Nov. 30, 1943. H. C. MACAN 2,335,776

STRIPPING ELECTRODEPOSITED METAL SHEETS

Filed May 11, 1939

Fig. 1.

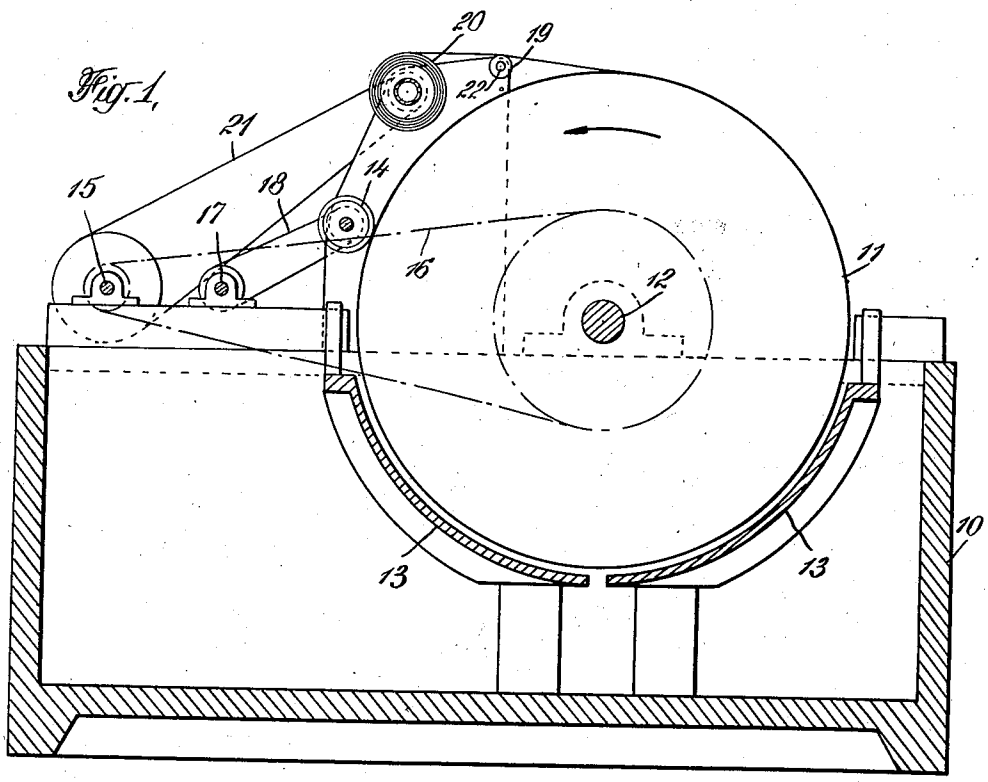


Fig. 2.

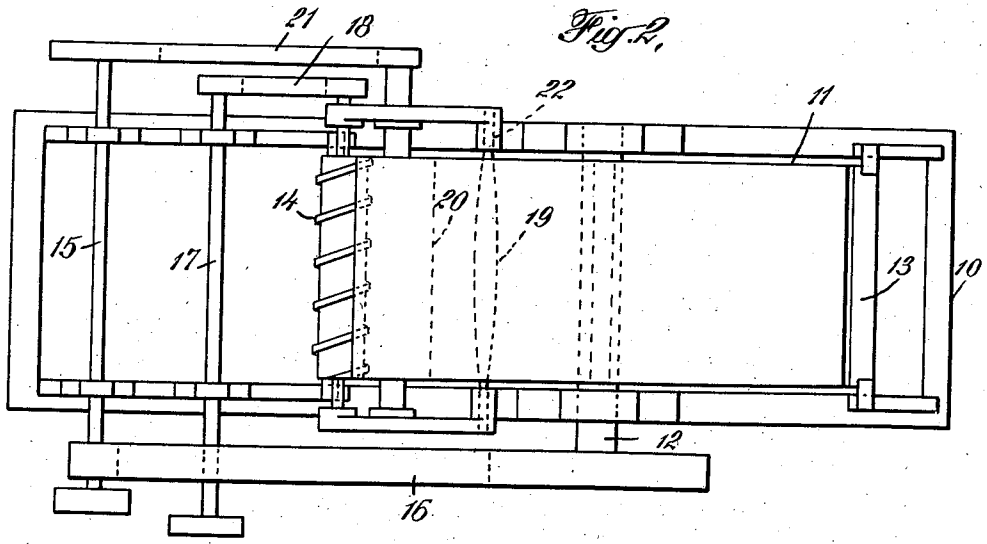
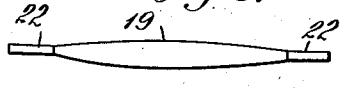


Fig. 3.



