May 17, 1927. 1,628,759

G. H. WORRALL

REENFORCED SHEET LEAD

Filed July 5, 1924

Fig. 1.

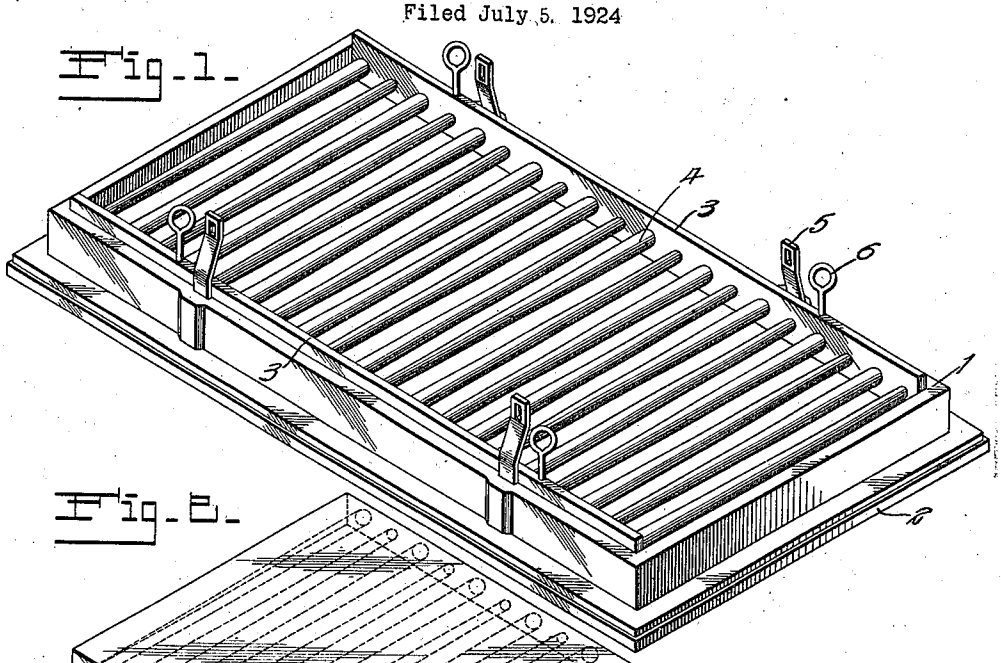


Fig. 2.

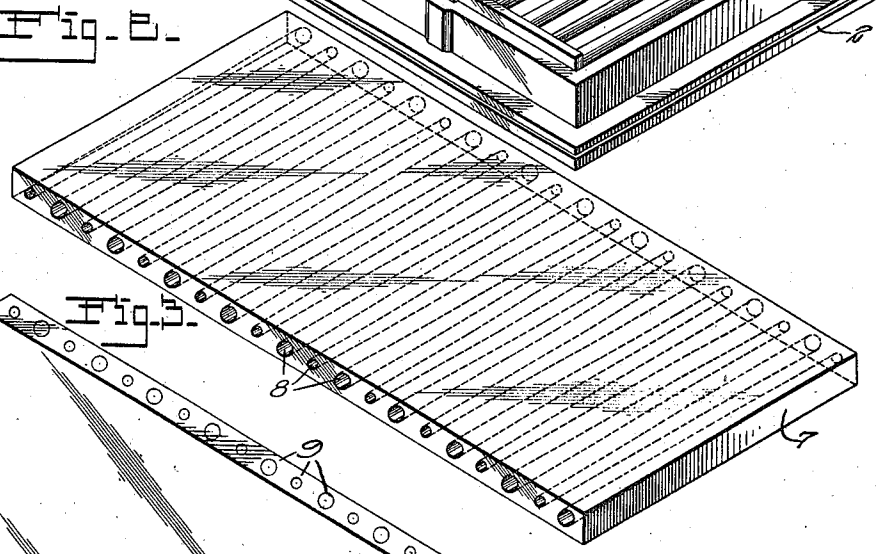


Fig. 3.

