H. A. EVANS.

PROCESS OF MELTING PIG IRON AND STEEL.

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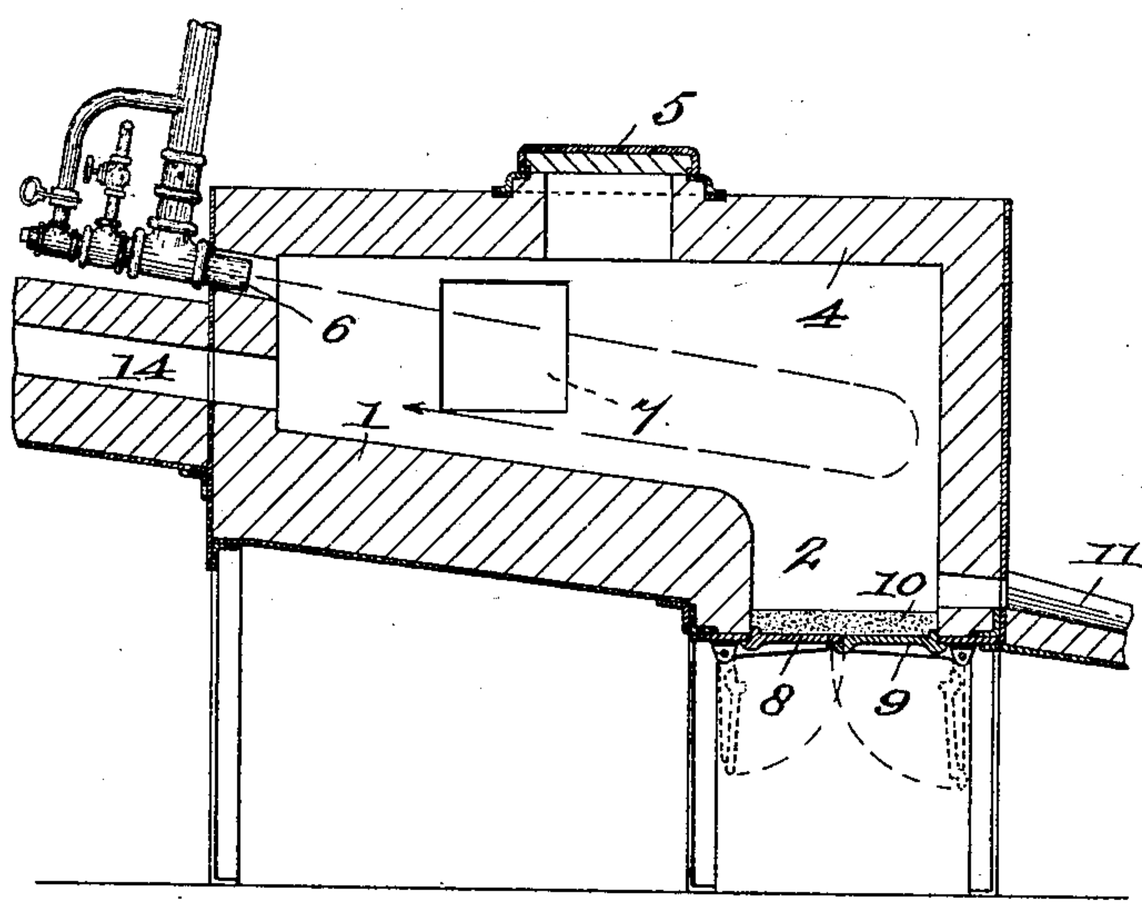