INVENTOR
Harry C. Macan
BY
Pennie Davis Marvin & Edmonds
ATTORNEYS

Patented Nov. 30, 1943 2,335,776

UNITED STATES PATENT OFFICE

2,335,776

STRIPPING ELECTRODEPOSITED METAL SHEETS

Harry C. Macan, Rutherford, N. J., assignor to Anaconda Copper Mining Company, a corporation of Montana

Application May 11, 1939, Serial No. 273,012

2 Claims. (Cl. 204—216)

This invention relates to stripping electrodeposited metal sheets from rotating cathodes, and provides an improved method and apparatus for continuously stripping such sheets. The invention is particularly adapted for use in stripping thin sheet copper from rotating cathodes, but is applicable to the continuous stripping of any electrodeposited metal.

A successful process for continuously producing thin sheet metal electrolytically involves depositing the metal electrolytically on the cylindrical surface of a rotating cathode drum which is partially immersed in a suitable electrolyte. As the cathode rotates above the surface of the electrolyte, the metal deposited on its surface is stripped therefrom and wound on a take-up reel.

Such a process for the manufacture of sheet copper has been in use for some time and has enabled the production of very thin sheet copper in greater widths than can be produced by other means.

The width of the sheet copper product is determined by the width of the cathode face of the drum, and thickness of the sheet is governed by the speed at which the drum rotates. At relatively low speeds, each unit of area of the cathode is immersed in the electrolyte for a relatively long period of time per drum revolution, and in consequence a relatively thick deposit is formed on the drum and a relatively thick sheet product is obtained. At higher speeds each unit of area of the cathode is immersed in the electrolyte for a relatively short period of time per drum revolution, and only a relatively thin deposit of copper is formed thereon. As a result, a thin sheet product is obtained. Sheet copper weighing as little as ⅛ of an ounce per square foot (corresponding to a thickness of 0.00017 inch) and even less may be made by this process, and thicker sheets are readily produced.

Copper sheets weighing one ounce per square foot and upwards (upwards of 0.00135 inch in thickness) may be stripped from the rotating cathode without particular difficulty by passing the sheet from the cathode over a cylindrical stripping roll or bar which serves to separate the sheet from the cathode surface. With thinner sheets, however, stripping is very difficult because of the ease with which the sheets tear at the edges. A tear not only spoils the product but causes serious delays in production. Because of the difficulty of stripping very thin electrodeposited sheet copper, it has heretofore been impossible to produce long lengths of copper weighing less than about one ounce per square foot.

The present invention provides an improved method for continuously stripping a thin sheet of electrodeposited metal from a rotating cathode which enables production of long lengths of such very thin sheet metal without tearing at the edges. The new method of stripping involves separating the center portion of the sheet in advance of its edge portions from the cathode. In this manner the sheet is stripped from its center portion outwardly toward its edges. The force required for stripping is applied principally to the center portion of the sheet, and such force as is necessary for stripping the sheet at its edges is transmitted thereto largely from the center portion. Thus a minimum of stripping strain is imposed on the edges of the sheet and the development of edge tears is minimized.

Suitable apparatus for carrying out the new method comprises a stripping member positioned in close proximity to the rotating cathode on which the sheet is produced. The stripping member is of such configuration and is so mounted that its upper surface is spaced a greater distance from the center portion of the drum surface than from the edge portions thereof. The sheet formed on the cathode is passed over the stripping member, which by virtue of its configuration, causes the force required for stripping to be applied principally to the center portion of the sheet, with a minimum of stripping strain being imposed on the edges thereof.

A preferred embodiment of the invention is described in detail below with particular reference to the stripping of thin sheet copper. In the following description reference is made to the accompanying drawing, in which

Fig. 1 is a diagrammatic cross-section through apparatus for producing sheet copper electrolytically, in which stripping apparatus in accordance with the invention is embodied;

Fig. 2 is a plan of the apparatus shown in Fig. 1; and

Fig. 3 is a plan of a preferred form of stripping roll.

The apparatus shown in the drawing comprises a tank 10 containing a suitable electrolyte, such for example as an acid copper sulphate solution. A cathode drum 11, which is partially immersed in the electrolyte, is mounted for rotation about its axis on a shaft 12. Anodes 13 curved to conform with the cylindrical cathode surface of the drum 11 are mounted in the tank 10 below the surface of the electrolyte in spaced relation with the drum. Suitable electrical connections (not shown) are made to the cathode drum and to

the anodes for the purpose of causing copper in solution in the electrolyte to deposit on the drum.

The cathode surface of the drum 11 is preferably of antimonial lead. A polishing brush 14 rotating in contact with the cathode surface maintains this surface in suitable condition for production of the copper sheet. The drum 11 is rotated in the direction of the arrow from a drive shaft 15 by means of a sprocket chain 16. The polishing brush 14 is separately driven from a drive shaft 17 through a sprocket chain 18.

As the drum 11 rotates, copper is deposited on the portion thereof below the surface of the electrolyte in the tank 10. The deposited copper is lifted in the form of a sheet from the cathode surface of the drum upon rotation of the drum above the surface of the electrolyte by passing it over a stripping roll 19. The stripped copper sheet is wound on a take-up reel 20 driven from the shaft 15 through a sprocket chain 21 and a slipping clutch (not shown) adapted to maintain proper winding tension.

