(No Model.) 4 Sheets—Sheet 1.

J. G. THOMAS & G. H. WHITE.

APPARATUS FOR COATING METAL SHEETS WITH TIN.

No. 443,879. Patented Dec. 30, 1890.

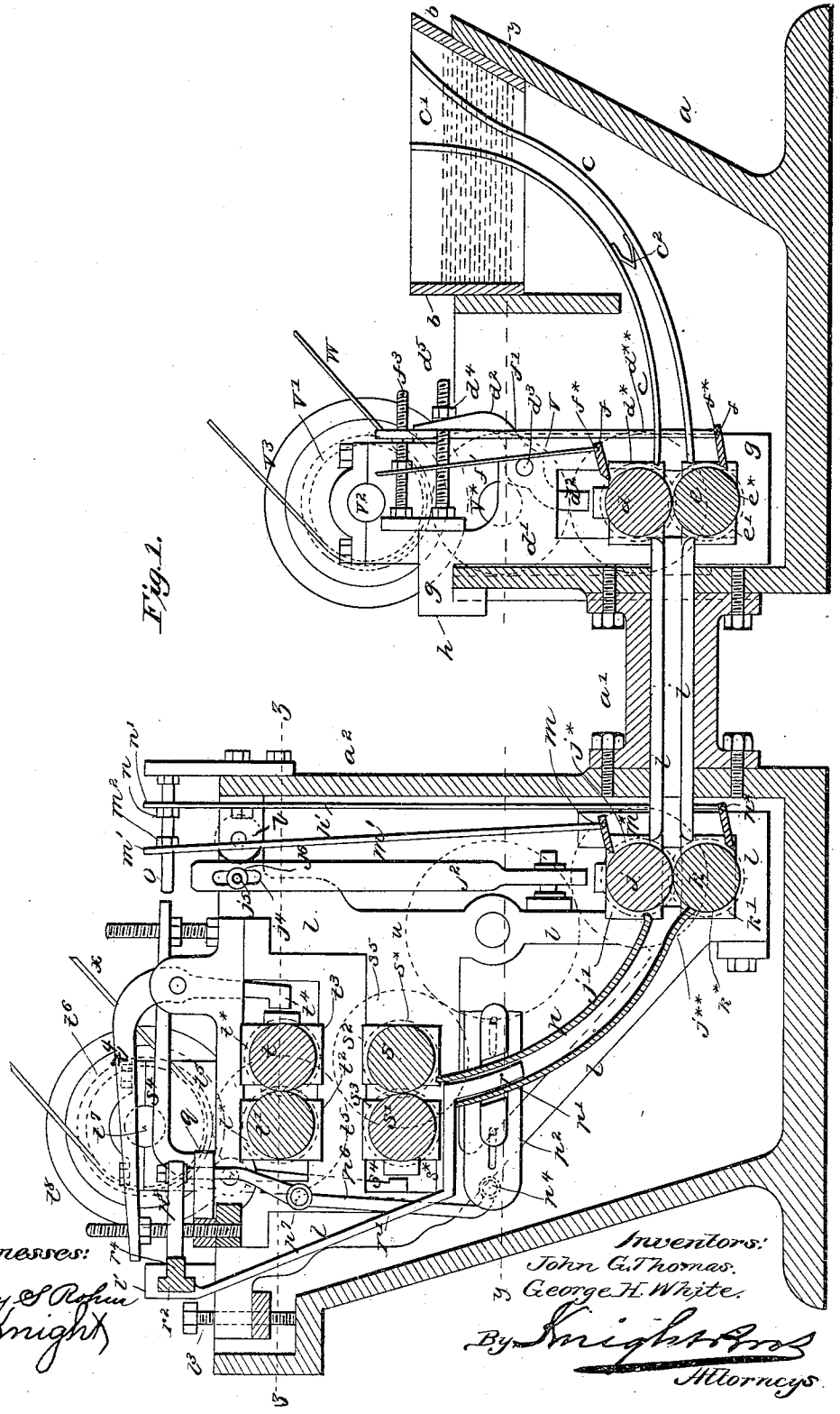


Fig. 1.

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J. G. THOMAS & G. H. WHITE.

APPARATUS FOR COATING METAL SHEETS WITH TIN.