Fig. 1

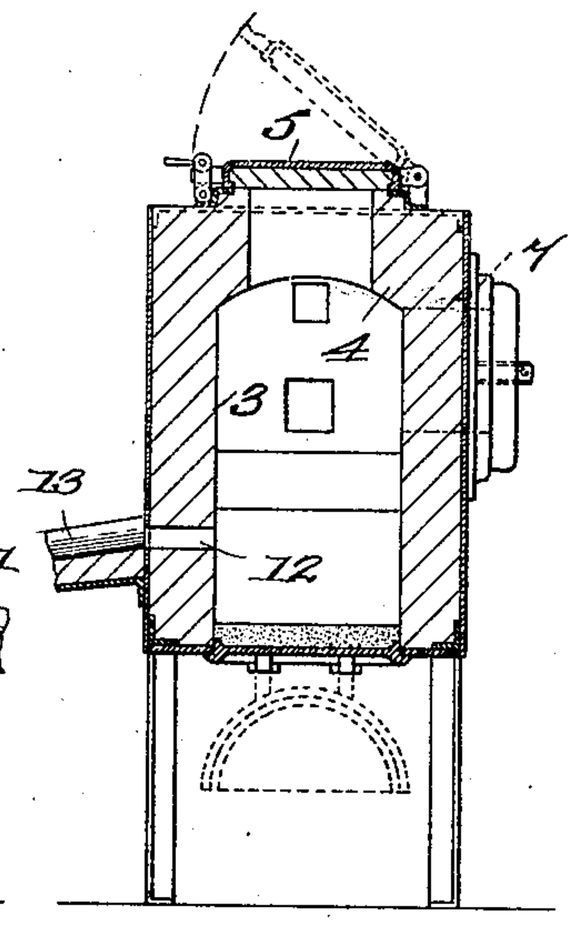

Fig. 2

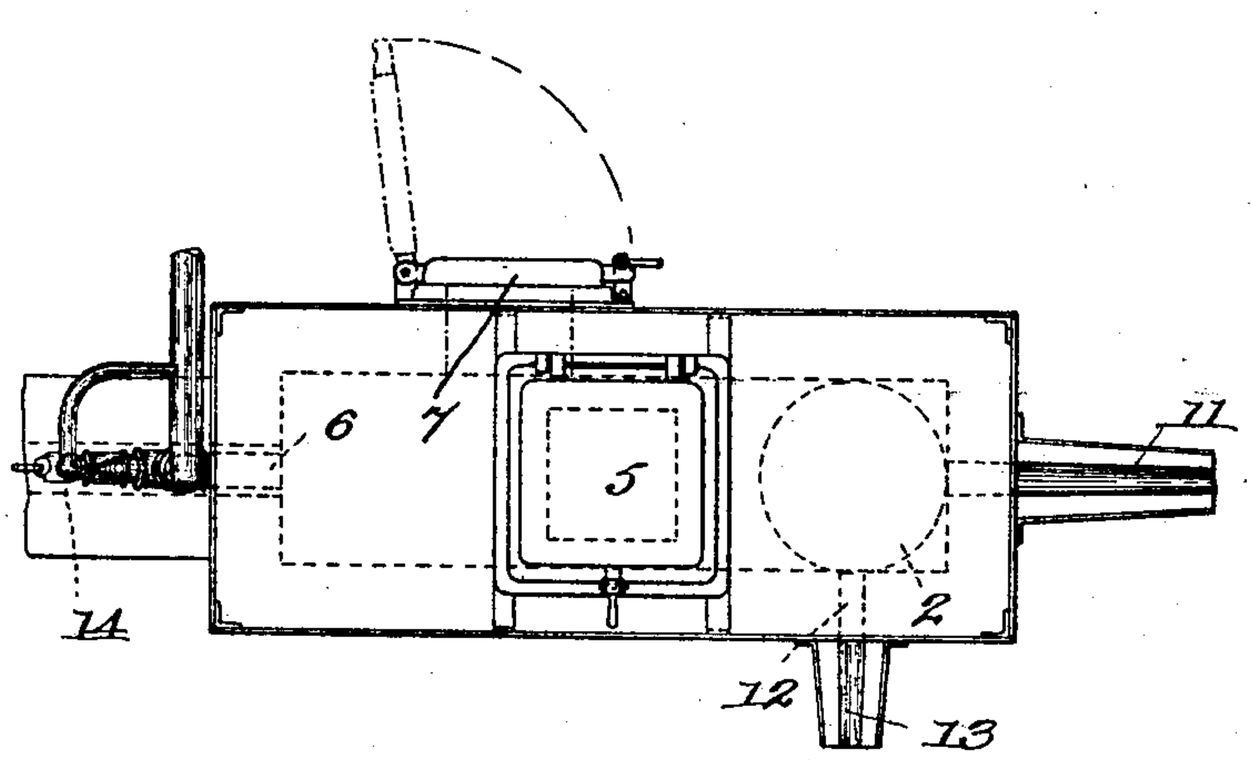

Fig. 3

Witnesses.

