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CATHODE

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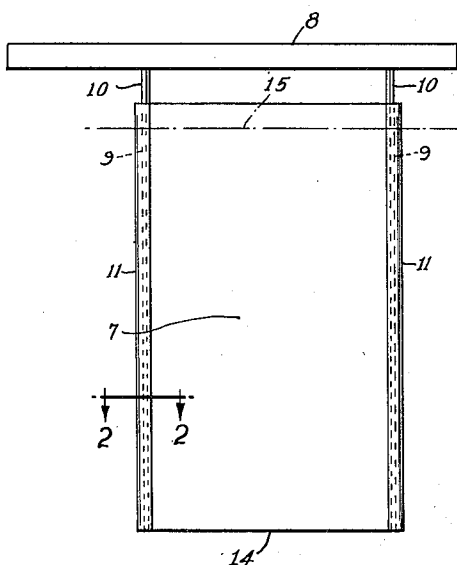


FIG. 1

FLEXIBLE PLASTIC TUBING

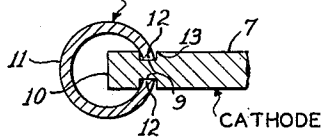


FIG. 2

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CATHODE

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1 Claim. (Cl. 204—281)

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This invention relates to cathodes, and more particularly to sheet cathodes intended to receive an electro-deposit of metal that is subsequently to be stripped therefrom. The invention is particularly applicable to the sheet cathodes on which zinc is deposited electrolytically, and from which it is subsequently stripped, in the electrolytic recovery of metallic zinc. It is also applicable to the blank cathodes on which starting sheets are deposited in the electrolytic refining of copper.

It is the object of the invention to provide an improved design of the insulating covering about the side edges of sheet cathodes of the character just mentioned, which covering prevents the metal deposited on opposite sides of the cathode from uniting around the edges of the cathode, and so becoming very difficult to remove by mechanical stripping. In accordance with the invention, the cathode sheet is formed with a pair of longitudinal grooves adjacent each of its side edges. The grooves of each pair are on opposite sides of the sheet and are spaced equal distances inwardly from the adjacent side edge of the sheet. A length of longitudinally-slit tubing of a flexible non-conducting plastic material surrounds and so covers each side edge of the sheet, with the slit edges of each length of tubing being received and clamped in the pair of grooves adjacent the side edge surrounded thereby. Cathodes thus made have been found to give long service life and to possess substantial advantages over cathodes provided with edge coverings of the types heretofore proposed and used.

A preferred embodiment of the invention as applied to cathodes for use in the electrolytic recovery of zinc (and applicable to cathodes on which starting sheets are deposited in the electrolytic refining of copper) is described below with reference to the accompanying drawings, in which

Fig. 1 is a plan of a cathode made in accordance with the invention; and

Fig. 2 is a section, on an enlarged scale, taken substantially along the line 2—2 of Fig. 1.

In the usual process for the electrolytic recovery of zinc, the zinc is deposited from an acidic zinc sulphate electrolyte on to aluminum sheet cathodes about one-eighth inch thick, which are suspended between lead anodes in tanks containing the electrolyte. The zinc deposits on both sides of the aluminum cathode sheets, and is later stripped therefrom by a hand operation. The stripping operation is very greatly simplified if the zinc is not allowed to

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deposit around the vertical side edges of the cathode sheets. It has been the practice for many years to prevent deposition at the side edges of the sheets by applying wooden strips to the vertical side edges of the aluminum cathode sheets. The wooden strips are formed with longitudinal slots, of width somewhat less than the thickness of the sheets, so that when the side edge of a cathode sheet is pressed into the slot, the strip is held in position thereon.

Wooden strips have a number of unsatisfactory features. For example, in an operation involving 10,000 cathodes in service, 20,000 strips are in use at any one time. The average life of a strip is only ten to twelve days, so that about 1800 strips must be replaced daily. The cost of the replacements, and for handling them, is considerable. The strips are subject to breaking, and broken pieces have on occasion entered and clogged electrolyte pipe lines and launders. The strips sometimes fall off when the cathodes are removed to the stripping floor, creating a working hazard for the labor force. The wooden strips soak up the electrolyte solution which causes them to swell and often crack. When cracking occurs, zinc that is not in suitable form for melting and subsequent use deposits under the strips. When the strips are no longer suitable for use, they are saturated with electrolyte solution, and in an operation of the size mentioned above, the zinc irrevocably lost when the saturated strips are discarded amounts to several thousand pounds monthly. Wooden strips are always suspect from the standpoint of introducing impurities that are detrimental to electrolysis into the electrolyte.

The improved cathode edge covering provided by the invention, which is considerably more economical than the wooden strips heretofore used and which is free from the above-outlined disadvantages of wooden strips, is shown in the drawings. The aluminum cathode sheet 7 (which is provided at the top with the usual metal cross-bar 8 for hanging it in the electrolyte tank and for making the electrical connection to it) is provided with pairs of grooves 9 adjacent each of its side edges. The grooves of each pair are disposed on opposite sides of the sheet, and are spaced equal distances inwardly from the adjacent side edge 10 of the cathode sheet, as best shown in Fig. 2.

