

March 20, 1928.

1,663,445

S. A. DAVIS

TIN PLATE

Original Filed June 25, 1919 3 Sheets-Sheet 1

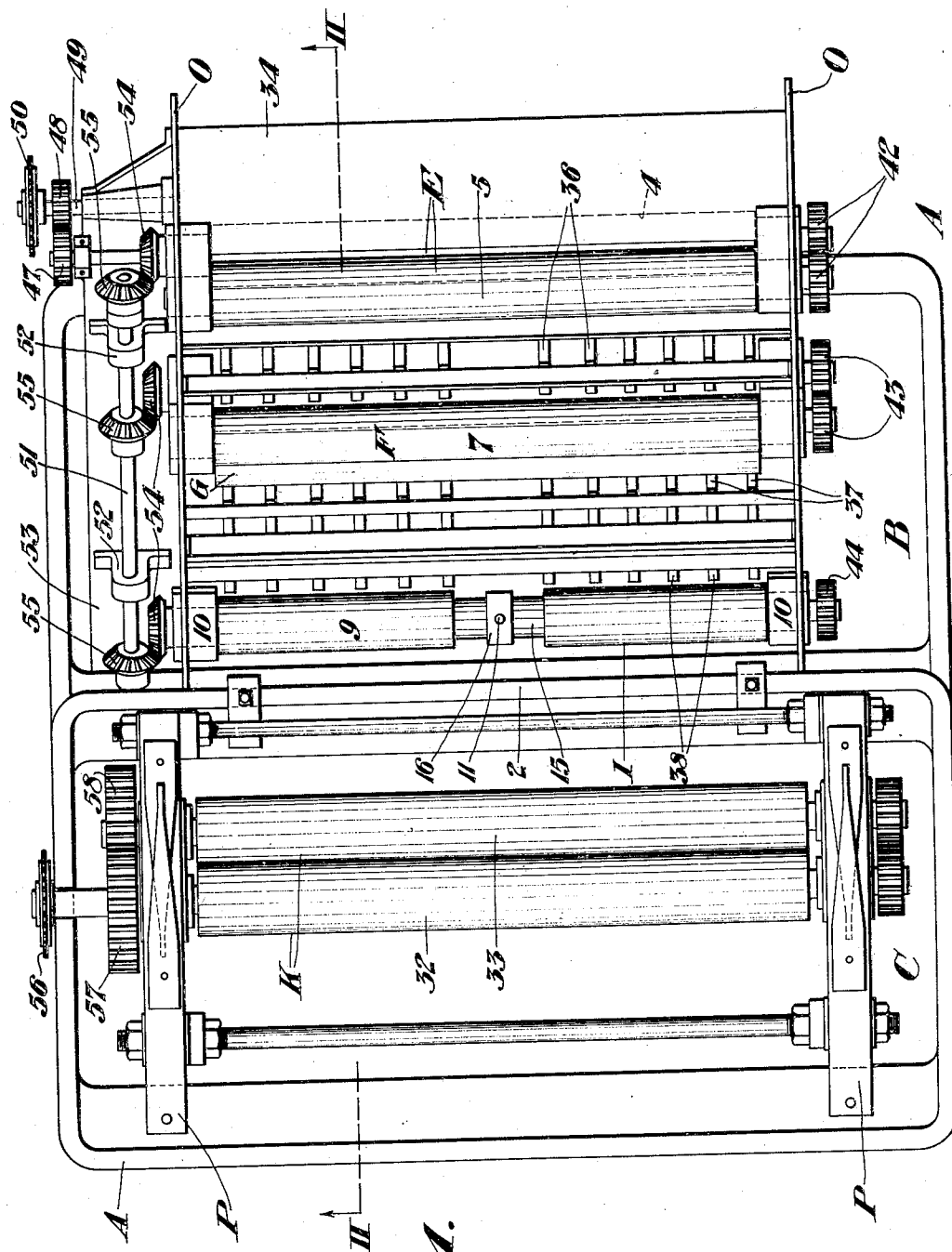


FIG. 1.

