

Aug. 6, 1957

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2,801,839

CRUCIBLES FOR METAL MELTING

Filed Oct. 1, 1953

2 Sheets-Sheet 1

Fig. 1.

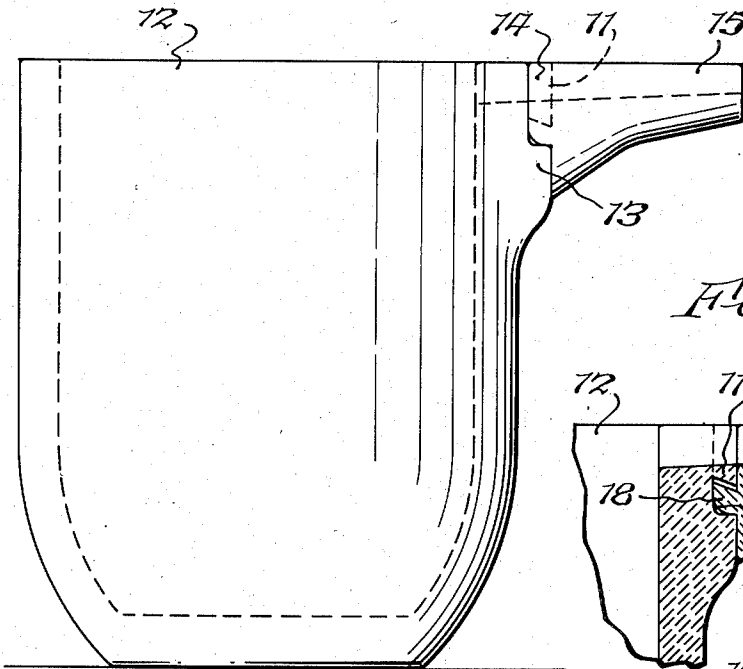


Fig. 4.

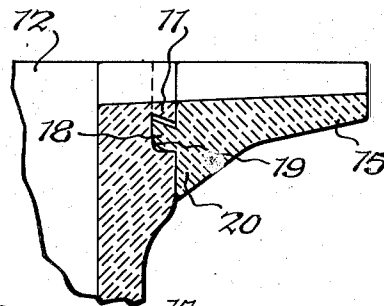


Fig. 2.

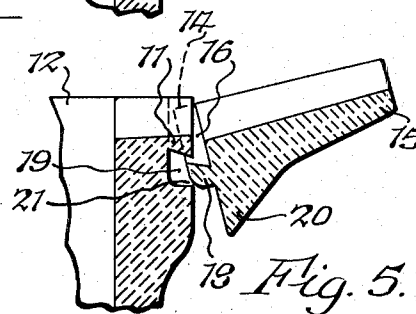
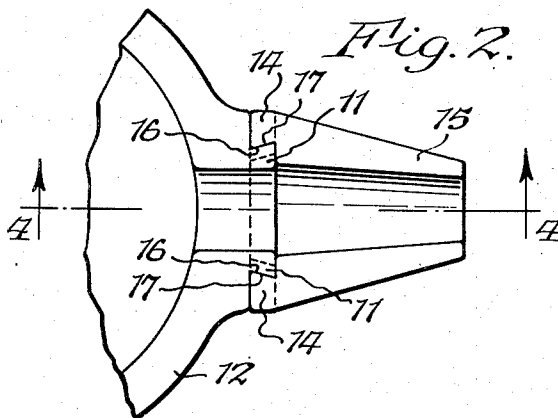


Fig. 5.

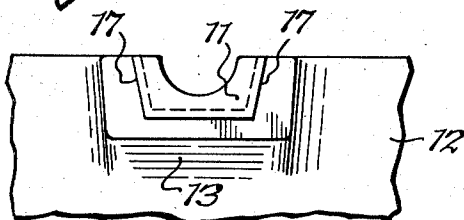


Fig. 3.

