

R. R. MOORE & J. H. KEES.
 APPARATUS FOR THE PRODUCTION OF MATTE AND SMELTING OF ORES.
 APPLICATION FILED APR. 20, 1909.

985,195.

Patented Feb. 28, 1911.

2 SHEETS—SHEET 1.

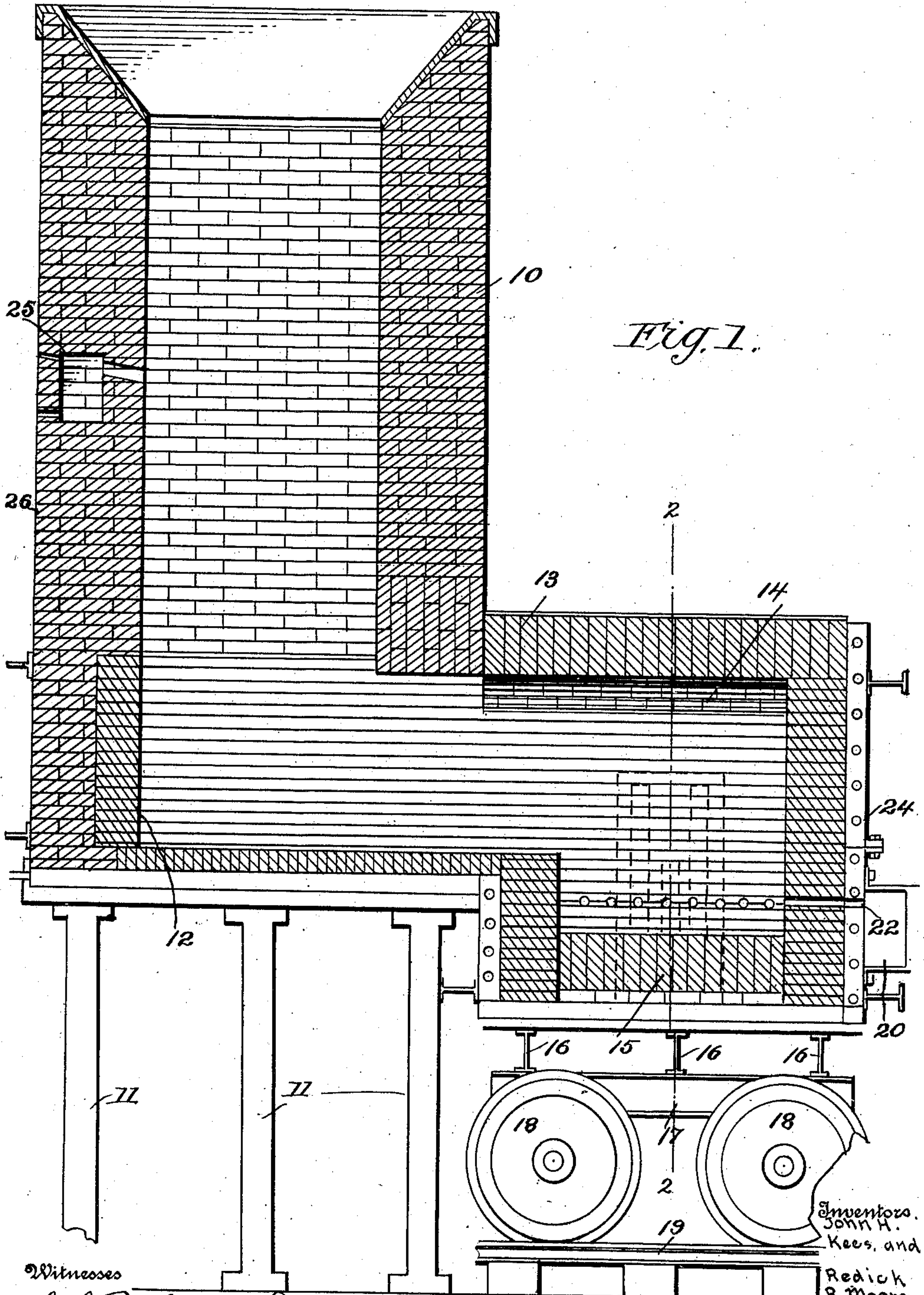


Fig. 1.

Witnesses
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 L. Cloud Newman.