Witnesses:

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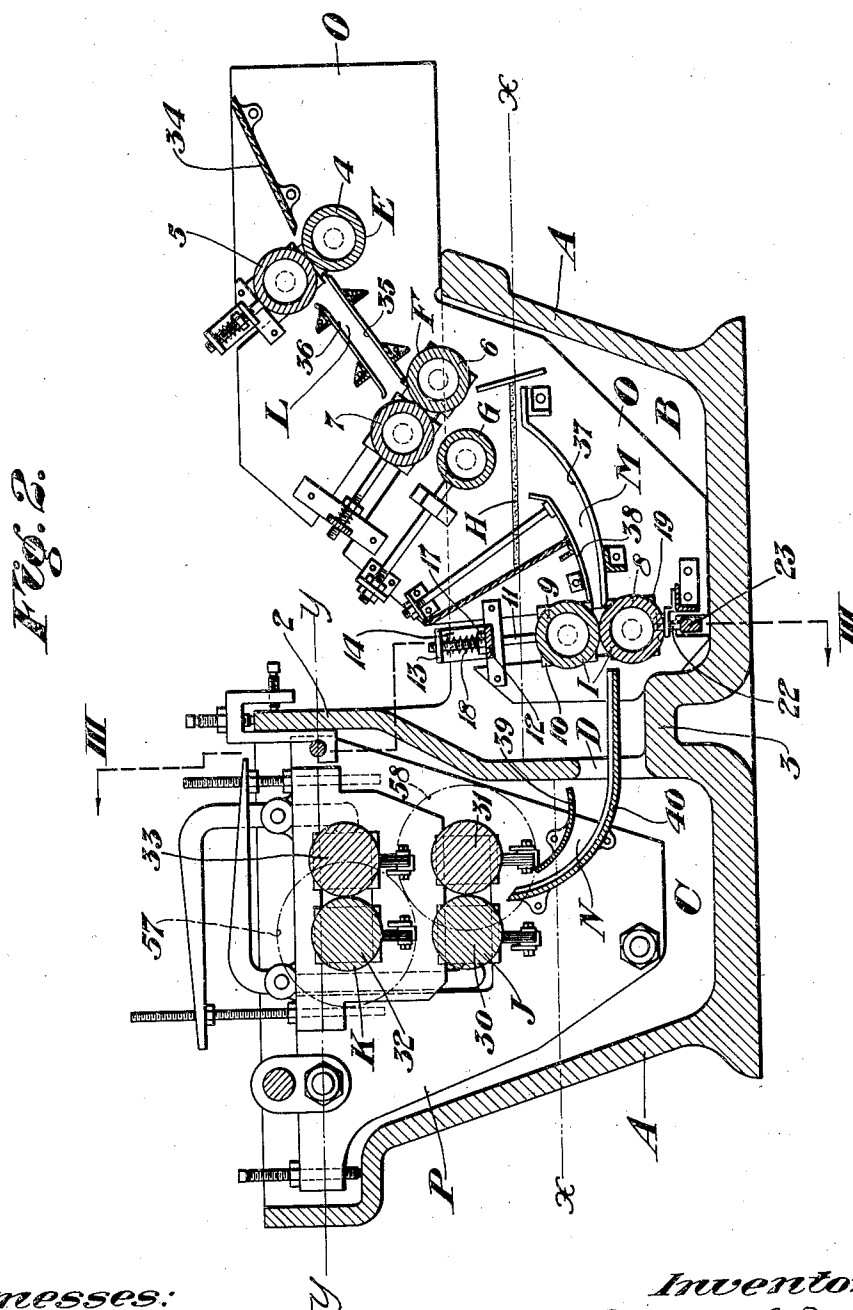
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TIN PLATE

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TIN PLATE

Original Filed June 25, 1919 3 Sheets-Sheet 3

Fig. 3.