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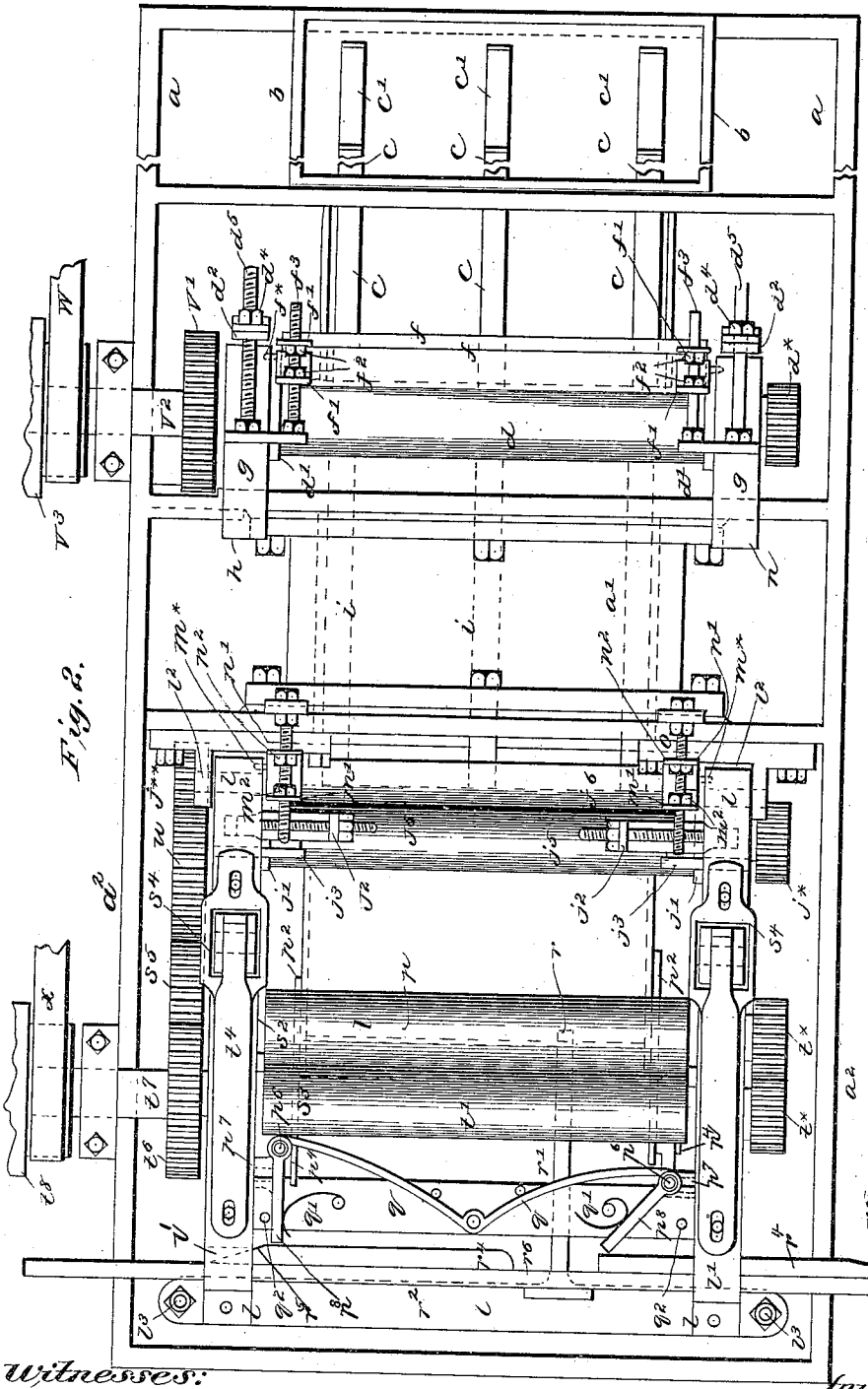


Fig. 2.

