M. M. MERRITT.

ELECTROLYTIC METHOD AND APPARATUS.

APPLICATION FILED SEPT. 18, 1918.

1,335,177. Patented Mar. 30, 1920.

2 SHEETS—SHEET 1.

Fig. 1.

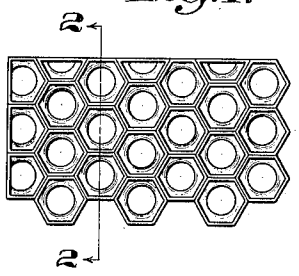


Fig. 2.

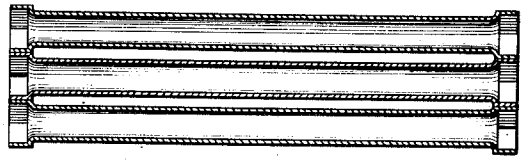


Fig. 3

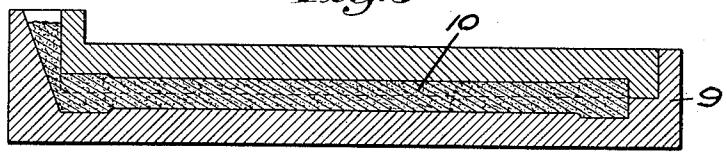


Fig. 4.

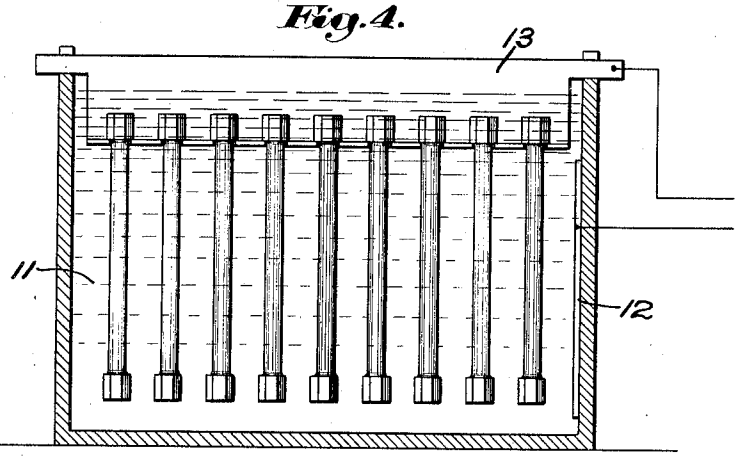
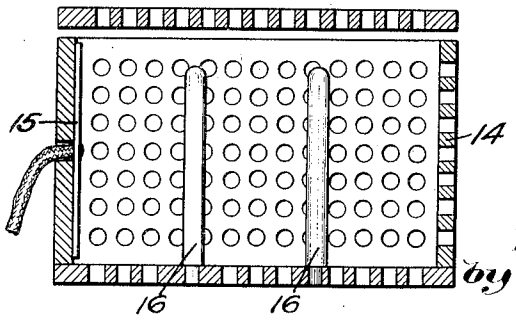


Fig. 5.



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2 SHEETS—SHEET 2.

Fig. 6.

