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PROCESS FOR CASTING STRAPS ON
STORAGE BATTERY PLATE LUGS
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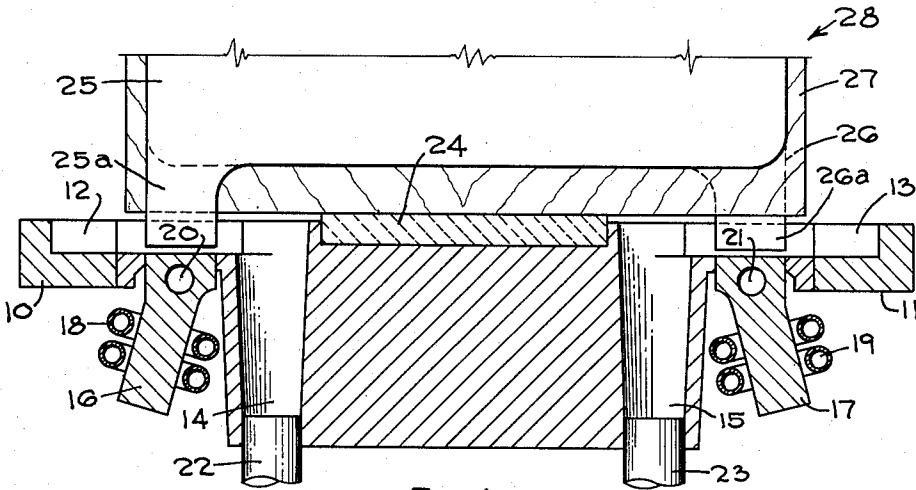


FIG. 1

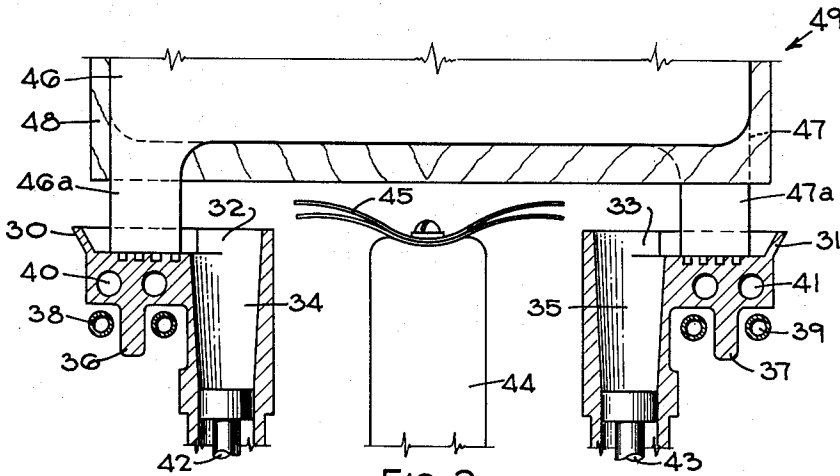


FIG. 2

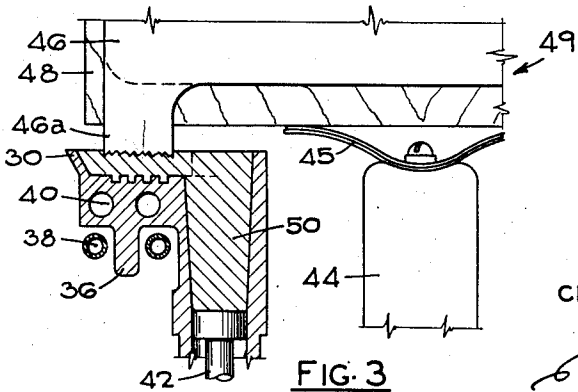


FIG. 3

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PROCESS FOR CASTING STRAPS ON
STORAGE BATTERY PLATE LUGS

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Application July 15, 1947, Serial No. 761,024

3 Claims. (Cl. 22—203)

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This invention relates to processes for casting straps on storage battery plate lugs.