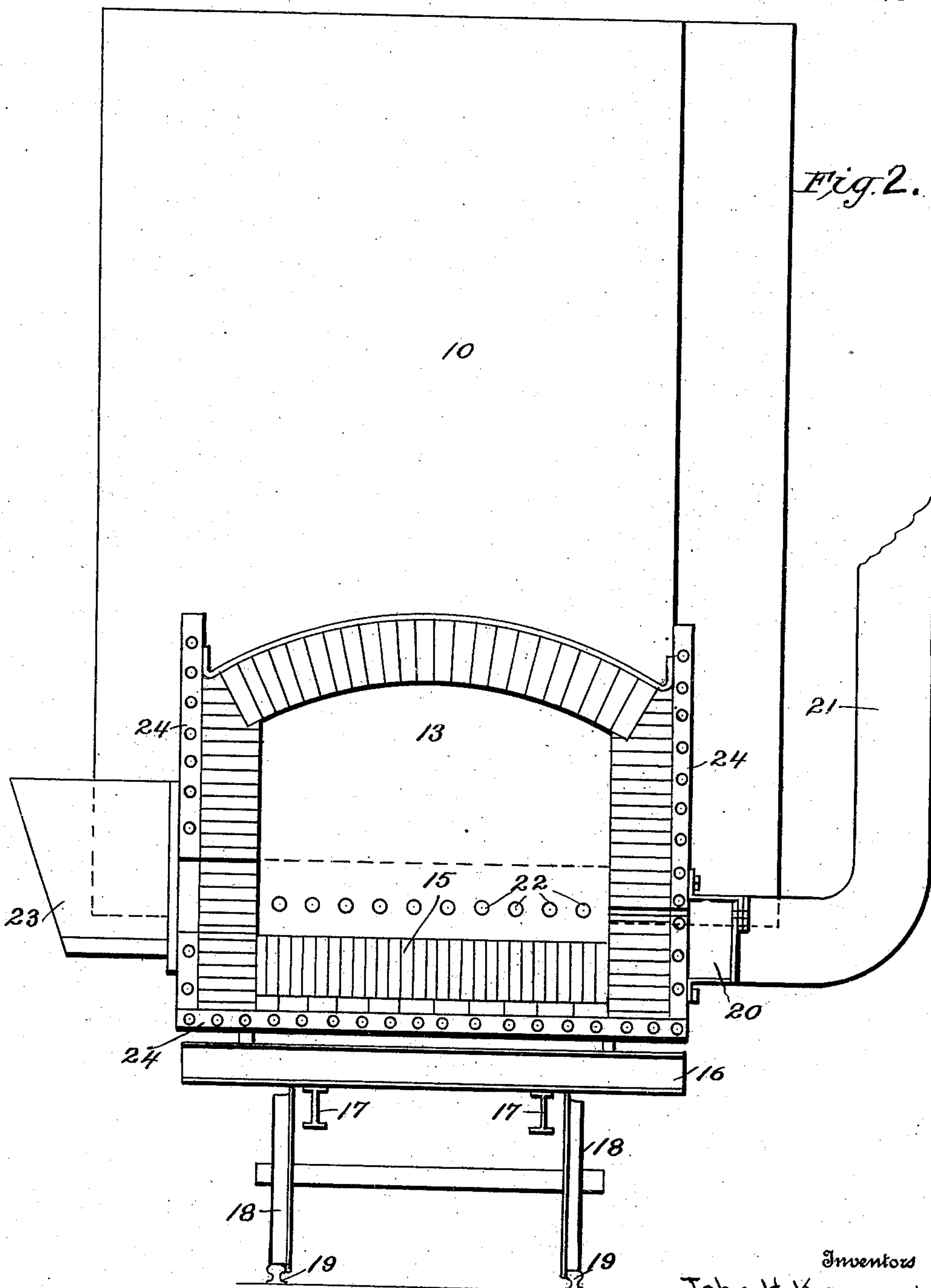
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UNITED STATES PATENT OFFICE.

REDICK R. MOORE, OF GARFIELD, AND JOHN H. KEES, OF SALT LAKE CITY, UTAH.

APPARATUS FOR THE PRODUCTION OF MATTE AND SMELTING OF ORES.

985,195.

Specification of Letters Patent.

Patented Feb. 28, 1911.