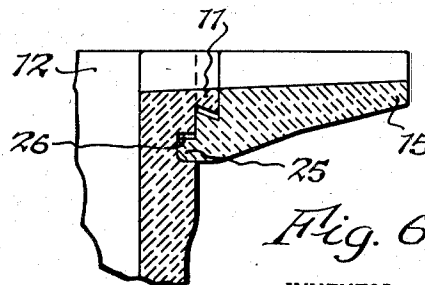


Fig. 6.

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Fig. 7.

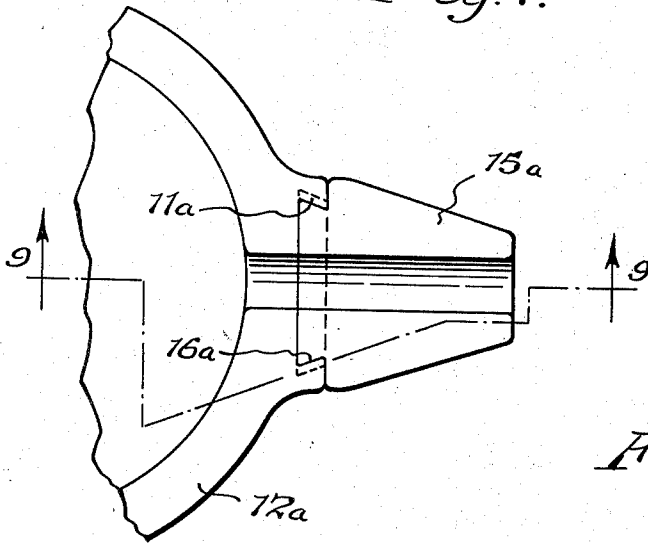


Fig. 8.

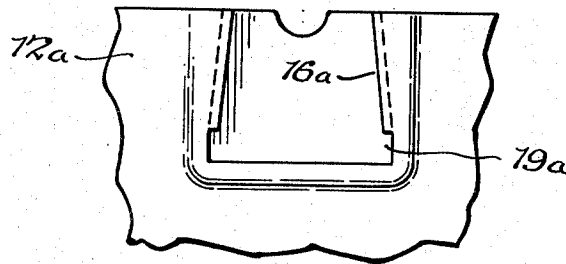
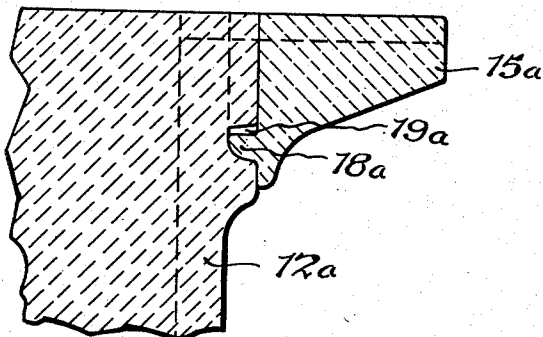


Fig. 9.



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CRUCIBLES FOR METAL MELTING

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Application October 1, 1953, Serial No. 383,651

6 Claims. (Cl. 263—48)

This invention relates to crucibles for melting or holding molten metals, which may be made either of the so-called clay graphite type of material or may be carbon bonded in accordance with Patents Nos. 1,356,939 and 1,458,726 to John L. Ohman. In recent years crucibles, particularly of the latter type, have been made in very large sizes and are permanently installed in tilting type furnaces where, after melting, the metal is poured out with the crucible still in position in the furnace. In order to accomplish this, it has become customary to equip each crucible with a long projecting pouring lip which extends through or over the wall of the combustion chamber.

Since it is impossible to form these long projecting lips at the same time that the crucible itself is formed by a spinning operation, the usual practice is to form the lip separately from the same material and to attach it by means of a suitable cement after both crucible and lip are otherwise finished. This is occasionally done at the plant of the crucible manufacturer but is more commonly done as the crucible is being installed in the customer's furnace.