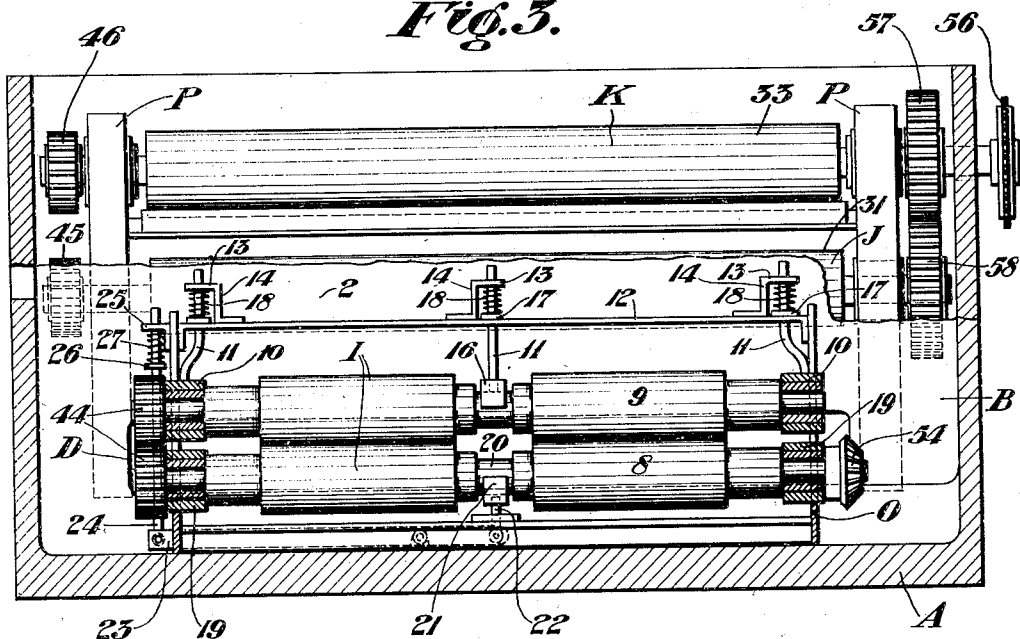


Fig. 4.

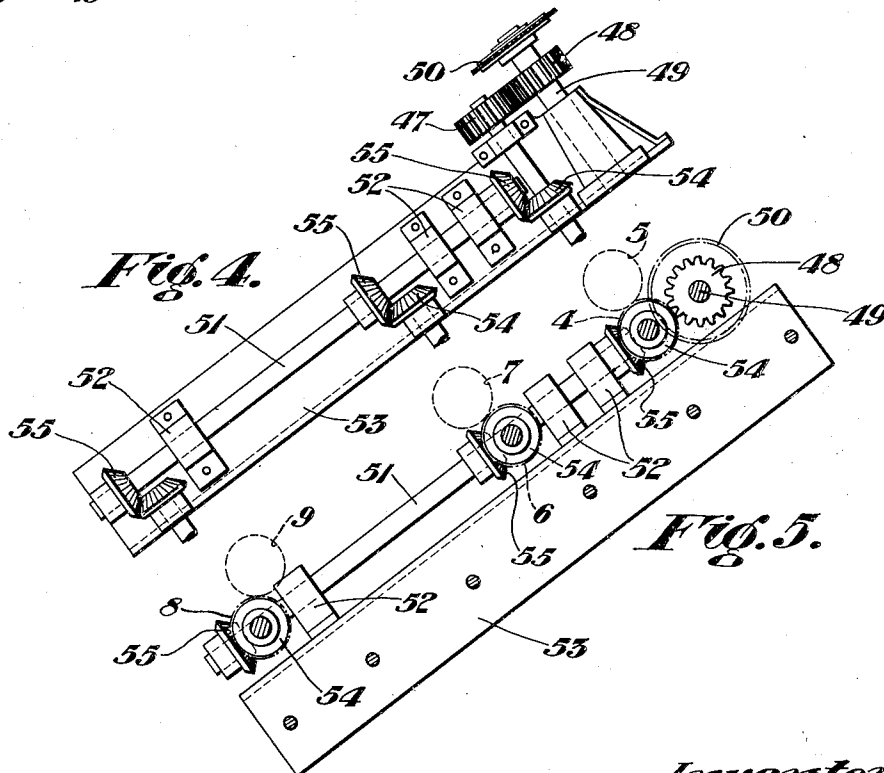


Fig. 5.

