(No Model.)

W. J. STILL.

STORAGE BATTERY.

No. 589,042. Patented Aug. 31, 1897.

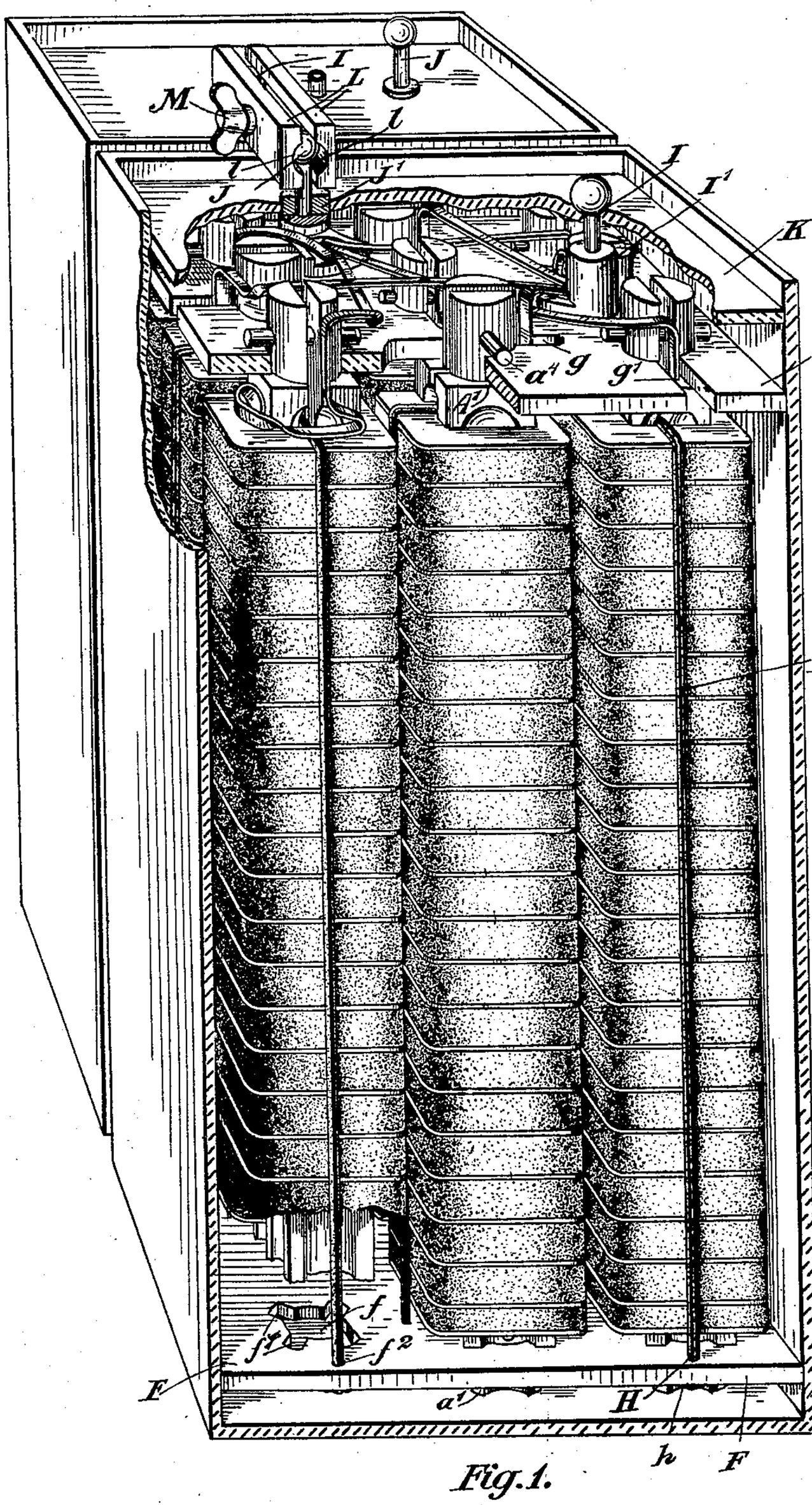

Fig. 1.

