

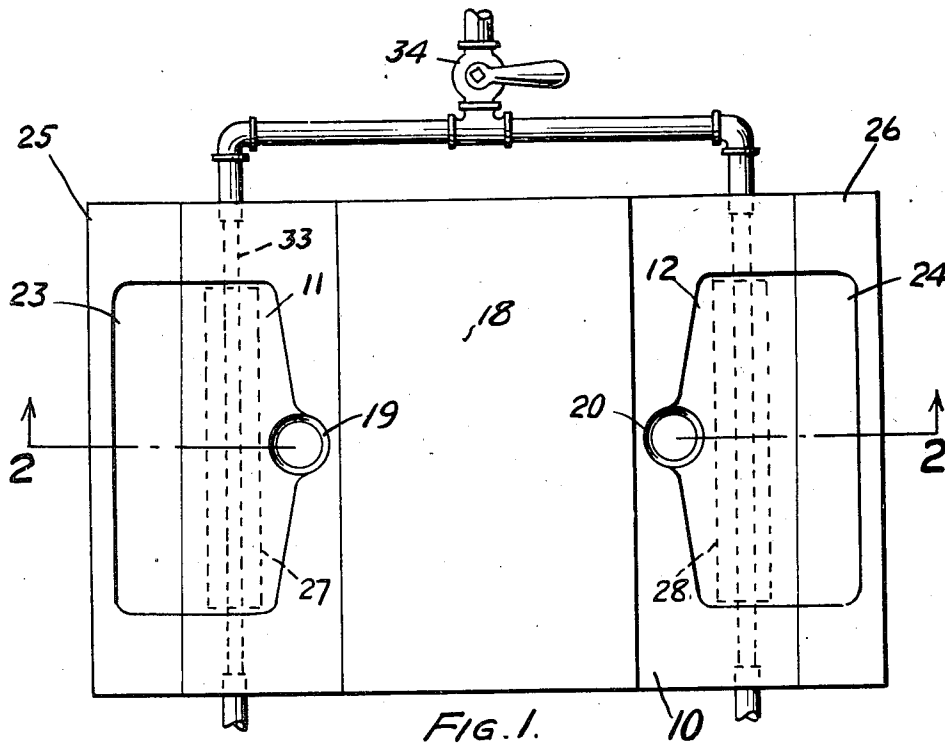
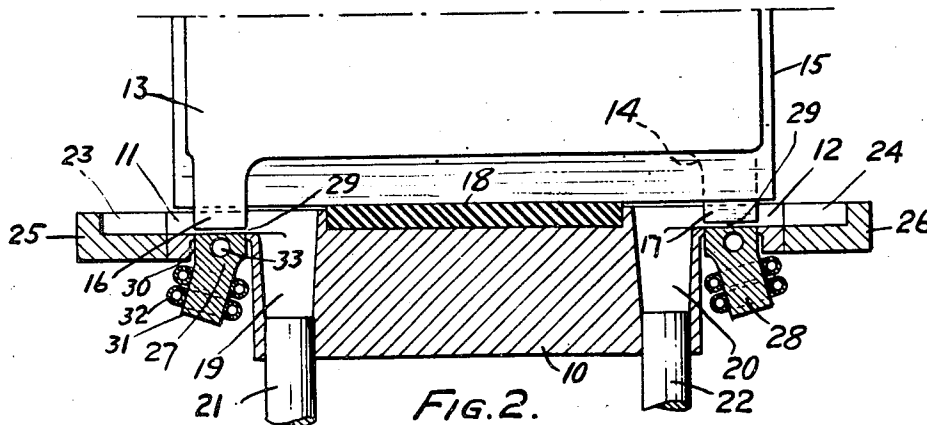
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MOLDS FOR THE MANUFACTURE OF STORAGE BATTERIES

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MOLD FOR THE MANUFACTURE OF
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2 Claims. (Cl. 22-74)

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This invention relates to the manufacture of elements for storage batteries and, more especially, to an improved mold or mold block within which there may be cast connecting straps on the lugs of positive and negative plates of a storage battery element, the mold block having provisions for superheating a limited area thereof to produce fusion of the end portions of the lugs without fusing the root portions thereof.

An object of this invention is to provide apparatus for the assembly of the plates of a storage battery element to suitable connecting straps at lower cost and with less expensive mold equipment than has been possible heretofore.

Another object is to provide apparatus for casting the positive and negative connecting straps to the plates of a group of positive and negative plates with interposed separators completely assembled in their final relative positions and to accomplish this without danger of injury to the separators and without the possibility of so-called "run-downs" of molten metal between the plates.

