(No Model.) 3 Sheets—Sheet 1.

J. S. LODER.

OXIDIZING PYRITE SMELTING FURNACE.

No. 567,986. Patented Sept. 22, 1896.

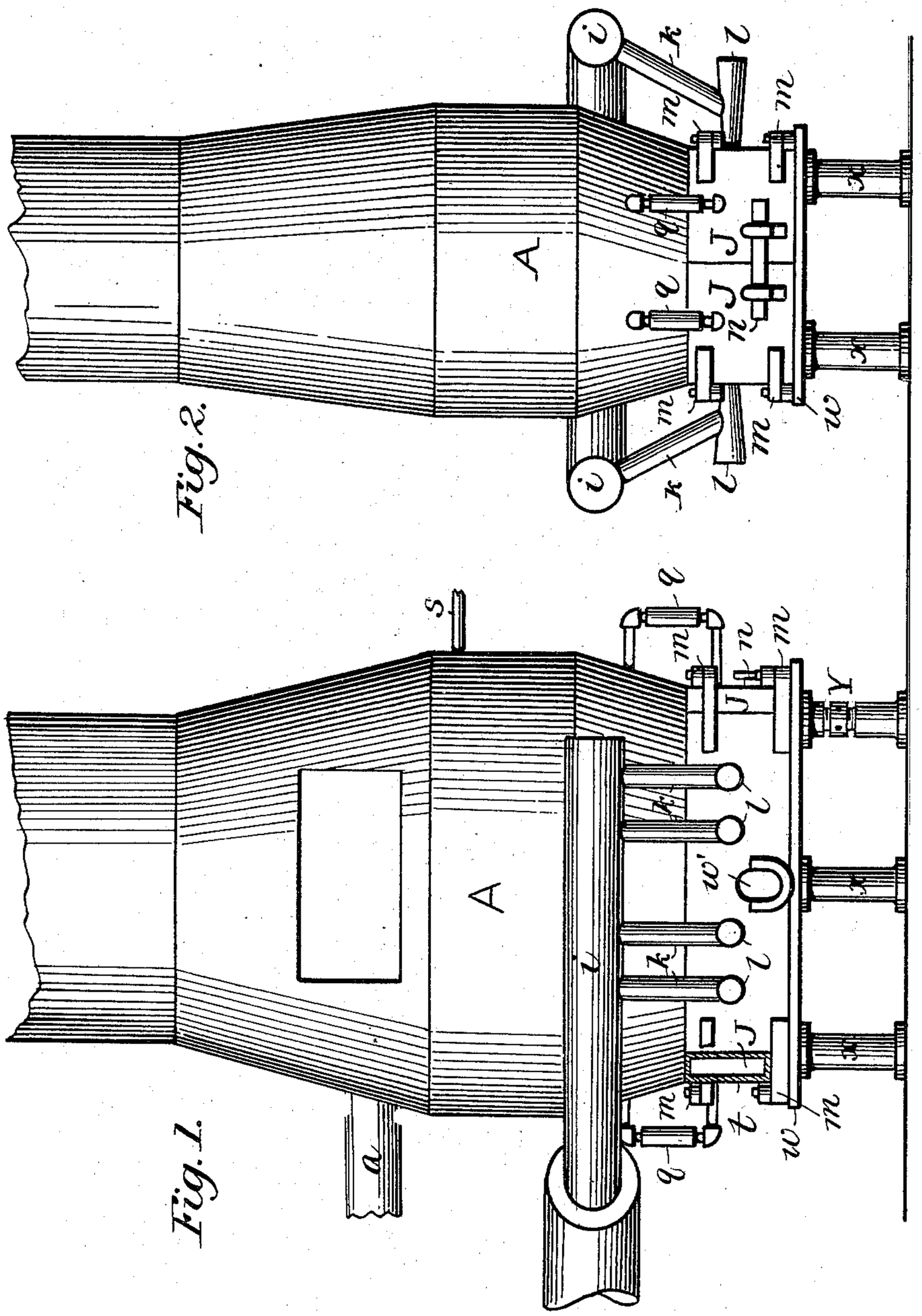

Fig. 1.