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UNITED STATES PATENT OFFICE.

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TIN PLATE.

Original application filed June 25, 1919, Serial No. 306,521. Divided and this application filed January 8, 1925. Serial No. 1,303.

This invention relates to tin plate, and more particularly to that cheaper grade of tin plate having a relatively thin or light weight coating of tin known commercially as "coke plate", this application being a division of my copending application, Serial No. 306,521, filed June 25, 1919, for manufacture of tin plate, issued March 3, 1925, as Patent No. 1,528,407.

Tin plate is sold universally by the base box, a base box being the equivalent of 112 plates, 14 inches by 20 inches by 30 gage, or totaling 31,360 square inches superficial area.

The standard commercial grade of coke plate as heretofore made carries approximately one and one-half pounds of tin per base box, is without a high luster, and is dull or dry in appearance. The coating on commercial coke plate is not entirely continuous, but contains small openings or channels running through the coating to the ferrous sheet underneath and forming what is technically known as "pin holes". As the thickness of the coating is increased on commercial coke plate its luster is improved, approximately in proportion as the weight of the tin per base box increases. The number of pin holes, however, do not decrease in the same proportion, in fact the number of pin holes remains about the same.

In the manufacture of tin plate as carried on commercially with the tinning machines of the prior art, the cleaned iron or steel plate or base is passed by hand, through a layer of flux into a bath of molten tin passing through the bath and surplus adhering tin removed from its surfaces by means of rotary, spring pressed sets of feed out rollers. When the ferrous base and molten tin are first brought into contact, a layer of iron-tin alloy forms on the surfaces of the base, this alloy having a melting point higher than that of the molten tin itself. The result of this action is that fine needle-like crystals of iron-tin alloy are formed, which protrude from the surfaces of the iron base and form a fine spongy or porous network of crystals, the interstices of which are filled with molten tin. When the iron base with its adherent alloy layer of crystals is later passed between the feed-out rollers of the tin pot, which are located within a

body of palm oil, the network of crystals is crushed and flattened against the iron base, and a large portion of the molten, interstitial tin is squeezed out and flows off the plate.

The plate, as it emerges from between the exit rollers, comprises a ferrous base covered with a coating composed of the mixture of crystals of iron-tin alloy and pure tin. The presence of the crystals produces what can be seen under a microscope to be a rough irregular surface, which in turn imparts the dull, or as technically termed, the "dry" appearance to the surfaces of coke plate as heretofore produced.

In carrying out this old process, great care is taken to keep the "yield" at or below a certain limit, the yield varying with different grades of tin plate and being determined by the particular grade of tin plate being made. Experience has shown that in practicing this old process the yield increased with an increase in the speed at which the plates pass through the tinning bath, and it has been the belief that a speed of 100 to 120 inches per minute was the maximum possible in the manufacture of coke plate. It is also a matter of general knowledge that keeping the plates within the bath of molten tin for too long time interval results in making plates having black spots (i. e. spots where the tin does not adhere to the base).

Referring now to the drawings which illustrate apparatus particularly adapted for use in making coke plate embodying my invention:—

Figure 1 is a plan showing a tinning pot adapted to produce tin plate according to this invention.

Figure 2 is a longitudinal section, on the line II—II of Figure 1.

Figure 3 is a sectional end elevation, on the line III—III of Figure 2.

Figure 4 is a plan, and Figure 5 is a side elevation, showing details in the construction of the roller driving mechanism for the machine.