The stripping roll 19 (Fig. 3) preferably is of a length approximately equal to the width of the cathode face of the drum 11, and is tapered longitudinally so that its greatest diameter is at its center. Cylindrical bearing sections 22 are formed at each end of the roll for mounting in suitable bearings.

The stripping roll 19 is mounted for rotation about its longitudinal axis in close proximity to the cathode surface of the drum, being spaced therefrom only a short distance of the order of several inches, and is positioned with its axis arranged substantially parallel to the drum axis of rotation. The mounting of the roll is such that it extends the width of the drum over the cathode face thereof, with its center section of greatest diameter overlying the center section of the drum.

The configuration of the stripping roll is such that, as the copper sheet from the cathode is drawn thereover to the take-up reel, the stripping force required for separating the electrodeposited sheet from the cathode is applied to the sheet principally along and adjacent its center line. Consequently the stripping of the sheet takes place from the center portion thereof outwardly toward its edges, and a minimum of stripping strain is imposed on the edges of the sheet. Because of the fact that electrodeposited sheets invariably have at least slightly irregular edges, it is very easy for a tear to start at the edge and carry into the body of the sheet. By minimizing the stripping strain imposed at the edges of the sheet, tears caused by stripping are substantially eliminated. Moreover, the stripping of the sheet proceeds from the center portion thereof outwardly toward its edges and hence the force applied to the sheet for stripping is in a direction outwardly from its center portion. This is opposite to the direction which a tear would follow, and hence such force as is necessarily applied to the side edges of the sheet for stripping purposes does not favor the development of tears.

The degree of taper of the stripping roll surface may be varied depending upon the thickness of the sheet being stripped. Generally speaking, a greater degree of taper is advantageous for thinner sheets. For copper of greater thickness than that weighing about one ounce per square foot, no taper at all is necessary, and the stripping of such sheets presents no particular problem. For stripping thinner sheets, however, the use of a tapered stripping roll in accordance with this invention greatly facilitates the stripping operation. A stripping roll 32 inches in length and having end bearing sections ¾ of an inch in diameter at each end advantageously is tapered inwardly to a center diameter of between about 1¼ inches and $1\frac{7}{8}$ inches.

The stripping roll may be of steel or other suitable metal or it may be faced with rubber. If necessary, a suitably configured doctor blade may be pressed against it in order to keep it clean.

Although it is preferred to employ a stripping roll such as that described above, the stripping member may take other forms. For example it is not necessary that the tapered surface of the stripping roll be curved longitudinally; instead it may be designed with straight tapered sections, with either a short cylindrical section or a convexly curved section in the center portion of the roll between the two tapers. It is not necessary that the stripping member be in the form of a roll. A stripping roll is ordinarily preferred because by rotating it does not drag against the electro-deposited sheet, but a non-rotating stripping member may be employed successfully. Such a stripping member may be in the form of a bar mounted transversely of the cathode drum and configured so that the upper surface of its center section is spaced further from the drum surface than the upper surface of its end sections.

When commencing production of copper sheet, a relatively thick deposit of copper is formed on the cathode surface of the drum. A thick deposit may be stripped initially by hand without much trouble. The free end of the sheet thus stripped is passed over the stripping roll and secured to the take-up reel, and thenceforward the entire operation may be automatic.

By means of the stripping method and apparatus provided by this invention it is possible continuously to strip long lengths of very light weight electrodeposited sheet metal such as sheet copper weighing only ⅛ or ¼ of an ounce per square foot. The new stripping method and apparatus also facilitates the winding of thin electrodeposited sheet on the take-up reel by eliminating edge wrinkles which form when a stripping strain is applied to the edges of such a sheet. The new stripping apparatus and method accordingly make it possible to produce smoothly wound rolls of very thin sheet metal.

I claim:

1. Apparatus for continuously stripping a thin sheet of electrodeposited metal from a rotating cathode drum solely by means of tension on the sheet comprising contact means engaging the stripped sheet and adapted to impart to the sheet sufficient tension to strip sheet metal from the cathode drum, and a curved stripping member of a length approximately equal to the width of the cathode face of the drum and disposed between the drum and the contact means in the path of the stripped sheet in such manner that the stripped sheet passes over the stripping member, the curvature of said stripping member being such that the central portion of the sheet passing over the stripping member is displaced outwardly beyond the edges of the sheet, whereby the stripping tension is applied to the sheet principally at the central portion of the sheet.

2. Apparatus for continuously stripping a thin sheet of electrodeposited metal from a rotating cathode drum solely by means of tension on the sheet comprising contact means engaging the

stripped sheet and adapted to impart to the sheet sufficient tension to strip sheet metal from the cathode drum, and a tapered stripping roll having a greater diameter at its center portion than at its end portions and having a length approximately equal to the width of the cathode face of the drum, the tapered stripping roll being disposed between the drum and the contact means in the path of the stripped sheet in such manner that the central portion of the sheet is displaced a further distance from a straight line between the contact means and the point at which the sheet leaves the drum than the edges of the sheet, whereby the tension required for stripping the sheet from the drum is applied principally to the central portion of the sheet.

HARRY C. MACAN.