No. 869,348. PATENTED OCT. 29, 1907.

R. N. CHAMBERLAIN.

STORAGE BATTERY GRID.

APPLICATION FILED FEB. 5, 1906.

2 SHEETS—SHEET 1.

Fig. 1.

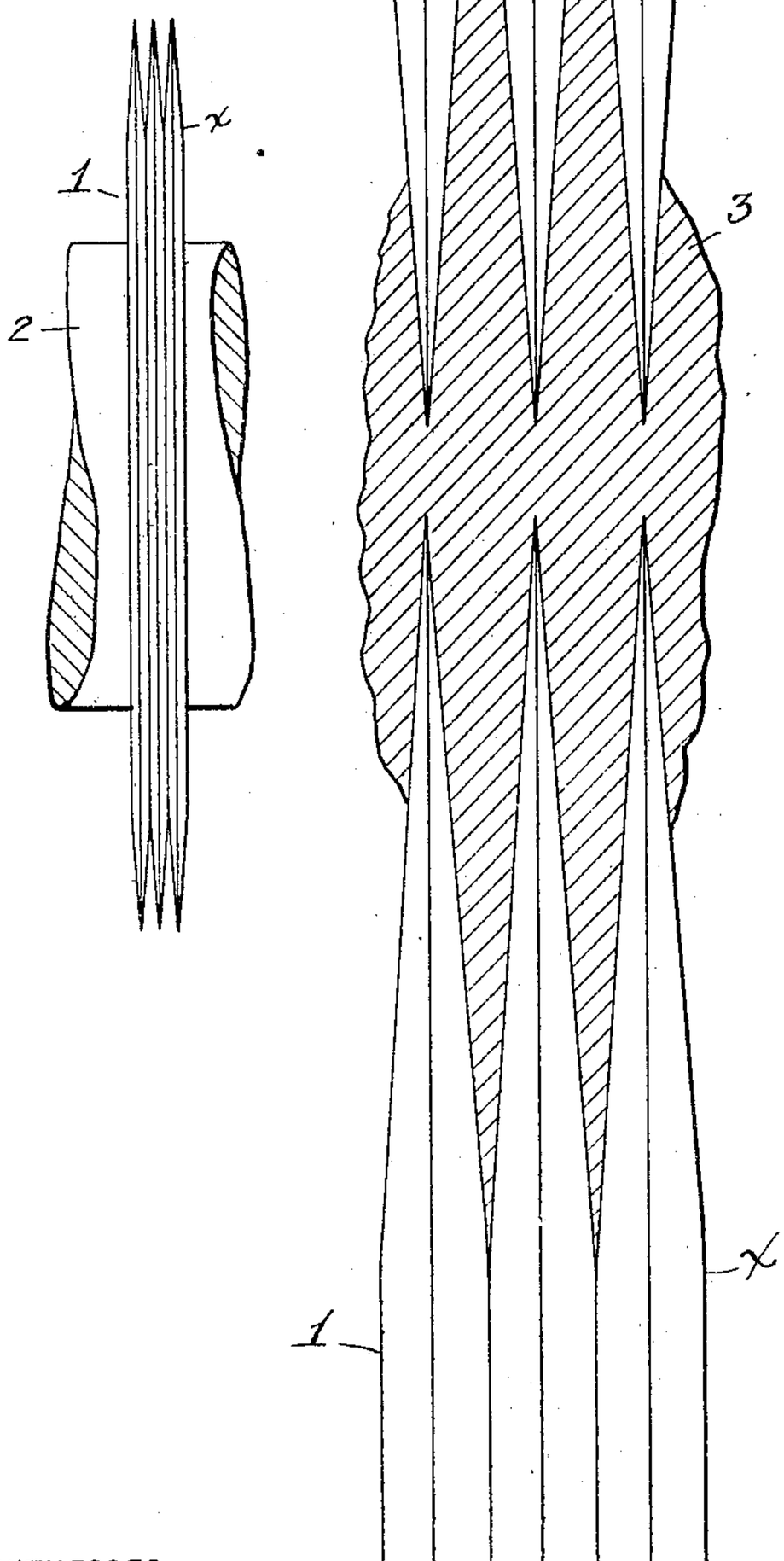
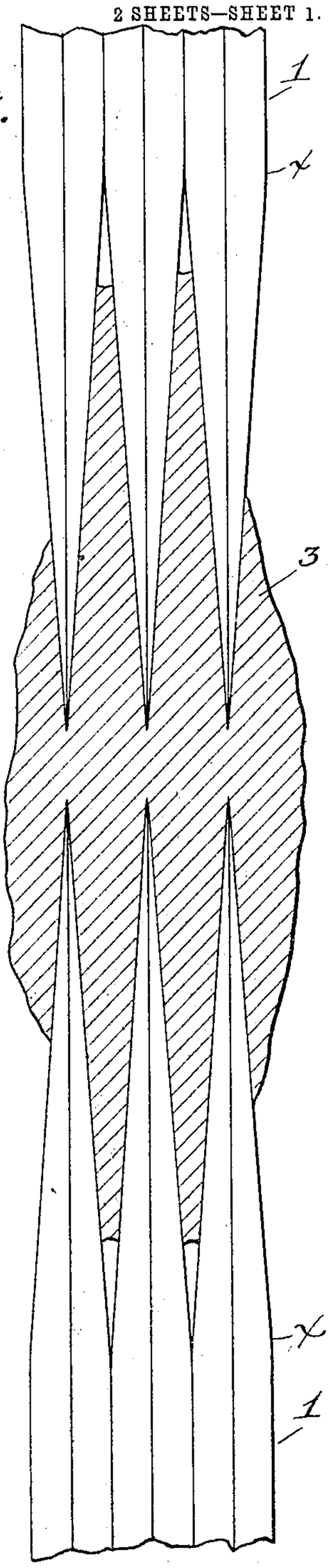


