

J. H. ROBERTSON AND D. JANKOWER.
 TUNGSTEN CRUCIBLE AND METHOD OF MAKING AND USING SAME.
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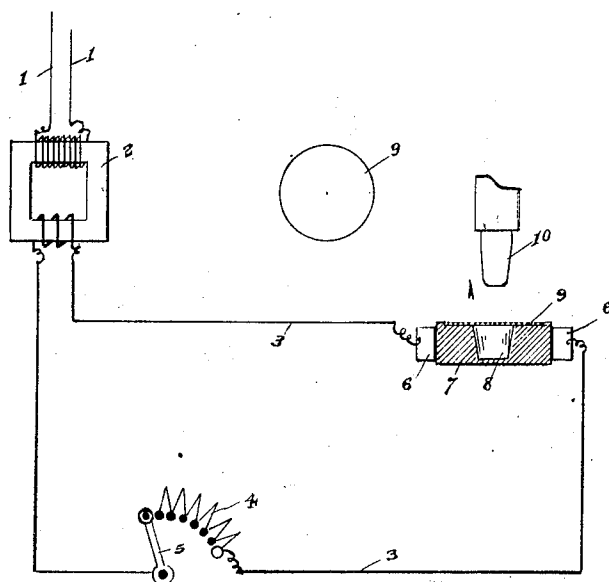


Fig. 1

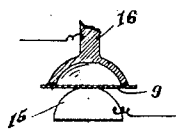


Fig. 3

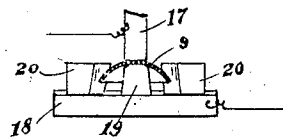


Fig. 4

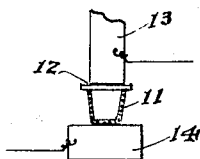


Fig. 2

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TUNGSTEN CRUCIBLE AND METHOD OF MAKING AND USING SAME.

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To all whom it may concern:

Be it known that we, JAMES HART ROBERTSON and DAVID JANKOWER, citizens of the United States, and residents of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Tungsten Crucibles and Methods of Making and Using Same, of which the following is a specification.

The objects of our invention are, first, to provide a crucible that will stand higher temperatures than those now in use; second, to provide a method of operation.

We attain these objects by the methods and apparatus illustrated in the accompanying diagrams, which are partially in cross section.

Figure 1, shows, in the secondary circuit of a transformer, a tungsten die, which is heated by reason of its resistance to the current, and an adjustable rheostat for regulating the amount of current passing through the said tungsten die; Fig. 2, shows a tungsten crucible placed between the electrodes of an electric circuit, of which it, the said tungsten crucible, forms a high resistance part; and Figs. 3 and 4, show modifications of Fig. 1.

In making small tungsten crucibles it has been found advisable to make them out of thin rolled sheet metal, and as tungsten is extremely hard and brittle when cold—and even at a low red heat—special means must be employed for its successful manipulation.

In explaining the present method of operation, attention is called to Fig. 1, in which numerals 1, 1, are line wires, connecting with the primary winding of transformer 2, the secondary winding of which is connected with circuit 3, 3, in which are placed a rheostat 4; switch 5; copper electrodes 6, 6; and a forming die 7, made from tungsten, or the combination of the same with a suitable alloy.

In the said die 7, there is an opening 8, in which the thin sheet tungsten disk 9 is pressed into crucible shape by means of the plunger 10, which is also of tungsten, being forced into the said opening 8, of die 7, over the said tungsten disk 9.

In starting operations, and before the tungsten disk 9, is placed in the depression on the surface of die 7, the plunger 10, is brought into the opening 8, of die 7; the switch 5, is then moved into contact with

rheostat 4, and enough current allowed to pass through die 7, and plunger 10, as will heat them to such a degree, that the disk 9, when laid in the depression on the surface of die 7—after the plunger 10, has been removed to its normal position—will be softened enough to be bent into shape by means of the said plunger 10, which is made so much smaller than the opening 8, in die 7 (plus the thickness of the tungsten disk 9,) that the crucible is formed by bending instead of drawing. After formation, the sides of the crucible, instead of being smooth and even, as in ordinary drawn metal, are irregular or corrugated, which difference however does not detract in any way from its efficiency.