This application is a continuation in part of my copending application Serial No. 569,387, filed December 22, 1944, now Patent No. 2,454,053, granted November 16, 1948, which in turn is a division of my copending application Serial No. 538,564, filed June 1, 1944, now Patent No. 2,454,051, granted November 16, 1948, both assigned to the assignee of the present application.

In these prior applications I describe and claim apparatus and processes for casting straps on plate lugs where lugs of inverted assembled elements are placed in molds, molten metal is poured into the molds to cast straps around the lugs, the mold floors are superheated to weld the lug tips to the straps, the castings are cooled, and the elements with straps cast thereon are ejected from the molds.

In a later copending application, Serial No. 708,672, filed November 8, 1946, also assigned to the same assignee, I describe and claim improvements in the apparatus wherein mechanism is provided for performing the operations listed in continuous and repeated cycles.

The process involved in casting and welding the straps to the lugs described in my later application is somewhat modified from that described in my earlier applications. For example, in the earlier applications I describe the element as supported during the strap casting operation on a fixed block on which the separators rest. I have since found in some instances it is preferable to support the element on the lug tips, which rest on the mold floors, in order to place the tips closer to the source of heat and to provide better compensation for unevenness in lug lengths. My later application, Serial No. 708,672, describes the process as including these modifications.

Reference may also be made to my application, Serial No. 568,797, filed December 19, 1944, now Patent No. 2,454,052, granted November 16, 1948, in which is claimed the improved battery element produced by the apparatus and process, and to my application, Serial No. 708,671, filed November 8, 1946, now Patent No. 2,496,991, granted February 7, 1950, in which is claimed the improved molds employed in the apparatus of application Serial No. 708,672. Both of these applications are also assigned to the assignee of the present application.

The principal object of the present invention is to provide improved processes for casting straps on plate lugs involving the steps enumerated in the appended claims.

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More particularly, the storage battery element is supported by its lug tips resting upon the floors of the molds. Molten strap metal at a temperature insufficient to melt the lugs is introduced into the mold cavities. The floors of the molds are rapidly heated to produce localized heating of the metal adjacent the lug tips to melt them and fuse them to the strap metal. Because of the melting of the lug tips, the element as a whole settles or moves downwardly until engagement with a stop or arresting means. Accordingly, there is compensation for unevenness since the ends of the longer lugs will first be melted and the action will be progressive until all lugs are of the same length. The heating is controlled so that the lug tips are fused to the strap metal while the lug roots are shrinkage gripped by, and upon cooling of, the strap metal.

The accomplishment of these and other objects of the present invention is explained hereinafter with reference to the accompanying drawing, wherein are shown preferred forms of apparatus for carrying out the processes of the present invention. In the drawing:

Figure 1 is a vertical sectional view of one form of apparatus which in modified form may be suitable for carrying out a process embodying the principles of the present invention;

Figure 2 is a vertical sectional view of a different form of apparatus also suitable for carrying out the process; and

Figure 3 is a vertical sectional view similar to Figure 3, but illustrating the parts at a different stage of the process.

Referring more in detail to the drawing:

In Figure 1 there is shown a strap casting apparatus that includes a pair of molds 10 and 11. Said molds have cavities 12 and 13 respectively and downwardly depending cavity extensions 14 and 15. Inserts 16 and 17 of heat conductive metal are fitted into the mold floors. Beneath the mold floors said inserts are surrounded by induction heating coils 18 and 19, which are connected to a suitable induction heating unit, not shown. Longitudinal ducts 20 and 21 are formed in the upper portions of said inserts and are connected to a suitable source of liquid coolant, not shown. Ejecting pins 22 and 23 are mounted for vertical movement in cavity extensions 14 and 15 and are connected to a suitable operating mechanism, not shown. A supporting platform 24 is mounted between molds 10 and 11. This apparatus is constructed as described in my application, Serial No. 538, 564, hereinbefore referred to.

