June 3, 1941. J. B. WHITMORE ET AL 2,244,035

METAL TREATING METHOD AND MACHINE

Filed May 7, 1938 7 Sheets-Sheet 1

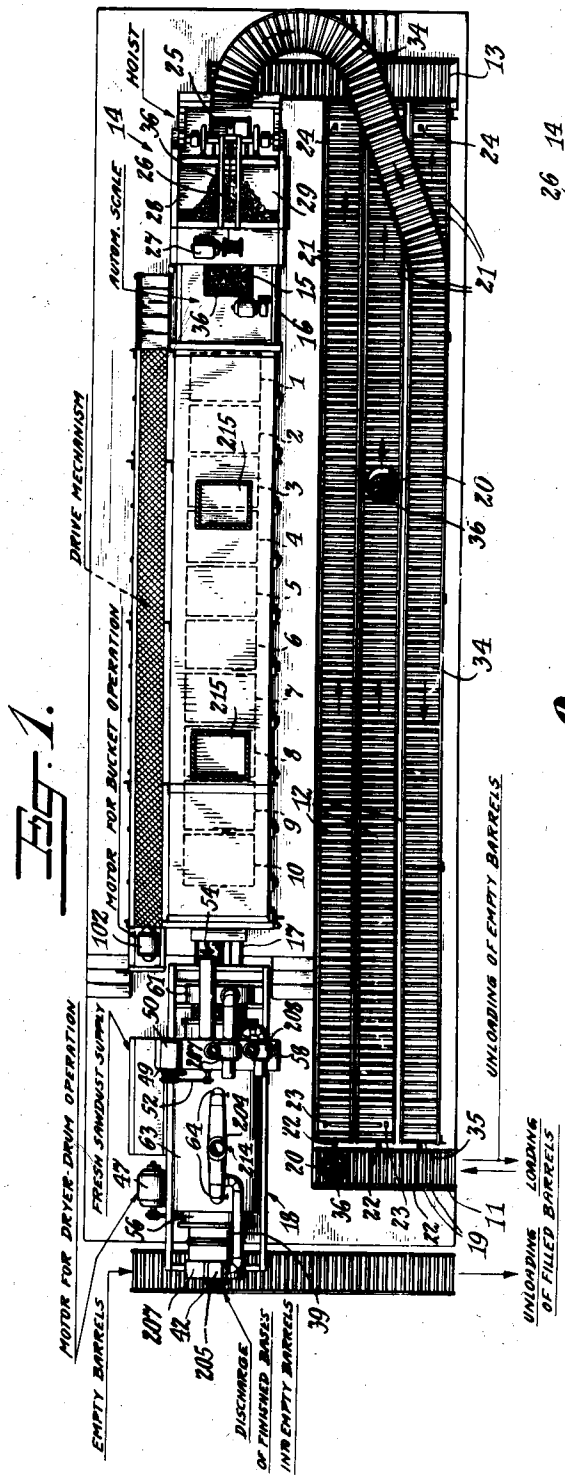


Fig. 1.

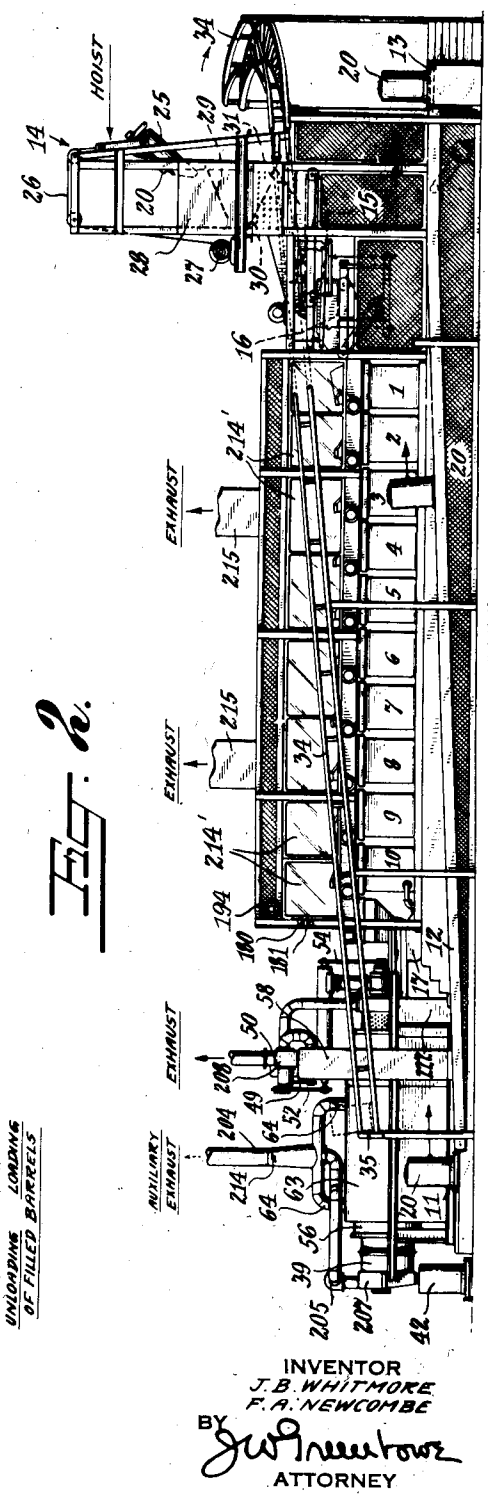


Fig. 2.

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METAL TREATING METHOD AND MACHINE

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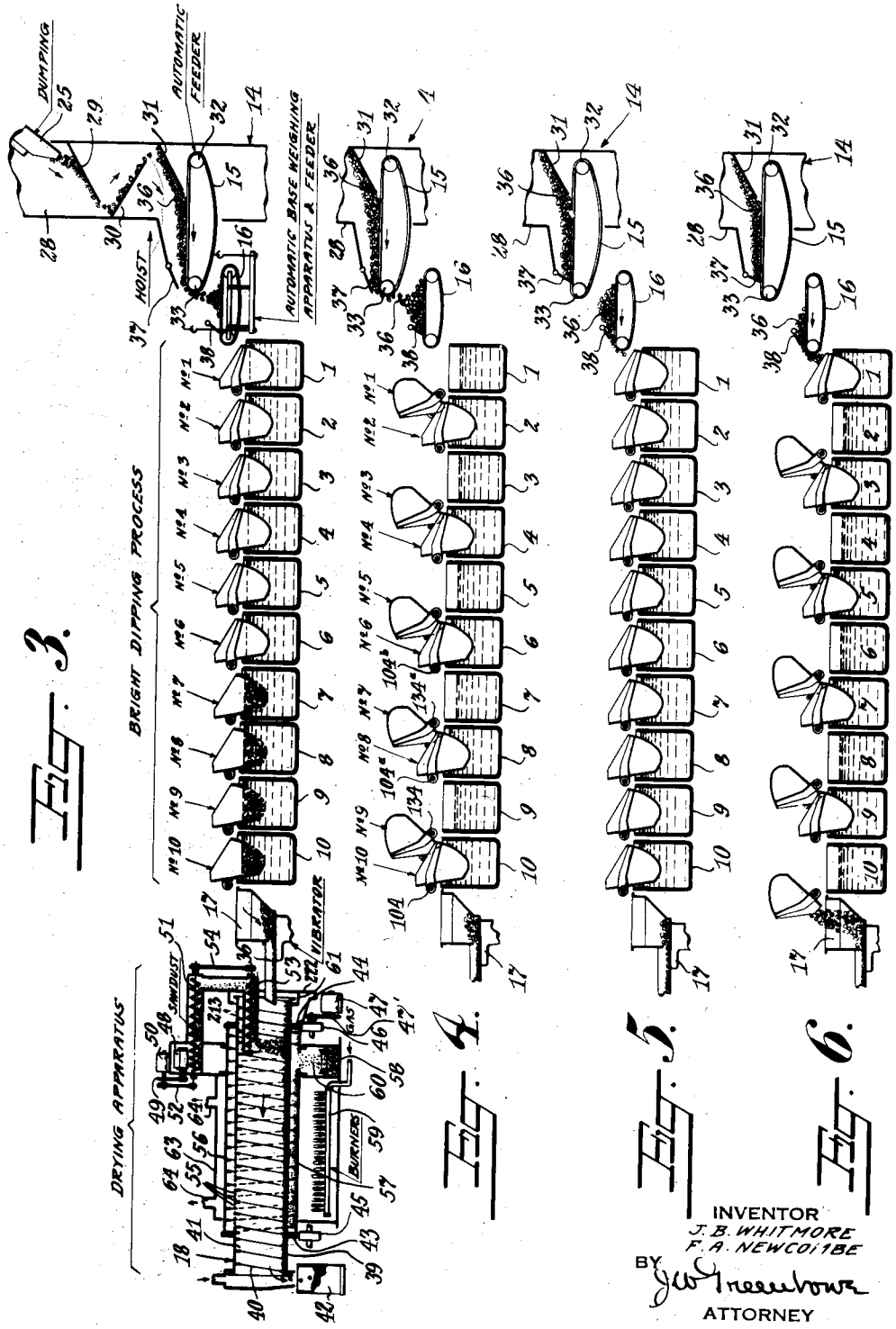


Fig. 3.

Fig. 4.