The most common practice has been to cut away a portion of the crucible near its upper edge to form a square cornered flat faced area against which one end of the lip is forced into close contact along with a suitable amount of a plastic refractory cement. The crucible and lip are then carefully wedged into position in the customer's furnace and held rigidly in place while the cement is heat hardened. This has been a difficult operation which is frequently accompanied by trouble with the lip slipping out of proper position or the joint between the two opening up due to shifting of the relative positions of the crucible and lip.

Attempts have been made to overcome these difficulties by providing a dove-tailed groove whereby the lip can be pushed downward into position at the top of the crucible rather than being simply butt jointed. This has prevented slippage between the two but has formed a weak joint and requires extreme precision in placing the crucible with lip attached in respect to the combustion chamber if breakage is to be avoided. Leakage at the joint has been a common experience where it has been impossible to fully seat the lip when furnace dimensions have prevented placing it exactly in the desired position.

One of the objects of this invention is to provide a lip for a crucible which is constructed to interlock with the crucible in such a manner that the lip will be supported on the crucible without exterior supporting means for the lip during the period before the cement securing the lip to the crucible becomes hardened. A further object is to provide a crucible construction in which the lip may be arranged in different angular relations to the crucible to enable the crucible to accommodate itself to minor differences in combustion chambers. Further objects of this invention are to provide a crucible with a lip which can be easily secured in place by users of

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the crucible; which is economical in the use of cement, and which also reduces the danger of leakage of metal at the joint between the crucible and the lip.

In the accompanying drawings by way of example illustrating some embodiments of my invention:

Fig. 1 is a side elevation of a pot or crucible embodying my invention.

Fig. 2 is a fragmentary top plan view thereof.

Fig. 3 is a fragmentary front elevation of the crucible before the lip is secured thereon.

Fig. 4 is a sectional fragmentary elevation thereof on line 4—4, Fig. 2.

Fig. 5 is a similar view thereof showing the lip in position to be applied to the crucible.

Fig. 6 is a similar fragmentary view of a modified construction.

Fig. 7 is a fragmentary top plan view of a modified construction, in general comparable to Fig. 2.

Fig. 8 is a fragmentary front elevation of the crucible of Fig. 7 before the lip is secured thereon.

Fig. 9 is a sectional fragmentary elevation on the line 9—9 of Fig. 7.

In general the principle of my invention is that the lip and crucible are provided with integral interlocking parts such as a dove-tail connection between the crucible and the lip which are moved into interlocking positions while the lip is held at an inclined position with reference to the crucible. Then by swinging the outer end of lip downwardly and the other end upwardly, the parts are interlocked. A stop is provided to prevent downward and swinging movement of the lip relatively to the crucible. These interlocking parts are so positioned that when the lip has been swung to the extent permitted by these parts or by a combustion chamber, the lip will be held firmly in correct relation to the crucible. The adjoining surfaces of the crucible and lip are covered with a suitable cement, which is heated to solidify the cement and produce a tight leak-proof joint between the lip and the crucible and also to securely hold the lip on the crucible. The interlocking parts or projections on the lip and the crucible prevent sidewise displacement as well as downward displacement of the lip and consequently, eliminate the necessity for other means for correctly holding the lip on the crucible during heating of the cement.

In Figs. 1 to 5, I have shown one embodiment of this invention, in which 12 represents a crucible which is provided on the upper front edge thereof with an outwardly projecting boss 11 and a lower lip supporting projection or stop member 13. 15 represents the pouring lip which is to be secured to the crucible and which has an interlocking member 14 formed to interlock with the projecting boss 11 on the crucible. The interlocking projecting parts 11 and 14 of the crucible and lip may be formed in any suitable manner to interlock with each other, and in the construction shown, I have formed the projecting boss 11 of the crucible with undercut sides. For example, the boss 11 may be of dove-tail shape, as shown, and with the sides 17 thereof diverging upwardly and the bottom undercut or inclined upwardly toward the crucible. The projecting part 14 of the lip is provided with a dove-tailed recess 16 and terminates at its lower end in a transversely extending substantially horizontal cross member 18, the upper surface of which may have an inclination corresponding to that of the bottom of the projecting boss 11. A space 19 is provided between the upper and lower projecting parts 11 and 13 of the crucible into which the substantially horizontal stop member 18 of the lip may enter. The lip in the construction shown in Figs. 1 to 5 is also provided with a downwardly extending projecting portion 20 which is

