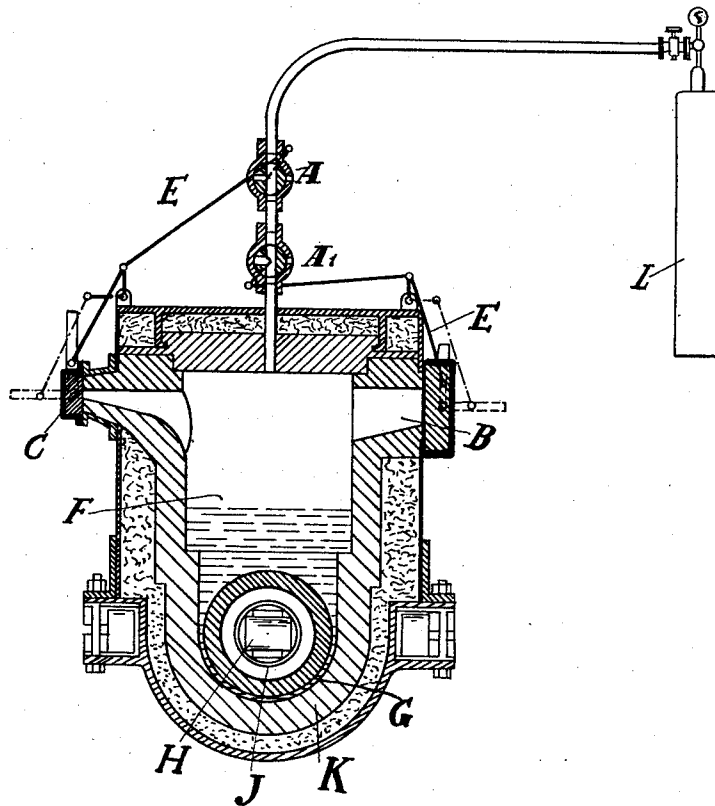


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T. METZGER
PROCESS FOR MELTING LIGHT METALS AND ALLOYS THEREOF IN
ELECTRICAL INDUCTION FURNACES
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Inventor
T. Metzger
By Mark & Clerk
attus

UNITED STATES PATENT OFFICE.

THOMAS METZGER, OF DUSSELDORF-GERRESHEIM, GERMANY.

PROCESS FOR MELTING LIGHT METALS AND ALLOYS THEREOF IN ELECTRICAL-INDUCTION FURNACES.

Application filed April 22, 1924. Serial No. 708,259.

To all whom it may concern:

Be it known that I, THOMAS METZGER, a citizen of Germany, residing at Dusseldorf-Gerresheim, Germany, Sonnbornstrasse 41, have invented certain new and useful Improvements in Processes for Melting Light Metals and Alloys Thereof in Electrical-Induction Furnaces, of which the following is a specification.

When melting metals by means of electricity for instance in induction furnaces having melting grooves or channels, the so-called Pinch-effect will occur in each case, according to the construction and the form and dimensions of the component parts of the furnace, especially of the melting grooves. The said phenomenon was partly utilized in certain types of furnaces for the purpose of agitating the metal bath, but in most instances such phenomenon was considered a rather undesirable disturbing of the current exciter and of the regularity in the movement of the material to be molten. Of late, endeavors were made in order to avoid the occurrence of such phenomenon as far as possible or otherwise to reduce its effect to such an extent, that the latter would cause no harm. Said Pinch effect consisting in the contraction of the mass through which the current passes, and which will even cause a total interruption of the bath of the mass to be molten, is the more powerful the higher the density of current in the material to be molten, and the lower the specific gravity of the said material. For that reason a certain relation between the level of the melting bath in the melting chambers filled with material and through which it will flow and the specific gravity of the mass must exist or must be effected in electrical melting furnaces, in which the bath and the melting groove connected horizontally or vertically or inclined with the bath forms the induced secondary circuit, that is to say, it is necessary to arrange the melting bath extending in the said type of furnace to the melting groove, at such a level, that the static pressure caused by the gravity of the mass will be sufficient for obtaining the desired success as regards the Pinch effect in the lower and narrower places, e. g. the most endangered points.

Said gravity and the cross-sectional load on the mass to be molten, which depends on the value of the specific gravity of the

latter, will cause an action adverse to the said Pinch effect, in so far as provision is made, as soon as the said Pinch effect commences to take action on the material, that is to say, as soon as an open space is formed or going to be formed, which does not contain any material, that such empty spaces formed or forming are filled up from above, so that to a certain degree the said Pinch effect is neutralized from the beginning. This purpose is attained to a sufficient degree at present with a series of furnaces having narrow melting grooves, for heavy metals, as for instance copper, brass and zinc, by giving the furnace such dimensions that it will show a handy and economical form and size.

