UNITED STATES PATENT OFFICE.

JAMES J. FRONHEISER, OF JOHNSTOWN, PENNSYLVANIA.

PROCESS OF PREPARING POWDERED OR GRANULATED ORES FOR FURNACES.

SPECIFICATION forming part of Letters Patent No. 287,117, dated October 23, 1883.

Application filed May 26, 1883. (Specimens.)

To all whom it may concern:

Be it known that I, JAMES J. FRONHEISER, of Johnstown, in the county of Cambria and State of Pennsylvania, have invented certain new and useful Improvements in the Process of Preparing Iron and Manganese Ores in a Powdered or Granular State for Use in Furnaces; and I 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 pertains to make and use it.

My invention relates to an improvement in the process of preparing powdered or granular ores, iron, and manganese for use in smelting-furnaces; and it consists in the process of forming masses or blocks of comminuted ore, lime, and furnace-slag, which consists in first mixing the ore, lime, and slag with water, then molding the said mixture into masses, and then strengthening said masses by treating them with a solution of silicate of soda, as will be more fully described hereinafter.

In most deposits of ore a certain quantity of the metallic portion is found very intimately mixed with gangue and foreign matter to such an extent as to render it unprofitable to transport, and often impossible to use, in its natural state. In the condition of lumps the ore cannot be mechanically concentrated; but after reducing the lumps of ore to a very fine powder the oxides of the metals can very easily be separated from the foreign matter by magnetic attraction, in consequence of the difference in their specific gravities, by means of jigging in water, subjecting to an air-blast, centrifugal force, or by any other means that may be preferred. The manner of separating the ore in a granular state from the extraneous matter forms no necessary part of this invention, and I do not, therefore, limit myself to any method of or means for performing this part of the process. After this fine ore has been obtained in any manner and from any source, I mix with it a certain quantity of ground blast-furnace cinder and lime. It is impossible to state the exact amount of the cinder and lime which is to be used with the ore, for these amounts will vary with the condition of the ore itself. Some ores will require nearly all cinder and but little lime, and others will require nearly all lime and but little cinder. The following analysis shows about the proportion of the elements contained in the blast-furnace cinder, though the elements may vary according to the ore, fuels, and limestone used: limestone and magnesia, fifty per cent.; silica, thirty-five per cent.; alumina, ten per cent.; soda and potash, one per cent.; oxide of iron, two per cent, and traces of sulphides and phosphates of these bases. In case the blast-furnace cinder does not contain the required amount of lime or alumina, I add fresh lime and aluminous clay or shale. I add enough burned lime to unite with the silica of the ore and form a cinder of the proper composition. The whole mass of cinder, lime, and ore is then moistened with water or other fluid, and, by means of the ordinary brick or fuel compressing-machines, pressed into masses of any desired shape or size. By simply exposing these pressed masses to the air and weather, or wetting them occasionally, they become in two or three days hard enough for use in any furnace. Should it be desired to make them still harder, the pressed masses, before they become perfectly dry, are immersed in a hot solution of soluble glass or silicate of soda. This solution of silicate of soda enters into chemical combination with the lime, magnesia, alumina, &c., of the mass and binds them together. The degree of hardness these lumps are to have will be governed by the strength of the solution of the silicate of soda and by the length of time the masses are allowed to remain in the solution. A solution containing ten per cent. of the dry silicate of soda will be found to be sufficiently strong for all ordinary ores.

I always use enough burned lime to satisfy all of the silica of the charge, which has the advantage of insuring the most perfect and desirable mixing possible, and thereby uniformly good metal, and makes the mixture, as it is used in this form, practically self-fluxing. When the ore does not contain over four per cent. of silica, which would require ten per cent. of lime, I add ten per cent. of blast-furnace cinder. I find that a mixture consisting of eighty to eighty-five per cent. of ore and twenty to fifteen per cent. of either blast-furnace cinder or lime to be all that is necessary. By preference equal quantities of lime and

blast-furnace cinder give the best binding proportions and work with the best result in the blast-furnace. The quantity of lime, cinder, and silicate of soda to be used will depend on the character and composition of the ore, fuel, and flux used, and on the grade or quality of the metal to be produced. If desired, the silicate of soda may be added to the wet mass before running it through the pressing-machine for the purpose of shaping it into blocks or masses.

I am aware that comminuted ore, in combination with cinders, lime, and carbon, has been heretofore molded into mases; also, that granulated washed mill-cinder, iron ore, coal-dust, and lime, and also comminuted iron ore and lime, have been treated in like manner. I am furthermore aware that it is not new to flux ores in the process of smelting, with lime and furnace slag or cinder. I am furthermore aware that to guard against the oxidation of iron sponge by coating it with clay or glassy slag is not new; nor is it new to coat ores with glass or silicious slag to prevent said ores, during the process of purifying, from destroying the silicious lining of the vessel used in the process. None of the above processes, therefore, do I broadly claim; but

What I do claim is—

The within-described process for forming masses or blocks of comminuted ore, lime, and furnace-slag, which consists in first mixing the comminuted ore, lime, and slag with water; second, molding said mixture into masses; and, third, strengthening said masses by treating them with a solution of silicate of soda, whereby a strong self-fluxing block is secured, for the purpose set forth.

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

JAMES J. FRONHEISER.

Witnesses:

CLIFFORD J. ELLIS,

D. J. JONES.