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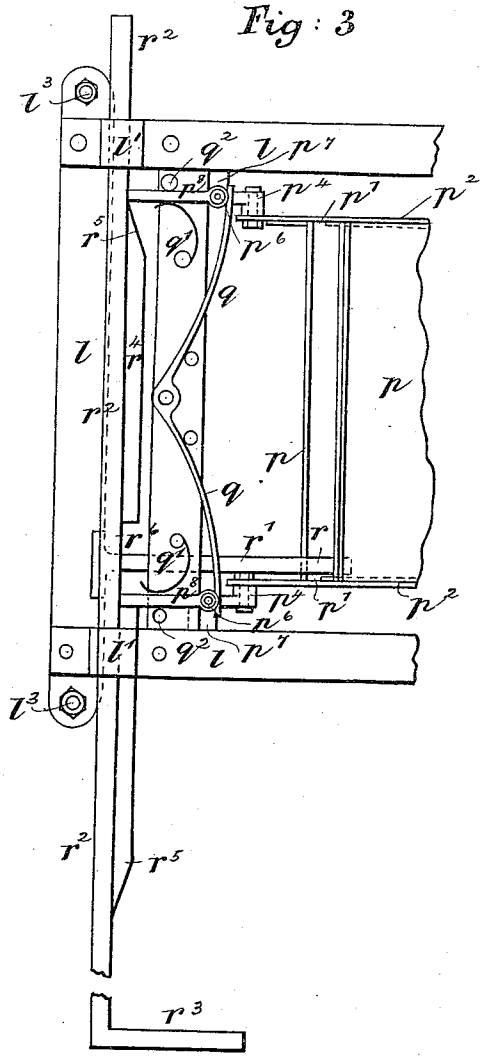
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APPARATUS FOR COATING METAL SHEETS WITH TIN.

No. 443,879. Patented Dec. 30, 1890.

Fig: 3



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APPARATUS FOR COATING METAL SHEETS WITH TIN.

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Fig: 4

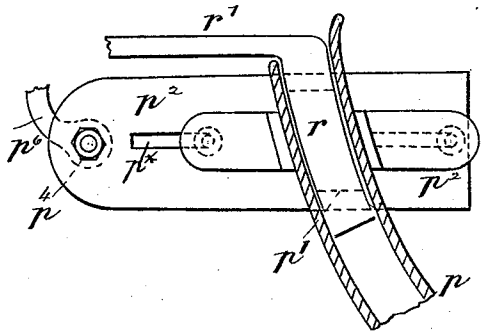


Fig: 6

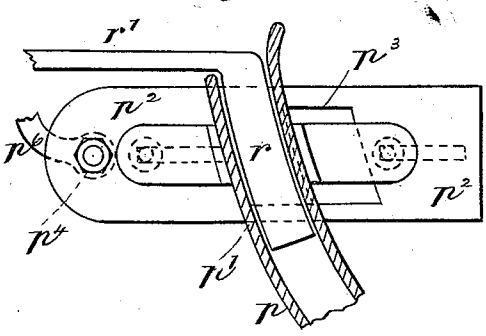


Fig: 5

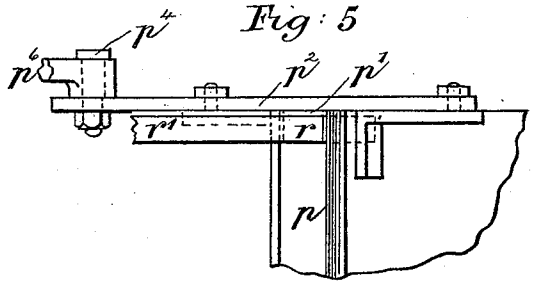


Fig: 9

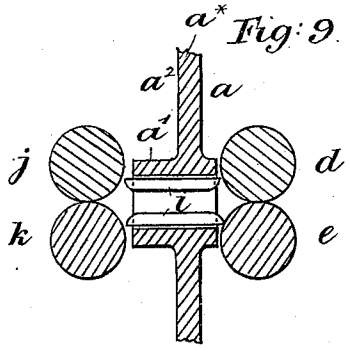


Fig: 7

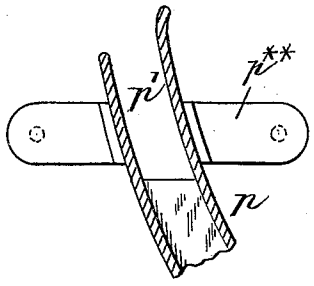
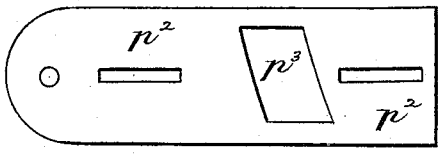


Fig: 8.



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UNITED STATES PATENT OFFICE.