Application filed April 20, 1909. Serial No. 491,140.

To all whom it may concern:

Be it known that we, REDICK R. MOORE, a citizen of the United States, residing at Garfield, in the county of Salt Lake and State of Utah, and JOHN H. KEES, a citizen of the United States, residing at Salt Lake City, in the county of Salt Lake and State of Utah, have invented certain new and useful Improvements in Apparatus for the Production of Matte and Smelting of Ores; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to smelting furnaces and has for an object to provide a furnace with means for a continuous production of matte of lead, copper, nickel, cobalt and precious metals without the need of calcining and without the use of carbonaceous fuel, whereby a great saving is effected in the cost of smelting and the losses in metal values incident thereto.

A further object of the invention is to provide in a smelting furnace a converting chamber with a furnace stack in communication therewith but with the converting chamber offset from the furnace stack.

A further object of the invention is to provide a converting chamber in communication with a furnace stack but in such a manner that the weight of the material in the furnace stack is not transmitted to the material within the chamber.

A further object of the invention is to provide in a smelting furnace a chamber with means for blasting the matte within the chamber and with a furnace stack in communication with the chamber in such position that the products of combustion from the blast of the chamber is passed into and through the stack and the material within the stack.

With these and other objects in view the invention comprises certain novel constructions, combinations and arrangements of parts as will be hereinafter more particularly described and claimed.

In the drawings, Figure 1 is a view of the improved matte blast furnace in vertical transverse section. Fig. 2 is a vertical transverse section through the converting chamber taken on line 2—2 of Fig. 1 looking in the direction indicated by the arrow.

Like characters of reference indicate cor-

responding parts throughout the several views.

The present invention embodies a blast furnace stack 10 supported in any approved manner, as upon the pillars 11, and lined as the occasion may require with highly refractory material indicated at 12. Offset from the interior of the stack 10 is the passage 13 extending in a horizontal plane and communicating with a converter or converting chamber 14, the vertical axis of which is parallel with the vertical axis of the stack. The bottom or base 15 of the converter is appropriately mounted upon beams 16 which in turn are mounted upon other beams 17 carried upon trucks 18 so that when the bottom of the converter has been burned out or for other reasons requires replacing it can be moved outwardly upon the track 19. The converter is surrounded by a flue 20 communicating by means of a pipe 21 with any approved source of compressed air supply and from such flue 20 a plurality of twyers 22 lead to the interior of the converter adjacent the bottom thereof. At one side, as indicated at 23, a discharge opening is provided through which the matte and slag are removed from the converter. The converter is also preferably water-jacketed as indicated at 24, which may be in the usual and ordinary form and is here shown only conventionally.

It has been discovered by applicants that more than enough heat escapes in the gases from the ordinary copper converter to smelt the sulfids of ores into a molten matte and the apparatus which is here disclosed utilizes the escaping heat from such mass for that purpose and for the heating of the silica and other constituents of the charge, and provides a cheap and economical smelting device for the smelting of sulfids, arsenids, etc., together with the necessary silica and such amounts of alumina, lime, etc., as ordinarily occur with ores of copper, lead or precious metals, to form liquid slags free from metal, or economically so, without the use of any carbon or other added fuel, and once the operation is started it is continuous as long as the blast of air is injected into the bath and the supply of sulfids, silica and fluxes is maintained in the shaft. In other words in the present invention the gases produced from the oxidation of the iron and sulfur of the bath of matte are not combustible and only the heat which they con-

tain when they leave the bath is utilized which is ample for melting the sulfids of the charge and the heating of the silicas and other constituents thereof.

5 It will be noted that the twyers are placed below the matte and slag level in the converter a sufficient distance to insure the employment of all the oxygen to support combustion in the converter, but it will be understood that additional or supplemental twyers may be employed either in the converter or stack or at any point where additional or supplemental supply of air blast may be found to be advisable or profitable. 10 Ordinarily the level of the matte and slag is somewhat above the bottom of the passage between the converter vessel and the stack and is maintained at such level substantially by the conversion of the mass within the 20 stack and the formation of the matte at the bottom which passes over into the converter and is discharged as above described.

The blast of the air through the matte and molten materials within the converter 25 raises the temperature of the gases of combustion to an intense heat, and these gases pass through the passages 13 and into the stack 10 where they pass into the interstices of the material within the stack coming 30 in contact with such material to convert it as above described.