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PROCESS OF MELTING PIG-IRON AND STEEL.

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To all whom it may concern:

Be it known that I, HOLDEN ALLEN EVANS, naval constructor United States Navy, a citizen of the United States, residing at Mare Island, in the county of Solano and State of California, have invented certain new and useful Improvements in Porcesses of Melting Pig-Iron and Steel; 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 make and use the same.

My invention relates to improvements in a process for melting pig iron and steel with oil fuel, or gas; and the objects of my improvements are to melt pig iron or steel, or a combination of pig iron and steel in an oil or gas burning furnace without injuring the useful properties of these metals, including the prevention of the entrance of the sulfur contained in the fuel into said metals. These objects are attained by means of the furnace illustrated in the accompanying drawings and by means of the process described below.

It is recognized that there is a great advantage in being able to take off small heats of iron at short notices. And while there is no difficulty in readily and successfully melting zinc, copper, brass and other metals, in small oil fed furnaces and even of fusing iron; yet, so far as I am aware, no one has heretofore been able to successfully melt iron or steel for commercial purposes in such furnaces, for the reason since the temperature required is so high, that either a large percentage of the metal is burned up and destroyed in the operation, and the rest of it mixed with slag, or that the sulfur from the fuel enters the iron or steel to such an extent as to seriously impair its usefulness. Indeed, both of these fatal defects, have been encountered heretofore whenever small oil fed furnaces have been employed to melt small quantities of iron or steel for commercial purposes. In fact these most serious objections, at the present time, enforce the use of cupolas whenever molten iron or steel is required; and, of course, the use of these cupolas entails a delay until a sufficient charge of iron is at hand. It therefore often happens that these delays extend over periods of a week or longer, because there is not sufficient work on hand to warrant the charging of the cupola, although a small iron or steel casting is most urgently needed in the meantime.

One of the reasons for the failure heretofore of those oil burning furnaces which professed to melt iron or steel, has been due to the following facts:—The temperature required to melt the metal is so high, that when it is kept under the influence of such temperature, as it must be in all such furnaces, prior to mine, in order to keep said metal sufficiently fluid to enable it to be tapped, the metal partially burns up and mixes with slag. Then too, the flame has, heretofore, been allowed to come into contact with the metal in such a way as to permit any sulfur that may be in the fuel to enter the metal. By my process I am enabled with the same flame to melt the iron or steel at one temperature, to keep it in its fluid condition at a lower temperature, and at all times prevent the sulfur in the fuel from entering the iron, all as will appear more fully herein below.

Referring to the accompanying drawings forming a part of this specification, and in which like numerals represent like parts in all the views:—Figure 1, is a longitudinal section of the furnace. Fig. 2, is a transverse section of the furnace, and Fig. 3, is a plan view of the same.

The furnace consists of an inclined hearth 1; a collecting chamber 2, for the molten metal, and is provided with walls 3, including a top 4. The frame work is built of plates and angle irons or castings and is lined with fire resisting material to form the said walls.

There are one or more doors 5, in the top for entering, and for charging the furnace, and for the escape of smoke and gases when the burner or burners 6, are first lighted. A door 7, may or may not be fitted to the side, at the hearth, for charging the furnace with additional iron or steel when the heat is on in the furnace.

The bottom of the collecting chamber

consists of two folding doors 8 and 9, on which a sand or other silicious bed 10, is placed.

The collecting chamber 2, is fitted with a spout 11, for tapping off the molten metal, and with a slag hole 12, and a spout 13, for drawing off the slag.

The flue 14, from the furnace is led from the lower part of the furnace at the end of the hearth 1, as shown. At the same end above the flue is placed the burner, or burners 6. For a small size furnace one burner is sufficient, while for a larger furnace two or more burners are necessary, depending on the size. The burner or burners are inclined at a small angle below the horizontal.

