No. 895,549. PATENTED AUG. 11, 1908.

G. A. FORD.

STORAGE BATTERY.

APPLICATION FILED OCT. 27, 1905.

2 SHEETS—SHEET 1.

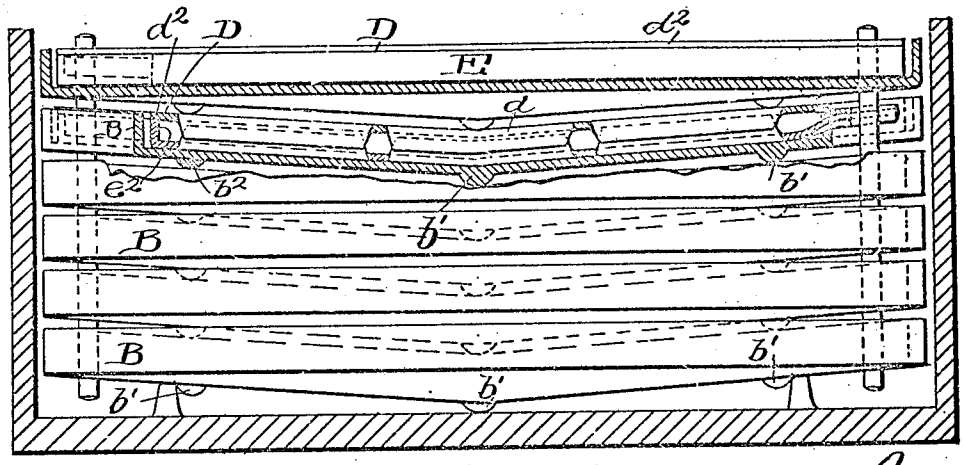


Fig. 1.

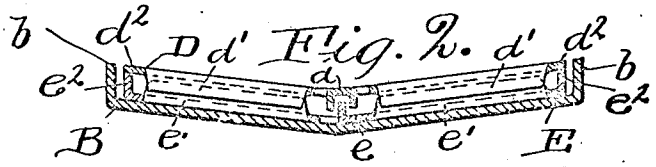
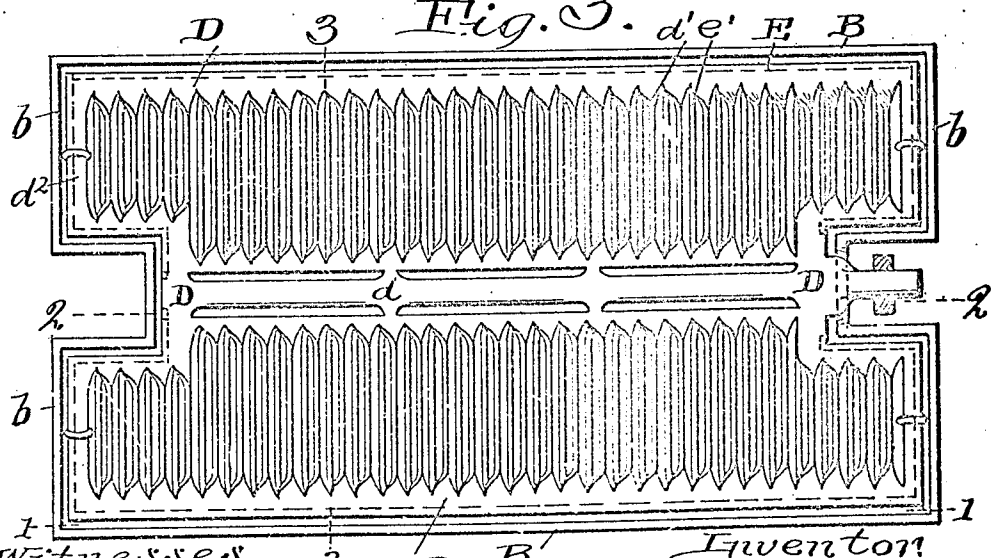


Fig. 2.

Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 4.

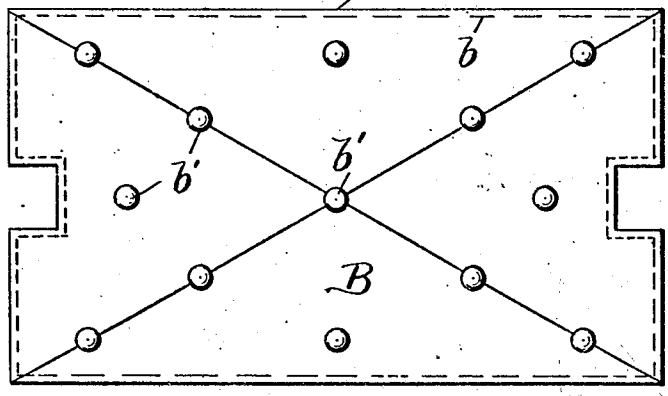


Fig. 5.