JOHN GLYN THOMAS, OF LLANGENNECH, AND GEORGE HENRY WHITE, OF LLIW FORGE, NEAR PONTARDULAIS, ENGLAND.

APPARATUS FOR COATING METAL SHEETS WITH TIN.

SPECIFICATION forming part of Letters Patent No. 443,879, dated December 30, 1890.

Application filed July 8, 1889. Serial No. 316,898. (No model.)

To all whom it may concern:

Be it known that we, JOHN GLYN THOMAS, iron and tin plate manufacturer, of Llangennech, in the county of Carmarthen, South Wales, and GEORGE HENRY WHITE, engineer, of Lliw Forge, near Pontardulais, in the county of Glamorgan, South Wales, Great Britain, subjects of the Queen of Great Britain, have invented certain new and useful Improvements in Means or Apparatus to be Employed in Coating Metal Sheets with Tin, Terne, and other Metals or Alloys, of which the following is a specification.

The principal object of our invention is to obtain a compact arrangement of apparatus in which the several processes from the fluxing or tinning to the finishing are effected in one continuous operation and in a better manner than heretofore. For this purpose we connect the tinning-pot with the grease-pot by means of a narrow neck or way of such dimensions and in such position as will allow a plate to pass freely therethrough, and so that the molten metal or alloy will maintain the same level in both pots. Each pot is heated by means of a fire, as is usual; but by reason of the small area of the neck or way and by regulating the fires we are enabled to maintain the metal in the two pots at different degrees of heat, as is necessary for the proper carrying out of the process. In the upper part of the tinning-pot we arrange a bottomless box, and in this box, upon the surface of the molten metal, the flux or tinning composition is supported, and through this box the metal plate is passed. From the flux or tinning composition-box guides are arranged to conduct the metal plate through the molten metal to the first pair of rolls, and the plate thence passes through the neck or way to the grease-pot, at the entrance to which it is received between another pair of rolls. Between this second pair of rolls and the next pair or finishing-rolls, which are arranged above the level of the molten metal, an inclosed guide or way is provided to conduct the metal plate in the desired path. This guide rises above the level of the molten metal and enters a short distance into the grease, which grease is supported upon the surface of the molten metal, and such guide is provided with doors or shutters at each side, covering openings through which a scraper or cleaner, at the times desired, removes any dross which may have accumulated upon the surface of the molten metal within the inclosed guide and which would be injurious to the plate, the doors or shutters preventing the return of the dross within the guide or way. The scraper or cleaner is operated by levers or connections, so as to move it to and fro across the surface of the molten metal, and the doors or shutters are so connected therewith and timed that when the scraper or cleaner commences its traverse from one side to the other of the inclosed guide the door behind it is closed and that in front of it is opened, so that any dross in front of the scraper is forced out therethrough. An important feature of this inclosed guide is that it incloses the surface of the molten metal through which the plate passes, and thus leaves only a very small area upon which dross can form, and we are thus enabled to readily remove such deleterious matter, as hereinbefore described. It will be evident that we may obtain the same effect by employing only a short inclosed guide entering a short distance into the molten metal and rising a short distance into the grease. We may employ closed or other guides to conduct the plates from any one pair of rolls to another pair. After passing through this inclosed guide the metal plate passes through two or more pairs of finishing-rolls working in grease, whence it is conducted away, as desired. We employ scrapers, cleaners, or brushes in connection with the various rolls, in order to keep their surfaces in good working order, and we, if necessary, employ rolls made of copper or other non-oxidizible metal or alloy in order to avoid chemical action as much as possible.

In order that the said invention may be more clearly understood and readily carried into effect, we will proceed, aided by the accompanying drawings, more fully to describe the same.

In the drawings, Figure 1 is a longitudinal section of an apparatus constructed accord-

ing to our invention, one of the doors or shutters of the guide or tube being shown in its open position. Fig. 2 is a plan thereof. Fig. 3 is a plan of part, both of the doors or shutters of the guide or tube being shown in their closed position. Fig. 4 is a detail view, on an enlarged scale, showing one of the doors or shutters of the guide or tube in its open position. Fig. 5 is a plan thereof. Fig. 6 is a similar view to Fig. 4, but showing the door or shutter in its closed position. Fig. 7 is a detail view showing the guide or tube separately. Fig. 8 is a detail view of a door or shutter separately, and Fig. 9 represents a slightly-modified construction of the combined pots.

a represents the tinning-pot. a^2 represents the grease-pot, and a' is a narrow neck or way connecting the two pots a and a^2 together. The narrow neck or way a' is of such dimensions and is so situated as to allow a plate to pass freely therethrough and the molten metal or alloy to maintain the same level in both pots a and a^2.