Fig. 2.

Fig. 3.



WITNESSES

Chas. F. Becker

Thos. Jerome

INVENTOR

Rufus N. Chamberlain

BY

Thos. & Jerome

ATTORNEYS

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2 SHEETS—SHEET 2.

Fig. 4.

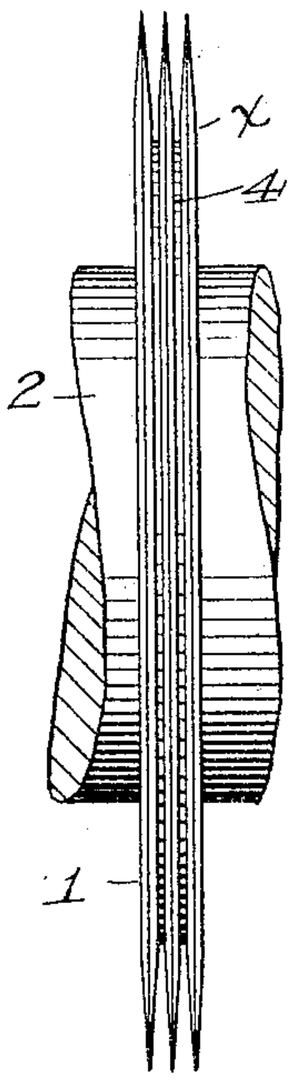


Fig. 5.