Fig. 2.

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(No Model.) 3 Sheets—Sheet 2.

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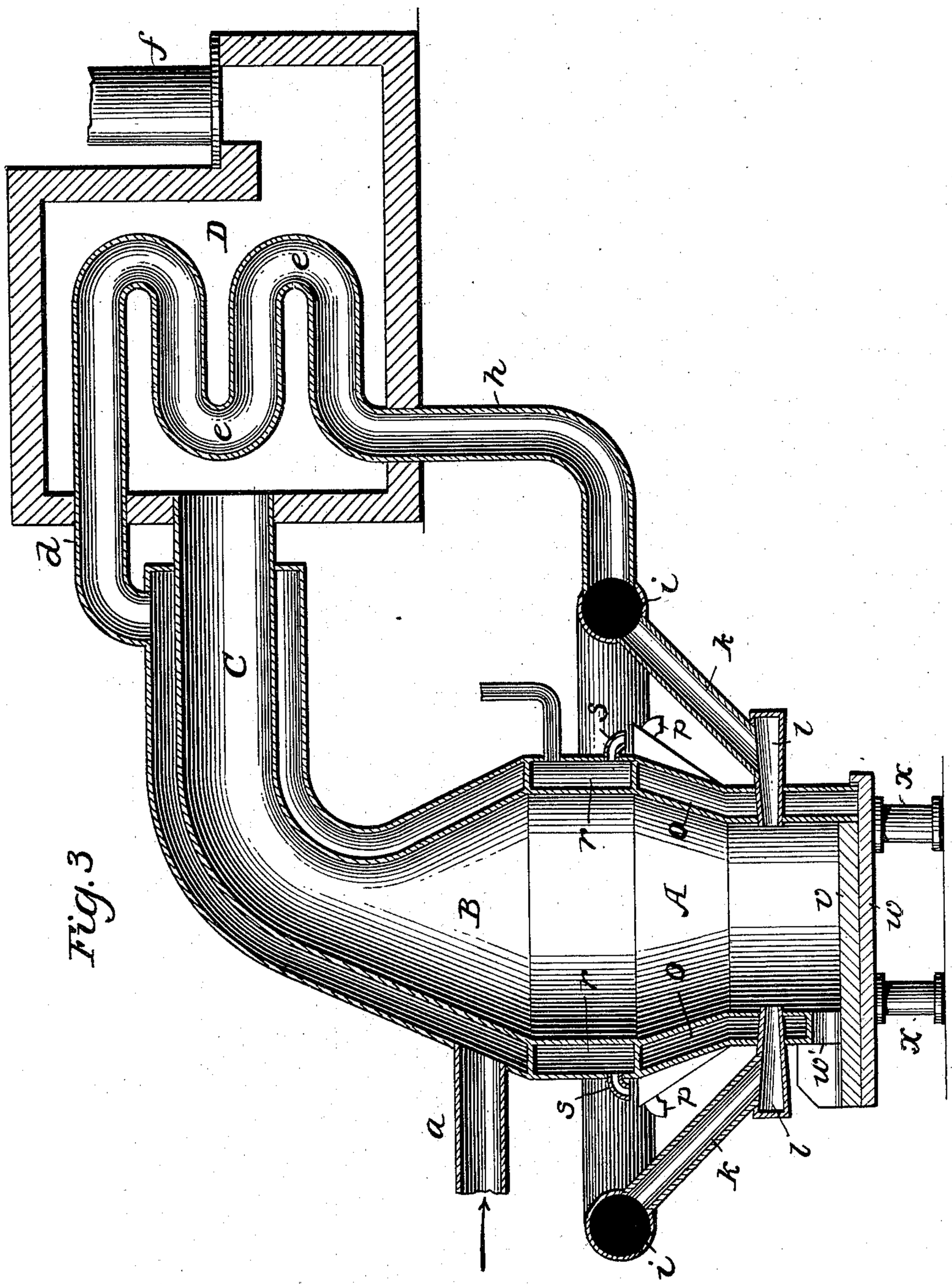

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(No Model.) 3 Sheets—Sheet 3.

