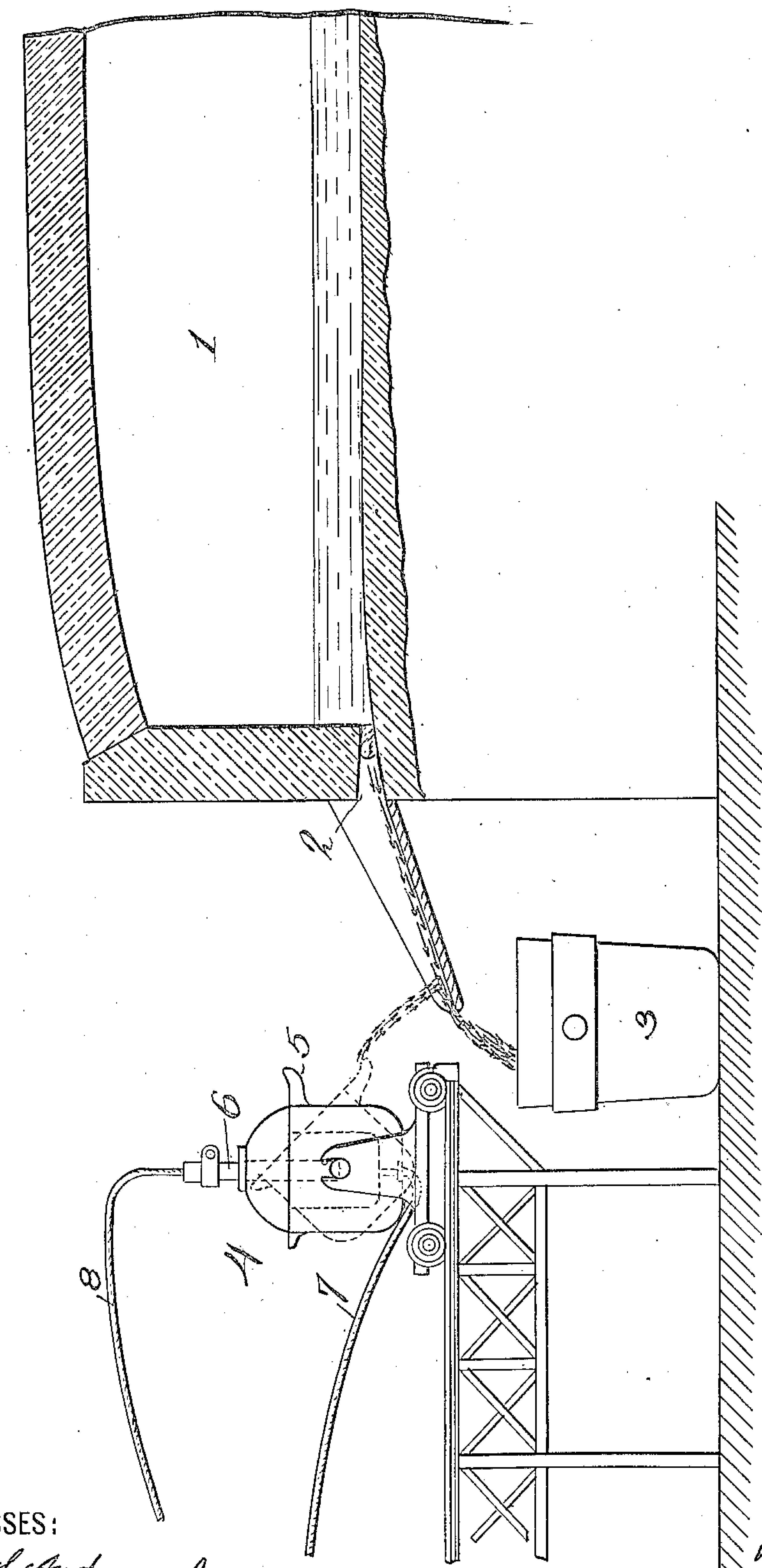
No. 813,278. PATENTED FEB. 20, 1906.

F. E. CANDA.

PROCESS OF COMBINING TITANIUM WITH OTHER METALS.

APPLICATION FILED JAN. 28, 1905.



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PROCESS OF COMBINING TITANIUM WITH OTHER METALS.

No. 813,278. Specification of Letters Patent. Patented Feb. 20, 1906.

Application filed January 23, 1905. Serial No. 243,020.

To all whom it may concern:

Be it known that I, FERDINAND E. CANDA, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented a new and useful Process of Combining Titanium with other Metals; 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 appertains to employ the same.

My invention relates to a process of combining titanium and titanium alloys with other metals, and particularly with iron and steel, and is particularly intended for the production of titanium steel.

It is well known that titanium even when present in small quantities has a remarkable effect upon iron and steel. When added to steel, it increases the hardness of the metal, produces a finer grain, and reduces porosity, besides imparting other valuable qualities to the metal. In the past, however, it has been found very difficult to introduce titanium into iron or steel under commercial conditions. I have found that when ferrotitanium containing twenty per cent. or more of titanium is introduced into molten steel it is not melted and does not combine appreciably with the steel, but remains substantially unchanged.

