

J. SALESSKY.

FURNACE.

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Fig. 1.

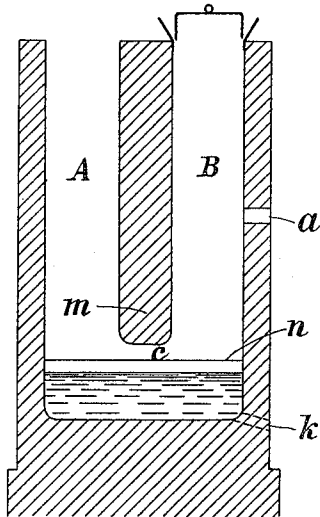


Fig. 2.

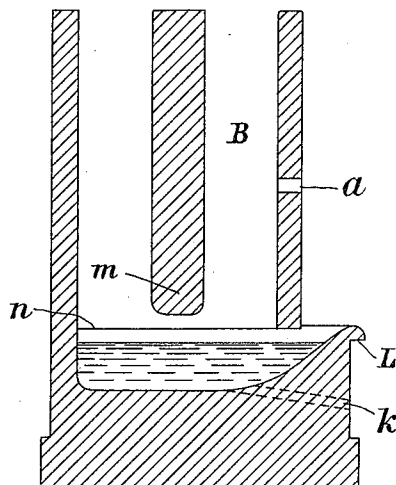
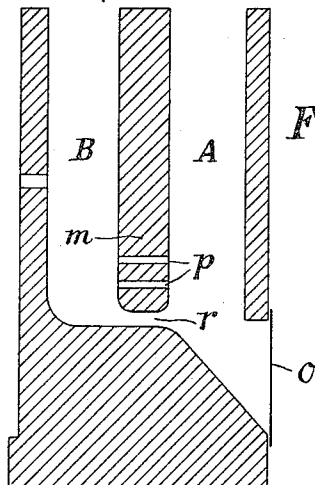


Fig. 3.



Witnesses

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To all whom it may concern:

Be it known that I, JOSEPH SALESSKY, a subject of the Czar of Russia, residing at Haus Armand, Wesdwschenka, Moscow, in the Empire of Russia, have invented certain new and useful Improvements in or Relating to Furnaces, of which the following is a specification.

Furnaces of the "shaft" type are differentiated from the flame or reverberatory furnace in that the heat produced by the fuel is better utilized in the former than in the latter. Notwithstanding the fact that the waste gases escaping from shaft furnaces carry with them many products of incomplete combustion, the efficiency of such furnaces for metallurgical purposes amounts to 30% and is even frequently higher. So great a utilization of the heat in shaft furnaces is due to the fact that the products of combustion are conducted through the layer of material to be smelted or heated, upon the height of which depends the more or less complete utilization of the heat. The efficiency of shaft furnaces is ascribable to the intimate contact of the combustion gases with the material to be treated, whereby the gases give up their heat to the material very completely. In addition, loss of heat by radiation takes place to a very small extent only, because the operation of the furnace is very intense and also because by reason of the compact construction of the shaft the outer surfaces are relatively small. Nevertheless reverberatory furnaces present advantages which render them indispensable for many purposes, in spite of the fact that the heat is utilized far less efficiently, the efficiency, generally speaking being below 18% in metallurgical furnaces. Thus for example any fuel can be used in such furnaces, while in shaft furnaces only carbonized fuel such as coke, charcoal, anthracite and the like can be used in cases where high temperatures are necessary. Only such products of combustion are conducted into the hearth of the reverberatory furnace as according to requirements can be kept either oxidizing, neutral or slightly reducing according as the combustion takes place with an excess, without an excess, or with a deficiency of air. No such regulation is possible in shaft furnaces however. In order to obtain a high temperature in shaft furnaces a large quantity of fuel must be charged with the material to be smelted or heated,

the layer through which the incandescent products of combustion are conducted being thus rendered disproportionately high, the result being that incompletely consumed products are obtained. By this means an atmosphere with a reducing action is always produced in shaft furnaces the result being that it is not possible to treat in shaft furnaces materials which will not withstand a reducing atmosphere. Shaft furnaces present the further defect that it is impossible to treat materials in it which may become impure by contact with the fuel. All these defects inherent in shaft furnaces consequently arise from the fact that in them the material to be treated has to be charged with the fuel, while, on the other hand all the advantages of reverberatory furnaces are due to the fact that in them the fuel is charged and consumed separately from the material to be treated. It is therefore obvious that a shaft furnace in which the fuel is charged either wholly or partially separately from the material to be treated but in which the products of combustion are conducted through the layer of material, would combine all the advantages of a shaft furnace and of a reverberatory furnace without their defects. As with this combination complete combustion products can be obtained as desired the efficiency of such a furnace will be higher than with an ordinary shaft furnace.