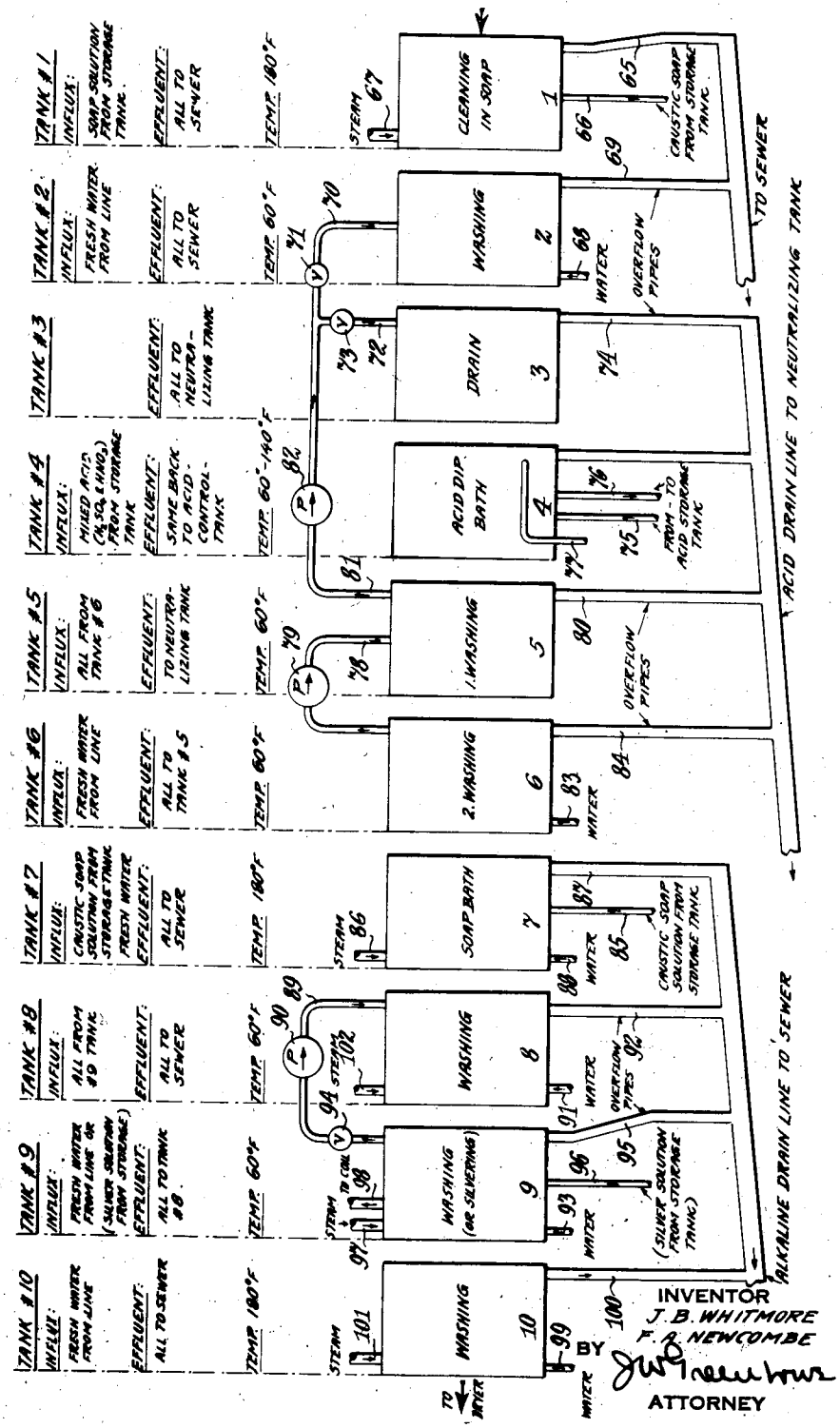
Fig. 5.

Fig. 6.

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METAL TREATING METHOD AND MACHINE

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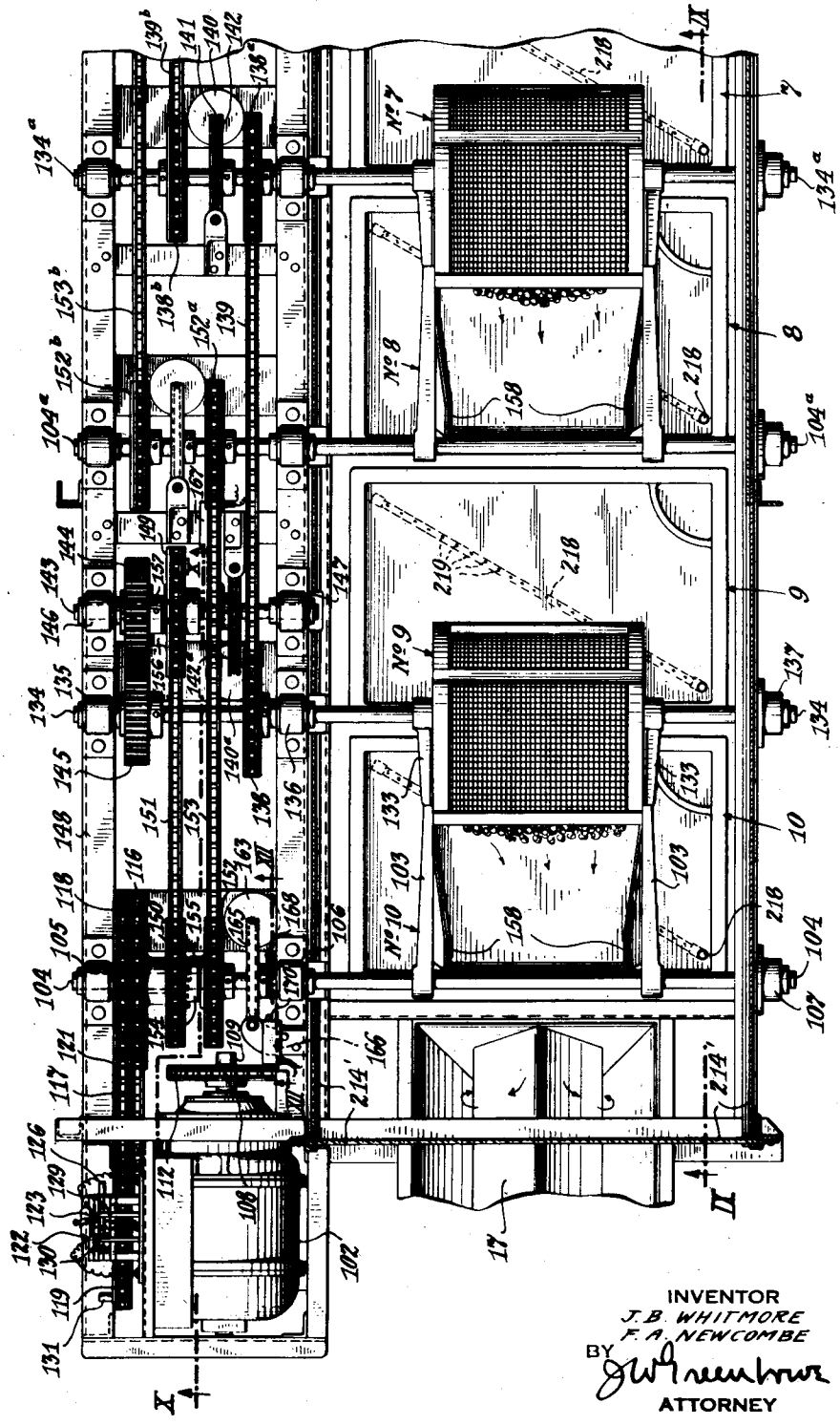


Fig. 8.

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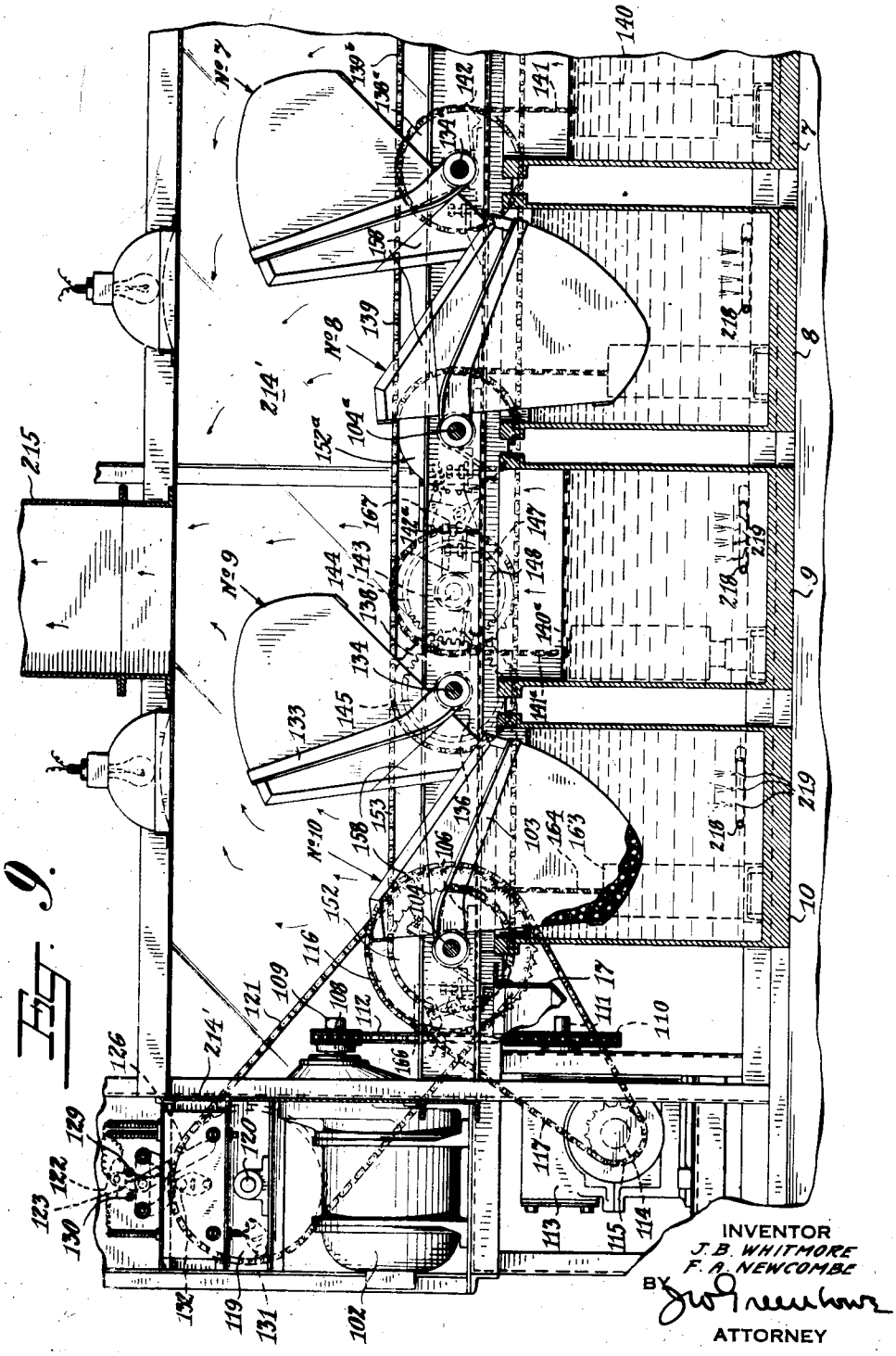


Fig. 9.

