T. VAN ALLER.

METAL MELTING POT.

APPLICATION FILED DEC. 4, 1919.

1,394,954. Patented Oct. 25, 1921.

Fig. 1.

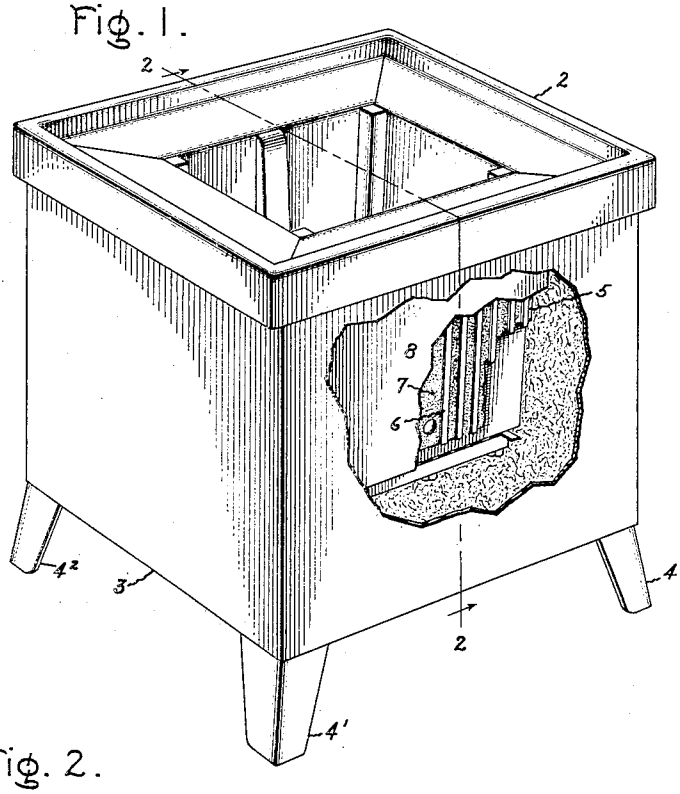


Fig. 2.

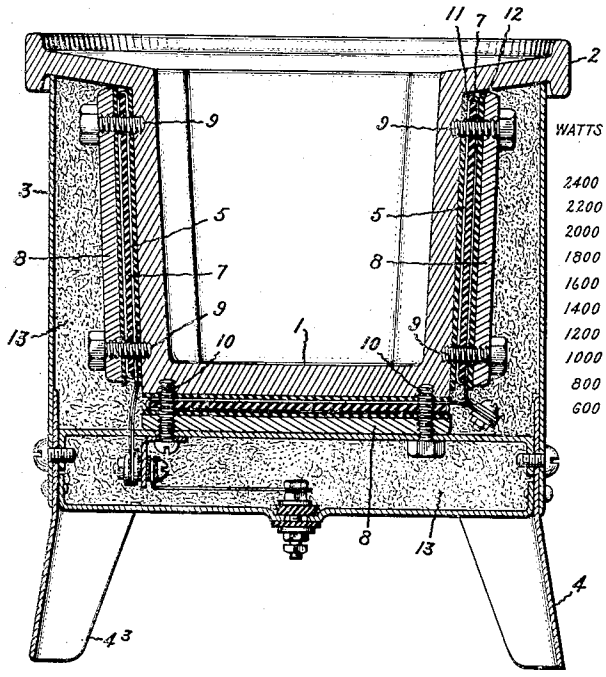
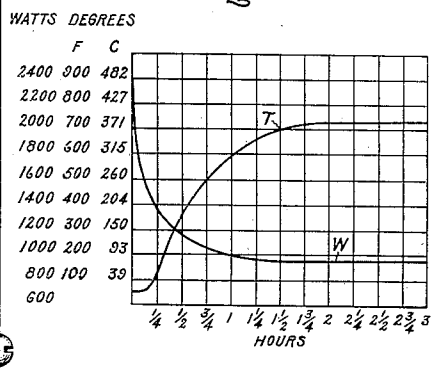


Fig. 3.



Inventor:
Tycho Van Aller,
by Albert G. Davis
His Attorney.

UNITED STATES PATENT OFFICE.