While a simple form of the apparatus is here shown, with the stack vertical and a single converter connected therewith, it is 35 to be understood that the number of converters or the exact angular position of the stack as shown is not essential to the present invention.

It is well known that when iron pyrites 40 or copper pyrites are heated to a high degree of temperature a portion of the sulfur is volatilized by the heat and this sulfur is ordinarily burned upon the top of the charge without useful effect and is lost. In order 45 to conserve the sulfur thus set free, in the present invention condenser 25 is employed preferably formed within the wall of the stack of the furnace 10 so arranged that the sulfurous gas proper may enter such condenser 25 through the passage 26 but with 50 such passage 26 inclined downwardly to prevent the charge within the stack from entering therein.

In operation the furnace stack 10 is 55 charged with the ores to be reduced and a quantity of the molten matte from any source is placed within the converter. Vapor of sulfur (S) and sulfurous acid (SO_2) are both present with nitrogen in the upper 60 part of furnaces treating pyrites or pyrrhotite or chalcopyrite, and the sulfur will be condensed upon the cool charge if the charge column is high enough above the source of heat for the charge to absorb the 65 heat out of the vapor of sulfur and associ-

ated gases to the temperature of the condensation, of sulfur, and as the charge is continually traveling downward the condensed sulfur will be again vaporized resulting in a zone in the stack where the gases permeating the interstices of the charge will be saturated with sulfur vapor. Now if there is an opening or pocket in the wall of the stack at the point of saturation the gases there will tend to enter and circulate through it, especially as its walls are cooler than the stack walls and chiefly on account of the cooling and condensation of sulfur and in doing so will deposit a part of the sulfur volatilized from the charge. If desired to secure more 80 active circulation of the gases and vapors through the condensers, the upper or punch hole shown in the outer wall of the furnace may be opened more or less and as there is a slight pressure in the furnace any desired 85 circulation may be secured but as the sulfurous vapors given off are very noxious it is preferable to recover the sulfur by other means. When this is done the valves supplying air to the twyers 22 are opened and the 90 blast from the pipe 21 discharges preferably heated air through the matte oxidizing the iron, sulfur, etc., of the matte forming ferrous oxids which will unite with the silica and other constituents of the charge in the 95 stack to form a molten slag and produce sulfurous gas which with the nitrogen of the air will give up its heat to the cooler charge thus melting down sulfids to form more matte and replenish the fuel of the converter 100 chamber and heating the silica and other constituents of the charge to a point where they readily form slag with the ferrous oxid already formed, and the gases pass out of the top of the stack in a cooled or partially 105 cooled condition.

In the use of the ores which come from the mines with parts broken finely it is preferable to charge the stack with the fine portion of the ores separate from the coarser ores 110 so that the heated gases will not be retarded by the fine particles of ores filling in the interstices between the coarse particles. For this purpose the stack is built as shown so that in charging the fine ores may be charged 115 upon one side of the stack with the coarser ores upon the other side.

What we claim is:—

1. The combination with a furnace of a converting chamber opening directly there- 120 into and offset therefrom with a shoulder therebetween positioned and arranged to maintain a column of silica and other constituents of the furnace charge in the furnace, and a bath of molten matte and slag 125 in the converter chamber the upper part of which is in continuous engagement with the base of the column of silica and other constituents, and means to facilitate the forcing of a blast of air through the matte and the 130

resulting sulfurous and nitrogenous gases through the charge in the furnace.

2. The combination with a converting chamber of a furnace offset therefrom and
5 opening directly thereinto permitting the sulfurous and nitrogenous gases to pass through the charge and having a bottom arranged to carry the weight of the charge therein and prevent the molten matte in the
10 converter chamber being subjected thereto while being maintained in engagement with the constituents of the furnace charge means to admit an air blast through the bath of matte and slag in the converting chamber

and the nitrogenous and sulfurous gases re- 15
sulting through a relatively high and large opening between the furnace and converting chamber into and through the furnace charge, means to charge the furnace, and
20 means to remove the liquid products.

In testimony whereof we affix our signatures in presence of two witnesses.

REDICK R. MOORE.
JOHN H. KEES.

Witnesses:

W. J. LEWIS, Jr.,
H. D. JACOBS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."