Each pot is heated by means of a fire, (not shown,) as is usual; but by reason of the small area of the neck or way a' and by regulating the fires we are enabled to maintain the metal in the two pots a and a^2 at different degrees of temperature, as is necessary for the proper carrying out of the process. For example, we may after the first heating of the pots draw off the fuel from the furnace beneath the pot a^2, or permit the fire to die out, and by retaining the fire beneath the pot a the metal in the two pots will be maintained at different degrees of heat.

In the upper part of the tinning-pot a is arranged a bottomless box b, and within this box and upon the surface of the molten metal the flux or tinning composition is confined and supported, and through this box b the metal plate is passed into the molten metal or alloy beneath. The plate is conducted through the tinning-pot a by means of guides c, which at their upper ends c', within the flux or tinning-composition box b, are curved outward or formed bell-mouthed in order readily to receive the plates as they are fed to the apparatus by the attendant, and the guides c are at their lower part and in the molten metal furnished with asbestus brushes c^2, projecting at an angle from the guides c and normally meeting at their lower edges in a V form, so that they will brush the surfaces of the plates after they have passed through the flux or tinning composition, and thus remove therefrom any dross or scruff that may be adherent thereto. From the flux-box b the guides c conduct the metal plates through the molten metal in the tinning-pot a to the first pair of rolls d e, which grip them and feed or carry them forward. The feed-rolls d e are mounted in suitable bearings d' e', carried by a framing g, formed with a supporting returned flange h within the tinning-pot a, and the bearings d' of the upper roll d are capable of slight vertical movement to allow of the rolls being forced together in order that they may obtain a proper grip of the plates. The feed-roll d is held in contact with the corresponding roll e with a spring-pressure by means of spring-levers d^2, which are mounted upon centers of motion d^3 at each end of the frame g, and at their lower ends bear upon the upper sides of the bearings d', and these levers d^2 are at their upper ends formed with holes therethrough to receive screws d^5, carried by the framing g, and upon which are screwed nuts d^4, which act upon the ends of the levers d^2 and exert the necessary force thereon. The feed-rolls d e are caused to revolve at the same speed by means of toothed wheels d^* e^*, fixed on the axes at one end thereof and geared together, and motion is communicated thereto by means of toothed wheel d^{**}, fixed upon the other end thereof, engaging a toothed wheel v, mounted upon a stud v^*, carried by the tinning-pot a, said wheel v engaging a toothed wheel v', fixed upon the end of a shaft v^2, provided with cone-pulleys v^3 to receive a band w, which conveys the necessary motion to the parts. Scrapers or doctors f are employed to act upon the rolls d e and free them from any scruff or dross or other impurities that may adhere to the surface thereof, and these doctors or scrapers f are mounted upon pivots or axes of motion f^*, carried in the frame g, and are acted upon by the lower ends of spring arms or bars f', the upper ends of which are formed with holes therethrough to receive screws f^3, upon which are screwed nuts f^2 which, act upon the upper ends of the arms f', and thus regulate the pressure of the doctors or scrapers f.

The plates are fed forward by the rolls d e through the neck or way a', where they are guided by rails or bars i to another pair of feed-rolls j k, situated at the lower part of the grease-pot a^2. These feed-rolls j k are mounted in bearings j' k', supported in a framing l, which also carries the whole of the working parts, hereinafter described. The bearings of the upper roll j are movable vertically, as described, with respect to the roll d and with the same object, and the upper roll j is similarly pressed upon the lower roll k by means of spring-levers j^2, mounted upon centers of motion j^3, carried by the framing l, and at their lower ends bearing upon the bearings j', while at their upper ends they are formed with slots j^4 to receive screws j^5, upon which are screwed nuts j^6, which act upon the ends of the levers j^2 to give the necessary adjustment. The rolls j k are at one end provided with toothed wheels j^* k^*, by means of which they are geared together, and the roll j is at its other end fitted with a larger toothed wheel j^{**}, which engages a toothed wheel u, carried by the framing l, and from which it receives motion. These rolls j k are also acted upon by doctors or scrapers m n, mounted upon pivots or axes m^* n^*, centered in the frame l, and such scrapers are acted upon by

the lower ends of spring arms or bars m' n', whose upper ends are formed with holes therethrough to receive screws o, upon which are screwed nuts m^2 n^2, so that by revolving the screw-nuts m^2 n^2 in the one or the other direction the pressure of the doctors or scrapers m n upon the rolls j k can be regulated as desired.