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Fig. 10.

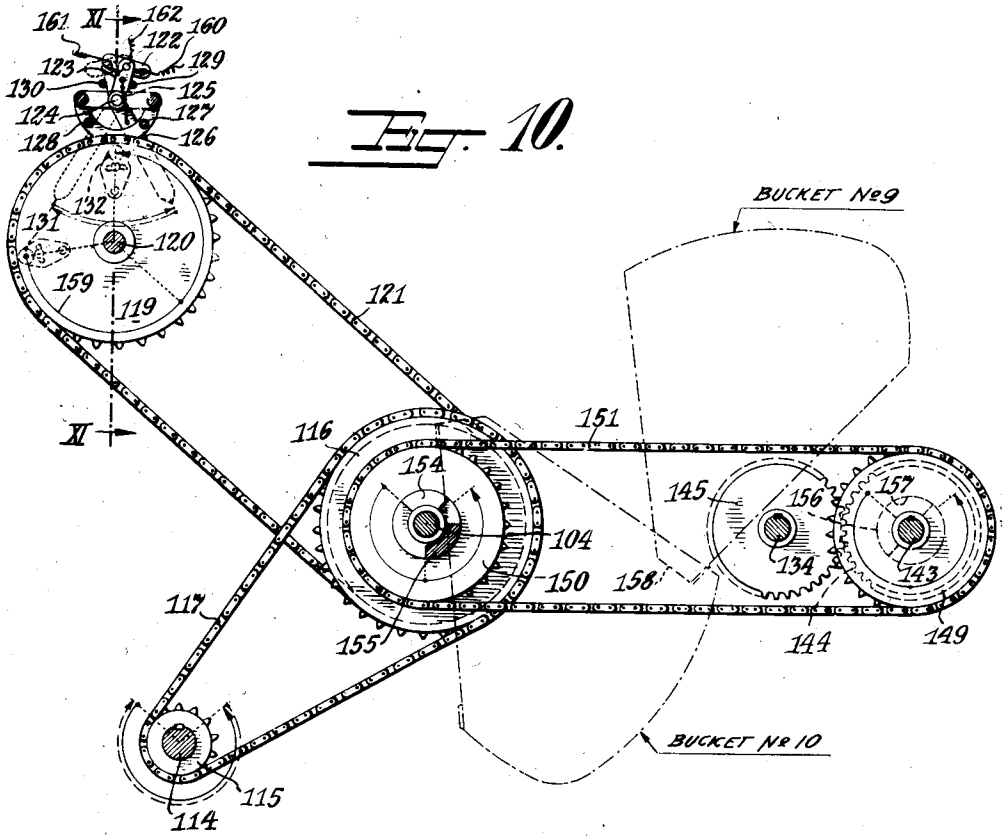
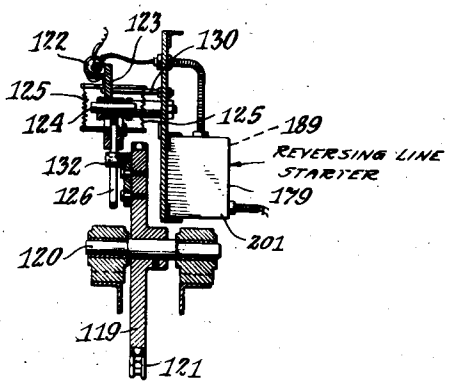
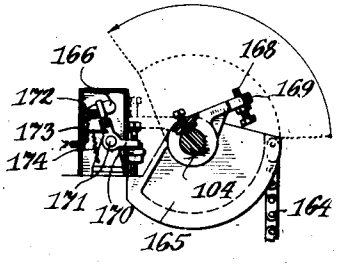


Fig. 12.

Fig. 11.





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Fig. 13.

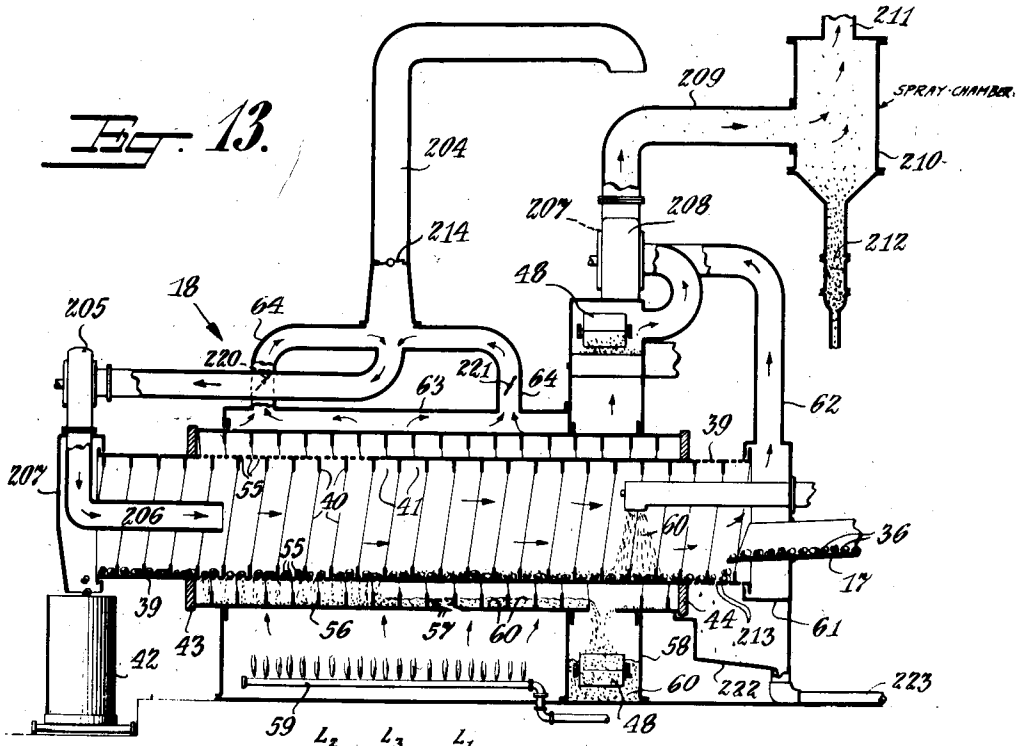
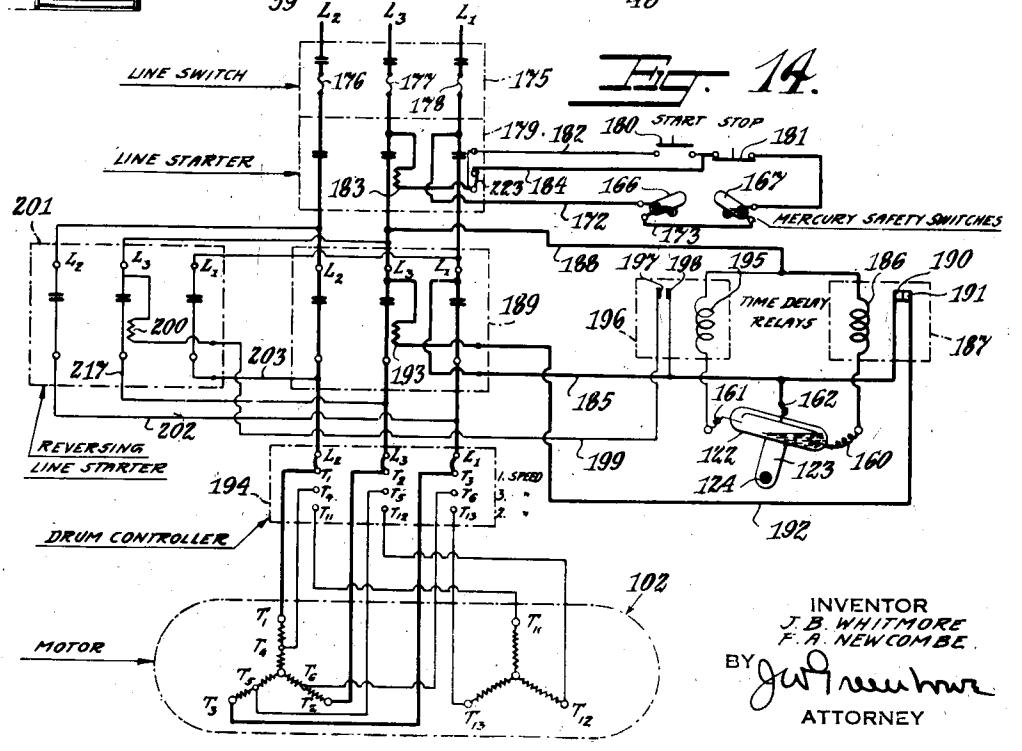


Fig. 14.



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Patented June 3, 1941 2,244,035

UNITED STATES PATENT OFFICE

2,244,035

METAL TREATING METHOD AND MACHINE

James B. Whitmore, Bloomfield, and Frank A. Newcombe, Nutley, N. J., assignors to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application May 7, 1938, Serial No. 206,696

21 Claims. (Cl. 266—7)

This invention relates to a method and machine for treating articles formed of metal, and is especially adapted for the treatment of bases for incandescent electric lamps.

The principal object of our invention, generally considered, is to clean, finish and dry metal articles, and especially brass bases for incandescent electric lamps.

Another object of our invention is the provision of means for conveniently transporting, elevating, weighing, and passing metal articles, such as electric lamp bases, through various liquids to clean and finish them, and finally through a dryer, in order to condition them for use in manufacturing lamps.

A further object of our invention is the provision of an automatic conveyor for transporting barrels or other receptacles containing metal articles to and from a cleaning machine.

A still further object of our invention is the application of an automatic hoist for elevating large containers, such as barrels, dumping them into a hopper, and transferring the empty barrels to a gravity runway by means of which they are transported for refilling, the elevator returning to starting position automatically.

An additional object of our invention is the provision of machinery for automatically weighing a charge of metal articles and dumping said charge into a bucket for treatment.

Another object of our invention is the provision of a series of foraminous buckets which receives a charge of metal articles for treatment at one end, and automatically transports said articles by dumping from one bucket to the next throughout the series, whereby said articles are subjected to treatments by means of liquids in which said buckets are immersed.