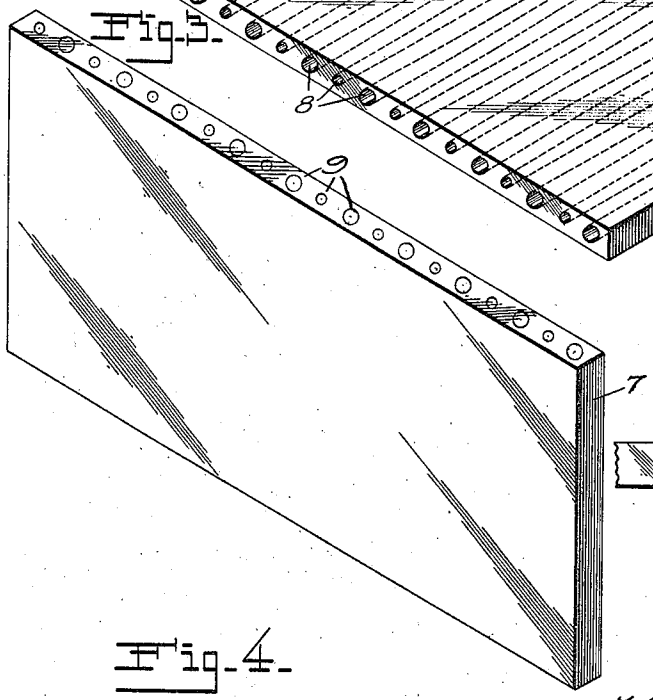


Fig. 5.

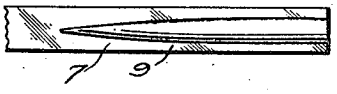


Fig. 4.



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UNITED STATES PATENT OFFICE.

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REENFORCED SHEET LEAD.

Application filed July 5, 1924. Serial No. 724,411.

This invention relates to reenforced lead articles, and more particularly to reenforced sheet lead.

Sheet lead is used in the arts for various purposes, one of which is that of a lining which must be chemically resistant; in such a case the lining must not only be fastened to its support but frequently must also be made continuous by joining the edges of the sheet or sheets by burning. Chemical sheet lead, which is unalloyed lead, is satisfactory at low temperatures, but at high temperatures it is subject to expansion and contraction and because of its low elastic limit and low tensile strength, especially at the higher temperatures, it pulls and buckles so that the cross-sectional area or thickness of the sheet is much reduced. On account of this fact, sheet lead especially when subjected to high temperatures, requires frequent repair and replacement which, on account of the high cost of material and the high cost of repair work, results in high cost of maintenance.

In order to overcome these objectionable features of chemical sheet lead, antimonial lead, which is lead alloyed with antimony, has been used. While an antimonial lead sheet at a high temperature does not have the tendency to buckle that chemical sheet lead has, and has a higher elastic limit and higher tensile strength at higher temperatures, it readily disintegrates at a temperature above 150° F., especially when subjected to the action of acids. It has also been proposed to join a sheet of chemical lead with a sheet of antimonial lead so as to provide a duplex sheet with chemical lead on one side and antimonial lead on the other. However on account of the differences in the melting points of unalloyed lead and alloyed (antimony) lead, difficulties were encountered in the lead burning operations necessary to join the edges of the sheet or sheets, with the result that such a duplex sheet was unsuccessful and its use abandoned.

One of the objects of this invention, therefore, is to provide a composite article and more particularly a reenforced lead sheet, having a body of lead and a reenforcement enveloped by the lead, in order to attain the advantages of chemical lead while increasing its strength and elastic limit, especially at the higher temperatures.

Another object is to provide a composite article in which the reenforcement is welded to the lead so that there will be a union therebetween.

Another object is to provide a composite article in which the reenforcement enveloped by the lead is of substantially the same elongation as the lead so that the union between the lead and its reenforcement will be maintained.

Another object is to provide a process of making reenforced leads to secure the above objects.

Further objects will appear from the detail description taken in connection with the accompanying drawing, in which:

Figure 1 is a perspective view of a mold for carrying on the process of producing the composite article embodying this invention;

Figure 2 is a perspective view of the lead slab;

Figure 3 is a perspective view showing the reenforcing metal poured into the cavities therein;

Figure 4 is an end view of a rolled sheet; and

Figure 5 is an enlarged detail edge view of a portion of a sheet.

