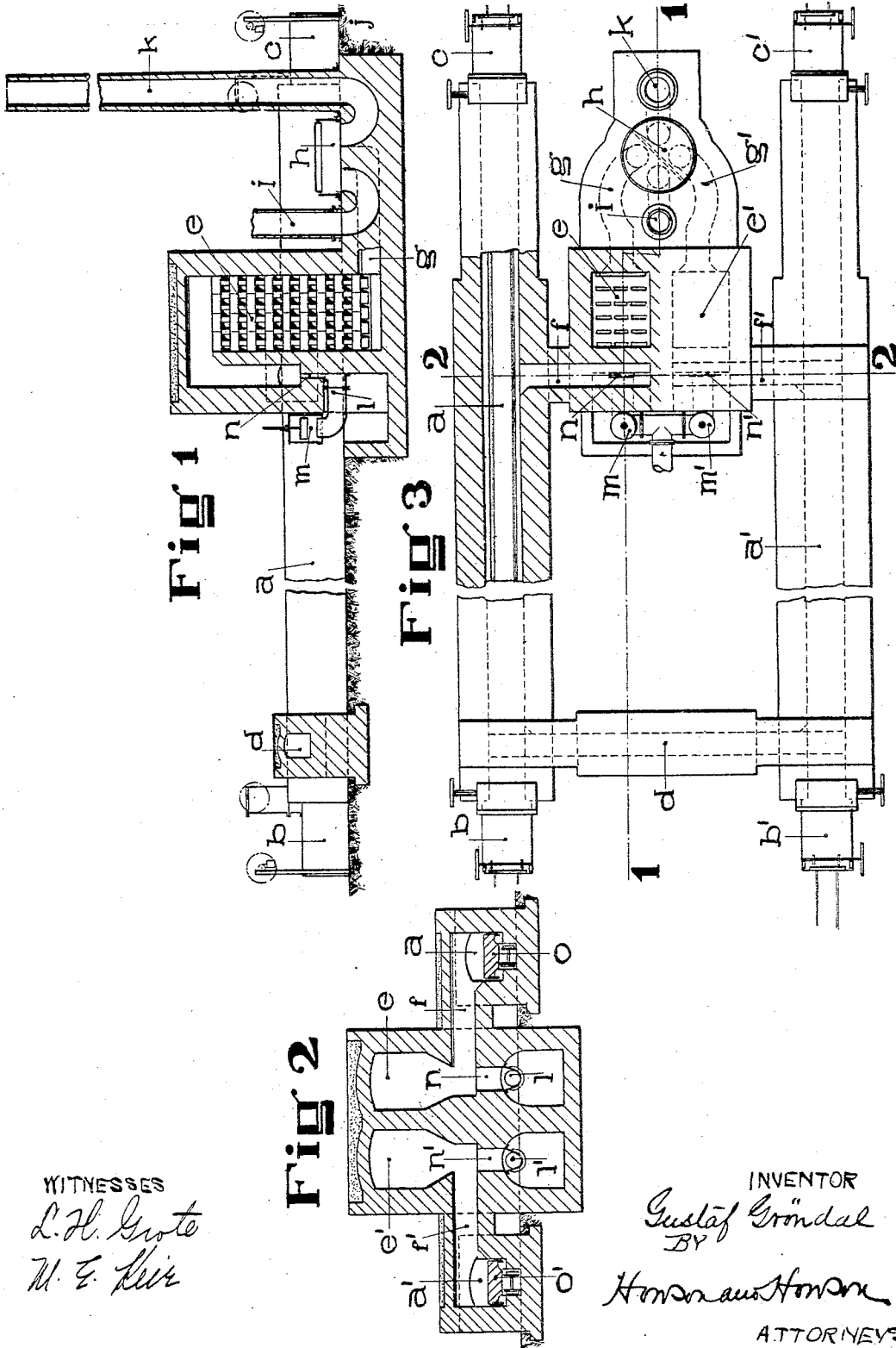


G. GRÖNDAL.
FURNACE FOR REDUCING ORES.
APPLICATION FILED NOV. 24, 1908.

936,124.

Patented Oct. 5, 1909.



WITNESSES
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GUSTAF GRÖNDAL, OF DJURSHOLM, SWEDEN, ASSIGNOR TO AMERICAN GRÖNDAL, KJELLIN COMPANY, OF NEW YORK, N. Y., A CORPORATION.

FURNACE FOR REDUCING ORES.

936,124.

Specification of Letters Patent.

Patented Oct. 5, 1909.

Application filed November 24, 1908. Serial No. 464,326.

