Aug. 10, 1948. F. E. FAIRLEY ET AL 2,446,697

APPARATUS FOR COATING METAL SHEETS

Original Filed Feb. 2, 1943 2 Sheets-Sheet 1

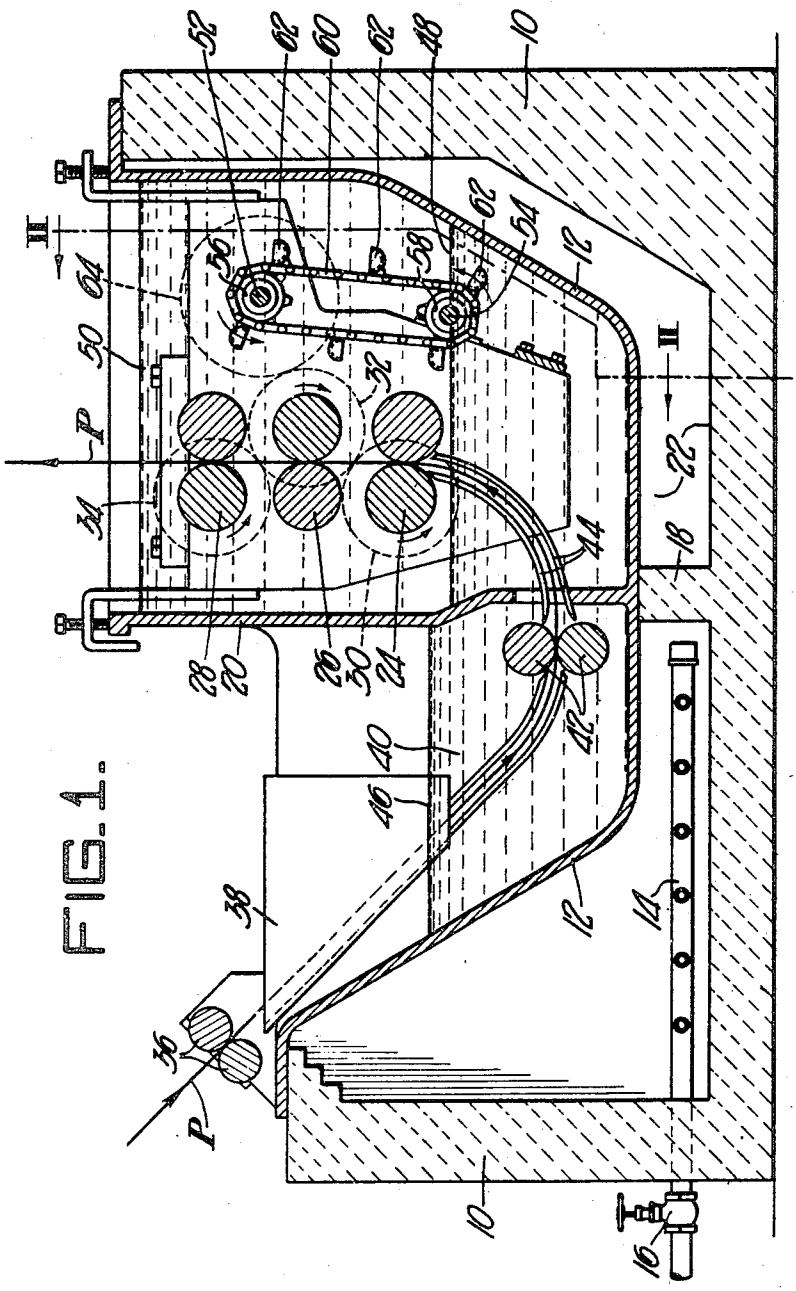


FIG. 1.