A still further object of our invention is the use of a vibrator feeder to take a large load, as discharged from the last bucket on the dip machine, and feed this load at a uniform rate to a dryer, thus increasing the efficiency of the dryer by receiving a uniform flow of material instead of intermittent loads.

A further object of our invention is the provision of drying apparatus for metal articles, comprising a rotating drum with means for causing said articles to advance from one end to the other, means for feeding sawdust or the like with said articles, means for heating said articles and sawdust in the apparatus, means for removing said sawdust from said drum before said articles, means for reclaiming, returning and renewing said sawdust, and means for visually inspecting said articles during their passage through the apparatus.

Other objects and advantages of the invention, relating to the particular arrangement and construction of the various parts, will become apparent as the description proceeds.

Referring to the drawings illustrating our invention:

Fig. 1 is a plan of apparatus embodying our invention for transporting, elevating, treating, and drying metal articles.

Fig. 2 is a side elevation of the apparatus illustrated in Fig. 1.

Fig. 3 is a diagrammatic elevational representation of the apparatus of Figs. 1 and 2, illustrating all of the treating buckets in normal positions immersed in tanks of liquid, with the even numbered buckets empty and the odd numbered buckets in positions in which their contents are treated by the immersing liquids, the automatic weighing and feeding device being shown in position shortly after it has been emptied into the first bucket.

Fig. 4 is a fragmentary diagrammatic view, corresponding to Fig. 3, but showing the next position, in which the odd numbered buckets have been raised and are discharging their contents into the even numbered buckets.

Fig. 5 is a fragmentary diagrammatic view, corresponding to Fig. 3, but showing the arrangement of the parts in the next position after the odd numbered buckets have been dropped to their normal positions, after discharge of their contents into the even numbered buckets.

Fig. 6 is a fragmentary elevational view, corresponding to Fig. 3, but showing the next position in which the first bucket is being filled from the automatic weighing and feeding device, and the even numbered buckets are discharging their contents into the odd numbered buckets therebeyond, except that the last bucket is discharging its contents into the hopper of a vibrator associated with the drying apparatus.

Fig. 7 is a chart showing the connections between the tanks, in which the treating buckets are immersed, and the compositions of the liquids desirably used in said tanks.

Fig. 8 is a plan view of four of the buckets and associated drying apparatus, corresponding generally with Fig. 1 but showing details on an enlarged scale.

Fig. 9 is a vertical sectional view on the line IX—IX of Fig. 8, in the direction of the arrows.

Fig. 10 is a vertical sectional view on the line X—X of Fig. 8, in the direction of the arrows.

Fig. 11 is a fragmentary sectional view on the line XI—XI of Fig. 10 in the direction of the arrows.

Fig. 12 is a detailed elevational view, partly in section, of one of the mercury safety switches shown in Fig. 9.

Fig. 13 is a diagrammatic view of the drying apparatus, supplementing that shown at the lefthand end of Fig. 3.

Fig. 14 is a wiring diagram of the motor and associated operating mechanism for the buckets.

Referring to the drawings in detail, like parts being designated by like reference characters, and first considering Figs. 1 to 6, inclusive, there are shown the general assemblies of apparatus for handling and treating metal parts, such as bases for incandescent electric lamps or other metal articles of similar character.

As such bases come from the machine which makes them, they, being generally made of brass, are more or less tarnished and dirty and it is desirable to clean and impart a bright and lasting finish thereto before they are used for manufacturing incandescent electric lamps. The machine of our invention involves generally a loading platform **11**, one or more automatic conveyors **12**, a transfer conveyor **13**, a hoist **14**, an automatic feeding belt **15**, an automatic weighing and feeding device **16**, and a series of tanks and associated foraminous buckets, which we have numbered **1** to **10**, inclusive, from right to left. Each tank, with a possible exception which will be discussed later, normally contains a liquid, and said tanks are interconnected, as will be explained in detail when Fig. 7 is described, so that economy in the use of the liquids is effected. Each bucket is constructed of screen or perforated sheet metal, so that liquid quickly drains out of, or flows into it, as it rises from or descends into its tank. The last bucket cooperates with and periodically discharges into a vibrator **17**, which in turn feeds drying apparatus **18** at a uniform rate of speed, smoothing out the intermittent loads coming from the last bucket.

The loading platform **11** is desirably formed of a series of rollers **19**, so that upon placing thereupon a container barrel **20** of lamp bases, or other brass or metal articles, the same may be readily moved by hand from the outer end, to align with the receiving end of one of the automatic conveyors **12**.

Each conveyor **12** comprises a series of rollers **21** which are driven by suitable power means to advance the barrels, or other containers **20**, from the receiving end to the discharge end of the conveyor. The construction of each conveyor is desirably such that a barrel placed thereon results in its automatic movement a sufficient distance to make place for another barrel, so that the movement of barrels from the receiving end to the discharge end is automatic, as long as barrels are fed thereto, until the conveyor is filled. This automatic movement of each conveyor is effected by suitable switch members **22** and **23** which are operated when a barrel is placed thereover.

A switch member **24** is provided adjacent the discharge end of each conveyor **12**, so that a barrel upon reaching said end stops the operation of the conveyor, until an attendant removes it to the transfer conveyor **13**. Upon placing a barrel on the transfer conveyor **13**, the attendant pushes it in the direction of the arrows until it reaches the hoist **14**, whereupon he pushes it onto the carriage **25** and causes the latter to raise said barrel, as by means of the operating cable **26** and the motor **27**, to the position illustrated in Fig. 2, and dump the contained articles into the hoist hopper **28**, where they slide down over the inclined plates **29** and **30** and **31** to be received on the automatic feeding belt **15**, which traverses the distance between supporting pulleys **32** and **33**.

The automatic hoist **14** is desirably so constructed, that when a barrel **20** is dumped it is then lowered to the level of, and delivered onto, the inclined roller slide **34** along which it descends by gravity to the discharge end, indicated by the reference character **35**, from which it may be removed for refilling.

The automatic feeding belt **15** is so constructed, and electrically connected with the mechanism for operating the automatic weighing and feeding device **16** that it operates to discharge the articles **36** being handled, only until the automatic weighing device has taken on the desired load, which may be a convenient charge such as thirty to forty pounds, whereupon the operating mechanism for the automatic weighing and feeding device **16** starts to discharge its load into bucket **1**, as illustrated in Fig. 6. A flap or gate **37** is desirably associated with the feeding belt **15** to cut off the flow of the articles **36** when the belt stops operating. A flap or gate **38** is also used with the automatic weighing and feeding device **16** for a similar purpose.

The machinery for operating the buckets **1** to **10**, inclusive, is so arranged and interrelated that the odd and even numbered buckets alternately operate to discharge their contents toward the left, as viewed in Figs. 3 to 6, inclusive, the operation of these buckets being timed, as by means of time delay relays in the driving motor circuit, to allow the desired amount of soaking of the bases, or other articles, in the treating solutions contained in some or all of the correspondingly numbered tanks **1** to **10**, inclusive.

Drying mechanism

After the articles **36** have passed through the tank solutions, as by being discharged from bucket **1** to bucket **2**, from bucket **2** to bucket **3**, and so on to bucket **10**, they are finally discharged from bucket **10** to the vibrator **17**, where they feed in a uniform stream, by vibration and gravity, into the drying drum **39** of the apparatus **18**.

This drum **39** is desirably provided with an inwardly extending flange **40** which forms a helical trough **41**, in the righthand end of which are received the articles **36**, in a uniform stream, and which are advanced toward the left, as viewed in Fig. 3, by corresponding rotation of the drum **39**, whereupon they are eventually discharged into a receiving barrel **42**, and are then ready for inspection prior to use in the manufacture of lamps. The drum **39** may be rotated by having supporting annular members **43** and **44** engaging an idler roller **45** and a drive roller **46**, geared to a suitable motor or other power device **47**, or driven therefrom by a chain **47'**.

In order to facilitate the drying operation, and to some extent polish the articles being treated in the tanks, sawdust **60** or other similar material is desirably fed to the drying drum **39**, shown in Figs. 1, 3, and 13, as by means of a conveyor **48**, operated by a chain **49** and motor or other power means **50**, which feeds sawdust to a worm **51**, which may also be driven from

the same motor 50 by means of a chain 52. The righthand end of the worm 51 discharges the sawdust to the corresponding end of a worm 53, which may be driven from the worm 51 by means of a chain 54, the lefthand end of the worm 53 discharging sawdust on the articles 36 after they have been fed to the drying drum 39.

In order to reclaim the sawdust for reuse, the drum 39 is formed with apertures 55 in a portion thereof, said apertures being large enough to permit the discharge of sawdust, while too small to allow the articles 36 to drop therethrough, so that the sawdust after serving its purpose, is discharged through said apertures 55 to an outer drum 56, likewise provided with a helical flange 57, said flange, however, winding in the opposite direction so that the sawdust received in the drum 56 is fed to the right, as viewed in Fig. 3, to be finally discharged into the bottom of the conveyor shaft 58, from whence it is elevated by the conveyor 48 for recirculation. New sawdust may be put in the system in any desired manner, as by means of a worm conveyor (not shown) between the fresh sawdust supply and the bottom portion of the conveyor shaft 58. Sawdust may be withdrawn through a suitable aperture (not shown) in the circulating system, as required.

Suitable means, such as a gas burner device or heater 59, is provided for heating the drums 39 and 56, whereby the articles 36 and the treating sawdust 60 are dried to the desired extent. In order to reclaim as much heat as possible and to take care of any fumes generated during the heating operation, a hood 61, with suitable piping and stack 62, is provided, in which the righthand end of the barrel 39 rotates. The burner device 59 and intermediate portions of the drums 39 and 56 are surrounded by a suitable housing 63, provided with one or more stacks 64 for carrying off the heated waste gases and circulating them through the dryer.