In accordance with this invention the body of lead is provided with a reenforcement which is enveloped by the lead as distinguished from simply being applied thereto in the form of another sheet. The reenforcement is, however, of such a character as to be of substantially the same elongation as the lead itself. Since, however, the purpose of the reenforcement is to strengthen the lead, the metal used should be one which has not only a higher tensile strength and higher elastic limit than lead, but this strength and limit must be maintained at higher temperatures. Moreover the reenforcement should be capable of forming a weld or union with the lead. A suitable metal which meets all of these requirements is antimonial lead containing from 6 to 10 percent of antimony.

In accordance with this invention a lead slab is cast with cavities therein and these cavities preferably run along the slab in substantially parallel relation. Into these cavities is then poured antimonial lead and this is preferably done while the slab is still hot so that the body and the reenforcement will form a union or weld. The slab is then elongated in any suitable manner

as by being passed through rolls as in the regular manufacture of sheet lead, and this rolling is accomplished while the reenforced slab is still hot. The rolling is preferably in a direction along the reenforcements so that the bars of antimonial lead will become elongated with the lead body and flattened out laterally, with the result that the composite article will be a sheet having reenforcements therealong, elongated therewith and welded thereto but enveloped by the lead.

Referring now to the accompanying drawing, 1 designates a mold of any suitable construction mounted on a base 2. Arranged in this mold is a pair of spacers 3 which are simply bars provided with holes to receive cores 4. It will be noted that these cores are tapering to permit them to be withdrawn from the slab and that they alternately extend with the smaller ends in opposite directions so as to secure a uniform sheet. The mold 1 may be provided with manipulative elements 5, while the spacers 3 may be provided with similar manipulative elements 6. It will be understood, of course, that the mold, spacers and cores may be made of iron, steel or any other suitable material.

The chemical or unalloyed lead is poured into the mold as shown in Figure 1, the mold taken off, the spacers withdrawn and the cores pushed out. This leaves a slab 7 as shown in Figure 2 provided with cavities 8 arranged therealong. This slab is then set on end as shown in Figure 3 and antimonial lead poured into the cavities 8 so as to form bars 9 therealong. The antimonial lead is poured into the channels as soon as the slab is chilled sufficiently to be solid and while it is still hot enough to form a weld or union between the body and the reenforcement of the slab. As soon as the antimonial lead has chilled sufficiently to be solid, the reenforced slab is rolled to the thickness desired while still hot, in a manner usual in the manufacture of sheet lead so that the welded union is facilitated by the rolling operation. As described above the rolling is along the reenforcement, and since the elongation of antimonial lead is near enough to that of chemical lead so as to be substantially the same in this process, especially where the reenforcements are enveloped by the lead, the body and reenforcement elongate together so as to form a composite sheet as shown in Figure 5. It will be noted that in this sheet the reenforcement will also elongate laterally and become squeezed out as more particularly shown in Figure 5, so that the bars are wider than they are thick and so that they taper from their side edges to the middle.

The result is, therefore, a composite sheet in which there is a continuous union between the reenforcement and the lead body and in which these two are united by a welded union so as to form to all intents and purposes an integral structure. These reenforcements may be nearer to one face than to the other of the sheet, as shown in Figure 5, by placing the cores off center, so as to give a larger wearing surface to one face of the reenforced sheet without in any way impairing its structural strength and elastic limit. The strength of the resultant sheet is greatly increased by the reenforcement. However, this reenforcement being enveloped by the lead body, the exposure will be only of the chemical lead while the reenforcement will be protected against exposure. On account of the welded union there will be no creeping of the chemical lead with respect to the reenforcement, even with changing temperatures and even at high temperatures, so that there will be no buckling of a sheet in that respect. Moreover since the antimonial lead is not exposed, there will be no disintegration, even if the sheet is exposed to acids at high temperatures. This sheet may be readily joined by burning since the reenforcements are imbedded and only exposed at the edges, while both faces to a considerable depth consist of chemical lead so that a sealed union may be formed by burning. It has, therefore, been found in practice that the composite article effectively overcomes creeping or crawling of lead sheets even at high temperatures and even when subjected to acids or other chemicals. Furthermore the sheet may be readily fastened to its support and since the reenforcements give the sheet its strength, fewer fasteners may be employed while the sheet between the fasteners will maintain its shape. Furthermore since the faces are of chemical lead, such fasteners may be covered by patches burned on to the faces of the sheet. On account of the greater strength of a sheet of a given weight as compared to the strength of an unreenforced lead sheet, a thinner sheet may be used for a given requirement. This fact, together with the cheapness of antimonial lead, results in economy and saving of material.

