

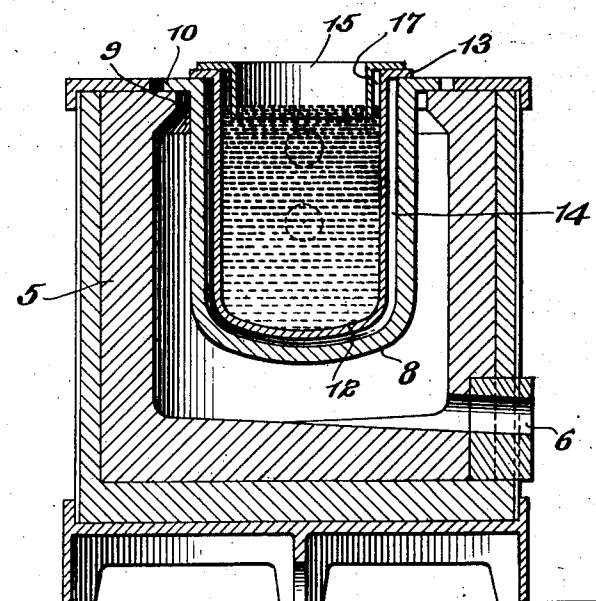
Feb. 16, 1926.

A. E. BELLIS ET AL

1,573,535

POT OR CRUCIBLE

Filed Oct. 18, 1920



Inventors
Arthur E. Bellis and
Charles S. Collins,
By their Attorney *C. P. Goepel*

UNITED STATES PATENT OFFICE.

ARTHUR E. BELLIS, OF SPRINGFIELD, MASSACHUSETTS, AND CHARLES S. COLLINS, OF NEW YORK, N. Y., ASSIGNORS, BY MESNE ASSIGNMENTS, TO THE BELLIS HEAT TREATING COMPANY, OF NEW HAVEN, CONNECTICUT, A CORPORATION OF CONNECTICUT.

POT OR CRUCIBLE.

Application filed October 18, 1920. Serial No. 417,785.

To all whom it may concern:

Be it known that we, ARTHUR E. BELLIS and CHARLES S. COLLINS, citizens of the United States, and residents of Springfield, in the State of Massachusetts, and borough of Bronx, city, county, and State of New York, respectively, have invented certain new and useful Improvements in Pots or Crucibles, of which the following is a specification.

This invention relates to pots or crucibles for use in the art of heat treating metals and more particularly to a pot or crucible adapted to contain a high temperature heat treating bath of salt solution, such for instance as is shown and described in the patent of Arthur E. Bellis, No. 1,358,816 granted November 16, 1920, or in the pending application of Charles S. Collins, Ser. No. 406,870, filed August 30, 1920.

In the art of heat treating metals through the medium of a salt bath solution, it is the present practice when treating high speed or alloy steels to use a graphite crucible for containing the salt bath components. All salts, as for instance chlorides, borates, carbonates, silicates, nitrates, etc., of sodium, barium, etc., which are liquid at 1,000 degrees F. in the presence of a combining element, invariably dissociate into a basic oxide and an acid gas. The basic oxide reacts with the acid constituents in the crucible wall, such as silicates, aluminates, etc., while the acid gas which also attacks the alloy metal being treated likewise combines with the carbides, silicides or basic components of the crucible structure. These reactions in the wall of the crucible, more or less violent, depending upon the proportions of acid and basic refractory agents therein, cause a distress in the wall structure so that graphitic or amorphous carbon is freed or released and enters the bath solution, where it may at times be seen floating on the top of the bath.

When the steel object to be treated is immersed into the bath it comes into contact with this carbon which gathers upon the surfaces of the steel. Therefore, when the bath solution is heated to the high temperature above referred to, a rapid combination of the carbon with the metal alloy occurs, thereby lowering the melting temperature

of the alloy steel being treated, which results in blisters appearing upon the surfaces of the metal.

In so far as we are aware the known methods or processes as now employed in this art, are wholly inadequate to overcome the serious objection above referred to. It is, therefore, the primary purpose and object of the present improvement to provide a pot or crucible which is of such physical construction that it is rendered substantially immune to distressing reactions with the chemical constituents of the bath resulting from the dissociation of the bath components, so that the presence of free carbon in the bath solution will be wholly obviated.

More particularly our invention comprehends a pot or crucible for use in the heat treatment of metals, preferably though not necessarily constructed of wrought iron or steel and containing in its physical structure a relatively low content of carbon, silica, alumina, or other binding agents either in the free or the combined form.

It is also a further object of our invention to provide a pot or crucible as above characterized which may be commercially produced at comparatively small cost, and used in connection with either of the crucible structures disclosed in our respective pending applications above identified.

With the above and other objects in view, the invention consists in the improved crucible having the novel structural characteristics which will be hereinafter more fully explained and subsequently incorporated in the subjoined claims.

Our invention may be better understood from reference to the accompanying drawing, wherein we have illustrated a crucible corresponding to the construction disclosed in the said application of Charles S. Collins and which represents a vertical sectional view through the pot or crucible structure. Referring in detail to this drawing, 5 designates a furnace which may be of any improved or conventional form and as herein illustrated may be provided with one or more openings such as indicated at 6, through which overflow or leakage may run off.