Referring now to Fig. 13 for a specific disclosure of the means for circulating the heated gases through the drying apparatus, also partly shown in Figs. 1 and 3, we find that the hot gases generated by operation of the burner 59, after passing around the inner drying drum 39 and outer drying drum 56, instead of passing directly to a stack, such as designated by the reference character 204, are drawn by a blower 205 and discharged directly into the drum 39 by means of a pipe 206. Dampers 220 and 221 are desirably provided in the outlet pipes from the outer drum 56 to equalize the suction from the blower 205. The pipe 206 passes into the outlet hood 207 from which the dried articles are discharged from the drum 39 into receiving can 42. The gases are withdrawn upwardly from the dryer 39, through the hood 61, at the other end of said drum, and pipe 62, by means of a blower 207, to combine with the discharge from a blower 208 which draws some of the hot gases through the drum apertures 55, over the sawdust in the outer drum 56, and on upwardly over the sawdust being transferred by the conveyor 48, thereby drying and ridding said sawdust of fine dust.

The gases are finally discharged into pipe 209 leading to spray chamber 210, from which stack 211 extends. In the spray chamber, any fine dust or sawdust drawn along with the stream of air by blowers 207 and 208, is washed out before passing to the stack 211 and carried by the water pipe 212 for discharge to a sump.

The stack 204 has a damper 214 to allow for adjustment in case it is desired not to use all of the hot gases from the burner 59 for recirculation, or in case the blower 205 fails to function. During normal operation said damper 214 will remain closed, allowing substantially no gas to discharge directly to the stack 204.

In order to avoid evaporating an unnecessary amount of water, that part of the inner drum 39 which extends beyond the outer drum 56, toward the buckets and treating tanks, is desirably provided with perforations 213, in order to drain away water which might possibly be received from the vibrator 17. Water which passes through said perforations 213 is desirably collected in an enclosure or funnel 222 for discharge to a sump through pipe 223. The sawdust is desirably fed from the worm 53 to the drum 39 at a point inwardly of the perforations 213, as shown most clearly in Fig. 13, thereby avoiding the absorption of an unnecessary amount of water.

"Bright dipping" and silvering process

In order to clearly show how the apparatus of our invention may be employed, we will now describe its use in connection with two treatments which brass bases for incandescent electric lamps may be subjected to, with reference to the diagrammatic showing in Fig. 7 of the manner in which the tanks of the embodiment of our invention disclosed are connected to sources of supply, drains, and to each other, as well as the character of the liquids received therein.

We will first describe the process of cleaning and brightening brass bases for incandescent electric lamps, which is generally designated as "bright dipping." From the chart of Fig. 7, it will be seen that tank 1 is employed for cleaning and grease removing, also to apply a coating of soap that prevents the bases from sticking together, and for that purpose is supplied with a caustic soap solution, desirably composed, by weight, of .2% of caustic soda and 1% of fish-oil soap. For tanks of the size employed in the illustrated embodiment of our invention, we desirably allow this solution to flow in at the rate of about forty gallons per hour, the temperature of said solution being maintained at about 180° F., by introducing steam thereinto at the rate of about forty pounds per hour. The overflow from this tank runs through drain pipe 65 to the sewer. The caustic soap supply pipe is designated by the reference character 66, and the steam supply pipe by 67. We prefer to form the tank 1 of iron and cover the entire surface, inside and out, with rubber, and make the associated bucket of bronze or stainless steel.

Water is desirably introduced into tank 2, for washing the bases, from the line through pipe 68, at the rate of about three hundred gallons per hour, the overflow from said tank passing through pipe 69 to the sewer. Although a pipe 70 is shown connecting with tanks 3 and 5, through valve 71, yet this is not used in the present process. The washing is effected in unheated water which is normally at a temperature of about 60° F. The tank 2 is made of iron and rubber covered inside and out, and the associated bucket may be formed of nichrome, stainless steel or bronze, thereby adapting them for use with acid solutions, if desired.

Tank 3 is, in the present process, employed merely for draining the wash water from the bases received from tank 2, the valve 73 being kept closed and the pipe connection 72 not being used. Water dripping from the bases; received from tank 2 is allowed to drain into a neutralizing tank through pipe 74. Tank 3 and its bucket are desirably formed of the same kinds of material as tank 2 and its bucket.

Tank 4 is desirably made of earthenware or stainless steel, its bucket formed of nichrome or stainless steel, and they are employed for the acid dip bath. For that purpose the tank receives a mixed acid solution through pipe 75 from an acid storage tank (not shown), the solution being returned to the storage tank through pipe 76. The acid mixture is desirably delivered to the bath at the rate of about twenty-five gallons per minute. The acid used may be made from mixed acid consisting of 78% of sulphuric acid, 10½% of nitric acid, by adding water to give it a specific gravity of 41°–47° Baumé. The bath is heated by the acid attacking the brass of the bases and its temperature ranges from 60 to 140° F. A cooling coil 77 is employed for preventing the temperature from rising above the higher figure. The acid returned to the storage tank is reconditioned automatically for reuse.

Tank 5 is made of iron and rubber covered inside and out and its bucket, as well as that in tank 6, is desirably formed of stainless steel or nichrome for washing, and the tank desirably receives about two thousand gallons of water per hour from tank 6, which is also used for washing and made of the same kind of material as tank 5, through pipe 78, said water being driven by pump 79. The overflow from tank 5 drains to the neutralizing tank through pipe 80. Pipe 81, which, through pump 82, may feed water to tanks 2 and 3, is not used in the present process.

Unheated water is employed for tanks 6 and 5 so that the baths are normally at a temperature of about 60° F. The acidity of the water in tank 5 is desirably maintained automatically, as by the use of a Leeds and Northrup conductivity controller, at 1 per cent sulphuric acid, or less. This acidity is caused by the acid carried over from tank 4, but if the acid content in tank 5 exceeds 1%, more water is desirably automatically flowed from the line into tank 6 to keep the acidity in said tank less than .2%. The use of water in this way; that is, delivering it first to tank 6 through pipe 83 and from there to tank 5 through pipe 78, cuts the water consumption for these two tanks in half. Any overflow from tank 6 passes to neutralizing tank through pipe 84.

Tank 7 is desirably made of iron, rubber covered inside and out, and its bucket of bronze, or stainless steel. The tank is employed for a soap bath and desirably receives, through pipe 85, a caustic soap solution formed of .2% of caustic soda and 1% fish-oil soap by weight, at the rate of about 25 gallons per hour. The bath is desirably maintained at a temperature of about 180° F., by steam introduced through pipe 86 at the rate of about thirty pounds per hour. Any overflow passes to the sewer through pipe 87. The water pipe 88 is not used in this process, except to wash out the tank. The only overflow from this tank is enough of the solution to make room for new in order to keep the bath up to strength. This is maintained automatically by a Leeds and Northrup conductivity controller made up especially for this purpose.

Tank 8 is made of iron, rubber covered inside and out, and its bucket may be made of bronze or stainless steel. They are used for washing the bases. For that purpose, the tank receives about one thousand gallons of water per hour from tank 9 through pipe 89, driven by pump 90. The water pipe 91 is not used in this process except to wash out tank, the overflow pipe 92 serving to allow the waste water to pass to the sewer. No steam is used in this tank for this process, so the temperature of the liquid is normally at about 60° F.

Tank 9 is made of iron, rubber covered inside and out, and its bucket is desirably formed of nichrome, or stainless steel, so that they may also be used for a silvering process. In the present process, tank 9 is for washing, desirably receiving about one thousand gallons of water per hour from the line through pipe 93. No steam is used, so the temperature of the bath is normally about 60° F. All of this water is desirably drawn to tank 8 through valve 94, but any overflow may pass to the sewer through pipe 95. Pipe 96 is not employed in the present process, nor are the pipes 97 and 98, which latter pipes connect with a coil which may be used for steam.

Tank 10 is made of iron, rubber covered inside and out, and its bucket may be made of bronze or stainless steel. They are used for washing, and water desirably flows thereto from the line through pipe 99 at the rate of about one hundred and fifty gallons per hour. The overflow from this passes to the sewer through pipe 100. A steam pipe 101 may be employed to heat the water to a temperature of about 180° F., by introducing about one hundred and fifty pounds of steam per hour.

The capacity of each tank, corresponding with the foregoing description, is desirably about one hundred gallons. Each bucket, because of the fact that in its extreme dumping position it has passed its upper dead center, is desirably counterweighted to insure its return to lowered position, as will subsequently be explained.

Another process which may be practiced, when using the described apparatus of our invention, is that in which bases are silver-plated or coated with a very thin wash of silver. In this process, tanks 1 to 6, inclusive, have the same liquids and are used in the same way as in the "bright dipping" process just described.

To prepare the bases for silvering, tank 7 has introduced thereinto a .2% solution of caustic soda, through pipe 85, preferably at the rate of about seventy-five gallons per hour. Strength is maintained automatically by a conductivity-controller. The overflow from this tank, which is necessary to maintain the bath at the desired strength, passes to the sewer through pipe 87. The bath is maintained at a temperature of about 180° F. by steam introduced through pipe 86 at the rate of about 80 pounds per hour. Water pipe 88 is not used in this process.

Tank 8 is employed for washing the bases preparatory to silvering and desirably receives about three hundred gallons of water per hour from the line through pipe 91, the overflow passing to the sewer through pipe 92. Pipe 89 is not employed in this process. The water is heated to about 180° F., as by introducing steam at the rate of about three hundred and fifty pounds per hour through pipe 102.

Tank 9 is for the silvering or "silver-strike" bath. It receives a silver solution, at a rate necessary to keep the bath up to strength, through pipe 96. The overflow from this tank is practi-

cally zero. The temperature is desirably maintained at about 180° F., by steam introduced to a coil through pipe 97 with the condensate withdrawn through pipe 98. The silver solution may be made from sodium cyanide, silver nitrate, and water.

Tank 10 contains wash water and desirably receives about three hundred gallons per hour from the line through pipe 99, the overflow from which passes to the sewer through pipe 100. The temperature of the water is desirably maintained at about 180° F., by steam introduced through pipe 101 at the rate of about three hundred and fifty pounds per hour.

Construction and operation of bucket mechanism

Figs. 8 to 12, inclusive, show some of the tanks, associated buckets numbered 7 to 10, inclusive, and the bucket-operating mechanism, on a scale enlarged as compared with the showing in Figs. 1 to 6, inclusive, the positions of said buckets being as shown in Fig. 4. The tanks and associated buckets desirably operate under a glass hood 214' which collects fumes and gases generated in the tanks during the treating operations and discharges them to a stack 215, at the same time providing for visual inspection.