In the accompanying drawings, the letter A designates a tinning pot, in itself an old and approved form. The pot is separated transversely by a vertical wall or partition 2 into compartments B and C. The lower edge of this partition 2, which terminates

above the bottom of the tinning pot and the upper edge of a rib or projection 3 on the bottom of the pot define the width or vertical dimension of a narrow passage or opening D through which the plates, while submerged in the bath of molten tin, pass from the compartment B into the compartment C. By separating the pot into two compartments B and C as above described, it has been found that the tin in one compartment will not, to any great extent, circulate or enter the other. In reality there are two separate bodies of molten tin, one of which is kept at a higher temperature than the other and one of which remains purer than the other after the apparatus has been put into operation. The particular pot shown is of a width which permits of two or more plates, side by side, being passed through the tinning pot. (See Figures 1 and 3.) Any of several known means may be used for heating the tinning pot and, preferably, will be constructed and arranged to maintain the tin in the compartment B at a considerably higher temperature than the tin in the compartment C.

The pot heating apparatus, not forming part of this invention, is not shown nor further described.

The side walls of the compartment C at the exit end of the pot are extended upwardly so that this compartment is considerably deeper than the compartment B, this old and well known construction making it possible to maintain a body of oil, generally palm oil, of the requisite depth or thickness, on top of the molten tin in the compartment C. The levels at which the bath of molten tin is maintained in the pot are indicated by the line X—X of Figure 2, and a thin layer H of flux is maintained on top of the tin in the compartment B on the entrance end of the pot. The approximate level of the upper surface of the oil is indicated by the line Y—Y in Figures 2 and 6. Due to the weight of the body of oil on the tin in the compartment C, the level of the tin in this compartment is somewhat lower than that of the molten bath in the compartment B.

Located immediately above the upper edge of the compartment B, at the plate entering side of the tinning pot, are two sets of spring pressed feed rollers E and F, which are arranged to move the pickled and washed plates forwardly and downwardly into the tin pot at an angle to the horizontal.

The set of feed rollers E is composed of rollers 4 and 5, and the set of rollers F which is composed of rollers 6 and 7 are at a somewhat lower level than the set E. An adjustable deflecting roller G is located below and on the discharge side of the set of rollers F, to guide and direct the front end of the plates forwardly and downwardly

through the layer H of flux into the molten tin in the compartment B.

Positioned within the compartment B, closely adjacent to the passage D, is a set of pressure rollers I composed of rollers 8 and 9. The upper roller 9 is mounted in sliding bearing blocks 10 which are provided with upwardly extending tension rods 11 which extend through a transverse bar 12 and through the overhang portion 13 of a bracket member 14 mounted on the bar 12. The center of the roller is provided with a bearing surface 15, and a bearing shoe 16 is mounted over the upper portion thereof. The shoe 16 is also provided with a rod 11 which is mounted as described above. The rods 11 are each provided with a shoulder 17, and a coil spring 18 is mounted around each of the rods 11 above the shoulder 17 so that one end of the spring bears against the shoulder 17 and the other end bears against the overhang portion 13 of the bracket 14. The springs 18 serve to normally hold the roller 9 in resiliently closed contact with the roller 8.

The roller 8 is mounted in bearing blocks 19 and is provided with a center bearing portion 20 which is supported by a bearing shoe 21 mounted on a post 22 which is pivotally supported at its lower end on a bar 23 which is mounted for rocking movement in the frame O and has its end pivotally connected to a link 24. The link 24 has its upper end passed through a bracket 25 on the frame O and is provided with a shoulder 26 at a point below the bracket 25 adapted to support the lower end of a coil spring 27 which is mounted around the link and has its upper end bearing against the bracket 25. The bearing shoe 21 and its resilient mounting described above, serve to normally force the roller 8 toward the roller 9 and to prevent bowing of the roller at its center.

The pressure rollers 8 and 9 which are submerged in the molten tin in the compartment B, have the double function of feeding the plates from the compartment B into the compartment C of the tinning pot and also to flatten and smooth the layer of iron-tin alloy which is formed on the iron or steel plates or sheets, as the plates enter the molten tin in compartment B of the tin pot.

It should be noted that the sets of feed-rollers E and F and the guide roller G are above the layer of flux H, and that the successive plates are mechanically fed and guided into the tinning pot. This mechanical feed is important since it permits the plates to be fed through the flux at the same speed that they are fed through the tin, while in the old hand-feed pots the plates are passed through the flux at a high speed and through the tin at a relatively low speed.