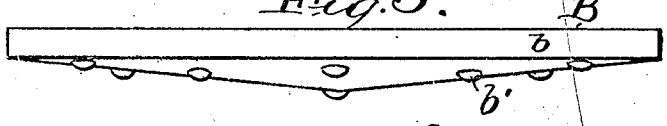


Fig. 6.

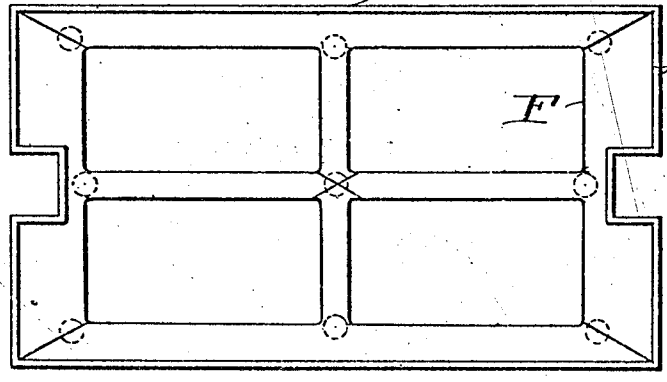
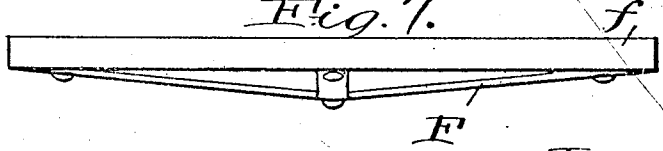


Fig. 7.



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UNITED STATES PATENT OFFICE.

GEORGE A. FORD, OF CLEVELAND, OHIO, ASSIGNOR TO HARRIET S. FORD, OF CLEVELAND, OHIO.

STORAGE BATTERY.

No. 895,549. Specification of Letters Patent. Patented Aug. 11, 1908.

Application filed October 27, 1905. Serial No. 284,619.

To all whom it may concern:

Be it known that I, GEORGE A. FORD, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Storage Batteries, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to storage batteries of the type shown and described in my prior patent No. 655,769, granted August 14th, 1900.

The objects of the invention are to increase the capacity of such batteries, to reduce their weight, and to diminish their cost. These objects are attained by reason of certain novel coöperating characteristics of the trays and of the electrodes, as will appear in the following description and the annexed drawing.

In the drawing Figure 1 is a front elevation of a storage battery embodying my invention, the containing jar being shown in section, and the two upper units being also shown in section,—the upper unit being sectioned in the plane indicated by line 1—1 of Fig. 3 and the unit next below it being sectioned in the plane indicated by line 2—2 of same figure. Fig. 2 is a transverse sectional view of one of the battery units in the plane indicated by line 3—3 of Fig. 3. Fig. 3 is a plan view of one of the battery units. Fig. 4 is a bottom view of one of the trays B. Fig. 5 is a side elevation of said tray. Fig. 6 is a plan view of one of the reinforcing spider-like frames which may be used; and Fig. 7 is a side elevation of the same.

The battery is made up of any desired number of superposed units—each unit consisting of a tray and an electrode and active material contained therein,—the stack or pile of units being contained in a suitable jar or receptacle A. It will be understood that any desired number of such units may be employed, and that they may be of any suitable configuration. It will be understood that the trays and electrodes may be of any size and contour to meet the requirements.

Each of the trays B has an approximately vertical marginal flange *b;* and the bottom of the tray inclines slightly upward from some central point to said flange, *b* this inclination being for the purpose of facilitating the escape of gases generated in said tray. These trays are to be made of some infrangible absorbent material, such as wood, wood pulp or paper pulp, and they may be made of any of the forms of pulp from which various kinds of paper are made, or they may be made from heavy paper or paper board, or even from wood veneer. If made from pulp they are molded into the desired shape while the pulp is plastic. If made from heavy paper or paper board the material must be moistened and made plastic in order that it may be pressed into shape. If the trays are made of wood veneer it must also be subjected to such treatment, well understood in the art, to render it capable of being molded into shape.