Between the feed-rolls j k and the next pair or finishing-rolls s s', which are situated above the level of the molten metal, which is indicated by the dotted line y in the grease-pot a^2, an inclosed guide tube or way p is provided to conduct the metal plate in the desired path and within the grip of the finishing-rolls s s'. This guide p rises above the level of the molten metal and enters a short distance into the grease, the level of which is indicated by the dotted line z, which is supported upon the surface of the molten metal, and such guide is at its upper end formed with openings p' at each side thereof, through which is removed any scruff or dross which may have accumulated upon the surface of the molten metal within the guide p, and which would be injurious to the plate. The openings p' in the inclosed guide p are normally both closed by means of sliding shutters or doors p^2; but such doors p^2 are formed with openings p^3 therein corresponding with the openings p' in the guide p, so that one or the other of the openings p' of the guide p may be opened at the times desired by bringing the corresponding opening p^3 of one of the shutters p^2 into alignment therewith, as hereinafter more fully described. Said shutters are provided with slots p^*, that receive pins projecting from the ears p^{**} at the sides of the guide p.

Within the upper part of the inclosed guide p works a scraper or cleaner r, which is, by a cranked arm r', connected with a horizontal sliding bar r^2, supported in guides l', and furnished at its end with a handle-bar r^3, by which it may be operated at the times desired to move the scraper to and fro across the surface of the molten metal within the inclosed guide p, and thus remove to the outside of the guide p any dross or scruff that may have accumulated upon the surface of the metal, the doors or shutters p^2 preventing the return of the scruff or dross within the inclosed guide p.

In order that the necessary movements may be imparted to the doors or shutters p^2, each door or shutter is by a pin-joint p^4 connected with the lower end of a lever p^6, which is mounted upon a center of motion p^7 upon the framing l, and the upper end of each lever p^6 is acted upon by a spring q to keep the doors or shutters p^2 normally closed. Upon the upper end of each lever p^6 is fitted with capability of partial revolution thereon a finger p^8, and each finger is acted upon by a light spring q' to normally force it outward against a stop q^2 when it assumes a position in line with the plane of motion of its corresponding lever p^6. These fingers p^8 are acted upon by a cam or enlargement r^4 of the sliding bar r^2, which is at its ends formed with inclines r^5, and at the middle of its length with a notch or recess r^6, situated over the scraper r.

The action of this device is as follows: When the parts are all in their normal position, as represented at Fig. 3, with the doors or shutters p^2 closed, the sliding bar r^2 will be in either of the extreme positions of its traverse, the scraper or cleaner r will be at rest at the corresponding side of the inclosed guide p, and the end of one of the fingers p^8 will be within the notch or recess r^6 of the sliding bar r^2. When, however, it is desired to remove the scruff or dross from the surface of the metal within the inclosed guide p, the sliding bar is moved endwise, and that finger p^8 which is within the recess r^6 is turned inward, and thus held by the cam or enlargement r^4, as represented at Fig. 2, so that its corresponding door or shutter p^2, which is at the rear of the scraper r, remains closed by the influence of the spring q, while at the same time one of the inclines r^5 acts upon the other finger p^8, moving it endwise, in which position it rides upon and is held by the cam or enlargement r^4, thereby overcoming the influence of the spring q and opening the corresponding door p^2 in advance of the scraper r, thus permitting the scruff or dross to be cleared off the surface of the molten metal within and removed from the inclosed guide p. Upon the arrival of the sliding bar r^2 and the scraper or cleaner r at the end of their traverse in removing the scruff or dross, as above described, the finger p^8, which has been riding upon the cam or enlargement r^4, will, by the influence of the spring q, snap into the notch or recess r^6 of the sliding bar r^2, thereby closing the door or shutter p^2 over the opening p' of the inclosed guide p, through which the dross has been expelled, and preventing its return. In this position of the parts the other finger p^8 will be clear of the enlargement r^4 of the sliding bar r^2, and will therefore be forced outward by the spring q' until it is arrested by the stop q^2, and is in position to be acted upon by one of the inclines r^5 of the sliding bar r^2, when by moving such bar endwise in the opposite direction the operations above described will be repeated. The most important feature of the inclosed guide p is that it incloses the surface of the molten metal through which the plate passes to the palm-oil or other grease, and thus a very small area only of the molten metal is required to be kept free from impurities, and this can be effected very readily by the means hereinbefore described. In practice it has been discovered that generally it is only necessary to clear the surface of the metal immediately before commencing work, as while the apparatus is being continuously worked the formation of dross or scruff upon the small area of molten metal within the guide p is so inappreciable that the removal thereof is unnecessary. It will be evident that, provided the upper part