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OXIDIZING PYRITE SMELTING FURNACE.

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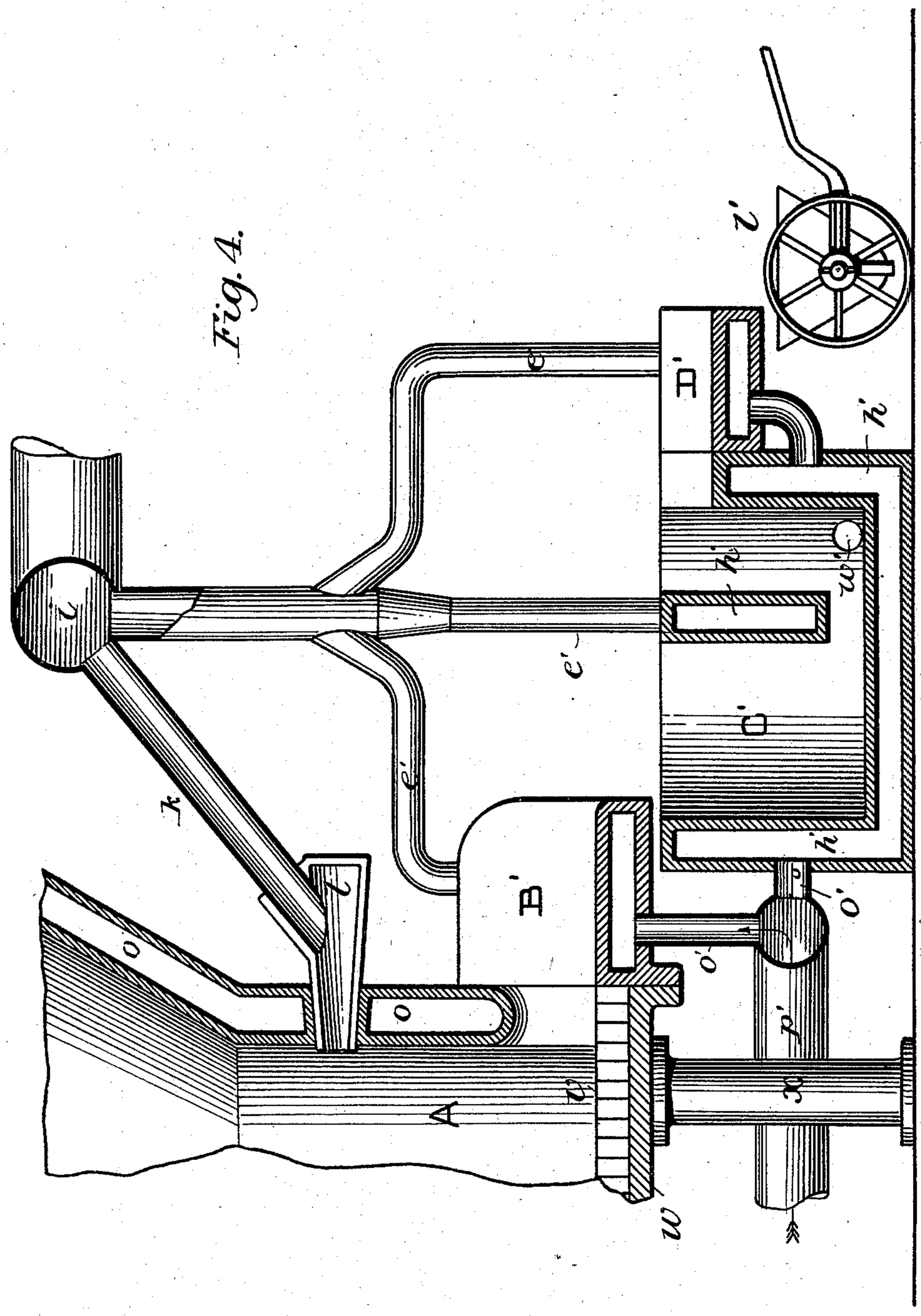
Fig. 4.