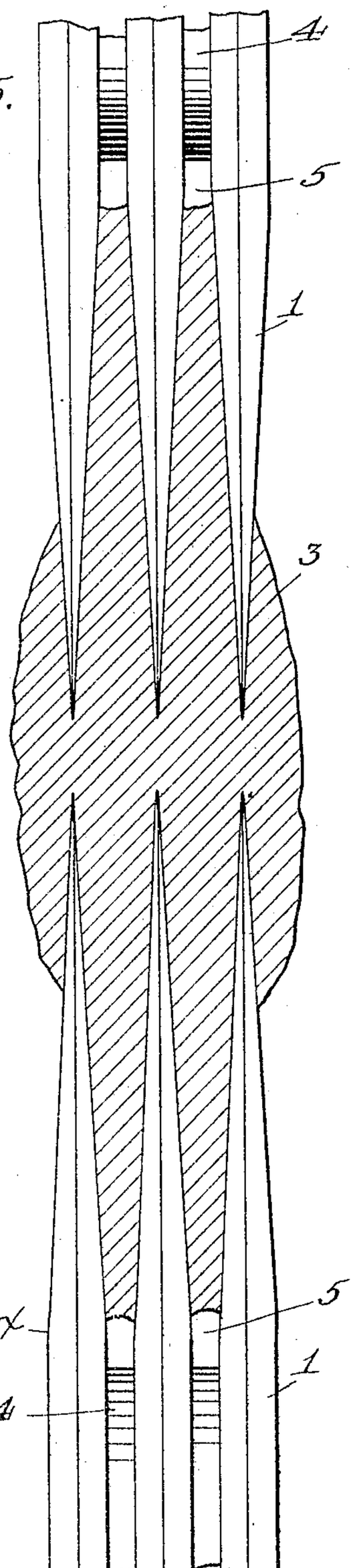
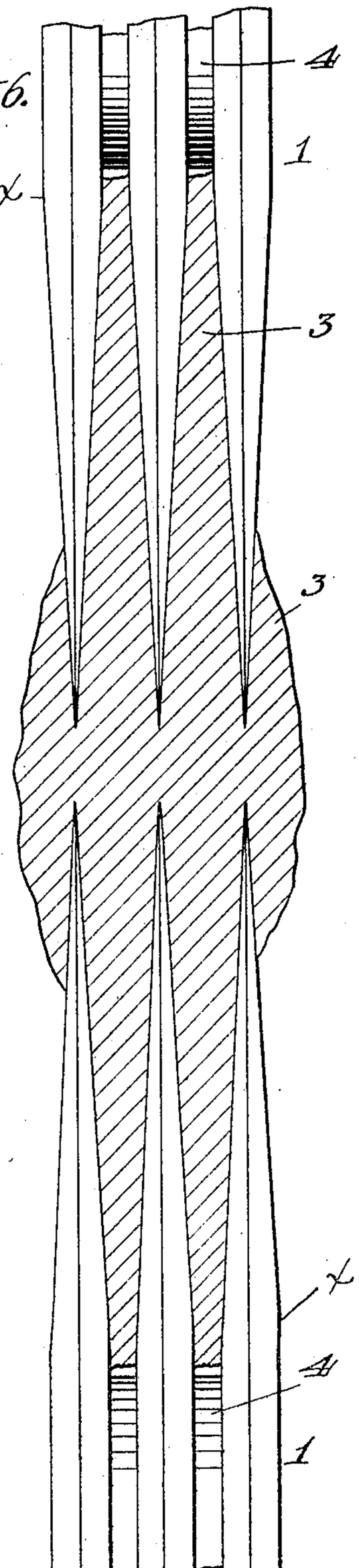


Fig. 6.



WITNESSES

Ira F. Becker

Anna Jerome

INVENTOR

Rufus N. Chamberlain

BY

ATTORNEYS

UNITED STATES PATENT OFFICE.

RUFUS N. CHAMBERLAIN, OF DEPEW, NEW YORK, ASSIGNOR TO GOULD STORAGE BATTERY COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

STORAGE-BATTERY GRID.

No. 869,348. Specification of Letters Patent. Patented Oct. 29, 1907.

Application filed February 5, 1906. Serial No. 299,610.

To all whom it may concern:

Be it known that I, RUFUS N. CHAMBERLAIN, a citizen of the United States, residing at Depew, county of Erie, State of New York, have invented certain new and useful Improvements in Storage-Battery Grids, of which the following is a specification.

In two co-pending applications, Serial No. 277,421, filed September 7, 1905, and Serial No. 294,783, filed January 5, 1906, I have described improvements in the knives, disks or rollers of tools or machines for making storage battery grids of the Gould type, and of the improved form herein described and claimed.