The upper irregular edges of the crucible are ground level on a flat wheel, so that a cover of tungsten will fit evenly on the same and allow of the crucible being used as shown in Fig. 2, in which 11, is the tungsten crucible; 12, tungsten cover for same; 13, upper electrode, and 14, lower electrode. The crucible 11, rests on the electrode 14, of comparatively low resistance, and the upper electrode, 13, which may be tipped with carbon, presses the cover, 12, into contact with the upper edges of the crucible.

When an electric current—controlled by a rheostat—is passed between the electrodes, 13, and 14, and through the tungsten crucible 11, the high electrical resistance of the latter causes it to generate enough heat to fuse or melt its contents, providing of course, that the said contents are of a lower fusing point than that of the tungsten crucible itself, which is approximately about 5,000 degrees Fahrenheit.

If desired, and if the upper electrode, 13, in Fig. 2, is tipped with carbon, an arc can be formed between it and the tungsten cover 12, in which case the latter will serve as the lower electrode. The wearing away of the cover will be slight as compared to that of the carbon.

While the tungsten (or alloy of tungsten) crucible is preferably used as shown in Fig. 2, it can also be used to advantage in regular assay furnaces and will greatly outlast ordinary crucibles, whether of clay or graphite.

A modification of the method of forming tungsten crucibles, such as already described, is shown in Figs. 3, and 4.

In Fig. 3, the lower electrode, 15, of the bending apparatus is in the shape of a semi-sphere flattened at the top, on which the disk of tungsten, 9, is placed. The interior of the upper electrode, 16, is cup-shaped, its edges resting on the upper surface of disk 9, near its periphery and causing the said disk, 9, to form part of the circuit, so that when the current is turned on the heating effect is produced through the medium of the said tungsten disk, 9, itself, unlike the method shown in Fig. 1, where the said disk, 9, is heated indirectly by the die 7. The current passes from the upper electrode, 16, to the outer edges of disk, 9, and from the center of the said disk, 9, to the lower electrode, 15, which, as well as the upper one, 16, is made of low resistance metal. When the disk, 9, has attained the proposed temperature, the upper electrode, 16, is forced downward, thereby changing the originally flat disk, 9, into a cup shaped crucible which, in this form, may be used to advantage for many purposes. To give it more of an elongated crucible shape it can be squeezed into an upright form by means of the side dies, or electrodes shown in Fig. 4, in which 9, is the original tungsten disk pressed into cup form; 17, upper electrode; 18, conductive base; 19, core of insulation; and 20, 20, side dies for pressing the sides of the cup against the core 19. The cup is held against the top of core, 19, by means of the upper electrode 17, the current passing from the same to center of cup, 9, and through it to

side electrode die 20, 20. When the cup is heated to the proper degree it is squeezed by the side dies around the core, 19.

In our experiments we have found that tungsten is far superior to other materials now in use for crucible purposes, both as regards its lasting qualities and its having the property of withstanding extra high temperatures, which, combined with its semi-conductive nature, makes it particularly adaptable for placing in and forming part of an electric circuit, and serving as a container in which refractory substances may be melted or fused.

We claim:

1. As an article of manufacture, a crucible made from commercial tungsten such as herein shown and described.

2. In a crucible made from a disk of sheet tungsten; the method of making the same, consisting in placing the said disk of sheet tungsten in an electric circuit in which are included forming die-electrodes and a regulating rheostat; heating, by means of an electric current the said disk of sheet tungsten until it is in a pliable condition, and then bending the same into crucible form.

Signed at New York city, in the county of New York and State of New York, this 8th day of July, A. D. 1919.

JAMES HART ROBERTSON.
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Witnesses:

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