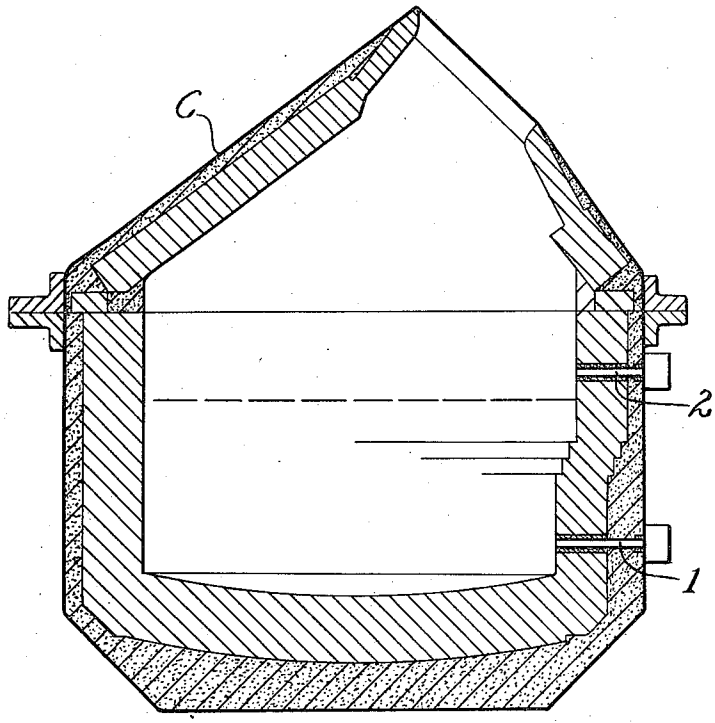
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PROCESS FOR MAKING IRON AND STEEL FROM SMELTER SLAGS

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PROCESS FOR MAKING IRON AND STEEL FROM SMELTER SLAGS.

Application filed August 15, 1921. Serial No. 492,341.

To all whom it may concern:

Be it known that I, CHARLES R. KUZELL, a citizen of the United States, residing at Clarkdale, in the county of Yavapai and State of Arizona, have invented certain new and useful Improvements in Processes for Making Iron and Steel from Smelter Slags, of which the following is a specification.

My invention has relation to improvements in processes for making iron and steel from smelter slags, and consists in the novel features more fully set forth in the specification and pointed out in the claims.

In the smelting of copper for making matte, the slag contains a large percentage of iron as oxide (i. e., wholly or partially combined with silica as silicate of iron) which, under the prevailing practice, is wasted. Now, it is the object of the present invention to recover this iron from the slag by reducing the oxide and converting the iron to cast or pig iron, although if desirable the process also contemplates the manufacture of steel from the recovered iron. The advantages of the invention will be better apparent from the following detailed description of the process, in connection with the drawing which represents a longitudinal section of a modified form of converter.

The smelter slag is introduced into a crucible, converter or equivalent vessel while still molten. We will assume that an ordinary copper converter is used, except that instead of a single row of tuyeres there are two rows, the one discharging below the surface of the bath when the converter is in blowing position, while the other will discharge above the bath.

After the molten slag has been introduced into the converter C, it is tilted back to blowing position and powdered coal, or powdered coal and flux (preferably powdered lime rock) are introduced by a current of air through the lower set of tuyeres 1 and into the bath. However, the amount of air that enters with the fuel, or the fuel and flux, is so regulated as not to be sufficient for complete combustion of the fuel. This, obviously must be the case, because the carbon in the fuel is brought into contact with the iron oxide to effect a reduction thereof. The number and size of the lower row of tuyeres 1 are limited to the capacity of air that is necessary to inject the powdered coal, or coal and flux, into the bath. However, it is important that the amount of air be kept as low as possible so that complete combustion of the fuel does not take place. As the iron oxide is reduced by the coal it will be replaced in the slag by the lime, and the basic constituent of the slag thus kept at a balance so as not to reduce the fluidity thereof. The metallic iron will drop to the bottom of the bath and may be removed after skimming off the slag. As the iron is gradually replaced by the lime there is a tendency for the slag to thicken, and an increased temperature is required to maintain the necessary fluidity to carry on the operation. For this purpose I provide a second row of tuyeres 2, above the first row and adapted to discharge air into the converter above the surface of the bath. This air supports the combustion of the volatile combustibles, such as CO, rising from the surface of the bath, during the reduction of the iron, and furnishes additional heat, which is transmitted to the bath by radiation and conduction. The bath is thus kept fluid so that the reduction may proceed practically to completion.

After the reduction has proceeded to the proper degree, the slag is skimmed off and the iron may be removed for cast iron or pig iron. However, if desired, the iron may be left in the converter or transferred to an ordinary steel converter and blown to produce steel, as well understood in the art.

While the coal and flux are preferably supplied to the bath through the lower row of tuyeres 1, I do not wish to be restricted to this method as, obviously it may be charged directly through the mouth of the converter, or otherwise. Then again if charged through the mouth of the converter the fuel and flux need not necessarily be powdered.

The use of the smelter slag while still molten as it comes from the smelter furnaces results in the saving of heat in the molten slag. A further economy results from the use of coal to bring about the reduction, since coal is cheaper than coke used in standard iron blast furnace practice. Then again the type of furnace in which the reduction takes place will permit the making of steel in the same furnace if desired.

In practicing the invention, the quantities

of the reagents, the manner of charging them into the bath and manipulation thereof will be determined largely by the skilled metallurgist in charge of the operation. The amount of fuel required may be reduced by preheating the air if desired.

Having described my invention, I claim:

1. The process of manufacturing iron from smelter slags which consists in subjecting a charge of molten slag to the action of a blast of air charged with powdered carbonaceous fuel directed into the bath of slag below the surface thereof, continuing the blowing operation with an excess of fuel in the presence of suitable fluxing material permeating the bath, and projecting above the bath a blast of a supporter of combustion.

2. The process of manufacturing iron from smelter slags which consists in introducing into the molten slag a reducing agent in the presence of a fluxing material, and projecting above the charge a blast of a supporter of combustion.

3. The process of manufacturing iron from smelter slags which consists in subjecting a charge of molten slag to a blast of air carrying powdered coal, introducing a suitable fluxing material into the charge, and projecting above the charge a blast of a supporter of combustion.

4. The process of manufacturing iron from smelter slags, which consists in charging the molten slag into a treatment vessel directly from the smelter furnace, introducing into the charge a reducing agent and a fluxing material, and projecting above the charge a blast of a supporter of combustion.

5. The process of manufacturing iron from smelter slags which consists in placing a charge of molten slag into a treatment vessel, introducing air and powdered coal into the charge in the presence of a fluxing material, the air being insufficient to complete the combustion of the coal while the coal reduces the iron in the charge, and introducing a supporter of combustion above the charge.

6. The process of manufacturing iron from smelter slags which consists in placing a charge of molten slag into a treatment vessel, introducing air and powdered coal into the charge to raise the temperature of the bath, the air being insufficient to complete the combustion of the coal which effects a reduction of the iron in the charge, introducing into the charge lime to replace the iron in the charge and to form a lime slag, directing into the treatment vessel above the charge a supporter of combustion for raising the temperature of the bath, and finally removing the iron.

In testimony whereof I hereunto affix my signature.

CHARLES R. KUZELL.