

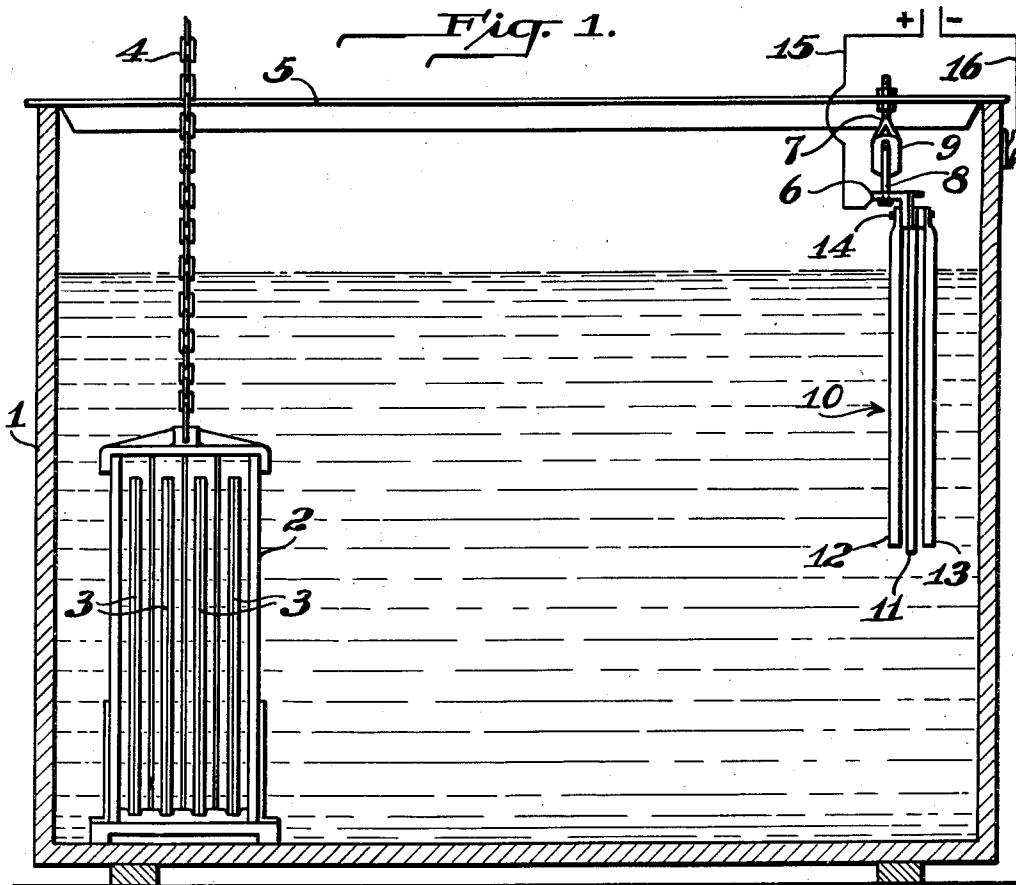
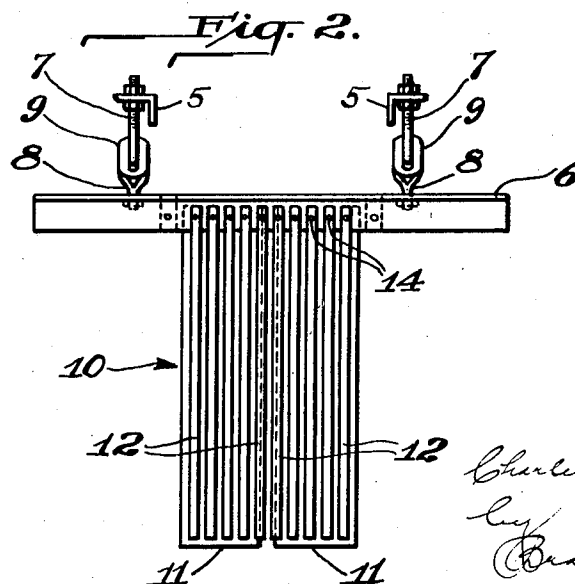
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APPARATUS FOR USE WITH ACID CLEANING EQUIPMENT