Another object is to provide for accomplishing the results above stated with simplified mold equipment adapted to cast the straps on the plate lugs of an element completely assembled with positive and negative plates and separators of any desired number and design of plates and with any desired plate separation with but minor and quickly made adaptation of the mold.

Another object of the invention is to provide apparatus for casting the connecting straps to the downwardly projecting plate lugs of the completely assembled element in such a manner as to avoid crystallization and weakening of those portions of the plate lugs which are relied upon for the mechanical support of the plates while providing for good and permanent electrical contact between the lugs and the strap.

The invention will be more clearly understood by referring to one embodiment thereof described below in connection with the accompanying drawing in which:

Fig. 1 is a plan view of a strap-casting mold embodying features of the invention; and

Fig. 2 is a sectional elevation on the line 2-2 of Fig. 1 showing also a portion of the inverted element.

In the drawing, 10 represents the mold block of any suitable material such as cast iron. It is provided with open top shallow mold cavities 11 and 12 of suitable shape and dimensions for casting the desired connecting straps. As shown in Fig. 2, the assembled element comprising positive plates 13, negative plates 14 and interposed

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separators 15, is located in an inverted position with the plate lugs 16 and 17 projecting downwardly into the corresponding mold cavities 11 and 12. The element may be held together by any suitable clamping device (not shown). The element is supported vertically on a slab 18 of heat-insulating and heat-resisting material whose upper surface is slightly above the upper surface of the mold proper. As shown in Fig. 2, the edges of the separators 15 rest on this slab and are thus prevented from coming into contact with the heated mold.

The mold cavities are provided with downwardly extending conical cavities 19 and 20 for integrally casting the terminal posts on the straps. Ejector pins 21 and 22 are shown at the base of the post cavities 19 and 20 for removing the completed element with attached strap-castings from the mold. The ejector pins may be actuated by any suitable means not shown.

To provide for filling the mold, the gate cavities 23 and 24, located in gate blocks 25 and 26, are shown, through which the molten metal may be poured into the mold cavities proper. The gate blocks are here shown as detachable but may be integral with the mold block. After the castings have solidified, the gates may be cut off either after the element and strap-castings have been removed from the mold or before removal. In the latter case, the gate blocks 25 and 26 will first be removed and the gates cut off in situ by any suitable means not shown.

Inserted through and closely fitting into suitable openings in the floor of the mold cavities 11 and 12 are the super-heating inserts 27 and 28, respectively. Since these inserts are alike, the one shown at 27 will now be described. It comprises a block of steel or similar heat-conducting refractory metal whose upper rectangular face is flush with the floor of the mold cavity 11 and is longitudinally substantially coextensive with that cavity. In width, it corresponds with the horizontal length of the plate lugs 16 and is located immediately below the row of these positive plate lugs. The vertical dimensions of the plate lugs 16 as here shown are such as to bring their ends close to but not actually in contact with the insert 27, leaving a narrow space 29 therebetween. Under some conditions, however, it may be satisfactory to bring these plate lugs into actual contact with the insert. Except for a short distance from its upper surface, the insert 27 is out of contact with the mold, there being interposed a clearance space 30 to limit the transfer of heat from the insert to the mold. The insert

27 forming a part of the bottom of the mold block 10 is provided with a projection or extension 31 which projects externally from and beyond and below the outer surface of the wall of the mold cavity 11. The extension 31 is surrounded by a tubular water-cooled electrical conducting coil 32 adapted to carry high-frequency alternating current for inductively heating the insert 27 in the well-known manner. Standard apparatus for developing and applying suitable high-frequency current for inductive heating is available on the market and it is not deemed necessary to illustrate or describe it here.

The insert 27 is provided with a duct 33 through which cooling-liquid may be circulated and suitably controlled as by the valve 34.

The operation of the apparatus above described is as follows:

The assembled element, comprising the desired number of positive and negative plates with interposed separators clamped together in their final relative positions, is inverted and supported on the mold as shown in Fig. 2, with the separators resting on the slab 18 and the plate lugs extending into the mold cavities 11 and 12, with their ends above and close to or in contact with the upper surfaces of the inserts 27 and 28, respectively. Molten metal, preferably lead-antimony alloy, is then poured into the mold cavities 11 and 12 via the gates 23 and 24 until the cavities are filled to the upper level including the spaces between and beneath the plate lugs. The temperature of the molten metal is such that the plate lugs will not be melted but will retain their shape or physical identity, as it has been found that such melting or softening produces crystallization and weakening of the lugs, causing them to break when subjected to stress or vibration in service. The shrinkage of the molten metal on cooling and solidifying, which occurs as the molten metal contacts the cooler surface of the lugs and mold, firmly grips the plate lugs and holds them mechanically attached to the straps. However, such mechanical contact between the lugs and the strap does not provide maximum and uniform electrical conductivity to insure minimum voltage drop and equal distribution of current between the plates when discharging at high rates.