In the type of battery girds known as the Gould, a large number of ribs, ridges or leaves, closely set together and separated by narrow grooves, are spun or rolled up from the body of the grid-blank to provide a greatly extended surface for the action of the electrolyte. For making such grooves it has been customary to use thin, flat sided steel disks, closely assembled together upon a shaft—the result of the operation of which is the production of similarly flat sided ribs or leaves upon the grid separated from each other by narrow spaces equal in width only to the thickness of the disks. A form of machine adapted to the making of such grids is shown in the patent of Richards, No. 699814 granted May 13, 1902. Such disks or knives, in order to produce ribs or leaves of the desired fineness and close arrangement are made of thin steel liable to break or crack near the base before it is worn out on its spinning or rolling surface and to bend and deflect from the work while in operation, and so produce imperfections in the grids; furthermore, the weakness of the disks limits the pressure at which the rolls may be operated and consequently the speed at which the grids may be made. These are some of the defects of the old form of machine, so far as the cutting, spinning or rolling knives or disks themselves are concerned. As to the product made by them I have found that the parallel sided ribs or leaves are weak mechanically owing to their height and thinness, and it is likely also that in the making of the grid the parallel sides of the knife or disk destroy to a certain extent the molecular structure of the ribs near the base, allowing the electro chemical action to penetrate more actively at that point. It may be that the lead at that point assumes more the structure of cast lead than rolled lead. At any rate, the parallel sides of the ribs of the grid seem to succumb to the extra electrochemical activity developed near the base of the rib with the result that they are eaten through and loosened from the main body of the plate in many cases. It seems also that with the deep parallel-wall grooves the diffusion of the acid which allows a more even action decreases, more or less in proportion to the depth of the groove. The rib, therefore, is weak from an electrochemical standpoint, as well as weak from a mechanical standpoint. While it is not intended here to suggest that the above noted defects are sufficient to prevent the successful making and use of such grids, they nevertheless present serious disadvantages in operation, and I have in the before-mentioned co-pending applications pointed out means for overcoming them by the employment of disks or knives beveled to a point remote from the cutting edge and substantially to the depth of the cut desired, resulting in the strengthening and stiffening of the disks or knives and the consequent shortening of the spinning or rolling operation, and also in important results as to the grid formed thereby, especially in the resulting openness of the grooves and consequent better distribution of the electrolyte throughout their depth and equalizing of the action of the current on the ribs; in the thickening of the bases of the ribs and consequent strengthening of them mechanically while affording a greater mass of material at the point where uneven action occurs, and the compacting of the lead at the base of the rib, just where under the old method, the action of the disks or cutters apparently resulted in a weakening of the molecular structure of the rib.

The form of disk or knife shown in my second above-mentioned co-pending application carries the improvement further by providing beyond the beveled surfaces of the disk or knife flat sided surfaces forming a channel between the disks into which the apex of the lead rib may flow, to a greater or less extent according to the thickness of blank employed and the depth of cut desired—thus forming higher ribs if need be, and larger capacity grooves by allowing the disks to feed deeper into the blank and preventing the partial destruction of the rib which would occur if it struck the base of the groove between the disks.

In the accompanying drawings, Figure 1 is an elevation to actual scale of part of a roll adapted to the formation of my improved grid, only a few disks being shown in place. Figs. 2 and 3 are sectional elevations, to a greatly enlarged scale, showing the effect upon the blank of two opposed rolls of the type shown in Fig. 1, Fig. 2 showing the effect of completely embedding the disks in the blank to the depth of the taper, and Fig. 3 the effect when the operation is stopped short of that depth. Figs. 4, 5 and 6 are similar views, illustrating the preferred form of the invention, in which the disks are slightly separated (preferably by thinning them and interposing washers), so that an expansion of the grid material into parallel-walled channels between the disks takes place, for providing greater capacity in the grid.

By way of illustration merely, the ribs on the two

sides of the grid are, in all instances, shown exactly opposite each other.

As the form of grid to which the invention relates and the general construction of the machine employed for making it are well known, I have herein not shown either the entire grid or the entire machine, but only so much thereof as is necessary to the clear understanding of my present invention.

In making the grid a flat blank,—usually of lead—is subjected to the action of a series of cutting, rolling or spinning disks, so disposed and operated as to work up out of the main body of the blank, and expanded above its original surface, a series of ribs or leaves, but leaving intact and unworked the edges of the blank, and sometimes also, portions traversing the blank; which unworked portions form a stiffening and conducting frame for the grid.