On account of the fact that the odd numbered buckets 1, 3, 5, 7, and 9 are in elevated position when the even numbered buckets 2, 4, 6, 8 and 10 are lowered, and vice versa, the counterweight and driving arrangement for the even numbered buckets is slightly different from that of the odd numbered buckets, so that it is possible to use a single reversible driving motor which is designated by the reference 102. Inasmuch as the mechanism for all of the odd numbered buckets, except No. 9, is alike, and that for all the even numbered buckets, except No. 10, is alike, only that for the four buckets 7, 8, 9, and 10, shown in Figs. 8 and 9, will now be described in detail.

Bucket number 10 is secured to arms 103 which are rigidly mounted on an operating shaft 104, rotatably mounted in bearings 105, 106, and 107, supported by suitable framework 148. The shaft 104 is rocked, or rotated first in one direction and then in the other, by the motor 102, from a sprocket wheel 108 on the motor drive shaft 109, which drives a sprocket wheel 110 on a shaft 111 through a sprocket chain 112. The shaft 111 is rotatably mounted in a gear box 113 and through reduction gearing, such as a worm and wheel, not shown, drives a shaft 114 carrying a sprocket wheel 115, which drives a sprocket wheel 116, rotatably mounted loose on the shaft 104, by means of a chain 117.

Rotated with the sprocket wheel 116 on the shaft 104, is a sprocket wheel 118 which drives a sprocket wheel 119, mounted on a shaft 120, by means of a chain 121, so that it serves to actuate the reversing mercury switch 122, see Figs. 10 and 11 for details, which is connected as by means of a circuit, such as illustrated in Fig. 14, to the motor 102 so as to alternately raise and lower the associated even numbered buckets, while lowering and raising the odd numbered buckets. In order to accomplish the actuation of the reversing switch, the same is secured to the top of a lever 123, pivotally mounted at its lower end at 124, and connected by means of springs 125 to a lever 126, also pivoted at 124 and adapted to oscillate thereabout between stops 127 and 128.

The lever 123 operates between stops 129 and 130, so that after the lever 126 has been moved from one extreme to the other by means of one of the actuating rollers 131 and 132 pivotally mounted on the sprocket wheel 119, the lever 123 and its associated reversing switch 122 snaps from one extreme to the other, under the action of the springs 125, to cause a reversal of the motor 102, with the raising of the lower set of buckets and the lowering of the other set, as will subsequently be explained.

Bucket number 9 is secured to arms 133 rigidly mounted on shaft 134, rotatably mounted in bearings 135, 136, and 137, supported on the same framework 148. The shaft 134 carries a sprocket wheel 138, operating the adjacent odd numbered bucket-carrying shaft 134ª by means of a chain 139 passing over a sprocket wheel 138ª fixed on said shaft. The shaft 134ª also carries a sprocket wheel 138ᵇ fixed thereon, which, by means of a chain 139ᵇ, operates the next odd numbered bucket, not shown, mechanism similar to that on shaft 134ª, which carries bucket number 7, being on the shafts carrying the buckets Nos. 5, 3, and 1, so that they all operate in unison with the buckets 9 and 7.

Each shaft for the odd numbered buckets 7, 5, 3, and 1, is biased by means of a counterweight, such as designated by the reference character 140, suspended by a chain 141 passing over and secured to a sprocket segment 142 fixed on the shaft 134ª, so that when the motor 102 is reversed, after raising the odd numbered buckets, the same tend to automatically return to their lowered positions under the action of the counterweight 140, and the corresponding counterweights for the other odd numbered buckets, with the exception that the counterweight 140ª for the bucket 9 is secured to a sprocket segment 142ª by means of a chain 141ª mounted on a countershaft 143, which moves with, but in a direction opposite to that of, the shaft 134, by reason of the intermeshing gears 144 and 145 fixed respectively on the shafts 143 and 134.

The shaft 143 is interposed in the operating train, between the sprocket wheel 116 on the shaft 104 and the shaft 134, in order to effect a reversal of motion of the latter as compared with the former. Inasmuch as the shaft 143 operates reversely, as compared with the shaft 134ª, the counterweights 140ª and 140 are respectively disposed on the left and right sides of their shafts 143 and 134ª, as viewed in Fig. 9, so that they tend to return the associated buckets 9 and 7 from raised to lowered positions, upon being allowed to do so by corresponding motion of the motor 102.

The shaft 143 is mounted in bearings 146 and 147 carried by the same framework 148. The shaft 143 also carries a sprocket wheel 149 loose thereon and operated, from sprocket wheel 150 movable with sprocket wheel 116, by means of chain 151 passing therearound.

The shaft 104 carries sprocket wheel 152 movable therewith and thereby actuates the shaft 104ª carrying the bucket 8 by means of a chain 153 operating over sprocket wheel 152ª fixed on shaft 104ª. This same operating motion is carried from the shaft 104ª through shaft-affixed sprocket wheel 152ᵇ and associated chain 153ᵇ to a corresponding sprocket wheel fixed on a shaft carrying the bucket 6, as shown in Fig. 4. By a similar arrangement, the motion is in turn transmitted to the remainder of this even series of buckets, so that all the buckets numbered 10, 8, 6, 4 and 2 operate together, just like the odd numbered buckets, only they move in the reverse directions or are reversed in their motions.

Counterweights 163, acting through chains on sprocket wheel segments 165 fixed on the shafts supporting the even numbered buckets, bias said buckets just like the counterweight 140 controls the bucket 7.

The operation of the buckets will now be described, starting from the position illustrated in Figs. 8, 9, and 10, assuming the motor starting to operate, after being reversed in direction, so that the shaft 114 is moving counterclockwise, thereby causing the driven sprocket wheel 116 and connected wheel 150 to also move counterclockwise, as viewed in Figs. 9 and 10, and the driver lug or segment 154, which extends from the latter sprocket wheel 150, to start to close up the space between it and the associated lug 155 extending toward the sprocket wheel 150 from the adjacent sprocket wheel 152.

In view of this initial lost motion between the lugs, there is no immediate raising of the even numbered buckets from the lowered positions illustrated in Figs. 4, 8, 9, and 10. The chain 151, from the sprocket wheel 150, however, operates immediately on the sprocket wheel 149 to withdraw the driver lug 156, extending therefrom into engagement with the driven lug 157 of the gear wheel 144, to allow the odd numbered buckets to drop by gravity under the influence of the associated counterweights 140a, 140, etc., so that their noses or tapered spout portions 158 are withdrawn from the registering even numbered buckets, and have entirely cleared said buckets by the time the even numbered buckets start to rise after engagement between the lugs 154 and 155.

By the time the even numbered buckets have been completely raised by the lug 154 acting on the lug 155, the sprocket wheel 119 has been rotated through the angle 159 and the roller 131 thereon has reached the position which the roller 132 formerly occupied, so that the lever 126 has moved from its full position at the right, toward its dotted position at the left, until it passes the point of alignment with the lever 123, where the actuating springs 125 snap both into their left-hand dotted positions against the respective stops 128 and 130, causing the mercury switch to break the circuit to the wire 160 and complete the circuit between the wire 161 and the wire 162, to cause a reversal of the actuating motor 102, thereby returning the driver lug 154 to allow the driven lug 155, and its sprocket wheel 152 and associated mechanism, to return to their positions illustrated in Figs. 4, 8, and 9, first allowing the even numbered buckets to drop out of the way of the odd numbered buckets, and, after the lost motion between the lugs 156 and 157 has been taken up, effecting a raising or upward tilting of the odd numbered buckets to the former positions shown, after which the operation may be repeated.

As a safeguard against raising either set of buckets beyond their normal upper positions, as illustrated in Fig. 9 for example, I preferably employ mercury safety switches 166 and 167 for breaking the circuit to the motor 102 and discontinuing the operation of the buckets, in case of failure of the reversing switch 122 to properly function and stop the buckets upon reaching their normal topmost positions.

Safety switch 166 may be associated with the shaft 104, as shown in detail in Fig. 12, so that upon said shaft turning through the proper angle to raise the bucket 10 to its maximum permissible elevation, the set screw 168, adjustably carried by the arm 169 extending from the counterweight segment 165, is just in position ready to rotate the lever 170, pivoted at 171, to trip said switch 166 and break the circuit between wires 172 and 173, forming part of the motor circuit, to thereby stop the operation of the motor 102.

Each switch 166 and 167 is preferably provided with a spring 174 for returning it to operative position, except when positively tripped by overrunning of the associated counterweight segment. The switch 166 has been described as associated with the counterweight segment 165, and the switch 167 is desirably similarly associated with the counterweight segment 142a which, of course, moves in the opposite direction upon raising of the associated bucket 9, so that the switch 167, although similarly constructed as compared with the switch 166, is normally inclined in the opposite direction, so as to be tripped when rotated counterclockwise, as distinguished from a clockwise tripping of the switch 166 as viewed in Figs. 9 and 12. It will therefore be seen that we have provided means for safeguarding the raising movement of both sets of buckets.

Motor control circuits

The wiring between the motor, reversing switch 122, and safety switches 166 and 167 is desirably as disclosed in Fig. 14, and the circuits there portrayed will now be explained. Although the circuits are for three-phase operation of the motor 102, it will be understood that we are not restricted to such operation. The reference characters L_1, L_2, and L_3 represent the three-phase supply lines which go through a line switch 175, and fuses or other circuit-breaking means 176, 177, and 178, to line starting switch 179 controlled by starting means or push button 180, and stopping means or push button 181.

The mechanism is put into operation by first closing the line switch 175, and then pushing in the starting button 180, to close a circuit through conductor 182 connecting supply lines L_1 and L_3 through safety switches 166 and 167, preferably arranged in series, to energize switch operating solenoid 183, to effect closing of the line starting switch 179. The switch 179 is preferably spring-biased to open position, so that the arrangement is desirably such that a stick circuit through conductor 184 may keep the switch closed if the starting button 180 tends to move to open position upon release. The stick circuit is, in the present embodiment, represented as closed by switch 223 when the starting button 180 is depressed, but such circuits are well known in the art. No such circuit is necessary if the starting button 180 will stay in closed position after being depressed. In either case the solenoid 183 is kept energized.