TYCHO VAN ALLER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

METAL-MELTING POT.

1,394,954. Specification of Letters Patent. Patented Oct. 25, 1921.

Application filed December 4, 1919. Serial No. 342,325.

To all whom it may concern:

Be it known that I, TYCHO VAN ALLER, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Metal-Melting Pots, of which the following is a specification.

My invention relates to electrically heated metal melting pots, and has for its object an improved type of pots in which the metal is automatically maintained at a constant fusing temperature.

In the use of melting pots for melting metals, such as tin and the like, the oxidation of the metal is an important factor. Where the metal is kept in molten condition for long periods the oxidation of the metal and its effect upon the container is a serious matter. This is particularly true in case the temperature of the molten metal becomes too high. In the case of tin, for instance, the amount of oxid which forms on the surface and must be thrown away is an important item. Furthermore, the oxid adheres to the vessel thereby reducing its capacity, and being non-conducting, prevents the transmission of heat. This incrustation is almost impossible to remove and in time the container becomes useless.

I have found that the amount of oxid can be very greatly reduced by continuously maintaining the proper temperature or approximately so. Tin and soldering metal should be at a temperature of from 350 to 400 degrees C. to be in the best condition for use. At these temperatures the rate of oxidation is very slow. The difficulty heretofore has been to maintain this temperature. Ordinarily, if left for a time with heat applied, the temperature will rise to a point at which oxidation is very rapid. On the other hand the heat applied must be sufficient to bring the metal to the proper temperature in a reasonable time and to return the metal to working temperature when cold metal is introduced. Various means automatically regulating the temperature have been proposed with varying degrees of success. They all involve, however, expensive apparatus and are complicated and liable to get out of order. I have found that by using a heating element made of nickel, I obtain a very satisfactory automatic regulation. Nickel, as is well known, has a positive temperature coefficient of resistance. Moreover at the temperature of from 350 to 400 degrees C. at which the molten metal is in its best working condition, the nickel does not oxidize. Furthermore, nickel is generally quite pure and, therefore, dependable, whereas a metal like iron is of a varying composition so that its characteristics cannot be depended upon. Nickel is very flexible and will not crack when subjected to severe bending. One of the most important points in its favor for use in metal melting pots is that at the temperature employed in melting pots the nickel has its greatest variation in resistance per degree of temperature. In order to take advantage of this quality of the nickel, however, it is necessary that the heat lag should be very small, that is, the heat should be transferred quickly from the heating units to the molten metal. With an arrangement of this sort heating units can be run at a higher current density, thereby bringing the metal to its proper temperature quickly because of the fact that its resistance is automatically varied so as to regulate the current. Furthermore, changes in voltage such as ordinarily occur do not have any material effect.

Another feature of my invention is that I place the heating unit in good thermal relation with the pot, so that the heat generated in the heating element may at all times be quickly transmitted to the molten metal, and any drop in the temperature of the molten metal may quickly affect the unit, thus decreasing its resistance and thereby automatically increasing the current input.

This automatic heat regulation also causes, in case the device is not being used, the current to drop to a point where the heat input equalizies the natural radiation loss thereby preventing the device from overheating and thus automatically prolonging the life of the pot and its contents. The heating unit is designed so that the heat input at working temperature equals the radiation loss. Since the current has been reduced automatically, only a small amount of heat need be radiated, and therefore a small radiating surface will be sufficient.

Further objects of my invention will appear from the following detailed description when taken in connection with the accom-

panying drawings in which Figure 1 is a perspective view of a metal melting pot with a part thereof broken away embodying my invention, Fig. 2 is a section taken on the line 2—2, of Fig. 1, and Fig. 3 is a diagram of curves of the temperature of the molten metal and the wattage.