To all whom it may concern:

Be it known that I, GUSTAF GRÖNDAL, a subject of the King of Sweden, and resident of Djursholm, Sweden, have invented certain new and useful Improvements in Furnaces for Reducing Ores, of which the following is a specification.

The present invention relates to a furnace for reducing ores by means of reducing gases.

On the accompanying drawing a suitable double furnace is represented as an example, said furnace being particularly adapted for reducing pulverized iron ore formed into porous blocks or briquets.

Figure 1 is a longitudinal section on line 1—1 of Fig. 3, Fig. 2 is a transverse section on line 2—2 of Fig. 3 and Fig. 3 is a plan view partly in section.

$a a'$ are two parallel tunnel furnaces having vestibules $b b'$ and $c c'$ respectively at their ends. At the entrance ends the tunnel furnaces communicate by a conduit d for the gas.

$e e'$ are two regenerators.

$f f'$ are conduits from the regenerators to the middle of the tunnel furnaces or thereabout and $g g'$ are conduits leading to a shifting valve h . From the valve h a conduit i leads to a gas-generator, not shown, and a conduit j leads to the chimney k .

$l l'$ are conduits controlled by valves $m m'$ for leading air under pressure to the regenerators and $n n'$ are air openings in the conduits $f f'$.

$o o'$ are trucks on which the ore briquets are conveyed through the furnaces in any convenient manner, not shown; the briquets, however, may be carried through the tunnel furnaces on any other movable supporting device.

The double furnace and regenerators may be heated in the following way: Generator gas is introduced through the shifting valve h and led through one of the regenerators for instance e into the tunnel furnace a and through the conduit d into the other tunnel furnace a' and thence through the conduit f' into the regenerator e' , air being allowed to enter through the air opening or openings n' . The gas now is ignited heating the regenerator e' and the combustion gases are discharged into the chimney k through the shifting valve h . After the regenerator e' has been heated sufficiently the air valve m'

is closed, the valve h is shifted and the gas is led the opposite way through the tunnel furnaces. The gas is ignited at n by the air pressed in through the valve m .

After the double furnace has been heated sufficiently trucks or other movable supporting device on which briquets are piled are pushed through the vestibules b and b' into the tunnel furnaces and by means of any suitable device the trucks are carried gradually through the tunnel furnaces in any convenient manner. The operation is conducted in such a manner that the reduction of the ore is completed when the trucks have passed the gas inlet from the conduits f or f' respectively. In the parts of the tunnel furnaces lying on the other side of said gas inlets the briquets are allowed to cool in the same atmosphere, *i. e.* in the portion of the gas mixture filling said parts of the furnaces. The gas is led into the furnace under pressure and the doors of the tunnel furnaces and vestibules should be tight so as to prevent the atmospheric air from entering the furnace, and thereby an oxidation of the reduced ore is prevented. Those parts of the tunnel furnaces in which the cooling is effected, should have such a length that the material loaded on the trucks occupying the vestibules $c c'$ for the time being has cooled down sufficiently to be removed from the tunnel furnace without any danger of re-oxidizing about the time the trucks standing at the gas inlets from $f f'$, *i. e.* the trucks whose material has been reduced, are to pass said inlets.

When the temperature of the regenerator through which the gas is fed has fallen so far that the gas does not leave the regenerator at the desired temperature the direction of flow of the gas is reversed and the reducing operation is carried on continually.

I claim:—

1. A regenerative double furnace for reducing ore by means of gas, consisting of two tunnel furnaces located parallel to each other, means for conveying the ore through said furnaces, a gas-conduit between the entrance ends of the furnaces, a gas-supply, two regenerators, gas-conduits from each of said regenerators to each of the tunnel furnaces, a supply of combustion air under pressure, conduits for said air opening into said gas-conduits, controlling valves in said air-conduits, and means for shifting the flow of

gas to the regenerators and to a chimney, substantially as and for the purpose set forth.

2. A regenerative furnace for reducing
5 ore by means of gas consisting of a plurality of tunnel furnaces, means for conveying ore through said furnaces, a gas conduit uniting the entrance ends of said tunnel furnaces, a
10 gas supply, a plurality of regenerators, gas conduits leading therefrom to said tunnel furnaces, a combustion air supply under pressure, conduits for said air opening into

said gas conduits, means to control said air supply, and means for shifting the flow of gas to the regenerators and to a chimney, 15 substantially as and for the purpose described.

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

GUSTAF GRÖNDAL.

Witnesses:

FREDRIK L. ENQUIST,
NILS ENQUIST.