In the embodiment of the invention here shown the pot or crucible includes an

outer wall or shell 8 which may be constructed or moulded of a metal alloy, graphite or any other suitable refractory material, more or less resistant to the attacks of oxidizing atmospheres. This outer or body wall of the pot extends through an opening 9 in the top wall of the furnace and is provided upon its upper end with an inwardly projecting annular flange 10 to rest upon the furnace wall.

Within the body wall 8 the shell or lining 12 of wrought iron, steel or other metal alloy is arranged and preferably has a cross sectional contour conforming to the internal contour of the crucible wall 8. This shell or liner 12 which constitutes the pot proper is provided upon its upper end with an out-turned flange 13 to be seated upon the flange 9 of the wall 8 whereby the shell 12 is suspended within the body of the crucible. Preferably, the wall of the shell 12 is spaced from the wall 8 as indicated at 14, so as to afford ample room for the expansion of the shell both laterally and longitudinally in a downward direction.

Within the upper end of the shell 12 the sealing ring 15 is arranged and has its annular body wall spaced from the wall of said shell, said ring being provided on one end with an outwardly projecting annular flange to seat upon the flange 13 of the shell. This ring which extends below the surface of the bath solution produces an annular sealed dead air space 17 which prevents the entrance of exterior air into the shell 8 above the bath solution and thus obviates oxidization of the shell at its upper end.

As thus far described, we have merely disclosed one desirable embodiment of the invention which has given satisfactory results in practice, but it will be understood that the present improvement is not to be limited to any specific form of the crucible and a metal pot corresponding to the liner 12 may alone be used. Obviously, however, the life of such a pot would be relatively short due to external oxidization, and therefore we prefer to provide the external refractory protecting wall 8 as referred to in our respective pending applications.

Accordingly, our present invention is to be understood as residing in the provision of a pot or container for the salt bath solution of wrought iron, steel, or other metal alloy which contains in its physical structure preferably less than 2% of carbon and also preferably less than 2% of silicates or aluminates in either the free or combined state. We have found in the actual use of a pot or crucible having a structural composition of this nature that the salt bath solution may be heated to very high temperatures, say to 1800 degrees F. and above, without causing a distress in the wall structure of the pot.

This we believe to be due to the fact that such a pot structure is practically inert to the action of the oxides and acids present in the bath solution as a result of the dissociation of the bath components. This desirable attribute in the wall structure of the pot results from the fact that the wall structure does not contain silica, alumina or other binding agents in sufficient quantity to be disintegrated by chemical reactions as is the case when the attempt is made to use the ordinary graphite crucible for the high temperature treatment of metals. Such crucibles usually contain approximately 60% of silicates or aluminates.

In our present invention, however, these agents are not present in such quantity as would result in any appreciable reaction with the basic and acid components of the salt bath such as would be necessary in order to free or release the carbon from the pot wall. Thus by means of our invention it will be seen that in the treatment of high speed and alloy steels at high temperature the metal article at all times retains its high melting point so that there is no possibility of the surfaces of the object when immersed in the bath being blistered by the combination of carbon with the alloy metal. It will therefore be manifest that a final product of very high quality may be obtained.

From the foregoing description, it is believed that the nature of our present improvement and its several advantageous features in actual practice will be fully appreciated. As hereinbefore observed we do not deem ourselves to be limited in so far as this invention is concerned to a pot or crucible of any particular size, form or construction, or to any specific material, the only essential requisite in order to procure the desired result being that the material from which the pot or crucible is formed, whatever its composition may be, shall contain comparatively limited quantities of carbon and silica, alumina or other binding agents.

We claim:

1. A pot or crucible adapted to contain a heat transfer bath consisting of a solution of chemical salts neutral to the metal to be treated and dissociating at high temperatures into a basic oxide and an acid gas, said pot or crucible having a wall composed of mineral components, including minor quantities of carbon and basic impurities in such predetermined proportions relative to the other components thereof that said wall structure is essentially immune to chemical reaction with the basic oxide and acid gas emanations from the bath solution whereby said bath solution is maintained free from impurities and neutral to the surface of the metal being treated.

2. A pot or crucible for use in the heat

5 treatment of high speed tool steels adapted
to contain a heat transfer bath consisting
of a solution of chemical salts neutral to the
metal to be treated and dissociating at high
temperatures into a basic oxide and an acid
gas, the crucible wall being of substantially
uniform thickness throughout and formed
from a ferrous metal alloy, said wall struc-
10 ture having combined with the other phy-
sical components thereof relatively small
quantities of silicates, aluminates or other
basic impurities whereby said wall struc-
ture is rendered essentially immune to chem-
ical reaction with the basic oxide and acid
15 gas emanations from the bath solution and
said solution maintained free from impuri-
ties and neutral to the surface of the metal
being treated.

3. A pot or crucible for use in the heat
20 treatment of high speed tool steels adapted
to contain a heat transfer bath consisting

of a solution of chemical salts neutral to
the metal to be treated and dissociating at
high temperatures into a basic oxide and
an acid gas, said pot or crucible having a
25 wall structure formed from a ferrous metal
alloy and containing, in combination with
the other components, not more than two
percent each of carbon, silicates, aluminates,
or other basic impurities whereby said wall
30 structure is capable of withstanding a tem-
perature of 1800° F. or greater without re-
leasing impurities from said wall structure
into the bath solution and whereby said
solution is maintained neutral to the sur-
35 face of the metal being treated.

In testimony that we claim the foregoing
as our invention, we have signed our names
hereunder.

ARTHUR E. BELLIS.
CHARLES S. COLLINS.