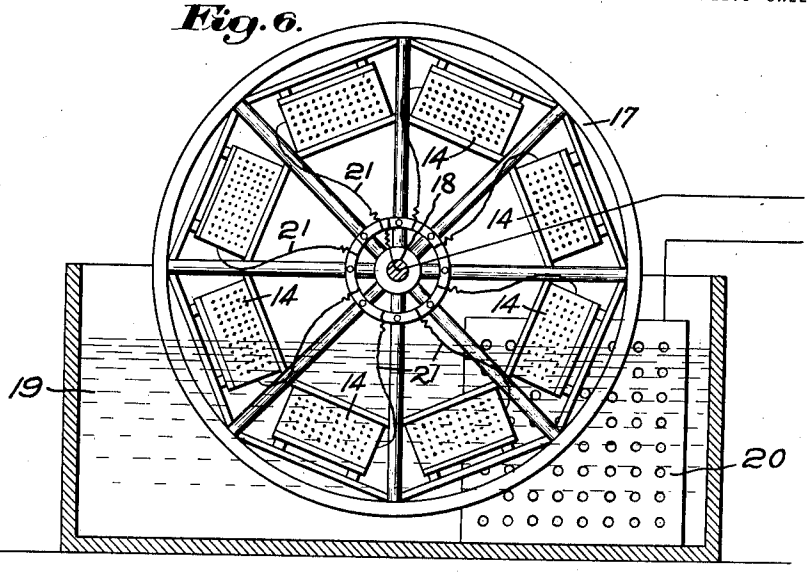
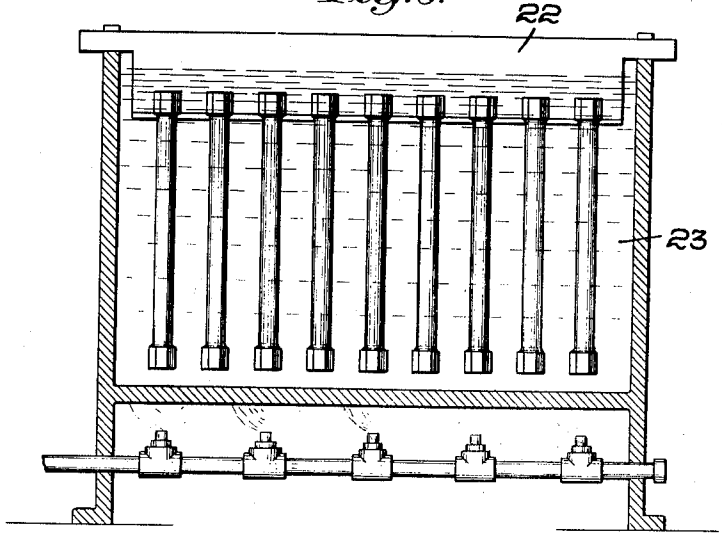


Fig. 7.



Fig. 8.



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UNITED STATES PATENT OFFICE.

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ELECTROLYTIC METHOD AND APPARATUS.

1,335,177. Specification of Letters Patent. **Patented Mar. 30, 1920.**

Application filed September 18, 1918. Serial No. 254,633.

To all whom it may concern:

Be it known that I, MATTHEW M. MERRITT, a citizen of the United States, and a resident of South Middleton, county of Essex, Commonwealth of Massachusetts, have invented an Improvement in Electrolytic Methods and Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention pertains to electrolytic methods and apparatus, and more particularly, though not exclusively, to methods and apparatus for the manufacture of small articles in quantity by electrolysis. My invention is particularly useful in connection with the manufacture of tubes for containers such as aeroplane radiators, which tubes are to be tinned exterior to the electrolytically deposited metal.

In the drawings, which show a preferred form of apparatus with which to practice an illustrative method constituting one embodiment of my invention:—

Figure 1 is an end view of a radiator section formed of nested hexagonal tubes;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is a section through a preferred form of mold in which the mandrel or matrix on which the electrolytic deposit is made may be formed;

Fig. 4 is a section showing a plurality of mandrels suspended in alkaline electrolyte for initial electrolytic deposit;

Fig. 5 is a section through a preferred form of container for holding the cathodes during a second electro-deposit, further illustrated in Fig. 6;

Fig. 6 is a section through an acid bath showing a preferred form of apparatus for use in connection with a supplemental or principal electrolytic deposit;

Fig. 7 is a section through a tube and mandrel after the second electrolytic deposit; and

Fig. 8 is a section through a preferred form of apparatus for removing the mandrel of fusible metal and for tinning the same.

While various phases of my invention are of general application, I have elected to disclose the same in connection with the manufacture of tubes such as are used by the United States and British Governments in the latest form of aeroplane radiator. These tubes are round in cross-section throughout their central portion, and are hexagonal at each end so that when assembled and dipped at each end in a fusible metal they will be secured together to provide a radiator in which the air circulates through the tubes and a water space is provided exterior to the tubes and between the tubes. These tubes have heretofore been manufactured by expanding the ends of round tubes, but this is unsatisfactory because, if sufficient metal is provided to permit of expansion of the ends, the central portion of the tubes must necessarily be thick, thereby unduly increasing the weight of the radiator and decreasing the full efficiency thereof.