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formed to fit against an upright surface of the lower supporting projection 13. It will thus be obvious that the boss 11 is formed to fit tightly into the recess 16 of the lip when the lip is moved upwardly relatively to the crucible, and by swinging the lip from the position shown in Fig. 5 to that in Fig. 4, the boss 11 moves into the recess 16 for tightly seating therein and the cross member or stop swings into the recess 19, to hold the lip in its interlocking engagement with the crucible. While I have shown the boss 11 on the crucible and the recess 16 on the lip, it is obvious that the boss may be formed on the lip and the recess on the crucible.

Such an alternative construction is shown in Figs. 7, 8 and 9 where the boss 11a is on the lip 15a and the recess 16a within the wall of the crucible 12a. Horizontal cross member 18a on the lip fits into space 19a of the crucible to form a stop to hold the lip from slipping downward.

The entire assemblage is very similar to that of Figs. 2, 3 and 4 except that the boss is on the crucible and the recess on the lip, as a result of which the taper of the lateral members must be inward rather than outward at the top so that the wedging action tightens as the inner end of the lip is raised upward.

It is desirable that the fit of the boss 11 in the recess 16 becomes increasingly tighter as the inner end of the lip in which the groove is formed is raised, so as to hold the lip tightly against the crucible. For this purpose, the lower edge of the stop member 18 is preferably rounded or beveled as shown at 21 so as to permit this upward movement of the inner end of the lip.

In applying the lip 15 to the crucible 12, suitable ceramic cement in plastic form is applied to the portions of the crucible and the lip which are to be joined together. The lip is then initially positioned approximately as illustrated in Fig. 5, at an inclination to the crucible with the lip positioned so that the dove-tailed projection 11 of the crucible enters into the dove-tailed recess 16 of the lip. The lip is then swung so that the dove-tailed recess of the lip swings upwardly to engage the dove-tailed projection on the crucible, and the outer end of the lip is swung downwardly about its connection with the crucible, until the inclination of the lip is greatly reduced. The parts will then occupy the positions shown in Fig. 4, whereupon the projection 18 of the lip rests on the projection 13 of the crucible. The lip will thus be supported on the crucible in its intended position. Additional cement may then be worked into any openings in the joint, preferably by using the operator's fingers. The crucible with the attached lip is then gradually warmed up and finally fired to full operating temperature to vitrify the cement.

While it is not a part of the present invention, a suitable cement may be made by mixing together 80 parts by weight of 40 and finer mesh SiC; 5 parts of flake graphite; 15 parts of a plastic fireclay; 2 parts of borax and 2 parts of dextrine. This should be mixed with water to a plastic condition and then buttered onto the parts to be joined.

An alternative form of my invention is shown in Fig. 6, in which the downwardly extending part 20 of the lip is replaced by a laterally extending tongue 25 which is formed to enter into a groove or recess 26 formed in the side of the crucible. This projection and recess together serve to prevent the lip from shifting downwardly from the lip when assembled on the crucible.

In the use of the construction described, it will be noted that in all cases, it is desirable that the end of the lip adjoining the crucible should first be placed into engaging position while the outer end of the lip tilts upwardly and the lip thereafter swung about a horizontal axis to move the outer end of the lip downwardly and the inner end upwardly. The lip is then allowed to settle downwardly into contact with a supporting member on the crucible

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which restricts further swinging of the lip. The lip is then held on the crucible by its own weight.

I find that a lip made and attached in accordance with my invention forms an extremely strong integral part of the crucible such that, if need be, after firing the assembly, one side of the crucible can be lifted from the floor by the lip without breaking it off, due to the wedging of the projection 11 in the recess. Also the angle between the lip and the crucible can be varied by several degrees by tilting the lip upwardly, if need be, to accommodate the lip to the combustion chamber before firing, without interfering with the self-supporting character of the lip. If under these circumstances, the projection 20 of the lip does not contact with the side of the crucible, or if the projection 25 does not fully enter the recess 26, cement may be employed to fill the spaces thus formed.