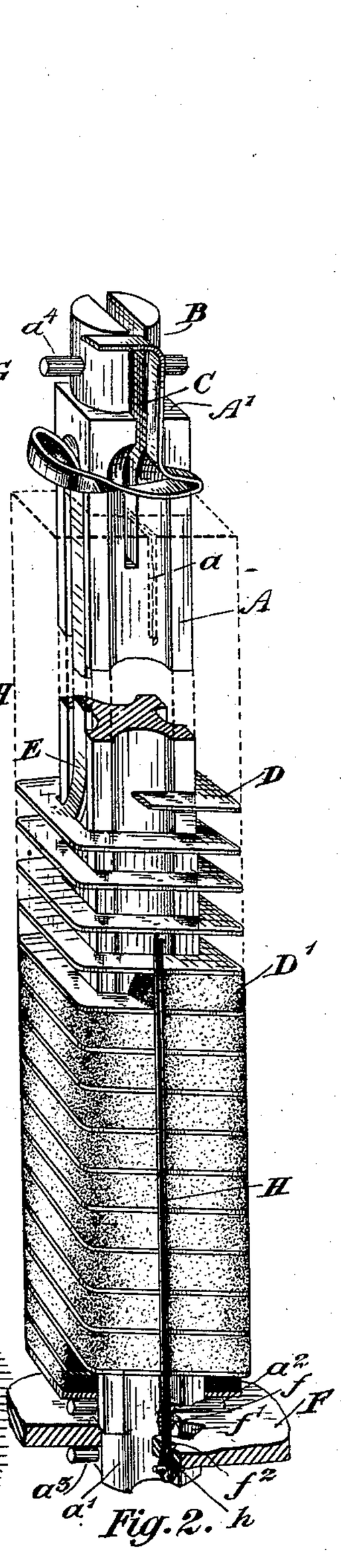

Fig. 2.

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WILLIAM JOSEPH STILL, OF TORONTO, CANADA.

STORAGE BATTERY.

SPECIFICATION forming part of Letters Patent No. 589,042, dated August 31, 1897.

Application filed February 10, 1896. Serial No. 578,769. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM JOSEPH STILL, electrician, of the city of Toronto, in the county of York, in the Province of Ontario, Canada, have invented certain new and useful Improvements in Storage Batteries, of which the following is a specification.

My invention relates to improvements in storage or secondary batteries; and the object of the invention is to design a simple, compact, and durable form of electrode in which the oxid may be held in such a manner that it may be thoroughly permeated with the acid and yet may be capable of expansion and contraction without shedding the oxid; and it consists, essentially, of forming the electrodes preferably of a rectangular spiral strip, the oxid being placed between the convolutions of the spiral and a post being provided for supporting the spiral, the lead from the electrode preferably leading off from the center of the spiral and the electrode and connections being otherwise constructed, as hereinafter more particularly explained.

Figure 1 is a perspective view showing two cells with the side and top of one broken away to exhibit the construction of the electrodes and their connections. Fig. 2 is an enlarged detail of an electrode, the central post being intermediately broken away, as well as the spirally-formed plate, a portion of the oxid being also removed.

In the drawings like letters of reference indicate corresponding parts in each figure.

A is the central or supporting post of each electrode, which is made preferably rectangular and is provided with grooves *a* throughout the major portion of its length.

B is a cylindrical top formed on the post A, and C is a slit made in the top longitudinally with the post.

D is a rectangular spiral of sheet-lead which extends edgewise around the post from near the top to the bottom. The spaces between the convolutions are filled with a continuous spiral layer of oxid.

E is a strip of lead which is preferably connected near the center to the spiral and extends upwardly through one of the grooves *a* to the top of the spiral, thus forming a lead from the electrode.

F is an insulating-plate provided with holes *f*, with wing recesses *f'*, through which extend the bottoms *a'* of the posts A of the electrode, which are reduced in diameter to fit into the hole thereof.

a^2 is a pin which is passed through the post A above the bottom shoulder and designed to separate the bottom of the spiral from the plate F.

a^3 is a pin which passes through the post A below the plate F and designed to hold the bottom of the post securely in the plate.

G is the top insulating-plate, which rests upon square shoulders A', formed at the bottom of the cylindrical top B. A pin a^4 extends through the top B of each electrode across the slit C, and the top plate G is made with slots *g* running one way and slots *g'* running at right angles thereto. It will of course be understood that the center of each slot *g g'* is circular, so as to receive the cylindrical top B of the post. The pins a^4, it will thus be seen, serve to hold down the top plate upon the shoulders A'.

H is an elastic looped band which is passed through the top slit C and down alongside of the electrode through holes f^2 in the bottom plate F'. Pins *h* are passed through the looped elastic bands, so as to hold them securely around the electrode.

The bands serve to press upon the oxid in the electrode and yet permit of a ready expansion and help contraction. The elastic bands H are passed down the two sides of the electrode, as described, and on each adjacent electrode the bands pass down on different sides, so that they form a means of insulating the electrodes from each other in case of jarring. The top of the band, which extends across the top of the spiral, is on a line with the slots *g* and *g'* in the plate G, and these slots are longer than the width of the electrode.