While there has been described and illustrated one embodiment of this invention, it will be understood that this invention is capable of other embodiments than those described. Furthermore while in the specific embodiment a rolled sheet has been described, it will be understood that other composite lead articles having a body of lead and a reinforcement enveloped by the lead may be made in accordance with this invention. It will further be obvious that various changes may be made in details without departing from the spirit of this invention; it is, therefore, to be understood that this invention is not to be limited to the specific details shown and described.

Having thus described the invention, what is claimed is:

1. A composite article having a body of lead and an enveloped reenforcement of a metal having a greater tensile strength at higher temperatures than the lead and of substantially the same elongation as the lead and welded thereto and therein.

2. A composite article having a body of lead and a reenforcement of lead alloy of substantially the same elongation as the lead and enveloped thereby.

3. A composite article having a body of lead and a reenforcement of antimonial lead of substantially the same elongation as the lead and enveloped thereby.

4. An elongated reenforced lead sheet in which the reenforcement is of a metal having a greater tensile strength at higher temperatures than the lead and of substantially the same elongation as the lead and is enveloped thereby.

5. An elongated reenforced lead sheet in which a lead alloy reenforcement is enveloped by the lead and welded thereto and therein.

6. A composite sheet having a body of lead reenforced with lead alloy bars which are nearer one face of the sheet.

7. A composite article having a body of lead and an enveloped reenforcement of a metal having substantially the same elongation as the lead and having a greater tensile strength than the lead at high temperatures.

8. A rolled composite sheet having a body of lead reenforced with lead alloy bars which are elongated laterally and longitudinally with the lead and enveloped thereby.

9. The process of making reenforced lead sheets consisting in placing a reenforcement of a metal having a greater tensile strength at temperatures above normal than the lead and of substantially the same elongation in the lead and elongating the lead and reenforcement together.

10. The process of making reenforced lead sheets consisting in placing a reenforcement of a metal having a greater tensile strength at temperatures above normal than the lead in the lead while both are at a welding temperature and elongating the lead and reenforcement together.

11. The process of making reenforced lead sheets consisting in pouring a reenforcing metal having a greater tensile strength at temperatures above normal than the lead into cavities in the lead and elongating the lead and reenforcement together.

12. The process of making reenforced lead sheets consisting in pouring a reenforcing metal having a greater tensile strength at temperatures above normal than the lead into cavities in the lead while at a welding temperature and elongating the lead and reenforcement together.

13. The process of making reenforced lead sheets consisting in molding a lead slab with cavities therein, pouring a reenforcing metal having a greater tensile strength at temperatures above normal than the lead into the cavities and elongating the slab.

14. The process of making reenforced lead sheets consisting in molding a lead slab with cavities therein, pouring a reenforcing metal having a greater tensile strength at temperatures above normal than the lead into the cavities while the slab is hot and elongating the slab.

15. The process of making reenforced lead sheets consisting in placing reenforcing bars of a metal having a greater tensile strength at temperatures above normal than the lead and of substantially the same elongation, in the lead and rolling the lead and reenforcement down to the desired thickness.

16. The process of making reenforced lead sheets consisting in placing reenforcing bars of a metal having a greater tensile strength at temperatures above normal than the lead and of substantially the same elongation, in the lead and rolling the lead and reenforcement in a direction along the bars down to the desired thickness.

17. The process of making reenforced lead sheets consisting in placing reenforcing bars of a metal having a greater tensile strength at temperatures above normal than the lead, in the lead and rolling the lead and reenforcement while hot down to the desired thickness.

18. The process of making reenforced lead sheets consisting in molding a lead slab with channels therealong, pouring the reenforcing metal into the channels and rolling the slab down to the desired thickness.

19. The process of making reenforced lead sheets consisting in molding a lead slab with channels therealong, pouring the reenforcing metal into the channels and rolling the slab in a direction along the reenforcing metal down to desired thickness.

20. The process of making reenforced lead sheets consisting in molding a lead slab with channels therealong, pouring the reenforcing metal into the channels while the slab is hot and rolling the slab while hot but in a direction along the reenforcing metal down to the desired thickness.

In testimony whereof I affix my signature this 24th day of June, 1924.

GEORGE H. WORRALL.