Upon closing of the line starter switch 179, current will flow from supply line L_1 through conductors 185, 162, reversing switch 122, conductor 160, solenoid 186 in time-delay relay 187 and on to line L_3 through the conductor 188. The time-delay relay 187 is for insuring that the buckets, after being lowered, stay in the treating solutions for the desired period of time, so that no action takes place until the selected period of time has elapsed. In other words, a dash pot or other time delay means may be used so that the circuit through the reversing line starting device 189 is not initiated, by the engagement between the contacts 190 and 191, until that period of time has elapsed, subsequent to closing the switch 179, or if the mechanism has been in op-

eration, subsequent to stopping the motor 102.

After the relay 187 has operated to cause the contacts 190 and 191 to engage, a circuit is completed from conductor 185 through contacts 190 and 191, conductor 192, and solenoid 193 which operates to close the circuit in the starter 189, so that current will flow through lines L_1, L_2, and L_3, and drum controller 194 to the field windings of the motor 102 which are selected by the drum controller. For example, in the first or connected position of the drum controller, the field windings energized for speed #1, comprise those designated T_1, T_2, and T_3.

Upon a further movement of the drum controller contact is made with windings T_4, T_5, and T_6, resulting in what we have designated as speed #3. A further movement of the controller effects connections with windings T_{11}, T_{12}, and T_{13}, resulting in what we have designated as speed #2. It will be understood that the movement of the controller may be effected manually, to set the motor for a desired speed of operation, and that after setting, the motor will then continue to operate at that speed, without further movement of the controller during the period of operation.

Upon the reversing switch 122 being tripped, by the movement of the lever 126 from its full to its dotted-line position, as viewed in Fig. 10, the circuit through the solenoid 186 is interrupted, resulting in separating the contacts 190 and 191 so that the circuit therebetween is broken, and the solenoid 193 deenergized, resulting in opening the switch in the reversing line starter 189 and stopping the motor 102.

Circuit is now made, instead, through conductors 162 and 161, and solenoid 195, resulting in the operation of the time-delay relay 196, and the closing of a circuit through contacts 197 and 198 upon the termination of the selected period of time. This engagement of the contacts 197 and 198 completes the circuit from conductor 185 therethrough to conductor 199 on through solenoid 200, to effect the closing of reversing line starter 201. The closing of starter 201 connects line L_2 to field winding T_3 on the motor through conductor 202, line L_1 to field winding T_1 of the motor through conductor 203, and line L_3 to the field winding T_2 of the motor, the same as heretofore, through conductor 217. This rearrangement of connections, of course, effects a reversal of the motor 102, so that it returns the raised buckets to lowered positions and the lowered buckets to raised positions, until the reversing switch 122 is tripped back to the initial position, whereupon the operation may be repeated.

If, on account of any defect in operation, either of the series of buckets is raised beyond the desired normal upper limit, one or the other of the safety switch 166 and 167 is tripped, breaking the circuit through the solenoid 183 and opening the line starter switch 179 to stop the operation of the motor 102. The operation may also be stopped by manually depressing the stop button 181.

General remarks

From the foregoing, it will be seen that we have devised apparatus which is adjustable over a wide range of output speed and may be used for various metal treating or finishing processes, such as "bright dipping" and silvering articles, such as bases for incandescent electric lamps, including the coating of brass with a protective film of soap.

The hoist used does not have to be an automatic one as a hand operated hoist will do. Also a hoist would not be needed if the machine was on one floor and the top of the hopper even with the floor above, as the hopper could then be filled without a hoist. Also the present hoist, as installed, can be loaded direct from an automatic conveyor automatically, without any manual labor being necessary, and in loading the hoist in this manner any number of barrels could be handled in a given period of time, depending upon the speed of transfer and hoisting.

The automatic weighing unit can handle a large variation in sizes of the articles weighed, also it can handle a wide range of weight, meaning that it is effective and accurate for small or large parts, either light or heavy.

The dip machine is not dependent on an automatic weighing or loading device, as it can be loaded by hand or by a mechanical or manual volume type feeder using a measure of some sort. In other words, the machine can be operated entirely independent of either hoist, hopper, or weighing or loading unit.

The apparatus also preferably includes means for heating bases and sawdust in a dryer with gas and circulating the heat throughout the dryer, means for automatically adding new sawdust, means for automatically removing a portion of the old sawdust at regular intervals, and means for visual inspection of bases throughout the entire process from start to finish.

Although the operations of raising and lowering the buckets 1 to 10, inclusive, from and into the associated tanks, causes considerable agitation of the liquids therein, yet such agitation is desirably amplified by means of pipes 218 provided with series of apertures 219 for discharging compressed air into the lower portions of the tanks for stirring the liquids therein.

After the final washing in tank 10, the articles are desirably transferred to the vibrator 17, as previously mentioned, from whence they pass through the dryer and are eventually received in barrel 42.

Although preferred embodiments of our invention have been disclosed, it will be understood that modifications may be made within the spirit and scope of the appended claims.

We claim:

1. The method of handling metal articles comprising delivering a container thereof to a hoist, causing said hoist to dump said articles from said container onto a feed belt, causing said feed belt to automatically discharge said articles onto an automatic weighing and feeding belt, until a given weight of articles has been collected as a batch, delivering said batch to the end one of a series of buckets associated with a corresponding series of tanks, and elevating and lowering said buckets with respect to said tanks whereby batches of said articles are transferred from one bucket to the next, and from there on through the series to be finally delivered to drying mechanism.

2. The method of handling metal articles comprising delivering a container thereof to a hoist, causing said hoist to dump said articles from said container onto a feed belt, and causing said feed belt to automatically discharge said articles onto an automatic weighing and feeding belt, until a given amount of articles has been weighed as a batch, for delivery to surface treatment apparatus.

3. Apparatus for treating metal articles com-

prising a series of tanks containing desired solutions, foraminous buckets mounted so as to be swingable alternately into and out of said tanks, with alternate buckets operating together, so that when the odd numbered buckets are out of their tanks the even numbered buckets are in their tanks and vice versa, whereby the raised buckets discharge into the succeeding lowered buckets, and the last of the series discharges into means for drying said articles.

4. Apparatus for treating metal articles comprising a series of foraminous buckets movable into and out of associated tanks, means for automatically weighing batches of said articles and delivering said batches one at a time to the first of said series of buckets, and means for operating said buckets so as to simultaneously tilt the odd numbered, and then the even numbered buckets, to pass said articles from one to the next along the whole series, whereby they are successively treated in solutions contained in said tanks.

5. Apparatus for treating metal articles comprising a series of foraminous buckets rockably mounted for movement into and out of associated tanks, means for delivering said articles in successive batches to the end one of said series of buckets, means for operating said buckets so that said end bucket, and every alternate bucket therefrom, discharges into the intermediate and succeeding buckets, and then said intermediate buckets discharge into the succeeding bucket, with the final one of the series discharging to drying means for said articles.

6. Apparatus for handling metal articles comprising conveyor means for transferring containers thereof, a hoist for receiving and raising said containers, a feed belt receiving said articles when dumped thereon by said hoist and automatically discharging the same, an automatic weighing and feeding belt receiving said discharged articles, until a given weight thereof has accumulated, and then discharging said articles therefrom, a series of buckets, with the first one receiving said articles from said last-mentioned belt and passing them to the next bucket, from where they pass successively through the succeeding buckets, tanks in which said buckets are alternately dipped and withdrawn therefrom, for treating said articles in liquids contained in said tanks, and drying mechanism receiving said articles from the end of said series of buckets.

7. In mechanism for treating metal articles, a series of tanks adapted to contain liquids, a series of shafts extending parallel to one another, transverse to and extending over said series of tanks, a corresponding series of buckets, one mounted on each shaft and adapted, upon rotation of the latter, to dip into or rise out of a tank, sprocket wheels on said shafts, a motor for driving said shafts, a chain connecting said motor to a sprocket wheel loose on the adjacent endmost shaft, a sprocket wheel tight on said shaft, a countershaft terminating short of said series of buckets, pivotally mounted and disposed parallel to and adjacent the next to the end shaft, intermeshing gears on said last-mentioned shaft and countershaft, a sprocket wheel loose on said countershaft, a chain connecting the loose sprocket wheel on the endmost shaft to the countershaft, so as to reverse the direction of motion between said adjacent bucket-carrying shafts; and sprocket wheel, chain connections between the endmost shaft and every alternate bucket-carrying shaft therefrom, so that said shafts move for raising and lowering their supported buckets simultaneously with the end shaft, similar connections between the next to and end shaft and the remaining bucket-carrying shafts, so that said remaining buckets operate together, but in the opposite direction from the first mentioned set of buckets, means connected to the endmost bucket-carrying shaft for reversing the direction of rotation of the motor, when one set or the other of the buckets reaches the top of its rising motion, means for insuring that said buckets return to lowered positions when permitted by said motor, and lost motion between the tight and loose sprocket wheels on the endmost shaft, and between the sprocket wheel and gear on the countershaft, whereby the lowering of the uppermost set of buckets starts before the lowermost set of buckets starts to rise, to avoid interference therebetween.

8. In mechanism for treating metal articles, a series of tanks adapted to contain liquids, a corresponding series of shafts extending parallel to one another, and each shaft extending transverse to said series and over one of said tanks, a foraminous bucket mounted on each shaft, adapted to hold said articles, and be rotated thereby into and out of its tank, a motor, driving means between said motor and the adjacent endmost shaft, a countershaft for the bucket-carrying shaft next to said end shaft, gearing between said countershaft and its bucket-carrying shaft, so that said shafts rotate in opposite directions, motion transmitting means between the end shaft and every alternate shaft of said series, so that one-half of said shafts and their buckets move with the end bucket, motion transmitting means between the next to the end shaft and the remaining shafts, so that the other shafts and their buckets move together in the opposite direction, whereby alternate buckets are lowered while the others are raised to discharge their contents into the following buckets or from said series, for transferring articles being treated from one end to the other of said series.

9. In mechanism for treating metal articles, a series of tanks adapted to contain liquids, a series of shafts extending parallel to one another, transverse to and extending over said series of tanks, a corresponding series of buckets, one mounted on each shaft and each adapted, upon rotation of its shaft, to dip into or rise out of the associated tank, a motor, driving means connecting said motor to one of said shafts, a countershaft disposed adjacent, and connected by gearing to, the shaft next to said motor-connected shaft, for reversing the direction of rotation therebetween, and driving means between said motor-connected shaft and alternate bucket-carrying shafts, and between the countershaft geared shaft and the remaining bucket-carrying shafts, so that alternate buckets are in elevated positions, while the remainder are lowered, for the purpose of causing articles to be dumped from one bucket to another throughout the series.