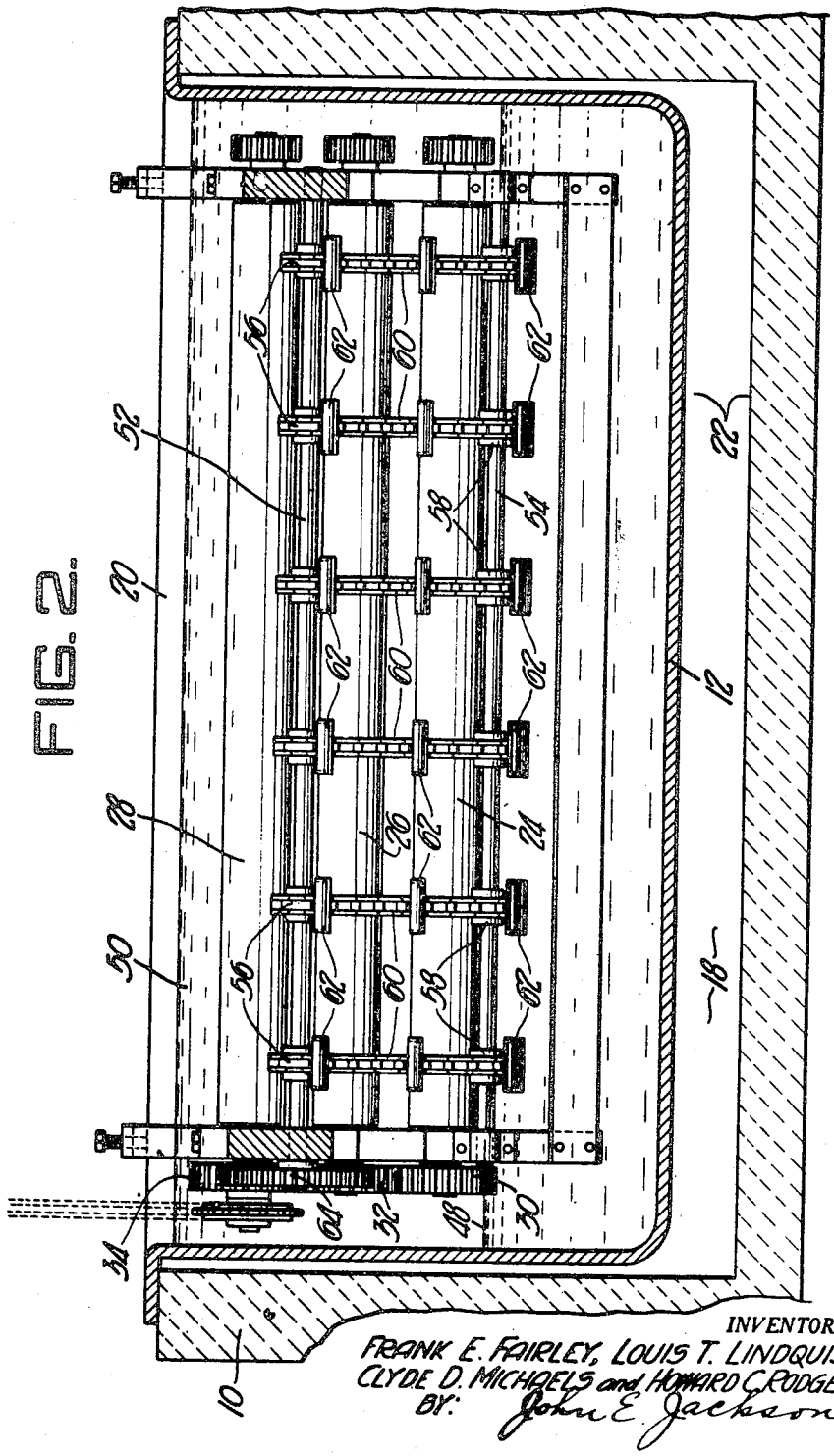
INVENTORS:
FRANK E. FAIRLEY, LOUIS T. LINDQUIST,
CLYDE D. MICHAELS and HOWARD C. RODGERS,
BY John E. Jackson
THEIR ATTORNEY.