If the crucible fits the combustion chamber in such manner that the crucible rests partly on the lip, it will be obvious that upward pressure on the lip will tend to force the parts of the dove-tail connection into tight engagement, thus assuring a good joint. Furthermore, the upwardly and inwardly inclined upper face of the projection 18 will be forced into engagement with the correspondingly inclined lower face of the boss 11, which will further urge the parts of the dove-tail joint into tightly fitting engagement, thus preventing leakage between the crucible and the lip.

It will be understood that various changes in the details, materials, and arrangements of parts which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention, as expressed in the appended claims.

I claim as my invention:

1. An interlocking joint between a crucible part and a lip part, one of said parts having a projection with laterally outwardly extending dovetail portions, and the other part having a recess which is undercut to receive said portions, and a pair of cooperating stops on said crucible and lip positioned crosswise of such portions for preventing downward movement of said lip relatively to the crucible.

2. An interlocking joint between a crucible part and a lip part, one of said parts having a dove-tailed projection and the other part having a dove-tailed recess, said projection being formed to fit snugly into said recess, the side walls of said projection and of said recess being angularly disposed both laterally and radially of the crucible to form a wedging connection when the inner end of said lip is moved upwardly, and a pair of cooperating stops on said crucible and lip for preventing downward movement of said lip relatively to the crucible.

3. An interlocking joint between a crucible and a lip therefor, including a projection on said crucible having undercut side walls, said lip having a recess also provided with undercut side walls and between which said projection of said crucible may enter, said side walls of said projection and recess being inclined relatively to each other both laterally and radially of the crucible to limit the extent to which said projection may move upwardly within said recess and to provide an increasingly tighter fit of said projection in said recess as said lip is moved upwardly, and cooperating stops on said crucible and said lip crosswise of said projection and recess which are movable into engagement when said projection is seated in said recess, to prevent downward movement of said lip relatively to said crucible, said side walls preventing lateral movement of said lip relatively to said crucible and said stops limiting the downward movement of said lip relatively to said crucible.

4. An interlocking joint between a crucible and a lip therefor, including a projection on said crucible having undercut side walls, said lip having a recess also provided with undercut side walls and between which said projection of said crucible may enter, said side walls of

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said projection and said recess limiting lateral, outward and upward movement of said lip relatively to said crucible, and stops on said crucible and said lip for limiting downward movement of said lip after said projection is seated in said recess, said side walls of said projection and said recess extending upwardly to permit said projection and recess to enter into tightly fitting relation with each other when said lip is slanted upwardly from said crucible and moved upwardly into engagement with said projection and said stops being positioned for engagement when the outer end of said lip is swung downwardly during upward movement of the inner end of said lip.

5. An interlocking joint between a crucible part and a lip part, one of said parts having a projection with laterally outwardly extending portions, and the other part having a recess which is undercut to receive said portions behind the undercut and hold them firmly against lateral displacement, a pair of cooperating stops on said crucible and lip crosswise of said portions for preventing downward movement of said lip relatively to the crucible, and a part on said lip extending downwardly below the stop on said lip and extending into engagement with a side wall of the crucible for bracing said lip.

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6. An interlocking joint between a crucible and a lip therefor, including a projection on said crucible having undercut side walls, and having a bottom wall which inclines upwardly toward said crucible, said lip having a recess provided with undercut side walls and between which said projection of said crucible may enter, said lip also having a bottom wall which slopes upwardly toward said crucible for engagement with the lower wall of said projection, said side walls of said projection and of said recess in said lip diverging laterally upwardly, and cooperating stop parts on said crucible and said lip for limiting downward movement of said lip after said projection is seated in said recess, said inclined bottom walls of said projection and said recess serving to urge said lip toward said crucible when upward pressure is applied to said lip.

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