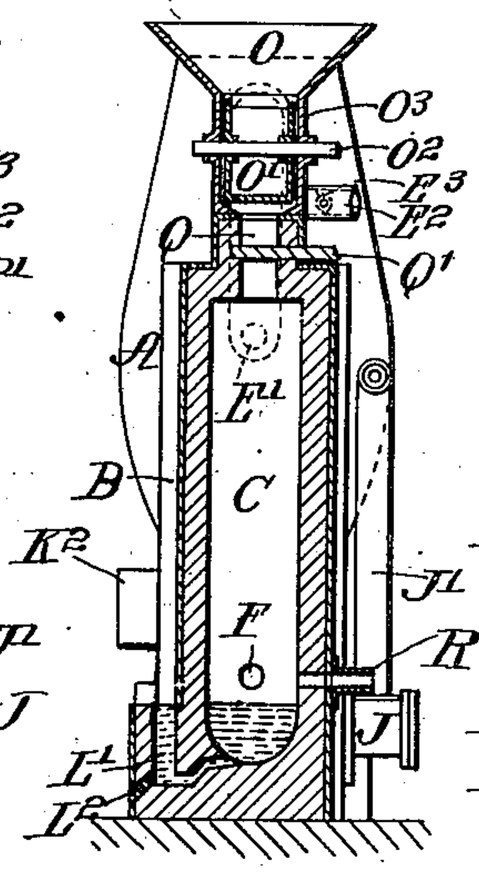
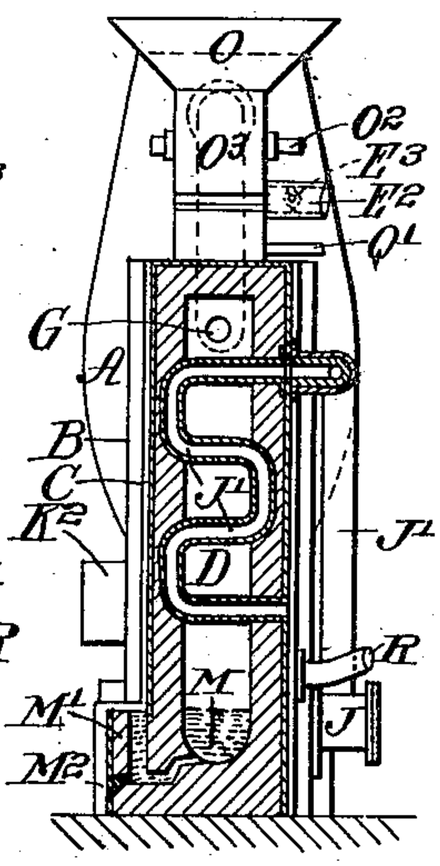


Fig. 4.



Witnesses:
N. G. Barrett
Clifford C. Bradbury.

Inventor:
Thomas James Heskett
by Thomas F. Sheridan
his Atty's

UNITED STATES PATENT OFFICE.

THOMAS JAMES HESKETT, OF BRUNSWICK, VICTORIA, AUSTRALIA.

PROCESS OF OBTAINING METALS FROM SULFIDS.

No. 844,452. Specification of Letters Patent. Patented Feb. 19, 1907.

Application filed July 16, 1906. Serial No. 326,500.

To all whom it may concern:

Be it known that I, THOMAS JAMES HESKETT, a subject of the King of Great Britain, residing at No. 2 Donald street, Brunswick, in the State of Victoria and Commonwealth of Australia, have invented certain new and useful Improvements in an Improved Process of Obtaining Metals from their Sulfids, of which the following is a specification.

My improved process has been devised, mainly, for the purpose of obtaining metals from complex sulfid ores; but it may also be used for obtaining any single metal from its sulfid.

According to my process if impure sulfid ores are to be treated they are first smelted in a blast or other suitable furnace with sufficient fuel and fluxes in order to remove any silicious or earthy materials which may be admixed with them and to produce a pure sulfid of the metals. This pure sulfid continuously flows from the bottom of the blast or other furnace into an oxidizing-chamber adjoining, where it forms and maintains a bath of molten sulfid. If, however, the ore to be treated is a pure sulfid and readily fusible, the preliminary treatment in the blast-furnace may be dispensed with, the pure sulfid being fed direct and continuously to said chamber through a hopper at the top. When the pure sulfid is fed direct to the oxidizing-chamber, a fire must be lighted in the said chamber to start the reaction and a bath of molten sulfid prepared and maintained.

In the oxidizing-chamber rapid oxidation of the sulfids of the metals is effected by an air-blast supplied to said chamber through twyers below the level of the molten sulfid. The oxids of the oxidizable metals, together with the sulfurous-acid gas generated in the oxidizing-chamber, pass therefrom into and near the bottom of a reducing-chamber. A continuous supply of any suitable reducing material—such as carbonaceous, hydrocarbonaceous, or gaseous, and either separately or in combination—is fed to this reducing-chamber. The oxids of the metals in their passage through the reducing-chamber are deoxidized, the least volatile metal being precipitated and collected in the metallic form at the bottom of said reducing-chamber. The oxids of the more volatile metals also become deoxidized, but owing to the heat in the reducing-chamber pass on along with the reducing-gases into and through further reducing-chambers connected with the first chamber, wherein the more volatile metals are condensed and deposited in the metallic state in the different chambers in their order of condensation. The sulfurous-acid gas passes off and can be afterward utilized for the manufacture of sulfuric acid.