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FIG. 2.



INVENTORS:
FRANK E. FAIRLEY, LOUIS T. LINDQUIST,
CLYDE D. MICHAELS and HOWARD C. RODGERS.
BY: John E. Jackson
THEIR ATTORNEY.

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APPARATUS FOR COATING METAL SHEETS

Frank E. Fairley, Canton, Ohio, and Louis T. Lindquist, Bessemer, and Clyde D. Michaels and Howard C. Rodgers, Birmingham, Ala., assignors to Tennessee Coal, Iron and Railroad Company, a corporation of Alabama

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4 Claims. (Cl. 91—12.1)

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This is a division from our Patent No. 2,388,131, granted October 30, 1945, for "Method of coating sheets."

The present invention relates to improvements in apparatus for coating sheets by passing them through molten metal, and in its broadest aspects provides means for effectively transferring heat from the molten coating metal to the body of oil usually maintained on top of the metal so as to keep the oil in the optimum operating condition.

While not limited thereto, the invention is peculiarly well suited for improving the operating conditions involved in the manufacture of terne plate.

In the production of tin-plate and terne-plate, it is customary to pass a ferrous metal sheet through a molten bath of the coating metal, then upwardly out of the bath through a body of palm oil. In the normal operation of apparatus used heretofore for this purpose, difficulties are frequently caused directly or indirectly by non-uniformity of the oil temperature. The present invention aims to overcome such difficulty by the provision of the herein claimed novel apparatus including means for transferring small quantities of the molten metal upwardly into the region of the upper zone of the oil and permitting such hot molten metal to descend through the oil and thereby give up heat thereto. In this way the oil is maintained at the optimum operating temperature and condition, due in part to the rapid heat exchange and in part to the gentle turbulence set up by the cascade of molten metal descending through the oil.

The invention will be fully apparent from the following detailed disclosure when read in connection with the accompanying drawings, in which:

Figure 1 is a vertical longitudinal section through the apparatus.

Figure 2 is a transverse section on line II—II thereof.

Referring in detail to the drawings, 10 represents the wall structure of a suitable heating chamber supporting a melting pot 12 the contents of which are adapted to be heated chiefly by a burner 14 supplied with gases or other suitable fuel under control of the valve 16. There is an intermediate wall 18 approximately in line with a transverse division wall 20 of the melting pot. As distinguished from prior practice, the portion of the melting pot to the exit side of the division wall is not directly heated by fire, since

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the chamber 22 below the exit half of the pot is blanked off by the wall 18.

Located on the exit side of the division wall 20 there are a plurality of conventional pairs of exit rolls 24, 26, and 28, driven by the gears 30, 32, and 34. The apparatus is also equipped with a pair of conventional feed-in rolls 36 which feed the plate P to be coated with molten metal through flux contained in a box 38, thence downwardly through the metal bath 40 which may be either molten tin or lead-tin alloy. A pair of feed rolls 42 driven in any suitable manner force the plate through a conventional guide or apron 44 which directs the plate to the lower set of exit rolls 24. The arrangement of the flux-box, feed-in roll, guides and exit rolls is similar to that shown in Patent No. 1,330,399.

The top level of the bath of molten metal at the inlet side of the division plate 20 is indicated at 46. The metal level at the right exit side of the division plate 20 is slightly lower, as indicated at 48. Superposed on the metal bath above the metal level 48 on the exit side of the melting pot is a body of palm oil indicated at 50, through which the outgoing sheets pass as they leave the pot.