As the combined electrodes with the top and bottom plates G and F can be removed simultaneously, being connected together, it will be seen that if any band becomes broken it may be replaced when out of the cell by simply passing the bands around through the slits and slots to the bottom plate F without removing any one electrode to do so.

The leads E of, we will say, the positive electrodes are connected to the binding-post

I, while the leads of the negative electrode are connected to the binding-post J. The lower portions I' and J' of the posts are cylindrical and made of lead and extend through the top plate K, which is of course sealed all around. The tops of the posts I and J are made with a tinned stem and spherical head. The top plate K rests upon the tops of the posts A. The negative binding-post J is connected to the positive binding-post I of the next cell by the plates L L, having arc-shaped grooves *l l* made in them.

M is a thumb-screw by which the spherical heads of the posts I and J are held securely in the grooves *l l*, so as to form a perfect contact.

By making the heads of the binding-posts spherical and forming a connection between them, as described, by the plates L with grooves I am enabled to provide for the perfect connection between the cells.

As it is very difficult in practice to get the electrodes of the same height, the benefit of the construction above described will be readily understood.

What I claim as my invention is—

1. In a storage battery, an electrode comprising a rectangular continuous hollow spiral of flat strip sheet-lead in flexible form with both edges free and an interposed hollow spiral of active material exposed at the inside and outside and a supporting-post for the electrode extending up within the spiral and forming a guide for the free lengthwise movement of the spiral, as and for the purpose specified.

2. In a storage battery an electrode comprising a rectangular hollow spiral of flat strip sheet-lead and an interposed hollow spiral of active material, a rectangular supporting-post for the electrode extending up through the spiral and longitudinal grooves in each side of the post as and for the purpose specified.

3. In a storage battery an electrode comprising a rectangular hollow spiral of flat strip sheet-lead and an interposed hollow spiral of active material, a supporting-post for the electrode extending up within the spiral and a lead from the center of the lead spiral as and for the purpose specified.

4. In a storage battery an electrode comprising a rectangular hollow spiral of flat strip sheet-lead and an interposed hollow spiral of active material, a rectangular supporting-post for the electrode extending up through the spiral, longitudinal grooves in each side of the post and a lead from the center edge of the spiral extending up through one of the grooves through the central opening of the spiral as and for the purpose specified.

5. The combination with the rectangular hollow spiral of flat strip sheet-lead and the hollow spiral of active material filling the spaces between the convolutions, of the central post having a top slit and the elastic band passing through the slit and from end to end of the electrode, the lower end of the band being suitably fastened, substantially as described.

6. The combination with the rectangular electrodes formed of a flat rectangular spiral with an interposed spiral of active material and central post with cylindrical top and slits in the tops of such posts, of the top and bottom insulating-plates oppositely-formed slots for each alternate electrode in the top plate and circular openings in the center of such slots to receive the cylindrical heads of the posts and an elastic band for holding the plates together having the top on a line with the slots as and for the purpose specified.

7. The combination with the spirally-formed electrodes having the reduced top and bottom ends forming shoulders, of the top and bottom insulating-plates into which such reduced ends fit as and for the purpose specified.

8. The combination with the spirally-formed electrodes having the reduced top and bottom ends forming shoulders, of the top and bottom plates and the winged holes in the bottom plate to receive the corresponding reduced ends as and for the purpose specified.

9. The combination with the spirally-formed electrodes having the reduced top and bottom ends forming shoulders, of the top and bottom plates and the pins extending through the bottoms of the posts above the shoulder and separating the bottoms of the electrodes from the insulating-plates as and for the purpose specified.

10. The combination with the spirally-formed electrodes having the reduced top and bottom ends forming shoulders, of the top and bottom plates and pins extending through the reduced ends to bind the posts of the electrodes to the top and bottom plates as and for the purpose specified.

11. The combination with the spirally-formed electrodes having the reduced top and bottom ends forming shoulders, of the top and bottom plates, slots in the same through which the leads extend, binding-posts to which the leads are connected, and the top sealing-plate resting on the tops of the posts and having openings through which the binding-posts extend as and for the purpose specified.

12. In a storage battery the combination with the electrodes and leads therefrom and binding-posts to which the leads for each cell are connected having stems with spherical heads, of a pair of connecting-plates for the cells having arc-shaped grooves and clamping means for holding the spherical heads in the grooves as and for the purpose specified.

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