The location of the pressure rollers I with respect to the layer of flux H also should be noted. It has heretofore been considered impossible to use submerged rollers in a tinning machine.

I have discovered, however, that by positioning the rollers I so that the distance from the flux H is not too great, and by allowing the plates to remain in the flux a sufficient time, that sufficient flux is carried down by the plates to maintain the rollers I in working condition. In other words, I have discovered that sufficient flux must be supplied to the rollers submerged in the tin to keep them in working condition and that the first rollers coming in contact with the surfaces of the plates after they pass through the flux utilize substantially all the flux carried by the plates. Therefore, to produce plates free from black spots it is the better practice to have only one set of rollers submerged in the tin, and these rollers should be sufficiently close to the flux to receive a plentiful supply of the flux carried to them on the surfaces of the plates.

Two sets of feed-out rollers J and K are provided which are located within the body of oil maintained on top of the tin in the compartment C of the pot A. The sets of rollers J and K are composed of rollers 30, 31 and 32, 33, respectively, which are arranged to not only feed the plates out of the tin pot, but also act to squeeze off surplus tin from the smooth alloy coated surfaces of the plates passing upwardly out of the tinning pot. The body of oil in which these rollers are submerged acts to prevent the molten coating on the surfaces of the plates from contacting with the atmosphere, until after the excess coating has been removed therefrom.

An inclined apron 34 is provided at the entrance end of the compartment B of the pot to receive the plates as they are delivered to the tinning pot. Plates 35 and 36 form a guide L for directing the front end of the successive plates as they emerge from between the set of rollers E into the bite of the set F.

Curved guide plates 37 and 38 forming a guide M are positioned within the compartment B so as to direct the forward end of the plates being tinned into the nip of the set of pressure rollers I, as is clearly shown in Figure 2. These guide plates 37 and 38 are, preferably, of skeleton form so as not to interfere with the settling of scruff and dross or any other foreign material in the molten tin to the bottom of the compartment B of the pot.

Curved guide plates 39 and 40 form a guide N which directs the forward end of the plates emerging from the set of pressure rollers I upwardly into the bite of the lower set J of two sets of feed-out rollers J and

K within the upper end of the compartment C of the tin pot. It will be seen by reference to Figure 2 that the rear end of the curved lowermost guide plate 40 extends backwardly through the passage D into proximity to the sets of rollers I.

The framework O, which supports the sets of feed rollers E, and F, guide roller G and pressure rollers I, and the stationary guides L and M, is removably secured within the compartment B so as to permit the feed-in apparatus to be removed bodily from the pot while the tin bath is molten. This is done at intervals in order to clean the tinning pot, and when necessary to make repairs to the feed-in apparatus. The sets of feed-out rollers J and K and guide N are similarly mounted on a framework P in the compartment C of the pot, and are taken out of and replaced in the compartment C in the same manner as the apparatus within the other compartment B.

The feed rollers 4 and 5 of the set E are connected together by a pair of spur gears 42 to positively drive both of these rollers, and the rollers 6 and 7 of the set F are likewise connected by spur gears 43 for a similar purpose. The pressure rollers 8 and 9 are also connected by spur gears 44 to positively rotate these rollers.

The pair of feed-out rollers J comprising the rollers 30, 31 are connected by spur gears 45 to positively rotate each roller, and the feed-out rollers K comprising the rollers 32 and 33 are similarly connected by spur gears 46 for the same purpose.

The rollers 4 and 6 of the feed-in rollers and roller 8 of the pressure rollers are the driven members of their respective sets.

The feed roller 4 is provided with a spur gear 47 which is in mesh with a spur gear 48 on a stub shaft 49, the stub shaft being journaled in the frame O, and carrying a sprocket wheel 50 which is adapted to be driven by a chain from a suitable motor, (not shown). A drive shaft 51 is journaled in suitable bearings 52 on an angle support 53 which is fastened on one side of the frame O. Each of the rollers 4 and 6 and roller 8 are provided with bevel gears 54 which mesh with bevel gears 55 on the shaft 51. From the above it will be clear that all of the rollers 4, 5, 6, 7, 8 and 9 are driven from the stub shaft 49.

