FREDERICK F. McINTOSH, OF GLEN OSBORN, PENNSYLVANIA.

METHOD OF PREVENTING OXIDATION OF MOLTEN METAL.

To all whom it may concern:

Be it known that I, FREDERICK F. McINTOSH, residing at Glen Osborn, in the county of Allegheny and State of Pennsylvania, a citizen of the United States, have invented or discovered a certain new and useful Improvement in Methods of Preventing Oxidation of Molten Metal, of which Improvement the following is a specification.

Various methods have heretofore been proposed for protecting molten metal from becoming oxidized by reason of its exposure to the atmosphere, which methods contemplate the formation of blankets of non-oxidizing gases upon or surrounding the otherwise exposed surfaces of the metal. The several substances that have been suggested for the formation of such blankets are gaseous at atmospheric temperatures and pressures, and accordingly their use involves the employment of conduits and mechanical expedients which largely militate against the commercial and practical expediency of the proposed methods.

The object of my invention is to provide a practical, effective and economical method for accomplishing the purpose contemplated by the above stated methods.

While unlimited to the protection of any specific metal or metals, my invention is particularly applicable to ferrous metals, such as plain and alloyed steel, cast iron, etc., the physical properties of which metals are well known to be prejudicially affected by the oxides, both metallic and non-metallic, which are mixed with the metal. Furthermore, my method, while useful for the protection of molten metal lying in a relatively quiescent state in a furnace or other container, is particularly suitable for the protection of metals while being poured from one receptacle to another, as from a furnace to a ladle, and from a ladle to a casting or ingot mold, and is herein described with reference to such particular use.

In the practice of my invention I protect the exposed surface of molten metal by forming adjacent thereto a blanket of vapor heavier than air, and which is generated from a substance that is liquid at atmospheric temperatures and pressures. The preferred substance is carbon tetrachlorid, a liquid which, under atmospheric pressure, boils at a temperature of about 170° F. and forms a non-oxidizing vapor having a specific gravity of more than four times that of air.

To protect molten metal while being poured, liquid carbon tetrachlorid is placed in a suitable container or containers arranged adjacent to the path of the stream of metal, and the heat of the metal being poured generates vapor which descends with the stream of metal. For example, to protect molten steel while being poured from an open hearth furnace into a ladle, containers supplied with a proper amount of liquid carbon tetrachlorid are placed over the furnace spout and upon the edge of the ladle just prior to the opening of the tapping hole. The heat of the spout and of the ladle will usually be sufficient to cause the bodies of liquid in the several containers to boil and form heavy vapors which settle down in the spout and fill the ladle. If the heat of the spout or ladle is not sufficient to effect the initial boiling of the liquid, additional heat may be supplied by dropping a small amount of hot metal or clay into the containers. The further generation of heavier vapors is effected by the heat of the flowing metal, which metal is, from the beginning to the end of the pour constantly protected by the descending heavy non-oxidizing vapor. At the end of the pour a vapor blanket remains on top of the metal and protects it in case it is not sufficiently protected by a slag blanket.

In pouring from a ladle to ingot or casting molds, containers of liquid tetrachlorid are arranged adjacent to the ladle spout and on the top of each mold, the generation of the protecting bodies of vapors being similar to that just explained with reference to the tapping of a furnace.

The manner of thus practising the invention is illustrated in the accompanying drawing which is a vertical central sectional view through a portion of an open hearth furnace, and through a ladle and ingot mold arranged successively below the spout of the furnace.

Containers 1 of carbon tetrachlorid are arranged on the upper edge of and below the spout 2 leading from the open hearth furnace 3, the carbon tetrachlorid vapor being indicated as descending around the stream of molten metal as it flows into the
ladle 4. On the edge of the ladle there are placed containers 5 from which protecting vapors descend into the ladle.

In pouring from the ladle into an ingot mold 6, the liquid carbon tetrachlorid may be placed in containers 7 suspended from the bottom of the ladle adjacent to the discharge orifice, and in containers 8 placed on top of the mold. The several containers may be provided with hinged covers held partially opened, as indicated, so that hot metal may not fall into them.

It will be observed of the method which I provide that it may be economically and practically employed, carbon tetrachlorid being a cheap commercial liquid product, the vapor of which may be generated at its point of use merely by placing the liquid in suitable containers adjacent to the path of the molten stream of metal and on the receiving receptacle. Furthermore, the method effectively accomplishes its desired purpose by reason of the non-oxidizing character of tetrachlorid vapor, its high specific gravity and because it is harmless to the metal being poured, to the surrounding apparatus and to the workmen.

I claim as my invention:

1. The method of preventing oxidation of molten metal while being poured from one receptacle to another, which consists in generating, by the heat of the metal being poured and from a substance which is liquid at atmospheric temperatures and pressures, a protecting blanket of non-oxidizing vapor which is heavier than air.

2. The method of preventing oxidation of molten metal while being poured from one receptacle to another, which consists in generating by the heat of the metal being poured a protecting blanket of carbon tetrachlorid vapor from a liquid body thereof.

3. The method of preventing oxidation of molten metal while being poured from one receptacle to another, which consists in generating in the path of the metal being poured a protecting blanket of carbon tetrachlorid vapor from a liquid body thereof.

4. The method of preventing surface oxidation of molten metal which consists in forming adjacent to an exposed surface of such metal a protecting blanket of carbon tetrachlorid from a liquid body thereof.

In testimony whereof I have hereunto set my hand.

FREDERICK F. McINTOSH.

Witnesses:

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