The chief feature of novelty of the present invention resides in the provision of means for elevating the molten metal to a point above the normal metal level 48 into the upper region of the body of oil 50, and permitting it to fall by gravity or cascade through the oil to thus raise its temperature and create a mild degree of turbulence or agitation. This maintains the optimum temperature and condition of the oil. In the embodiment of the invention illustrated, we provide upper and lower shafts 52 and 54, the upper shaft carrying a plurality of sprockets 56 immersed in the intermediate or upper region of the oil, and the lower shaft 54 carrying a plurality of sprockets 58 whose lower portions extend into the molten metal bath. Conveyor chains 60, each carrying a plurality of buckets 62, are trained around the sprockets 56 and 58, and suitable means are provided for driving the conveyor. In the machine illustrated, the upper shaft 52 carries a gear 64 which meshes with the gear 32 carried by one of the exit rolls 26. It is to be understood, however, that the conveyor may be driven independently of the exit rolls, if desired, by a separate motor drive, so that the bucket conveyor for lifting the molten metal and dropping it through the oil body can be driven at times when it is not possible to run the exit rolls. Thus the condition of the oil bath can be maintained, even

though temporary shut-downs are necessary to make repairs or adjustments in the coating apparatus.

In the normal operation of the apparatus, the sheet to be coated is fed downwardly by the feed rolls **36** through the flux in the box **38** and into the molten bath **40**, then through feed rolls **42** and exit rolls **24**, **26**, and **28**. By the latter, the sheet is fed upwardly and out to a suitable discharge point, and while being discharged is passed through the body of palm oil **50**, which is effectively maintained at a proper temperature without the application of direct heat to the pot in the zone of the oil, the heat transfer being effected by the cascading effect of the molten metal descending through the oil body. This affords a very efficient manner of effecting a rapid transfer of heat uniformly through all regions of the oil.

The improved apparatus disclosed represents a marked advance over prior practice since it reduces the tendency of the oil to break down, and thus prolongs the useful life of a given batch of oil, effecting a marked economy in oil consumption. Coupled with this economic advantage, the lack of oil troubles makes it possible to increase production, and the elimination of direct firing to heat the oil reduces the danger of fires and also the fuel cost. Experience also indicates that the invention contributes to a longer life of the melting pot. This makes for lower maintenance costs. Because of the maintenance of the oil at optimum temperature and condition, the quality of the coated metal product is improved and the amount of material of less than prime quality is reduced.

While the invention is peculiarly well-suited for the making of terne-coated ferrous metal sheets or plates, it is also applicable to the coating of sheets or plates with tin. Various modifications may be made by those skilled in the art without departure from the invention as defined in the appended claims.

We claim:

1. Metal-coating apparatus comprising a vessel adapted to contain a bath of molten coating metal covered by a body of oil, a bucket conveyor mounted within said vessel and having one portion extending below the normal level of the metal bath and another portion extending into the body of oil, said conveyor being adapted to discharge small quantities of molten metal successively into the oil so as to effect an exchange of heat from the molten metal to different regions of the oil.

2. Metal-coating apparatus comprising a vessel adapted to contain a bath of molten coating metal covered by a body of oil, spaced upper and lower shafts supported for rotation within said vessel, each carrying a plurality of sprockets, the lower shaft and sprockets being so located that said lower sprockets extend into the bath and the upper shaft and sprockets being so located as to be immersed in the oil, and bucket conveyor chains trained over said sprockets effective to lift small quantities of molten metal and discharge them into the oil body so as to effect an exchange of heat from the molten metal to different regions of the oil.

3. In an apparatus for coating metal sheets by passing them through a bath of molten coating metal having a quantity of oil floating thereon, a pot adapted to contain said bath and oil, and a conveyor in said pot disposed largely above the level of the metal but dipping therebelow and thereby effective to lift quantities of metal from the bath and discharge them into the oil.

4. Metal coating apparatus comprising a vessel adapted to contain a bath of molten metal covered by a body of oil, coacting rolls for feeding a sheet upwardly from said bath and through said body of oil, and a conveyor located wholly within said vessel, spaced from the path of the sheet and largely above the level of said bath, adapted to transfer molten metal from the bath to a region thereabove and discharge it into the oil.

FRANK E. FAIRLEY.
LOUIS T. LINDQUIST.
CLYDE D. MICHAELS.
HOWARD C. RODGERS.

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