The general character of the grid of my ipresent invention is the same as that of the Richards patent abovereferred to, and a machine sinnilar in its general construction to the one therein described may be employed. But to form the grids of my present invention, I adopt disks of the form shown in the drawings and which are more fully described in my aforesaid pending applications.

The grid forming roll is comprised of disks, knives or rollers 1, placed in series on a shaft 2 and fastened and held from rotation thereon in any suitable manner. Only a few disks are shown but a number are used in practice, varying with the size of the grid and the number of ribs desired. The disks are beveled from their cutting edges substantially to the depth of cut desired and the remainder of their surfaces are flat-sided as shown. The result of embedding disks or knives of this shape in a lead blank 3 is shown in Figs. 2, 3, 5 and 6. If no washers are placed between the disks or knives, so that the beveled edges form in cross-section a V, as shown in Fig. 1, the result of an almost complete and of a complete embedding of the disks or knives in the blank are shown respectively in Figs. 2 and 3. The intended method of working when the machine is of the form shown in Fig. 1, is exhibited in Fig. 3. It will be noticed that if, by reason of too great penetration of cut, due either to an effort to obtain greater capacity or to slight irregularities of the action of the machine, or of the form of the cutting disk, the apex of the lead leaf o rib ascend into the converging angle between the disks, as shown in Fig. 2, it is apt to be torn thereby, and in any event to be prevented from sufficient expansion to allow slight changes of depth of cut and capacity. In the form, shown in Figs. 4, 5 and 6 therefore, designed to avoid this difficulty, the bevel ends at the point x where it meets the flat side of the disk, the angle between the two surfaces being rounded more or less as may be desired, and the disks are separated from each other, for example, by the washers 4, There is thus provided a channel 5 into which any expansion of the rib due to accidental or intentional excess depth of cut takes place.

In Fig. 6 is shown the result when the embedding of the tool into the lead blank is sufficient to cause the apex of the lead rib to pass slightly beyond the beveled face of the tool and into the channel 5. It is in any case not intended that there shall be any great flow of metal into the channel 5 but only sufficient to provide for necessary irregularities of action and slight modifications in capacity and thickness of blank. In any case the ribs or ridges are, in cross-section, of substantially conical or frusto-conical shape, they are of greatest thickness and strongest at the bottom, are compacted equally throughout by the crowding effect of the beveled disks or knives, instead of being loose-textured at the base where greatest strength is needed and they provide between them outwardly flaring grooves or channels for the electrolyte and formed or applied active material—thus avoiding the uneven and deleterious electrochemical results already noted. The preferred form shown in Fig. 6 has the further advantage of providing greater capacity while not destroying the beneficial effects of the frusto-conical form of the main body of the rib.

Other means than those shown for separating the disks may be employed, the disks and washers are clamped upon the shaft in the usual manner, and in other respects the general construction of the machine may be of any usual or preferred construction, that shown and described in the said Letters Patent of Richards being only instanced by way of example.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:—

1. A lead storage battery grid, having its main body or portion which is intended to become active or carry active material, formed of a series of relatively high, thin and closely set leaves or ribs of rolled or spun metal, compact and dense throughout, integral with the remainder or frame portion of the grid, said ribs being relatively thick at base, tapered substantially from base to apex, raised at the apex above the surface of the surrounding frame portion of the grid and having between them narrow and deep channels decreasing in width from substantially the surface to the mid-thickness of the grid.

2. A lead storage battery grid, having its main body or portion which is intended to become active or carry active material, formed of a series of relatively high, thin and closely set leaves or ribs of rolled or spun metal, compact and dense throughout, integral with the remainder or frame portion of the grid, said leaves or ribs being relatively thick at base, tapered nearly from base to apex, parallel-walled at the apex and raised at the apex above the surface of the surrounding frame portion of the grid and having between them narrow and deep channels decreasing in width from near the surface to the mid-thickness of the grid.

RUFUS N. CHAMBERLAIN.

Witnesses:
WM. P. HAMMOND,
HARRY E. KNIGHT.