In practising a preferred form of my invention, I first cast in any suitable mold 9 (Fig. 3) a mandrel or matrix 10 of fusible metal, preferably formed with a sufficient content of tin or the like so that when melted it will form a suitable tinning agent. I then support a plurality of these matrices or mandrels in an alkaline bath 11, preferably cyanid of potassium, and having an anode 12, the same being connected in any suitable way so that a preliminary coating of copper or other suitable metal may be electrolytically deposited on the cathode. This preliminary coating may be, and preferably is, very thin, the purpose thereof being to provide an initial layer of copper which will later form the interior of the tube to which the material forming the matrix will combine to provide a tinned surface. I have found that, where the initial electro-deposit is made in an acid bath, the interior surface of the tubes after completion is very rough, while if the initial deposit is made in an alkaline bath the interior surface will be smooth and well tinned. The deposits in the alkaline bath 11 may continue for a few minutes, after which the cathodes are removed from the rack 13 in which they have been suspended in the alkaline bath and are placed in containers or tumbling boxes 14 (Fig. 5). Each of these tumbling boxes may contain a hundred of the tubes; and the tumbling boxes may be provided at one end with a contact 15, and are preferably provided with pins 16 which prevent the cathodes from becoming wedged in any given position, while leaving them free to tumble during the operation later described. The sides of the container 14, which is prefer-

ably of wood or other non-conductive material are perforated with a great number of holes so that the electrolyte can pass freely therethrough. I then mount the containers 14 on a rotatable carrier typified by the wheel 17 rotatable about an axis 18 and partially immersed in an acid electrolyte 19 containing any suitable anodes 20. The containers 14 may be wedged upon the wheel 17, the number of such containers mounted on any given wheel preferably being sufficient so that, when the wheel is revolved, the total cathode surface immersed in the electrolyte at any given time will be substantially constant. The plates or contact 15 in the ends of the containers 14 are connected to the circuit by wires 21. During electro-deposition the wheel 17 is preferably rotated at such a speed that each container will be immersed in the electrolyte approximately two seconds, and will be out of the electrolyte approximately four seconds. During the revolution of the wheel the cathodes in the boxes are tumbled so that no cathode will touch another cathode in exactly the same place for any considerable length of time. The number of cathodes in each box is, however, sufficient so that each will receive current directly from the plates 15 or indirectly from such plates through the other cathodes. After electro-deposition in the bath 19 has been continued for a sufficient time to give the required thickness of deposit, the cathodes are removed in the condition shown in Fig. 7, and the ends thereof are then cut off on the lines A—A. The cathodes are then again suspended in any suitable rack 22 (Fig. 8), and are immersed in molten fusible metal 23 for a sufficient time to melt the mandrels or matrices, after which the shells or tubes are removed, being thoroughly tinned inside and outside.

As before stated, I have found that the tinning on the inside of the tubes is much more satisfactory where the deposit is made first in an alkaline bath and later in an acid bath. The cathode should be washed after being taken out of the alkaline bath, and before immersion in the acid bath. The copper or other metal deposited by alternate immersion and emersion is much finer-grained, tougher and less porous than when deposited while constantly immersed in the bath, and the tumbling of the cathodes in the boxes not only effects a large saving in the cost of the operation, but prevents defects in the deposited surface arising from continued support or contact at any one point, while promoting evenness of deposit. The fusible metal having tinning properties may be used again and again, the only loss being that portion utilized in tinning the surfaces of the tubes.

While I have shown and described one embodiment of my invention and one method of practising the same, it will be understood that major changes involving omission, alteration, substitution, reversal of parts, and even changes in the mode of operation, may be made without departing from the scope of my invention set forth in the appended claims. It will also be understood that my invention is applicable to the manufacture of a variety of products within the scope of the appended claims.

Claims.

1. The electrolytic method which comprises providing a mandrel, mold or matrix as a cathode, initiating electrolytic deposit of metal thereon in an alkaline electrolyte and continuing electrolytic deposit thereon in an acid electrolyte.

2. The method of making tubes for containers, which comprises providing a cathode of fusible metal, initiating electrolytic deposit of metal thereon in an alkaline electrolyte and continuing electrolytic deposit in an acid electrolyte.

3. The method of making tubes for containers, which comprises providing a cathode of fusible metal, initiating electrolytic deposit of metal thereon in an alkaline electrolyte, continuing electrolytic deposit in an acid electrolyte, and removing the cathode by immersion in a fused mass of fusible metal, thereby to provide a thin, electrolytically deposited tube tinned both inside and outside with the fusible metal.

4. The electrolytic method which comprises loosely confining a plurality of cathodes in a container and tumbling said cathodes together during electro-deposition while the container is alternately immersed in the electrolyte and emersed therefrom.

In testimony whereof, I have signed my name to this specification.

MATTHEW M. MERRITT.