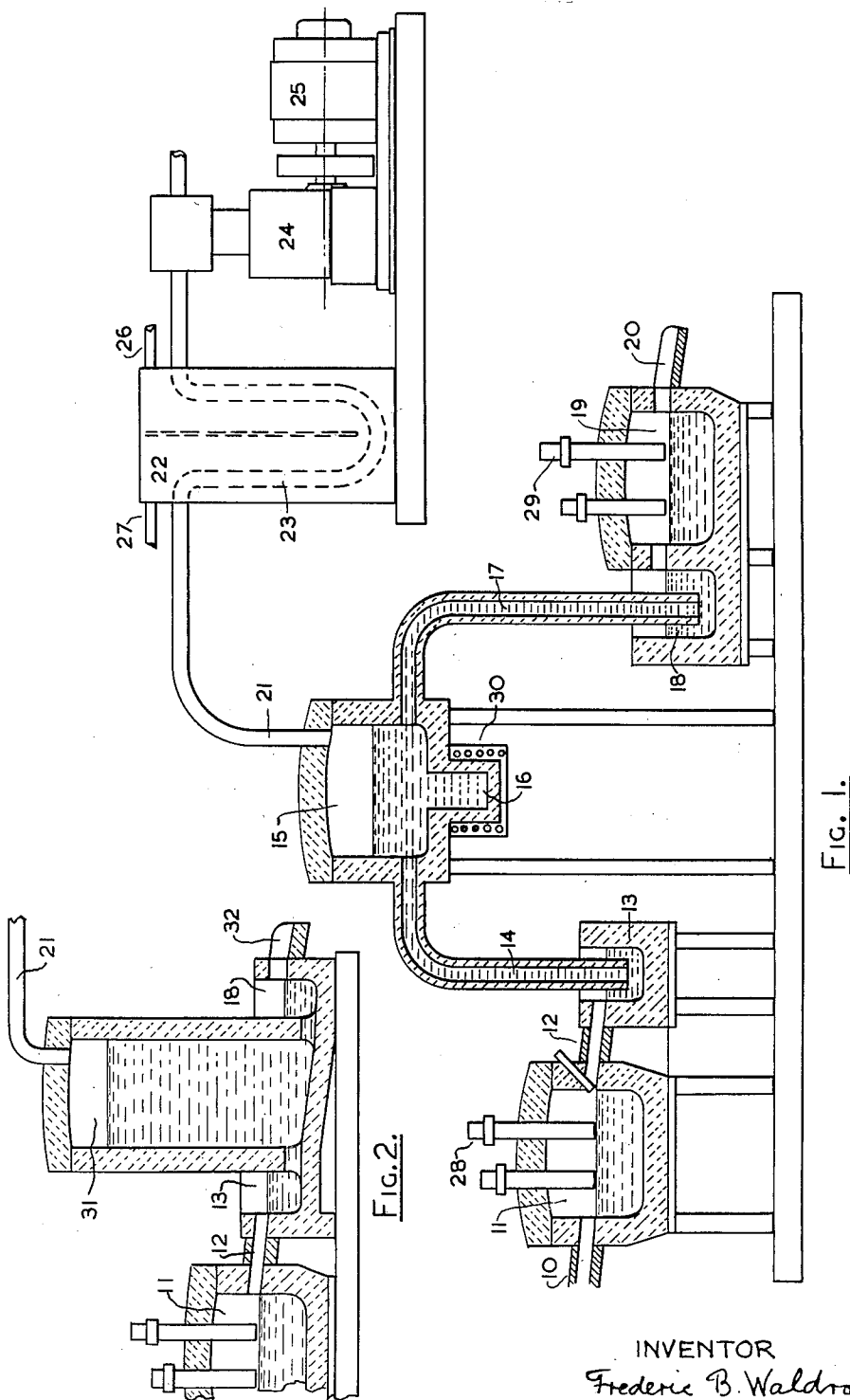


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MANUFACTURE OF STEEL
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UNITED STATES PATENT OFFICE

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MANUFACTURE OF STEEL

Frederic Barnes Waldron, Eccleston Park,
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2 Claims. (Cl. 75—49)

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This invention relates to improvements in the manufacture of steel and has for its object the extraction of the gases which are occluded, dissolved or capable of liberation from the steel while it is in the molten state.

Since this invention is applicable without change of essentials to the manufacture of all ferrous metals the word steel will be used to include iron, steel, high carbon steel or alloy steel.

Hitherto it has been proposed to take a separate batch or a separate furnace full of metal and place it in communication with a vacuum chamber from which the gases are drawn off and after this treatment the metal is run off intermittently in to moulds.

These vacuum chambers for use with continuously flowing metal have hitherto always taken the form of an inverted U channel and none proposed to use an open chamber of sufficient height to allow the molten metal to rise an appreciable height inside it.