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UNITED STATES PATENT OFFICE.

JOHN S. LODER, OF DENVER, COLORADO.

OXIDIZING PYRITE-SMELTING FURNACE.

SPECIFICATION forming part of Letters Patent No. 567,986, dated September 22, 1896.

Application filed July 19, 1895. Serial No. 556,511. (No model.)

To all whom it may concern:

Be it known that I, JOHN S. LODER, a citizen of the United States, residing at Denver, Arapahoe county, State of Colorado, have invented certain new and useful Improvements in Oxidizing Pyrite-Smelting Furnaces, of which the following is a specification.

My invention relates to the smelting of the various combinations of iron, copper, nickel, zinc, gold, silver, platinum, and other metals, both natural and artificial, on the one side, and metalloids or non-metals, such as sulfur, arsenic, and antimony on the other, and is equally applicable whether the elements are combined in pairs or exist in more complex forms. This smelting is carried on in one operation, without any preparatory treatment whatsoever, in a vertical blast-furnace constructed as shown by drawings hereto attached.

The object of my invention is to provide economical and practical means whereby such ores, or any of their compounds, as pyrites, sulfids, arsenide, or antimonide and other ores of an approximate chemical nature may be easily smelted and a matte produced therefrom which contains all the metals of any value that have an affinity for sulfur or sulfid compounds, with one (1) per cent. or more of carbonaceous fuels added to the above compounds when fed into the furnace.

In the present and most practical methods of smelting such ores or their compounds they are first roasted in a mass, (reverberatory furnaces or other methods being used to oxidize these ores,) thereby driving off the combustible elements. Then the oxids so produced are heated and fused in furnaces with thirty to fifty per cent. carbonaceous fuels, which fuels take the place of or supply the combustible elements destroyed in roasting and requiring three or four smelting operations before the product is of a commercial value.

In the carrying out of my inventions and smelting operations I utilize the combustible elements of such ores and their compounds instead of destroying them, so that instead of using thirty to fifty per cent. of carbonaceous fuel I require only one to three per cent., and the result is effected in one operation, producin a commercial product by the use of an improved vertical blast-furnace which produces both an oxidizing and reducing action at the same time.

The furnace receives the ores directly, and the entire heat from the ores and their compounds, with their combustible elements, while in the furnace, is utilized to heat the blast of the furnace for the purpose of igniting the combustible elements and for producing a reducing-blast in the lower or smelting zone and maintaining an oxidizing blast in the upper or oxidizing zone of the same furnace.

In the accompanying drawings, Figure 1 is a front view of the lower part of my improved furnace. Fig. 2 is a side view. Fig. 3 is a transverse sectional elevation showing the receiving-chamber communicating with the flue. Fig. 4 is an enlarged part-sectional view showing the spout and matte-receptacle.

A is the body of the furnace, with water-jackets *o r*, supported on a base-plate *w*, which rests on columns *x x* and is protected from the molten contents of the furnace by a layer of refractory substance *v*.

The columns *x* may take the form of jack-screws, as shown at Y, Fig. 1.

From the body of the furnace extends a funnel B to a flue C, which communicates with a structure containing a chamber D, from which leads a chimney *f*.

The hollow hood or funnel B and the flue C are constructed with double walls, as shown, communicating with the blast-pipe *a* and between which the blast for said furnace passes, thereby heating the air of the blast and correspondingly cooling and protecting the surfaces of the funnel B and the flue C from the action of the flame from the furnace. The blast may be further heated by passing it by means of a connecting-pipe *d* to a coil of pipe *e* within the chamber D, which coil of pipe is heated by the furnace fumes and gases as they pass through on their way to the stack *f*. From the coil of pipe *e* the blast is conducted by a pipe *h* to the bustle-pipe *i* of the furnace, from whence the blast, now heated, is distributed to the twyers *l* by means of the twyer-pipes *k* in the usual manner.