In carrying out the process of the present invention using the apparatus of Figure 1, storage battery plates 25 of one polarity having plate lugs 25a, plates 26 of opposite polarity having plate lugs 26a, and separators 27 are assembled in their final relation to form an element 28 and clamped together. Prior to such assembly the lugs are cut to the same length as nearly as practicable, which is substantially their final length. The assembled element is inverted from its normal position, and lugs 25a and 26a placed in mold cavities 12 and 13 respectively. The element is supported by platform 24 on which the edges of the separators rest. Lugs 25a and 26a are directly over inserts 16 and 17 and spaced slightly thereabove. This relation is fully illustrated in Figure 1.

Molten metal to form integral straps and terminal posts, commonly an alloy of lead, is poured into the mold cavities surrounding the lugs. The straps are cast within cavities 12 and 13 and the posts within cavity extensions 14 and 15, the upper faces of ejecting pins 22 and 23 providing bottoms for said cavity extensions.

When the metal is poured, its temperature is insufficient to melt or soften the lugs. Either shortly before the metal is poured or shortly thereafter, heating coils 18 and 19 are energized. If before, the mold temperature must be such as to not melt the lugs. The heat from said coils is transmitted to the lug tips through inserts 16 and 17 and melts said tips and fuses them with the adjacent molten strap metal. The coils are deenergized before the remainder of the lugs outside of the tips have been fused. Coolant is passed through ducts 20 and 21 to solidify the castings. The strap castings contract on cooling and thus a shrinkage grip is provided between the straps and the lug roots in the areas above the autogenously fused lug tips.

The completed elements, with straps cast thereon, are ejected from the molds by raising ejecting pins 22 and 23. Gates formed at the sides of the straps may be trimmed as desired.

In Figures 2 and 3 there is shown a strap casting apparatus that includes an opposed pair of molds 30 and 31. Said molds have cavities 32 and 33 respectively and downwardly depending cavity extensions 34 and 35. Integral heat transfer members 36 and 37 depend from the undersides of the molds and induction heating coils 38 and 39 are suitably supported in proximity to said heat transfer members and connected to an induction heating unit not shown. Longitudinal ducts 40 and 41 are formed in the mold bodies beneath the floors and are connected to a suitable source of coolant not shown. Ejecting pins 42 and 43 are mounted for vertical movement in cavity extensions 34 and 35 and are connected to a suitable operating mechanism not shown. An element support 44 is fixed between molds 30 and 31 and includes means for carrying the weight of the elements as they settle following the fusing or welding operation. Such means preferably comprises resilient leaf springs 45, as shown, although in some instances fixed supporting means are satisfactory. The apparatus just described is as shown and described in my copending applications, Serial No. 708,671 and 708,672, hereinbefore referred to, and is claimed in said application, Serial No. 708,671.

In carrying out the process of the present invention using the apparatus illustrated in Figures 2 and 3, plates 46 of one polarity having plate lugs 46a, plates 47 of opposite polarity hav-

ing plate lugs 47a, and separators 48 are assembled and clamped together as before to form an element 49. Lugs 46a and 47a are cut to approximately equal lengths somewhat longer than their final lengths. The assembled element is inverted and lugs 46a and 47a placed in mold cavities 32 and 33 respectively. The element is supported on the mold floors, on which the lug tips rest and the separator edges are spaced above leaf springs 45. This relation is fully illustrated in Figure 2.

Molten metal at a temperature insufficient to melt the lugs is poured into the mold cavities and the heating coils energized to melt the lug tips as described previously, the sequence of the steps of pouring the metal and energizing the heating coils being optional: the coil may be energized before, during, or after pouring of the metal. As the tips are fused with the adjacent strap metal, the element settles until the separator edges contact leaf springs 45, which resiliently support the element and restrains and arrests downward movement thereof against the weight of the element. This relation is fully illustrated in Figure 3, wherein the strap and post casting is indicated at 50. Following these steps, the castings are cooled and ejected as before.