Some of these proposals have included means for heating the vacuum chamber or the metal therein but the devices for doing this have been confined to electrical resistance heating or heating of the molten metal by channel type electric induction which requires an internal solid core contained in a refractory insulating casing.

According to this invention the steel is made by a continuous process such as is described in my British Patent No. 543,245 accepted 1942, and while it is flowing continuously in the molten state it is caused to pass through an enclosed gas tight chamber which is maintained at a pressure appreciably below that of the outside atmosphere.

A convenient method of carrying out the invention is shown in the accompanying drawing in which

Fig. 1 is a sectional elevation showing one way in which the plant may be arranged.

Fig. 2 is a sectional elevation showing an alternative arrangement of the plant.

Referring to Fig. 1 steel in an advanced state of refining flows continuously from a persistent source along channel 10 into furnace 11 which is shown with electrodes 28 for an electric refining process on the metal. The metal flows thence continuously along channel 12 into hearth 13.

Chamber 15 stands at a higher level than furnace 11. It is made gas tight and the gases in it are drawn off by a vacuum pump 24 driven by electric motor 25. The pipe 21 connects the hot chamber 15 to the pump and coils of it 23 pass through the cooler 22 and reduce the temperature of the gases until they can be safely taken by the

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pump. Water enters the cooler by pipe 26 and leaves by pipe 27.

The vacuum maintained in chamber 15 may be such as to keep the level of the metal in it at 4 to 5 feet higher than the level of the metal in hearth 13.

A pipe 14 lined with fireclay dips into the metal in hearth 13 and connects with the bottom of chamber 15 so that the metal will flow continuously from one to the other by virtue of the vacuum. Another similar pipe 17 on the opposite side and at the bottom of chamber 15 conducts the metal continuously down to hearth 18 in which the metal level is kept lower than that in hearth 13 by an amount chosen to ensure the required rate of flow through chamber 15.

Chamber 15 may be heated by coreless induction 30 from an alternating electric current and applied to a pocket 16 arranged below the main hearth of the chamber. The resultant agitation will assist in liberating the gases and a metallurgical process may also be included if desired.

The molten metal in hearth 18 having been degasified as described above may flow on continuously through chamber 19 in which it may flow quietly or be cooled or be heated by electrodes 29 for further refinement. It flows thence by channel 20 into moulds or it may flow continuously to a plant for forming it into commercial shapes. Such plant may be for tube making as described in my United States Patent No. 2,359,453.

Fig. 2 shows another convenient arrangement of the plant embodying the same principles as the plant shown in Fig. 1. Molten metal from a persistent source flows through furnace 11 along channel 12 into hearth 13 which connects with the bottom of chamber 31. This chamber is of sufficient height to allow the metal in it to rise 4 or 5 feet higher than the metal in hearth 13 and the space above this metal is maintained at a vacuum which will cause the metal to rise this amount. The pipe 21 connects through a cooler to a vacuum pump similar to that shown in Fig. 1.

An outlet at the bottom of chamber 31 connects to hearth 18 in which the metal is kept lower than that in hearth 13 by an amount chosen to ensure the required rate of flow through chamber 31.

The molten metal flows on continuously through channel 32.

Fig. 1 and Fig. 2 show only one upper degasifying chamber but the number of such chambers is not limited and a chamber of type 15 may be followed by a chamber of type 31 or they may be

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connected in the reverse direction and the later one or more may be used for cooling the molten metal after it has been degasified. The degasification chambers may be preceded or followed by any number of chambers of furnaces and in any of them the metal may be heated or cooled or may be subjected to any suitable metallurgical process.

The types of chambers and other plant are convenient ones as shown but any others may be used and any other type of heating and cooling may be adopted.

Having described my invention I declare that what I claim is:

1. A method of extracting gases that are occluded in molten steel which comprises continuously flowing such molten steel into the bottom of an enlarged chamber which is maintained under vacuum, continuously and unrestrictedly flowing the molten steel through said chamber while it rises therein to a substantial height due to the vacuum in said chamber whereby the occluded gases are separated from the steel and are withdrawn from said chamber by a gas extraction appliance and withdrawing the degasified steel from a point at the bottom of said chamber into a chamber at atmosphere pressure.

2. A method of extracting gases that are occluded in molten steel which comprises continuously flowing such molten steel into the bottom of an enlarged chamber which is maintained un-

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der vacuum and in which the steel is heated and agitated from below by coreless electric induction, continuously and unrestrictedly flowing the molten steel through said chamber while it rises therein to a substantial height due to the vacuum in said chamber whereby the occluded gases are separated from the steel and are withdrawn from said chamber by a gas extraction appliance and withdrawing the degasified steel from a point at the bottom of said chamber into a chamber at atmospheric pressure.

FREDERIC BARNES WALDRON.

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