A length of longitudinally split tubing 11, of flexible non-conducting (dielectric) plastic composition, is placed in position to surround each side edge 10 of the cathode sheet. The slot edges

12 of the tubing are received and clamped in the pair of grooves adjacent the side edge that the tubing surrounds. The width of the grooves 9 is substantially the same as the wall thickness of the tubing, so that a reasonably close fit of the tubing in the grooves is attained. In consequence there is a minimum of cathode exposed for receiving a deposit of zinc beyond the inner edges 13 of the grooves. The clamping action of the tubing to the cathode results from the natural resiliency of the plastic material of which the tubing is formed. The grooves 9 in which the slit edges 12 of the tubing engage are necessary to insure proper locating of the tubing on the sheet, and to insure that it will be securely held in place.

The length of the tubing should be sufficient to extend from the bottom edge 14 of the cathode sheet to a little above the level 15 to which the cathode is normally immersed in the electrolyte. No tubing is provided to cover the bottom edge 14 of the cathode, because it is not necessary to protect this edge to insure easy mechanical stripping of the electrodeposit formed on the cathode.

While the foregoing description has been made with special reference to aluminum cathodes for electrolytic zinc recovery, the structure described is essentially the same as is used in making cathodes according to the invention for the production of starting sheets to be used in electro-refining copper. The chief differences are that in the latter case the cathode sheet is of copper rather than aluminum, and the electrolyte in which it is immersed is an acidic copper sulphate solution.

Many different flexible plastic materials are available in tubing form for use in accordance with the invention, and the choice of material will generally depend on such factors as cost and the nature of the electrolyte in which the cathode is immersed. Polymerized ethylene plastic ("Polythene") tubing, and plastic copolymers of vinylidene chloride and vinyl chloride and of vinylidene chloride and acrylonitrile (available under such trade names as "Saran," "Geon" and "Velon") in tubing form have been found to give excellent results when used to cover the edges of cathodes used in the acidic zinc sulphate electrolyte of an electrolytic zinc plant. Other plastic compositions, both natural and synthetic, such as rubber, polymerized vinyl chloride, ("Koroseal"), polymerized chloroprene ("neoprene"), polymerized tetrafluoroethylene ("Teflon"), and copolymers of vinyl chloride and vinyl acetate ("Vinylite") also may be used in appropriate cases for making the tubing 11.

Under present (1947) market conditions, the cost of plastic tubing for covering the edges of cathodes used in the electrolytic recovery of zinc is about five times as great as the wooden strips previously used, but they last about a year instead of only the ten to twelve days for wooden strips. Thus only about one-thirtieth as many replacements are required annually as in the case of wooden strips, and replacement costs are only about one-sixth that of the wooden strips. In addition, the plastic tube edgings are largely free from the other disadvantages of wooden strips. Being flexible, they do not break easily. Their natural resiliency is not seriously impaired by prolonged immersion in the electrolyte, and they grip the cathode sheets tightly, so they do not drop off in service. They are impervious to the electrolyte, so metal is not

deposited under them, and none is lost, when it becomes necessary to replace them, on account of absorption of electrolyte in them. They do not introduce impurities into the electrolyte. They are narrower than wooden strips, and hence cathode sheets dressed with them are easier to place in the electrolyte tanks than are cathodes dressed with wooden strips. They are not more difficult to apply to the cathode sheet than are the wooden strips. In every respect they have proven eminently satisfactory.

While particular mention has been made of the advantages of plastic tubing for dressing cathodes in accordance with the invention, as compared with wooden strips for the same purpose, it is recognized that other proposals for dressing the edges of such cathodes have also been made. These other proposals, however, have been even less practical in commercial operation than the use of wooden strips, as evidenced by the fact that they have not been used on a commercial scale to any substantial extent. For example, it has been proposed to apply hard rubber or similar edgings to cathodes by riveting or cementing the edging strip in place. These proposals have the serious commercial disadvantage of involving great expense to apply the edging, so that the advantages gained from the improved properties of the edging material are largely offset. Further, when it becomes necessary to replace the edging, additional large expenses are involved in detaching it from the cathode sheets, and a considerable proportion of the sheets themselves become irreparably damaged. A further objection to riveting the edging in place is the necessity for, and difficulty of, insulating the metallic rivets from the cathode sheet. These factors have made the various proposals heretofore made for applying edgings of such materials as hard rubber to cathodes for use in electrolytic zinc recovery even less practical, in large scale operation, than the use of wooden strips, notwithstanding the disadvantages of the latter. The present invention avoids the commercially impractical features of the prior proposals for the use of hard rubber and like edgings, while securing the full benefits involved in the use of a better material.

We claim:

A cathode for use in the electrolytic recovery of zinc and adapted to receive an electrodeposit of zinc that is subsequently to be stripped therefrom, consisting essentially of an aluminum sheet formed adjacent each side edge with a pair of longitudinal grooves, the grooves of each pair being disposed on opposite sides of the sheet and being equidistant from the adjacent side edge of the sheet, and a length of longitudinally slit tubing composed of flexible polymerized ethylene plastic surrounding each side edge of the sheet, the grooves being each of a width substantially equal to the wall thickness of the tubing, and the slit edges of each length of tubing being received and clamped in the pair of grooves adjacent the side edge of the sheet surrounded thereby, the interlocking of the plastic tubing in the grooves of the aluminum sheet substantially completely preventing any zinc from being deposited under said tubing.

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