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APPARATUS FOR USE WITH ACID
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5 Claims. (Cl. 204—25)

The invention relates to apparatus for use in connection with acid treating operations, such as the acid grooving of laminated glass. In acid grooving laminated glass, the plates to be grooved, each consisting of a sheet of cellulose plastic, to each of whose faces a sheet of glass is cemented, are placed in a metal rack and immersed in a bath of concentrated sulphuric acid which eats out the plastic to the depth of about one-eighth inch, the grooves thus formed being subsequently filled with a sealing material. In practicing this process, the tank which contains the acid, as well as the racks for carrying the plates, the heating coils, and other equipment used in connection with the operation exposed to the acid are gradually eaten away by the acid and require replacement from time to time. The apparatus of the present invention provides means and procedure whereby the equipment is protected from the acid, so that it will not deteriorate in service and may be used indefinitely without replacement and repair. Briefly stated, this result is accomplished by placing an electrode in the acid tank and passing an electric current through the bath with the electrode as the positive pole, and the tank and equipment to be protected as the negative pole. The tank thus becomes an electrolytic cell, and if a plating material such as copper is provided at the positive pole, or if copper sulphate is added to the bath, a plate of copper is deposited on the inner surface of the tank upon the equipment which is grounded to the tank and which forms a part of the negative pole or cathode of the cell. It is not necessary, however, that the plating material be used, as the flow of current without any plating action, will protect the tank and equipment from acid corrosion.

One of the obstacles in the practice of the invention has been the development of a satisfactory electrode, and the present invention relates particularly to the electrode. Pressed graphite has been used, but is consumed too rapidly. Crushed graphite may also be used in a perforated container, but this disintegrates, and washes through the container in cleaning. Ordinary metal electrodes are not suitable, as they quickly become coated with a non-conducting film, due to the reaction of the acid bath with the metal, so that they have to be removed and cleaned at very short intervals. The object of the present invention is to overcome the foregoing difficulties and provide a self-cleaning electrode of simple construction and low cost

which can be used for long periods without replacement and without cleaning. One embodiment is illustrated in the accompanying drawing, wherein:

Figure 1 is a vertical section through an acid tank with the equipment therein shown in edge elevation. And Fig. 2 is a front elevation of the electrode.

Referring to the drawing, 1 is a tank preferably of iron or steel containing a bath of concentrated sulphuric acid, and 2 is a metal rack also preferably of iron, carrying the laminated glass plates 3 to be grooved. The rack is supported by means of the chain 4 from a suitable hoist (not shown), by means of which the rack is lowered into the acid and removed therefrom after the completion of the grooving operation. The rack is grounded electrically with respect to the tank by allowing it to rest on the bottom of the tank during the grooving operation.

Extending across the top of the tank is a pair of iron bars 5, 5, from which the angle iron 6 is supported by means of the suspending devices 7, 8, having the porcelain insulators 9 interposed therein, so that the angle 6 and the electrode carried thereby is insulated from the supporting bars and the tank. The electrode consists of two copper plates 11, 11 and a series of bars 12, 12, 12, etc. and 13, 13, 13, etc. arranged on opposite sides of the plates and closely adjacent thereto, as indicated in the drawing. These bars are preferably of the composition known as Allegheny metal or "Ascology", which consists of an alloy of iron, nickel and chromium. The copper plates and the bars are supported from the angle 6 by means of the bolts 14.

Current is supplied to the electrode from the positive lead 15, while the negative lead 16 is connected to the tank. An electrolytic cell is thus provided with a current flow from the positive electrode 10 to the tank and to any metal equipment in the tank which is grounded thereto, such as the rack 2, which carries the laminated plates 3, that are to be grooved. Other equipment (not shown) which is commonly used in acid grooving operations, such as agitators, heating coils and the like may be similarly protected from corrosion by grounding them to the tank so that they become part of the negative pole or electrode of the cell.