If the same type of furnace is used for melting light metals, as for instance magnesium, or aluminium or alloys thereof in particular, electron and the like, it would be necessary to give the furnace and the melting groove in particular for the purpose of imparting to the molten light metal the required high static pressure by its own gravity, such a construction and height, that an economical working of the plant would no longer be possible, since the proportional value of the head or top weight in respect of the radiating surface would become too unsatisfactory and the useful effect of the furnace obtainable be reduced too far. Besides, the furnace would necessarily attain such vertical dimensions, that it would be difficult to attend and operate it, and in addition too large a space would be required for the erection of such furnace. Owing to the high conductivity of light metals, which with aluminium is $2\frac{1}{2}$ times as large as with brass, in a furnace constructed according to the same principles for brass melting only relatively small intensity of current and energy could be applied and consequently pretty long melting periods would be required, so that for the reasons stated working of such furnace would prove too uneconomical.

In order to provide equally favorable conditions in respect of the application of sufficiently high intensity of current, favorable dimensions as well as economy in operating the furnace according to the invention, such furnace must be of such construction that the melting process is accomplished, whilst the interior space of said

furnace is subjected to a moderate pressure of gas adapted to the properties of the light metals or alloys thereof, which are to be molten, the process being carried out by the use of a suitably selected neutral gas, which at the same time will delay oxidation of the heated mass.

It has been suggested to work electrical melting furnaces for zinc and alloys containing zinc in such a manner that during the melting step the furnace is subjected to a far higher gas pressure, but this suggestion was hardly ever reduced to practice. It is intended in this instance to raise the boiling point of the material considerably in order to prevent the formation of zinc vapors and their noxious consequences; thus a measure of entirely different purpose and result is concerned, as in the foregoing case. In the latter case for instance with aluminium, the interval between the melting point (625 degrees) and the boiling point (2300 degrees) is about 1700 degrees centigrade and the danger of the formation of metal vapors does not exist. Therefore not the employment of high pressures of gas (from 4 to 12 atmospheres) is concerned, but a moderate pressure figuring as a rule below one atmosphere. Whilst the former are handled with difficulty only in view of the construction of the furnace, especially as regards the former tightness of the jackets and closures, the process according to the present invention dealing with low pressures only, is easily to be carried out.

In order to reduce the furnace to equal dimensions and output and in order to be able to apply a sufficiently high density of current, it will do to subject the melting bath to about the pressure indicated, in order to overcome the Pinch effect simultaneously.

In the accompanying drawing an induction furnace having a melting groove, is illustrated by way of example, which is suitable for the process above described.

F is the melting chamber from which extends a vertical melting groove G, which is connected in known manner with the main hearth for the material to be molten. K is the refractory furnace lining in the interior, said furnace being closed at the top by means of a cover. The furnace is of the tilting type and possesses a tap hole C and at B the charging opening closed by a door.

H is the transformer iron and J the primary coil. The melting bath is shown by broken lines. The furnace is provided all round with a mantle or jacket, the connection points of which can be made gas-tight. Through the cover or any other suitable place of the melting chamber passes an inlet pipe for the neutral gas, which in the example illustrated is drawn from the steel flask L indicated diagrammatically, and which latter is provided with a manometer and reducing valves. At A and A¹ three way cocks are interposed which will effect the connection of the pressure-gas container with the furnace and which cocks can be set in such position, that the gas can leave the furnace chamber. As is shown diagrammatically the said cocks are positively connected at E with the connection doors. On moving the said doors an automatic locking will take place, so that the cocks A and A¹ respectively are closed and the pressure passes through A and A¹ into the open air, previous to opening the doors C or B. In a similar manner by means of a device brought into connection with the cocks and the rods E respectively the supply of current to the furnace can be interrupted, if or before A or A¹ is turned into blow-off position.

I claim:

1. A process for melting aluminum, magnesium like light metal and alloys thereof in induction furnaces, consisting in filling the interior of the furnace above the melt bath with neutral gas at such pressure that the pressure of the molten metal increased by the gas pressure results in a total pressure in the secondary circuit eliminating or reducing to a minimum the Pinch effect in the melt.

2. A process for melting aluminum, magnesium and like light metals and alloys thereof in induction furnaces, consisting in filling the interior of the furnace above the melt bath with gas at such pressure that the pressure of the molten metal increased by the gas pressure results in a total pressure in the secondary circuit eliminating or reducing to a minimum the Pinch effect in the melt.

In testimony whereof I have affixed my signature.

THOMAS METZGER.