There are many advantages growing out of the use of the described trays; for example, they cannot be broken; they are very much lighter than the trays heretofore used in batteries of this type; and they are so very absorbent of the battery liquid that when immersed therein they offer comparatively but little resistance to the current flow. They have also certain disadvantages, for example, the acid battery solution will in time disintegrate them, unless the material employed in constructing said trays is acid proof. I have, however, obtained excellent results in such storage batteries by using trays made from ordinary paper board. Such trays have retained their shape and usefulness after being immersed in the acid battery solution for many months. Acid proof paper and paper pulp are, however, well known in the paper makers' art, and such material may be used if desired. Speaking generally, it may be said, however, that such material is not so porous as some of the other materials mentioned which are not acid proof. Therefore, the acid proof material offers more resistance to the current flow and is less desirable from this standpoint. Moreover, the up-turned marginal edges or flanges of these trays are liable, when immersed in the battery solution, to lose their strength and to fall over or flatten out, thereby defeating the purpose for which they are provided. This action may be substantially prevented, however, by reinforcing these marginal flanges. They may, for example, be reinforced by impregnating them with paraffin or asphaltum, or some other analogous material, which not only stiffens them but also renders them substantially non-ab-

sorbent. Another means for satisfactorily reinforcing the marginal flanges of these trays is to employ a skeleton frame on which the bottom of the tray will rest, which frame F is provided with an up-turned marginal flange *f* against which the outer surface of the flange of the tray may lean. This frame must, of course, be made of some material which will retain its shape during use, and which, preferably, is not affected or disintegrated by anything with which it comes in contact during use. It may, for example, be made of gutta percha. This latter construction is probably that which imparts the greatest durability to the battery, but has the disadvantage of adding weight and further of offering resistance to the passage of the current to those parts of the bottom of the tray which lie upon the parts of the supporting frame. There is, therefore, a question, whose answer largely depends upon the use to which a battery is to be put, whether it is better to so increase the weight and internal resistance for the purpose of increasing the durability of the battery, or to provide a less durable battery which weighs less and has less internal resistance.

All things considered, I believe that for ordinary uses the preferred construction includes trays made of acid proof pulp, with their marginal flanges reinforced by being impregnated with asphaltum and having on their bottom several downwardly projecting integral bosses. In each of these trays B is placed a compound electrode greatly resembling that which is shown in my pending application Serial No. 217,344. There are certain differences, however, which will be presently explained. On the bottom of each of the trays are depending bosses *b'*, which, when the battery is assembled, rest upon the electrodes of the unit just below it. These bosses are preferably made integral with the trays. They may, however, be separate spacing pieces, as at b^2 Fig. 1, which may be made of pulp, or wood and are preferably made of such material because then they do not greatly increase the internal resistance. They may, however, be made of other material, not bibulous, in which event they will serve the purpose of properly spacing the elements, but will increase the resistance and thereby entail a certain loss in capacity. When they are made integral with the trays, they strengthen them, and therefore this is the preferred construction.

Each one of the electrodes is made of two plates, namely; the plates D and E. Each has a central longitudinal web (indicated by *d* and *e* respectively) and laterally extended wings *d'* and *e'* formed by transversely slitting the plate between this rib and the marginal edges and twisting the parts between the slits, up in the case of the bottom plate, and down in the case of the top plate. The marginal edge of the bottom plate is turned up forming a flange e^2. The marginal edge d^2 of the top plate rests upon this flange, serving measurably as a cover, which prevents any of the active material from passing over the top of the flange into the tray. Not only therefore is the active material prevented by the trays from falling from one electrode down to another, but by reason of the described construction of the electrode, said active material is measurably held between the two plates and in intimate contact with them.

I claim:

1. A storage battery unit consisting of a tray molded from paper pulp having a reinforced upturned marginal flange, a bottom which inclines upward from a central point toward said flange, and integral bosses extending downward from the bottom of said tray, and an electrode in said tray.

2. A storage battery unit consisting of a tray made of infrangible absorbent material having an upturned reinforced marginal flange and an electrode in said tray consisting of two plates each having a plurality of vanes and the bottom plate having an upturned marginal flange and the top plate having a marginal edge which rests upon the top of said marginal flange, the vanes of said two plates intermeshing substantially as described.

3. A storage battery unit consisting of a skeleton frame having an upturned marginal flange, a tray made of infrangible flexible absorbent material and having an upturned marginal flange, which tray is fitted to and rests upon said frame, and an electrode within said tray and supported thereby.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

GEORGE A. FORD.

Witnesses:

ALBERT H. BATES,

E. L. THURSTON.