In accordance with the present invention, the plate lugs 16 and 17, Fig. 2, are located over the inserts or projections 27 and 28. These inserts are of substantially the same width as the lugs 16 and 17 and extend along the molds as shown in Figure 1 a distance corresponding to the corresponding dimension of the plate assembly. Accordingly, the limited or localized area of heating provided by the inserts 27 and 28 is effective for application of heat to a localized portion of the mold in close proximity with the tips of the plate lugs. Heat is generated in the plate lugs to raise their temperature in a brief period of time to effect a welding or fusing of the lugs to the cast metal strap for only a short distance above the floor of the mold and without welding or fusing the roots or major portion of the lugs. In the illustrated form of the invention the projections or extensions of the inserts are surrounded by high-frequency heating coils 32 also of limited width since, it will be seen, they closely encircle the inserts.

High-frequency current is passed through the heating coils 32 to heat inductively the inserts 27 and 28, the intensity and duration of the current and the resultant temperature and rate

of application of heat by the inserts 27 and 28 to the metal being such as to melt the metal just above the upper surfaces of the inserts and melt the tips of the plate lugs, thus welding them together for only a short distance, without melting or softening the roots or major portion of the lugs. The intensity and duration of the current required to obtain the best results will vary with the dimensions of the strap-casting and the size and spacing of the plate lugs. With the volume of current available from standard apparatus for inductive heating applied to a standard type of storage battery element, a few seconds has been found adequate to give satisfactory results. As soon as the current is interrupted, cooling-water is circulated through the ducts in the inserts to prevent further heating effect and also hastens the cooling, solidification and final shrinkage around the strap of the lug roots.

The length of the mold cavities 11 and 12 may be made sufficient to provide for the maximum width of element. For smaller elements, it is only necessary to block off the ends of the mold cavities. No other adjustment is necessary to provide for elements of various numbers or thickness of plates or various plate spacing.

It may be remarked that space is provided above the level of the molten metal in the mold and at the roots of the lugs for the access of air, which tends to keep the metal cool at the roots of the lugs and also to keep the adjacent portions of the separators cool.

It will be noted that there is provided, in accordance with this invention, a new and improved apparatus by which a group of storage battery plates are assembled by their conducting lugs to a suitable connecting strap, with the plate lugs at their roots and over the major portion of their length adjacent the plates mechanically tightly gripped by the adjacent metal of the strap without being autogenously welded thereto, while the tips of the lugs are autogenously welded to the adjacent metal of the strap.

While one convenient form of apparatus for carrying out the process and producing the product of this invention has been described, including inductively heated means for applying the superheating temperature locally to the tips of the plate lugs and the adjacent metal of the strap casting, it is not intended to limit the scope of the invention to this particular apparatus since other means may be employed for applying localized superheating for the selective fusing of the lug tips to the adjacent metal of the strap.

The process herein described is not claimed in this application for the reason that it is the subject of my divisional application Serial No. 569,387, filed December 22, 1944. The product produced by the apparatus is not claimed in this application for the reason that it is the subject of my divisional application Serial No. 568,797, filed December 19, 1944. Both of these applications are assigned to the assignee of the present application.

It will be obvious to those skilled in the art that modifications may be made in details of construction and procedure without departing from the spirit of the invention which is not limited in respect to such matters or otherwise than the appended claims may require.

I claim:

1. A mold for casting straps on the plate lugs of a storage battery element provided with an open mold cavity adapted to receive the plate lugs of the storage battery element and char-

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acterized by the provision of a heat-conducting refractory metal extension which projects externally from and beyond the outer surface of the wall of the mold cavity adjacent the tip-ends of the lugs when positioned in said cavity, and is longitudinally substantially coextensive therewith and laterally substantially corresponding with the dimension of the lugs lengthwise of said plates, said outwardly projecting extension forming a core to receive and to be heated by an induction heating coil for rapid localized heating of the mold in close proximity with the tips of the plate lugs for fusion of their end portions with the cast metal.

2. A mold for casting straps on the plate lugs of a storage battery element comprising a mold block provided with an open top mold cavity adapted to receive the plate lugs of the storage battery element and characterized by the provision of a heat-conducting refractory metal extension which projects externally from and beyond and below the outer surface of the bottom wall of said mold cavity, and is longitudinally substantially coextensive therewith and laterally corresponds substantially with the dimension of the lugs lengthwise of said plates, a heating coil associated in inductive relation with and received by said extension for generating heat in said extension and in the area of said mold adjacent the

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tips of the plate lugs for their localized end-fusion with the cast metal, and said refractory extension having an opening therein for flow of a cooling fluid.

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