The object of my invention is to overcome the difficulties which have heretofore stood in the way of introducing titanium into iron or steel under commercial conditions and to cause the same to combine with iron or steel by a method which is easily carried out and is relatively inexpensive.

Ferrotitanium containing relatively high percentages of titanium while substantially infusible in any ordinary furnace, such as is used for melting iron or steel, may be fused in an electric furnace. According to my invention I provide in convenient proximity to the furnace in which the metal to be treated is melted an electric furnace suitable for the melting of the titanium-bearing material employed, (and which is usually ferrotitanium containing thirty per cent. or more of titanium,) and in this furnace I melt the titanium-bearing material and add it in a molten condition to the molten iron or steel. Inasmuch as a very thorough mixture of the titanium-bearing material and the molten iron or steel is desirable, I preferably unite the two while the molten iron or steel is being run from the furnace in which it was melted into the ladle or other receptacle customarily employed by causing the molten titanium-bearing material to flow into said ladle or receptacle at the same time and preferably in such manner that the streams of the two molten materials join, the flow of the molten titanium-bearing material being so regulated, by preference, that it takes nearly as long to run the required amount of such material into the ladle as is required to run the desired amount of iron or steel into said ladle. In this way a very thorough diffusion of the titanium throughout the mass of molten metal is obtained, and the titanium has the maximum opportunity for effective action; but it will be understood that when the steel is melted in crucibles or the like I may pour the proper amount of titanium-bearing material molten directly into the molten steel in the crucibles.

In the accompanying drawing I show diagrammatically an apparatus which I may employ for carrying out my said process on an industrial or commercial scale. In said drawing, 1 designates a furnace in which the steel is melted. This furnace is shown in section in the drawing. It may be of any suitable type, but customarily is an open-hearth furnace. 2 designates the spout of this furnace, and 3 the ladle or other receptacle customarily provided to receive the molten metal. In convenient proximity to the furnace 1 I provide an electric furnace 4 for melting the titanium-bearing material. In the particular form shown such furnace comprises a carbon crucible 5, forming one electrode, and a carbon rod or bar 6, adapted to be introduced into the said crucible and forming the other electrode, the crucible being arranged to tilt to discharge into the ladle 3; but the particular construction of the electric furnace employed is not material. Suitable current-leads 7 and 8 are provided. The electric furnace is arranged to discharge into the spout of the furnace 1.

In carrying out my process a quantity of ferrotitanium of known composition sufficient to introduce the desired amount of titanium into a ladleful of molten steel is melted within the electric furnace 4. In such a furnace the ferrotitanium may be melted with little or no waste, and because a material relatively rich in titanium may be melted the cost of the operation in proportion to the amount of metal to be treated is sight, only a small furnace and the expenditure of a comparatively small amount of electrical energy being required. When the furnace 1 is tapped, the molten ferrotitanium is poured into the ladle, with the molten steel, preferably in such manner that the streams join and preferably at such rate that the flow of ferrotitanium continues until the ladle is full—in other words the flow of titanium-bearing material being as nearly as may be proportional to the flow of molten metal. In this way a titanium steel of known and uniform composition may be produced. The steel thus produced is cast into ingots or other forms in the ordinary way.

do not limit myself to the use of an electric furnace for melting the titanium-bearing material, but prefer it because such a furnace is compact and relatively portable, is easily handled, and preserves the material melted within it in a condition of relative purity. The same method may be used in adding titanium to iron and to other metals.

Instead of using ferrotitanium I may use ores containing titanium, the process being the same. In such case the electirc furnace employed is preferably one which is tapped from the bottom, so as to permit the titanium bearing material to be drawn off free from slag and earthly impurities.

It is obvious that the process herein described is susceptible of many variations and modifications and that apparatus other than that illustrated herein may be used in carrying it out. I do not limit myself to the particular details of the process herein described or to any particular apparatus for carrying out that process

What I claim is—

1. The herein-described process of combining titanium with other metals, which consists in melting separately titanium-bearing material and the metal to which the same is to be added, and then uniting the two molten substances.

2. The herein-described process of combining titanium with iron or steel, which consists in melting separately ferrotitanium and the iron or steel, and then uniting the two bodies of molten metal.

3. The herein-described process of combining titanium with iron or steel, which consists in melting a titanium-bearing material by the action of an electric current and then adding such molten material to a mass of separately-melted iron or steel.

4. The herein-described process of combining titanium with iron or steel, which consists in melting ferrotitanium by the action of an electric current and then adding such molten material to a mass of separately-melted iron or steel.

5. The herein-described process of combining titanium with iron or steel, which consists in melting separately the titanium-bearing material and the metal to which the same is to be added, and then pouring the molten substances simultaneously into a suitable receptacle.

6. The herein-described process of combining titanium with iron or steel, which consists in melting separately the titanium-bearing material and the metal to which the same is to be added, and then pouring the molten substances simultaneously into a suitable receptacle and causing the streams of the two molten substances to join.

In testimony whereof I have hereunto affixed my signature in the presence of two witnesses.

FERDINAND E. CANDA.

Witnesses:

ALPHONSE KLOH

H. M. MARBLE.