In starting the operation, about .05 per cent of copper sulphate is added to the bath, this amount being kept fairly constant during the operation by copper dissolved from the plates

11, 11. The current applied will vary somewhat with conditions. With a tank of 270 cubic feet capacity, thirty-three amperes have been used with good results at a voltage of 3.8, which is more than sufficient to overcome the internal resistance of the bath. The electrode 10 has a long period of life and can be used for several months without cleaning. Copper is removed from the plates 11 by the electrolytic action of the cell, but this action is slow, as a large part of the current passes through the portions of the electrode made up of the bars 12 and 13, which due to their resistance to the acid and to their resistance to removal by electrolytic action will last indefinitely. Because of the electrolytic action of the cell, there is a slight deposit of copper on the inner surface of the tank and on the equipment. Due to the fact that the metal of the bars 12 and 13 lies in a different portion of the electromotive series than copper, there is a small local flow of current between the copper plates and the bars 12 and 13, and this flow of current acts to keep the surface of the metal members free from an insulating film (which is believed to be in the nature of an oxide), which would otherwise form on the surfaces of the members and interfere with the flow of current from such members through the bath and to the cathode portion of the cell. If the copper plates are used alone, they become coated with the insulating film in a very short period of time, so that no current will then pass from the electrode 10 to the rack 3 or the walls of the tank itself. Similarly, when the bars 12 and 13 of nickel chromium iron alloy are used alone, a similar film forms on the surface of the bars and soon stops the flow of current through the bath. The use of the copper plates, in combination with the nickel chromium iron alloy bars, gives the most satisfactory results of any combinations tested, but it is possible to secure similar results if other metals are used in place of the copper, such as lead, tin, zinc. It is also possible to substitute for the nickel chromium iron alloy, bars or plates of nickel, iron or chromium, the essential requirement being that the two metals constituting the electrodes occupy a different position in the electromotive series, so that when placed in an acid bath, a supplemental flow of current will occur from one metal to the other metal, thus preventing the depositing of a film of insulating character which would otherwise have to be removed at relatively short intervals. The electrode, as above described, therefore,

constitutes a self-cleaning anode which not only has long life, but which is kept free from insulating film during a long period of service.

In using the apparatus, it is possible to use plating materials other than copper, such as nickel or chromium, which may be substituted in the bath in place of the copper sulphate heretofore referred to. Other acids, such as nitric or formic acid, or a mixture of nitric or sulphuric acid may be used in place of the concentrated sulphuric acid, although the latter gives the best results, and its use is preferred.

What I claim is:

1. Apparatus for acid treating material comprising a metal tank for the acid bath, an electrode in the tank insulated therefrom comprising a pair of adjacent metal members one of which lies in the group consisting of copper, lead, tin and zinc, and the other of which lies in the group consisting of chromium, iron and nickel, and a source of electric current having its positive lead connected to the electrode and its negative lead connected to the tank.

2. Apparatus for acid treating material comprising a metal tank for the acid bath, an electrode in the tank insulated therefrom comprising a pair of adjacent metal members one of which is copper and the other of which lies in the group consisting of chromium, iron and nickel, and a source of electric current having its positive lead connected to the electrode and its negative lead connected to the tank.

3. Apparatus for acid treating material comprising a metal tank for the acid bath, an electrode in the tank insulated therefrom comprising a pair of adjacent metal members one of which is of copper composition and the other of nickel chromium iron composition, and a source of electric current having its positive lead connected to the electrode and its negative lead connected to the tank.

4. Apparatus for acid treating material comprising a metal tank for the acid bath, an electrode in the tank insulated therefrom comprising a plate of copper composition, and a series of strips on each side thereof and parallel to the plate of metal, lying in the group consisting of chromium, iron and nickel.

5. Apparatus for acid treating material comprising a metal tank for the acid bath, an electrode in the tank insulated therefrom comprising a plate of copper composition and a series of strips on each side thereof and parallel to the plate, of nickel chromium iron composition.

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