Referring to the drawings, 1 is a receptacle for the material to be fused, which is made of any suitable material. This receptacle is provided with a flange 2 at its open end, which flange serves as a means of support in a casing 3. The casing 3 is preferably made of sheet metal and is provided with four legs 4, 4^1, 4^2, 4^3, which support the complete unit. The outer surfaces of the receptacle 1 are flat in order that a heating unit may be placed in close thermal relation therewith. In the preferred form, this receptacle is provided with four rectangular sides and a bottom as shown in the drawings. A heating unit 5 is placed in close thermal relation with each of said sides and bottom. These heating units are made of an element having a positive temperature coefficient, preferably nickel 6, which is wound around a flat piece of insulating material 7, preferably mica, or any other way known to the art, and such a unit is secured to each of said sides and bottom of the pot by means of a metal clamp 8 and screw bolts 9 and 10 respectively. The clamp 8 is made of a metal having the same temperature coefficient of expansion as the receptacle 1, and its object is to prevent the warping of the heating unit 5, and hold it in close thermal relation with the receptacle. It will be observed from Fig. 2 that the unit 5 is insulated from the sides of the receptacle by a strip of mica 11, or other suitable material and from the clamp 8 by a similar insulating member 12. The several units 5 are electrically connected in series to suitable terminals. The intervening space between the receptacle 1 and the casing 3 is filled with a suitable heat insulating refractory material, such as asbestos wool 13.

Having described the construction of a melting pot embodying my invention, its operation will be readily understood. When fusing metals, such as tin, soldering metal, and the like, it is desirable to quickly reduce the metal to a molten state and thereafter maintain it at some constant temperature, in the case of tin, soldering metals, and the like, at from 350 to 400 degrees C. Obviously, when more cold metal is placed in the receptacle 1, the temperature will be lowered, in which case the watts input must be increased to fuse the cold metal and then reduced to maintain the desired temperature of the molten metal. This regulation I accomplish automatically by using a heating element, having a positive temperature coefficient of resistance. It is of course understood that the resistance of such an element increases proportionately with increases in temperature, which correspondingly decreases the current. It is clear then that with a constant voltage, at some temperature the current will also be constant. As stated hereinbefore, in the case of tin, soldering metal and the like after reduced to the molten state the temperature should be maintained at from 350 to 400 degrees C. I have found that a heating element of nickel produces the desired result. For example, as shown by the curve W in Fig. 3, with an input of 2400 watts at 115 volts, at the end of an hour the watts have dropped to 1200, while the metal has been raised to approximately 300 degrees C as shown by curve T. At the end of one and a half hours, the watts have dropped to 1100, while the metal has been raised to approximately 375 degrees C, which is the proper working temperature. Thereafter the wattage and temperature of the metal remain practically constant due to the increased resistance of the nickel element. A slight variation in voltage will not affect the operation described.

It is also obvious that to maintain the molten metal at a constant temperature, the heat input must equal the radiation loss. As previously stated, this is taken care of by so designing the unit so that the input equals the radiation loss at the working temperature.

While I have described my invention as embodied in concrete form and as operating in a specific manner in accordance with the provisions of the patent statutes, it should be understood that I do not limit my invention thereto, since various modifications will suggest themselves to those skilled in the art without departing from the spirit of my invention, the scope of which is set forth in the annexed claims.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. An electrically heated melting pot, comprising a receptacle for the material to be fused and a heating unit in good thermal relation therewith, having such a positive temperature coefficient of resistance that a constant working temperature is maintained regardless of the working condition within the pot.

2. An electrically heated melting pot, comprising a receptacle for the material to be fused and a heating unit in good thermal relation therewith to rapidly raise said material to the working temperature, said unit having such a positive temperature coefficient of resistance that said working temperature will be constantly maintained.

3. An electrically heated melting pot, comprising a receptacle for the material to be fused and a heating unit in good thermal

relation therewith, having such a positive temperature coefficient of resistance that a constant working temperature is maintained regardless of the working condition within the pot, said heating unit being so designed that the heat input equals radiation losses at the working temperature of the metal.

4. An electrically heated melting pot, comprising a receptacle for the material to be fused, a heating unit in good thermal relation therewith having a nickel resistance element so designed that the heat input equals the radiation losses at the working temperature of the metal.

5. An electrically heated melting pot, comprising a receptacle for the material to be fused, a heating unit in good thermal relation therewith having a nickel resistance element whereby a constant working temperature is maintained regardless of the working condition within the pot.

In witness whereof, I have hereunto set my hand this 2nd day of December, 1919.

TYCHO VAN ALLER.