It is the object of the present invention to provide a furnace which shall fulfil these requirements to the fullest extent and therefore effect a great improvement in the art.

Various constructional forms of the furnace are illustrated in the accompanying drawing.

In the drawing, Figure 1 is a vertical section of the furnace showing the shaft and the dividing wall therein. Fig. 2 is a similar view, disclosing a slight modification in the furnace structure. Fig. 3 is a vertical section through the furnace showing a still further modified form of the same.

As shown in Fig. 1 the shaft is divided by a wall *m* into the two shafts A and B; it will be obvious that instead of two single shafts the furnace might comprise a plurality of shafts arranged in pairs, each pair corresponding to the construction shown in Fig. 1. The shaft A is charged with the material to be smelted or heated while the shaft B is charged only with fuel, either with a flux for scorifying the ash, or with-

out a flux. The partition *m* does not extend right to the bottom so that a communicating passage *c* between the two shafts is left, and through this the combustion gases can pass from the shaft B into the shaft A. The combustion air (either cold or heated) is introduced into the shaft B through one or more openings *a*. The combustion gases from the shaft B pass either wholly or in part into the shaft A through layers of the material to be smelted or heated, whereby the exceedingly valuable main principle of the ordinary shaft furnace is retained. The combustion products are conducted downward in the shaft B and thus only pass through highly incandescent fuel and through the passage *c* reach the shaft A with the highest possible temperature obtainable having regard to the proportion between the supplied air and fuel. It is impossible with any existing furnace to produce such high temperatures as can be obtained in this shaft owing to the properties referred to above, as the conditions are not so favorable in any of the existing furnaces. When it is desired to exert a reducing action upon the material the shaft A is charged with some fuel in addition to the material to be treated. The principle characterized above can be modified in many ways for obtaining the operative conditions suited to each case, depending upon the properties of the material to be treated and upon the final product to be obtained.

k is the tap hole through which the molten material is tapped. If the slags are to be discharged continuously, an open breastwork can be provided in the furnace hearth so that the slags can flow continuously over the sill *L* (Fig. 2). Here also the material is discharged through the taphole *k*. If the material to be treated is not to be obtained in the molten condition, the lower part of the furnace hearth is provided with discharge apertures in accordance with Fig. 3 which, during the operation of the furnace are closed by means of doors *o*. The arrangement of the shafts for the material or the fuel is as shown in Fig. 3. It will be seen on reference to the drawing that communication between the two shafts takes place through apertures *p* formed in the partition *m* and through the elongated passage *r*.

When molten material is to be obtained it fills the lower part of the hearth up to the level *n* in Figs. 1 and 2 in such a manner that between the latter and the lower edge of the partition *m* a space remains through which the gases pass from B to A. By this means the molten metal is always

covered with a layer of slag upon which the fuel of the shaft B floats. In this manner the fuel is separated from the molten mass by a layer of slag. Under the influence of the solid incandescent coal this layer of slag will lose its last traces of metal which may accidentally have been brought from the shaft A.

The gases passing out of the shafts can be utilized for preliminarily heating the material to be treated, for dry distillation, for preliminarily heating or drying the fuel and also for heating the air as is very generally effected. If it be desired to reduce the loss of heat due to radiation the shafts or one of them can be provided with double walls throughout the whole or a part only of their height between which air is conducted and absorbs the radiated heat and is utilized in a preliminarily heated condition.

What I claim and desire to secure by Letters Patent of the United States is:—

1. In a furnace the combination of two chambers, one for the fuel and one for the material to be treated, a partition separating these chambers and extending down almost to the furnace hearth in such a manner that communication between these chambers is established at the lower end, means being provided for admitting cool or heated air to the fuel shaft at a point situated at a distance above the lower end of the said partition, and means provided at the top of the fuel shaft for discharging part of the gases therethrough, the other portions of which flow downward through the entire layer of fuel into the chamber containing the material to be treated.

2. A furnace comprising a fuel chamber, a chamber for the material to be treated, and a partition between said chambers extending down within a short distance of the hearth of the furnace in such a manner that communication is established between the said chambers at the lower end, the furnace having an inlet port provided in the fuel shaft wall and situated above the level of the lower end of the partition and through which heated or cold air may be admitted, the furnace further having openings provided at the top of the fuel shaft through which part of the gases may be discharged, and means for admitting air to the chamber containing the material to be treated.

In testimony whereof I affix my signature in presence of two witnesses.

JOSEPH SALESSKY.

Witnesses:

ALEXANDRE ROSENBLUM,
VICTOR SANALSTRÖM.