The apparatus which I have devised in order to carry out my process consists, essentially, of an oxidizing-chamber, a reducing-chamber, and a condensing chamber or chambers in communication the one with the other by means of closed passages. These when impure sulfid ores are to be treated are combined with a blast-furnace.

The apparatus, including the blast-furnace, is illustrated in the accompanying drawings, in which—

Figure 1 is a central longitudinal vertical section; and Figs. 2, 3, and 4 are vertical cross-sections on the lines *a a*, *b b*, and *c c* of the oxidizing-chamber, the reducing-chamber, and the condensing-chamber.

Only one condensing-chamber is shown in the drawings; but two or more may be used, if necessary.

A represents the blast-furnace; B, the oxidizing-chamber; C, the reducing-chamber, and D the condensing-chamber.

E is an inclined passage connecting the blast-furnace A at its lowest end with the lower end of the oxidizing-chamber B.

E′ is a flue which connects the upper end of the blast-furnace A with the upper end of the oxidizing-chamber B.

E² is a pipe through which air may be admitted to the flue E′ to insure complete oxidation in the oxidizing-chamber B of any fumes of metallic sulfid coming from the blast-furnace A.

E³ is a valve which controls the amount of air passing through the pipe E².

F is a flue leading downward from the upper and opposite side of the oxidizing-chamber B and connected to the lower end of the reducing-chamber C.

F′ is a pipe to admit air to the flue F to insure complete oxidation therein of any fumes of metallic sulfid coming from the oxidizing-chamber B and before they reach the reducing-chamber C. Said pipe F′ is provided with a valve (not shown) to regulate the supply of air passing to the flue F.

G is a passage connecting the upper end of the reducing-chamber C with the upper end

of the condensing-chamber D, and G′ is another passage connecting the lower end of the condensing-chamber D with a chimney-stack H.

I are small twyers in the lower end of and passing through the side of the oxidizing-chamber B below the entrance to the passage E, leading from the blast-furnace A. These twyers lead from an air-box J on the outside of said chamber B. Air is supplied to the said box J through the flue J′. Said flue J′ enters the condensing-chamber D and after passing from one side to another of said chamber in a zigzag form passes therefrom to the air-box J. The air in its passage through that part of the flue J′ which is within the condensing-chamber becomes heated and in that condition is fed to the oxidizing-chamber B.

K is a well at the bottom of the oxidizing-chamber B, and K′ a tapping-hole to withdraw the oxidized molten metal therefrom.

K^2 is a siphon slag-hole in said oxidizing-chamber B, which is also provided with a tapping-hole K^3 at the lowest level of the siphon. Said slag-hole is situated at a point above the entrance to the inclined passage E leading from the blast-furnace A. In the lower end of the reducing-chamber C is a well L, provided with a siphon tapping-hole L′. In the lower end of the condensing-chamber D is another well M and siphon tapping-hole M′. By means of these siphon tapping-holes the reduced metals may be continuously siphoned off. The siphon tapping-holes L′ and M′ in the reducing and condensing chambers, respectively, are provided at their lowest levels with tap-holes L^2 and M^2 to empty them when required.

N is a hopper for feeding pure sulfid direct to the oxidizing-chamber, and when the temperature is not sufficient to carry out the reactions carbonaceous material may be fed through the same hopper.

O is a hopper for supplying carbonaceous or hydrocarbonaceous material to the reducing-chamber C for deoxidizing purposes.

N′ and O′ are circular receptacles situated, respectively, below the hoppers N and O. Said receptacles are supported on spindles N^2 and O^2 in the frames N^3 and O^3. Said spindles are rotated by any ordinary mechanical means.

P and Q are vertical passages connecting the upper end of the oxidizing and reducing chambers with their respective hoppers. Said passages P and Q are provided, respectively, with dampers P′ and Q′. The circular receptacles N′ and O′ at each revolution feed the material from the hoppers N and O, at the same time forming a seal between the atmosphere and the chambers beneath.

R is a pipe through which carbonic-oxid or hydrocarbon gas may be introduced to the lower end of the reducing-chamber C.

S is a flue provided with valve S′ at the top of the blast-furnace A, through which the products of combustion are conveyed from the furnace A to the atmosphere when the ore to be treated is not readily volatilizable and the waste gases contain no valuable product.

T is a valve in passage E′, which is closed when valve S′ is opened.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The process of obtaining metals from sulfids, which consists in oxidizing and desulfurizing the melted ores in an oxidizing-chamber, precipitating the unoxidizable metals and collecting them in the bottom of the chamber, passing oxids of the metals and the sulfurous-acid gas in a highly-heated condition into a reducing-chamber, there bringing the oxids and sulfids into contact with a reducing material, collecting the less volatile metals at the bottom of the reducing-chamber, passing the more volatile metals to condensing-chambers, and there precipitating them in the order of their condensation.

2. The process of obtaining metal from sulfids, which consists in the oxidation of the oxidizable portions, separating the oxidizable and non-oxidizable portions, reducing the oxidizable portions and precipitating first the least volatile and then the more volatile metals in order.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

THOMAS JAMES HESKETT.

Witnesses:
WALTER S. BAYSTON,
FRANK BAYSTON.