The modification of the process as carried out with the apparatus of Figures 2 and 3 has the advantages that the lug tips are melted more quickly after energization of the coils, since the lug tips are in closer proximity to the mold floors, and any unevenness in lug lengths is taken up by melting the ends of the longer lugs until equal in length to the lugs of shorter length. Each lug tip is melted for a sufficient distance to insure an autogenous weld between the tip and the strap, the unevenness in lengths never being so great that any of the shorter lug tips are out of the melting region. All lug tips are fused to the strap metal.

A resilient support of the type shown in Figures 2 and 3 is preferred to a fixed support for the reason that the support may yield as the lugs contract on cooling. This yielding removes stresses which might be placed on the lugs during contraction. Nevertheless I do not wish to exclude the use of a fixed support, which, as shown in Fig. 1, may be provided by lowering the supporting platform 24 until the lug tips rest on the floors of molds 10 and 11. After melting of the lug tips and settling of the element 28, the separators 27 engage the platform 24 to arrest further downward movement.

The molds of Figures 2 and 3 are of the same width as finished straps, and hence the need for trimming is eliminated.

While I have illustrated the process as applied to complete elements, it is obvious that a similar process would be applicable for casting straps on plate groups clamped in suitable jigs, in which case the plate groups would be supported on the plate edges either throughout the process, as in Figure 1, or finally, as in Figures 2 and 3. Such plate groups could then be assembled with plate groups of opposite polarity and separators as commonly practiced in the battery manufacturing art.

From the foregoing description it is evident that I have provided improved processes for expeditiously and economically assembling storage battery elements. Moreover I have provided processes wherein straps are formed about the lugs of a storage battery group or element in such a manner that only the tips of the lugs

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are autogenously joined to the straps, the remainder of the lug aside from the tips being held secure by shrinkage of the strap casting upon cooling. Thus a bond is produced between the strap and lugs which is free of crystallization effects and is mechanically strong.

While I have disclosed but certain specific processes, it is obvious that these could be varied somewhat without departing from the invention. Therefore I do not wish to be limited by the disclosure set forth, but only by the scope of the appended claims.

I claim:

1. In a process for casting straps on plate lugs of assembled storage battery elements comprising positive and negative plates and interposed separators the steps of inserting the lugs in opposed pairs of molds with the element inverted from its normal position, the element being supported by the lug tips resting on the mold floors, introducing molten metal to the molds to form straps, heating regions of the mold floors and thereby fusing the lug tips with the molten strap castings, the element settling as the lug tips fuse and coming to rest on means that engage the separator edges, cooling and solidifying the castings without fusing or crystallizing the remainder of the lugs aside from the tips, and ejecting the castings from the molds.

2. A process for casting straps on plate lugs of assembled storage battery elements comprising the steps of inserting the lugs in opposed pairs of molds with the element inverted from its normal position, the element being supported by the lug tips resting on the mold floors, introducing molten metal to the molds to form straps, the metal being at a temperature insufficient to melt the lugs, inductively applying heat to the mold floors prior to the introduction of

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the molten metal and continuing the application of heat until the lug tips are fused with the molten strap castings, the element settling as the lug tips fuse, arresting the settling of said element after melting of the ends of the longer lugs to produce uniformity in length of all lugs, cooling and solidifying the castings before focusing of the lug roots, and ejecting the castings from the molds.

3. In a process for casting straps on plate lugs of an assembled storage battery element comprising positive and negative plates and interposed separators, the steps of inserting the lugs in opposed pairs of molds with the element inverted from its normal position with the lug tips engaging the floors of the molds for support therefrom of said element, introducing molten strap metal to the molds, heating those regions of the floors of the mold engaged by said lug tips to melt and fuse them to the strap metal, the weight of said element causing the element to move downwardly as the lugs are shortened by the melting of their tip ends, arresting said downward movement after melting of said tip ends to produce uniformity in length of all lugs and cooling and solidifying said strap metal to form a strap fused to the tip ends of said lugs.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,235,779	Engel	Aug. 7, 1917
2,454,053	Galloway	Nov. 16, 1948