The operation of the furnace is as follows: The folding doors 8 and 9, in the bottom of the collecting chamber 2, are closed and the bottom of the collecting chamber covered with sand or silicious material 10. The pig iron or steel, or a combination of the two, is placed on the hearth through either the side door 7, or top door 5; the burner, or burners, are lighted, the top door being open; this door is left open until the burner or burners are well lighted and the furnace well warmed up, and when this is accomplished the door is closed and the gases escape through the flue 14. When this is done the flame from the burner, or burners, is so adjusted by regulating the supply of blast and fuel that it strikes the end of the furnace farthest from the burner, just above the collecting well, and then returns along the hearth to the flue. The burner, or burners, are then further regulated to give a good combustion and the blast is made just sufficiently strong to draw out the flame to that length which will cause its hottest points to come in contact with the metal on the hearth 1, its oxidizing points to play above the same and its cooler parts to overlie the collecting well. This regulation is ascertained by observing in the well known manner the color of the flame through a small hole in the flue near the furnace, or it can be observed through a peep hole in the furnace itself. When the proper regulation is accomplished, the hottest part of the furnace is therefore the hearth end, while the end where the metal is collected is at much lower temperature; but, yet, it is sufficiently hot to keep the metal fused. The iron, or steel, on the hearth melts and immediately flows down the incline to the collecting end. Here, owing to the character of the flame at this point, the temperature is not sufficiently high to burn the metal or injure it in any way; but, at the same time, the temperature is found sufficiently high in practice to insure hot metal at all times. The tapping off hole is kept open until the metal begins to run out and then stopped until sufficient metal has collected to tap off. When the charge on the hearth has been reduced by melting, the furnace can be recharged with new metal either through the side door or the top door.

The air or other blast for the burner and for combustion may be supplied by a fan, a rotary blower, or by a compressor.

It should be observed that, if I used a straight flame instead of a reflected flame, not only would I be compelled to lengthen my hearth, but the iron or steel would so cool in running to the collector, over this extended hearth that an additional burner would be necessary to keep it fluid; and when this additional burner is supplied, the heat liberated would be so high as to cause the iron or steel to burn. By reflecting my flame back on itself, however, I am enabled to cause a relatively long flame to practically twice traverse a relatively short hearth, and thereby deliver more heat at the point needed than would be possible with a straight flame. Furthermore, by adjusting this flame as described above, I can bring its oxidizing and reducing points to any place desired, and thereby effectually prevent the sulfur of the oil from entering the metal. In fact, careful analyses taken after practical tests made over long periods, have shown, that in no case has the sulfur content of the metal increased, and in some cases the sulfur in the metal has actually decreased after being melted by my furnace. Experiments too have shown that unless the blast is just right, as stated above, my results will not be attained. That is to say, if too little blast is used, the hot part of the furnace is too near the collecting end, and the iron will be burned; and if too much blast is used, the furnace is cooled off by too much cold air, and also, the flame is drawn out too long, so that the maximum temperature is found in the flue and stack, which likewise results in burning up the iron and leaving only a mass of slag on the hearth. Again, if the furnace is too short with a given flame, the collecting end will be too hot, and the metal will be burned. If the furnace is too long the collecting end will be too cold and the metal will not run well. It is therefore evident that there is a useful dependence between the length of the furnace and the length of the flame, which is ascertained by observing the flame as above described, which I take advantage of and utilize in my invention.

Having now described my invention what I claim is:—

1. The process of melting iron, or steel, which consists in causing the hottest part of a flame to play on said metal, while its

oxidizing parts play above said metal, and in collecting the molten metal while causing the same to be maintained in its fluid condition by a cooler portion of said flame, substantially as described.

2. The process of melting iron, or steel, in an oil or gas fed furnace which consists in producing a suitable flame; regulating the same to cause its hottest part to play on the metal while its oxidizing part plays above the same; in collecting the molten metal; and in causing the cooler part of the flame to maintain the said metal in its molten condition, substantially as described.

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

HOLDEN ALLEN EVANS.

Witnesses:

C. M. RAY,

JOHN P. HATCH.