The water for cooling the jackets *r* comes from any convenient source through the supply-pipe *t* and when heated overflows from

the spouts *s* into the necks of the lower jackets *o*, which are thus supplied and protected by hot water rather than by cold, which is the usual custom. From these jackets *o* the water escapes in the customary manner through the spouts *p*. As thus constructed, one water-jacket sets directly on top of the other, furnishing the entire walls and body of the furnace, saving thereby the expensive brick and other work in construction, which has heretofore been required.

I heat the water that is required for the lower jacket, which is the smelting-zone of the furnace, allowing me to maintain a more uniform degree of heat and to attain a much higher temperature than the old system of using cold water at the smelting-zone, thereby saving a large per cent. of heat and preventing the danger of cracking or breaking the jacket.

Another great advantage is the readiness with which the furnace can be cooled in case of accident, and the ease with which repairs can be made, while in the old system it takes weeks to cool the furnace sufficient to make the many repairs which are needed from time to time. My furnace can be constructed at seventy-five per cent. less cost than usual.

The air-jacket protects the hood from the oxidizing action of the heated gases and further assists the blast of the furnace.

It will be seen that the chamber D heats the air and acts also as a fume-chamber without the use of additional heat other than that obtained from the furnace. I am aware that there are other outside heating arrangements for the purpose of promoting smelting operations where the fuel has been used for heating the air, but entirely different from this.

B′ is a spout for removing the contents of the furnace when molten. C′ is a receiver and settler for holding the molten material which escapes from the furnace A by means of the spout B′. D′ is a spout on said receiver for permitting its contents to escape either into a slag-pot *l′* or elsewhere. The walls of these furnace accessories, spouts, and receiver are made hollow, with spaces *h′*, as shown, and from a main pipe *p′* air is forced by branches *o′* to one or each of these parts, and passing through the hollow walls cools and protects the same, becoming at the same time itself heated. It then escapes through the pipes *e′* to the bustle-pipe *i*, from which it is conducted to the twyers by the twyer-pipes *k* in the usual manner.

The danger heretofore experienced in using water-jacketed slag-spouts is that they often chill and the slag hardens, requiring to be cut out. The air-jacketed slag-spouts above described can be kept uniform and at a much higher temperature without danger of explosion and such formations accumulating. The air that is forced through this slag-spout is supplied from the usual blower and is sufficient to go directly into the furnace as a part of the blast to be used in the smelting operation.

The doors J of the furnace are water-jacketed and are attached to the furnace by hinges *m*, and are fastened in closed positions by latches *n*.

The chambers *t′* of the doors are supplied with water from any of the other jackets by means of the pipes *q*, which are jointed and made flexible, so as to allow the doors to open and shut without disconnecting the pipes or interrupting the water supply.

The air-jacketed receiver or matte-receptacle described receives and separates the product from the smelter and utilizes the heated air that has been produced within the receptacle, and the same is introduced into the furnace, thereby assisting the smelting operation. In this receptacle the sulfids carrying the values of the different metals having the greater specific gravity separate from the slag and settle to the bottom of the receptacle, where the sulfids are drawn out through an aperture *w′*. It is then run into pots, then into molds, and in this form it becomes a commercial product.

Without limiting myself to the precise construction and arrangement of parts shown, I claim as my invention—

1. In a smelting-furnace, the combination with the body portion, of a hood and flue mounted thereon, twyers entering at the base of the body portion, a bustle-pipe, pipes leading from the bustle-pipe to the twyers, a casing surrounding the hood and flue, with an intermediate chamber, a pipe leading from the upper end of said chamber and connecting with the bustle-pipe, and a heating-chamber into which the products of combustion pass, the said chamber surrounding a portion of said connecting-pipe and communicating with an exit-flue, substantially as described.

2. A smelting-furnace comprising superposed water-jackets, the uppermost jacket having a water supply and an outlet emptying into the lowermost jacket, the latter having an outlet, a hood and flue supported by said uppermost jacket, a casing surrounding the hood and flue with a chamber intervening between the two, twyers entering the base of the furnace, a pipe communicating with the twyers and the chamber, and a heating-chamber receiving the products of combustion and inclosing a portion of said communicating pipe, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN S. LODER.

Witnesses:
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W. B. DUVALL.