of the guide p is formed inclosed, the lower part thereof may be of skeleton form, or that a separate short inclosed guide p may be employed, entering a short distance into the molten metal and rising a short distance into the grease, separate guides being employed to conduct the plates from the rolls j k to the inclosed guide p, and, if desired, instead of employing a number of separate guides or a skeleton guide c in the tinning-pot, such guide may be formed inclosed. If desired, the scraper r may be dispensed with and the scruff or dross may be removed when required from the surface of the inclosed guide p by other means, such as a ladle or other hand-tool. After passing through the inclosed guide p the plate passes between two pairs of finishing-rolls s s' t t', working in the grease, whence the finished plate is conducted away, as desired. The rolls s s' are mounted in bearings s^2 s^3, carried by the framing l, and those s^3 are capable of slight horizontal movement, and are acted upon by a spring-lever s^4 to press the roll s' with the necessary spring-pressure upon the roll s, and these rolls are at one end fitted with toothed wheels s^*, by which they are geared together, and one of them s is at the other end fitted with a toothed wheel s^5 of larger diameter, which engages both the wheel u and a similar toothed wheel t^5 upon the the roll t', which is the first driven roll, and engaging the wheel t^5 is another toothed wheel t^6, fixed upon a shaft t^7, which is mounted in bearings carried by the grease-pot a^2, and is provided with cone-pulleys t^8, which are driven by means of a band x, and motion is thus communicated through the entire train of wheels to the various rolls in the grease-pot a^2, as will be readily understood. The final rolls t t' are similarly mounted in bearings t^2 t^3, and those t^3 are acted upon by a spring-lever t^4, as hereinbefore described with respect to the rolls s s', and they are similarly fitted with toothed wheels t^* upon the ends thereof to gear them together.

If desired, we may form any of the rolls of copper or other non-oxidizible metal or alloy, in order to avoid chemical action as much as possible, and we may employ inclosed or other guides to conduct the metal plates from any one pair of rolls to another pair.

The entire frame l, carrying the working parts within the grease-pot, is mounted upon trunnions or centers of motion l^2, and is capable of regulation by means of a set-screw l^3, for the purpose of adjusting the frame and rolls to a proper level.

In lieu of forming the tinning-pot a and grease-pot a^2 as separate vessels connected by the narrow neck or way a', such pots may, if desired, and as represented at Fig. 9, be formed in one, with a division-wall a^* to separate the molten metal into two parts, such division-wall being formed at a suitable point with a narrow way a' therein, for the purposes hereinbefore described.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is—

1. In an apparatus employed in coating metal plates, the combination of the rolls s' s' and an inclosed narrow guide or tube descending into the molten metal and rising into the grease below the rolls, such guide being provided with openings at each side thereof, and suitable doors or shutters, substantially as herein shown and described, and for the purpose stated.

2. In an apparatus employed in coating metal plates, an inclosed guide or tube descending into the metal and rising into the grease, such guide being provided with openings at each side thereof, suitable doors or shutters adapted to close such openings, and a scraper or cleaner adapted to work in the guide or tube, the doors or shutters and the scraper being relatively operated in manner substantially as herein shown and described, and for the purpose stated.

3. In an apparatus employed in coating metal plates, a tinning-pot and a grease-pot connected by a narrow neck or way, an arrangement of guides and rolls to conduct the plates through both pots beneath the surface of the metal, doctors or scrapers to act upon said rolls, an inclosed guide or tube descending into the metal and rising into the grease, such guide being provided with openings at each side thereof, suitable doors or shutters to close such openings, and a scraper or cleaner working in the guide or tube, all in manner substantially as herein shown and described, and for the purposes stated.

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