10. In mechanism for treating metal articles, a series of tanks adapted to contain liquids, a series of shafts extending parallel to one another, transverse to and extending over said series of tanks, a corresponding series of buckets, one mounted on each shaft and each adapted, upon rotation of its shaft, to dip into or rise out of the

associated tank, an electric motor, driving means connecting said motor to one of said shafts, a countershaft disposed adjacent, and connected by gearing to, the shaft next to said motor-connected shaft, for reversing the direction of rotation therebetween, driving means between said motor-connected shaft and alternate bucket-carrying shafts, and between the countershaft geared shaft and the remaining bucket-carrying shafts, so that alternate buckets are in elevated positions, while the remainder are lowered, for the purpose of causing articles to be dumped from one bucket to another throughout the series, and a reversing switch in the circuit to the motor and actuated from the motor-driven shaft, so that upon raising one set of buckets the motor is reversed to lower said set and raise the other set, effecting another reversal and return of said buckets to initial positions.

11. In mechanism for treating metal articles, a series of tanks adapted to contain liquids, a corresponding series of shafts extending parallel to one another, and each shaft extending transverse to said series and over one of said tanks, a foraminous bucket mounted on each shaft, adapted to hold said articles, and be rotated thereby into and out of its tank, an electric motor, driving means between said motor and the adjacent endmost shaft, a countershaft for the bucket-carrying shaft next to said end shaft, gearing between said countershaft and its bucket-carrying shaft, so that said shafts rotate in opposite directions, motion transmitting means between the end shaft and every alternate shaft of said series, so that one-half of said shafts and their buckets move with the end bucket, motion transmitting means between the next to the end shaft and the remaining shafts so that the other shafts and their buckets move together in the opposite direction, whereby alternate buckets are lowered while the others are raised to discharge their contents into the following buckets or from said series, for transferring articles being treated from one end to the other of said series, counterweights for insuring the return of the buckets to lowered positions, and safety switches in series in the motor circuit and associated with adjacent counter-weights, so that excessive raising of one or the other of the sets of buckets stop the motor.

12. Apparatus for handling metal articles, comprising conveyor means for transferring containers thereof, a hoist for receiving and raising said containers, a feed belt receiving said articles when dumped thereon by said hoist and automatically discharging the same, an automatic weighing and feeding belt receiving said discharged articles until a given weight thereof has accumulated, and then discharging said articles therefrom, a series of buckets, the first of which is positioned to receive said discharged articles, said buckets being swingable alternately into and out of corresponding tanks containing desired liquids, with alternate buckets operated together, so that when the odd numbered buckets are out of their tanks the even numbered buckets are in their tanks, and vice versa, whereby the raised buckets discharge into the succeeding lowered buckets, and means for drying said articles, receiving the same from the last bucket of the series.

13. Apparatus for handling metal articles, comprising conveyor means for transferring containers thereof, a hoist for receiving and raising said containers, a feed belt receiving said articles when dumped thereon by said hoist and automatically discharging the same, an automatic weighing and feeding belt receiving said discharged articles, until a given weight thereof has accumulated, and then discharging said articles therefrom, a series of tanks adapted to contain liquids, a corresponding series of buckets mounted on shafts over said tanks, the first of said buckets being adapted to receive said articles from said last-mentioned belt, said buckets being adapted upon rotation of the shafts to dip into, or rise out of a tank, sprocket wheels on said shafts, a motor for driving said shafts, a chain connecting said motor to a sprocket wheel loose on the adjacent endmost shaft, a sprocket tight on said shaft, a countershaft terminating short of said series of buckets, pivotally mounted and disposed parallel to and adjacent the next to the end shaft, inter-meshing gears on said last mentioned shaft and countershaft, a sprocket wheel loose on said countershaft, a chain connecting the loose sprocket wheel on the endmost shaft to the countershaft so as to reverse the direction of motion between said adjacent bucket-carrying shafts and sprocket wheel, chain connections between the endmost shaft and every alternate bucket-carrying shaft therefrom, so that said shafts move for raising and lowering their supporting buckets simultaneously with the end shaft, similar connections between the next to the end shaft and the remaining shafts, so that said remaining buckets operate together, but in the opposite direction from the first-mentioned set of buckets, means connected to the endmost bucket-carrying shaft for reversing the direction of rotation of the motor, when one set or the other of the buckets reaches the top of its rising motion, and means for preventing interference between said buckets, whereby the articles are passed from the first bucket through the series of buckets in the corresponding tanks, and drying mechanism receiving said articles from the end bucket of said series.

14. Apparatus for treating metal articles, comprising a series of tanks containing the desired solutions, buckets mounted so as to be swingable alternately into and out of said tanks, with alternate buckets operating together, so that when the odd numbered buckets are out of their tanks the even numbered buckets are in their tanks, and vice versa, whereby the raised buckets discharge into the succeeding lowered buckets, and drying mechanism receiving the articles discharged from the last of said series of buckets, said mechanism comprising coaxial hollow cylinders, the inner one extending beyond the outer, inwardly extended flanges helically arranged in both cylinders, whereby rotation of said cylinders will transport contained articles from one end to the other of the inner cylinder, the flanges of one cylinder being right handed, and those of the other left handed, apertures in said inner cylinder adjacent the discharge end for allowing drying material to be passed from said inner to said outer cylinder, and returned towards the starting end of said outer cylinder, conveyor means for transporting and feeding said material to the inner cylinder after discharge from said outer cylinder, and means for heating said cylinders.

15. In mechanism for treating metal articles, a series of tanks adapted to contain liquids, a series of shafts, a corresponding series of buckets, one mounted on each shaft and each adapted, upon rotation of its shaft, to dip into or

rise out of the associated tank, an electric motor, a line starter switch, driving means connecting said motor to one of said shafts, a countershaft disposed adjacent and connected to the shaft next to said motor-connected shaft, for reversing the direction of rotation therebetween, driving means between said motor-connected shaft and alternate bucket-carrying shafts, and between the countershaft-connected shaft and the remaining bucket-carrying shafts, so that alternate buckets are in elevated positions, while the remainder are lowered, for the purpose of causing articles to be dumped from one bucket to another throughout the series, a reversing switch in the circuit to the motor and actuated by the motor-driven shaft, a pair of time delay relays, a pair of reversing line starters, and means connecting said reversing switch to said motor time delay relays and reversing line starters, so that said motor operates, after starting, for a predetermined number of revolutions, first in one direction, until it trips the reversing switch to break the motor circuit and stop the motor for a period of time predetermined by the setting of one of the relays, after which period one of the reversing line starters is energized to close the circuit to the motor in a direction opposite to that in which it previously operated, so that it starts in said direction and moves through the same predetermined number of revolutions, whereupon it trips the reversing switch in the opposite direction, to break the motor circuit and again stop said motor for a similar selected period of time determined by the setting of the other relay, after which period the other reversing line starter is energized to close the circuit to the motor in the opposite direction, so that it starts in said direction and repeats the operations, so that one set of buckets is first raised, the motor reversed to lower said set and raise the other set, effecting another reversal and return of said buckets to initial positions.

16. The method of handling metal articles, comprising delivering a container thereof to a hoist, causing said hoist to dump said articles from said container on to a feed belt, causing said feed belt to automatically discharge said articles on to an automatic weighing and feeding belt, until a given weight thereof has been collected as a batch, delivering said batch to the end one of a series of buckets associated with a corresponding series of tanks, said tanks containing liquid in which said buckets dip, moving said buckets from immersed positions to where they discharge their contents to adjacent buckets, in such a manner that the odd numbered buckets discharge into the even numbered buckets simultaneously, and then the even numbered ones discharge into the following odd numbered ones simultaneously, whereby said articles are transferred through the entire series of buckets, and a desired treatment effected in liquids in said tanks.

17. The method of handling metal articles, comprising delivering a batch thereof to the end one of a series of buckets associated with a corresponding series of tanks, said tanks containing liquid in which said buckets dip, moving said buckets from immersed positions to where they discharge their contents to adjacent buckets, in such a manner that the odd numbered buckets discharge into the even numbered buckets simultaneously, and then the even numbered ones discharge into the following odd numbered ones simultaneously, whereby said articles are transferred through the entire series of buckets, and a desired treatment effected in liquids in said tanks.

18. The method of handling metal articles, comprising delivering to a hoist, causing said hoist to dump said articles onto a feed belt, causing said feed belt to automatically discharge said articles onto an automatic weighing and feeding belt until a given amount thereof has been weighed as a batch, and washing each batch, first in a soap solution, then in water, then in acid, then in water, then in a soap solution, and finally in water, in order to impart a bright and lasting finish thereto.

19. The method of handling metal articles, comprising delivering to a hoist, dumping from said hoist onto a feed belt, causing the latter to automatically discharge said articles onto an automatic weighing and feeding belt, until a given amount has been weighed as a batch, serially delivering such batches to one of a series of foraminous buckets movable into and out of associated tanks, and operating said buckets so as to pass said articles from one bucket to the next, whereby they are successively treated in a soap solution, water, acid, water, a soap solution, and water, in order to impart a desired finish thereto.

20. The method of handling metal articles, comprising delivering a batch thereof to the end one of a series of buckets associated with a corresponding series of tanks, said tanks containing liquids in which said buckets dip, moving said buckets from immersed positions to where they discharge their contents to adjacent buckets, in such a manner that the odd numbered buckets discharge into the even numbered buckets simultaneously, and then the even numbered ones discharge into the following odd numbered ones simultaneously, whereby said articles are successively transferred through a soap solution, water, acid, water, a soap solution, and finally water, serially contained in said tanks, in order to impart a bright and lasting finish thereto.

21. The method of handling metal articles, comprising delivering to a hoist, causing said hoist to dump said articles onto the feed belt, causing said feed belt to automatically discharge said articles onto an automatic weighing and feeding belt, until a given amount thereof has been weighted as a batch, passing successive batches of said articles from one bucket to another in a series to wash them in one solution after another, smoothing out the rate of flow by discharging said articles on a vibrating feed device, and finally delivering them by said device in a practically uniform stream to drying mechanism.

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