The pair of rollers 30, 31, forming the set of feed rollers J, and the pair 32, 33 forming the set K, are adapted to be driven by a sprocket wheel 56, this wheel being mounted on an extension of the shaft of the roller 32. The roller 32 has a spur gear 57 which meshes with the spur gear 58 on the roller 31.

The gears and other drive mechanism for the feed-in rollers E and F, pressure rollers I, and feed-out rollers J and K, are arranged

so that each of the rollers will be positively driven, at a uniform surface speed of at least 150 or more inches per minute, thereby providing for feeding plates into, through, and out of the tinning machine at a uniform and relatively high speed.

The improved method by which coke plate embodying this invention are produced consists generally of the successive steps of passing the cleaned plates through a body of flux, then through a bath of molten tin to form a porous coating of iron-tin alloy on the surfaces of the plates, then subjecting the submerged alloy coated plates to pressure, to flatten and smooth the alloy coating and expel surplus tin from the interstices of the porous coating, then passing the plates through a second bath of substantially pure tin, and then removing the plates from said second molten tin bath through a body of oil, and subjecting the coated plates to pressure to remove excess tin adhering to the plates as they pass through the oil, and maintaining the travel of said plates at a uniform speed of at least 120 inches per minute from the time they enter the flux until they pass out of the oil bath on top of the tin bath.

In carrying out the improved method of this application with a machine constructed as above described, the uncoated ferrous metal plate after being pickled and washed, is placed on the apron 34 and moved downwardly until its front end enters the nip of the set of feed rollers E. The plate, upon entering these rollers, is then mechanically fed forward through the guide L into the nip of the second pair of feed rollers F, which are located immediately above the layer of flux H in the flux box. In passing from between the rollers F the plate is directed into the flux H by the adjustable guide roller G so that it does not come into contact with any stationary part of the apparatus below the level of the flux, thus avoiding dislodgment of congealed flux and other substances which have previously been deposited and which otherwise would be carried into the molten tin bath. The uniform movement of the sheet through the flux into the tin bath and between the pressure rollers I carries sufficient flux to these submerged rollers to maintain them in proper working condition. Heretofore in the well known hand-feed apparatus the plates were fed

very fast through the flux and then at a comparatively slow speed through the tin bath, which resulted in the plates being insufficiently fluxed and a poorly coated plate being made.

After passing through the flux, the plate enters the molten tin in the compartment B, passing through the curved guide M. This guide is preferably of skeleton construction as shown, so as to permit deposition on the bottom of the compartment B of scruff, dross or other foreign matter. The guide M discharges the plate into the nip of the set of pressure rollers I.

As the plate is passed through the tin in the compartment B an iron-tin alloy coating is formed on the surfaces thereof, and as the plate passes between the pressure rollers I the alloy is flattened and surplus tin is squeezed out and removed from the alloy coating. The plate then passes through the opening D and is deflected by the curved guide N upwardly through the bath of tin in the compartment C and into the nip of the first pair of feed-out rollers J which are in the oil bath above the tin in the compartment C.

As the plate passes through the feed-out rollers J and K, any excess tin adhering to the iron-tin alloy on the plates is removed by the pressure of these feed rollers, and a finished coke plate is produced having an outer layer of substantially pure tin which has the luster and other properties and characteristics of the heavy coating of charcoal plates together with the desired light yield.

The advantages of my invention, which will be apparent to those skilled in the art, are in the production of a coke plate having the finish or luster of the more heavily coated charcoal plates, but with a lighter coating of tin than has been possible heretofore.

I claim—

As a new article of manufacture a coke plate consisting of a ferrous metal base coated with tin, and having the thin light weight coating of from 1.5 to 2.5 pounds per base box characteristic of coke plate and being substantially continuous, non-porous and free from pin holes, providing a bright luster typical of charcoal plate.

In testimony whereof I have hereunto set my hand.

STEWART A. DAVIS.