Dec. 23, 1958 N. RANSOHOFF 2,865,831

ELECTROPLATING MACHINE

Filed Dec. 6, 1955 8 Sheets-Sheet 1

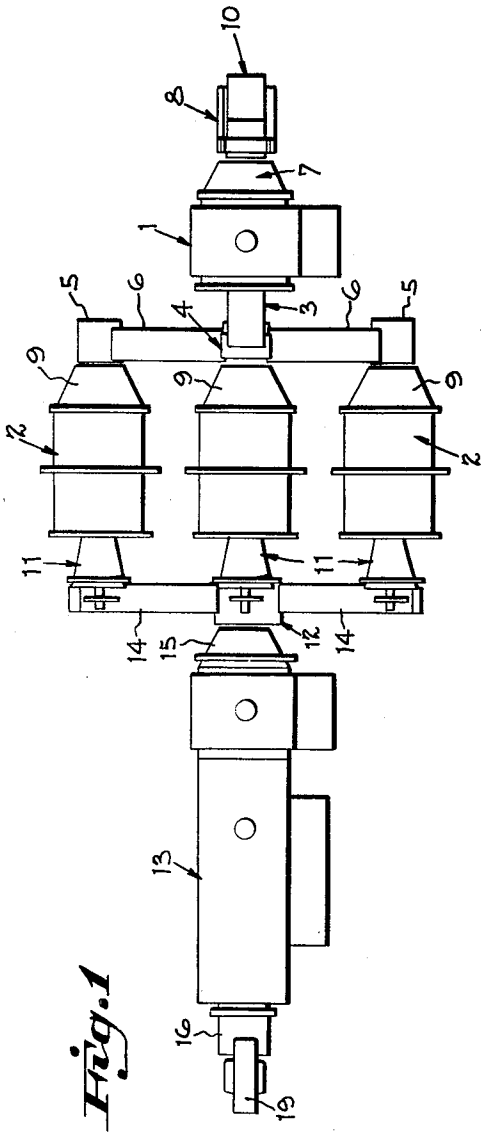

Fig. 1

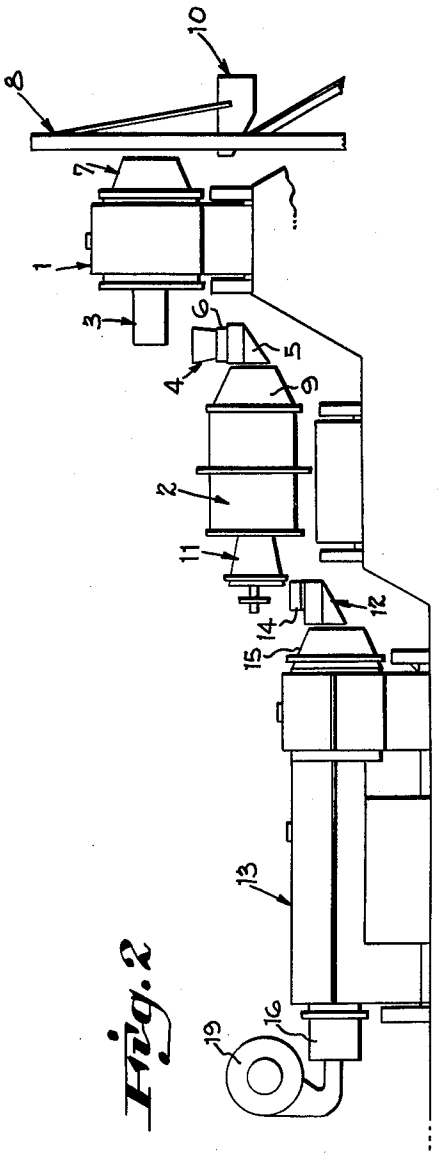

Fig. 2

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ELECTROPLATING MACHINE

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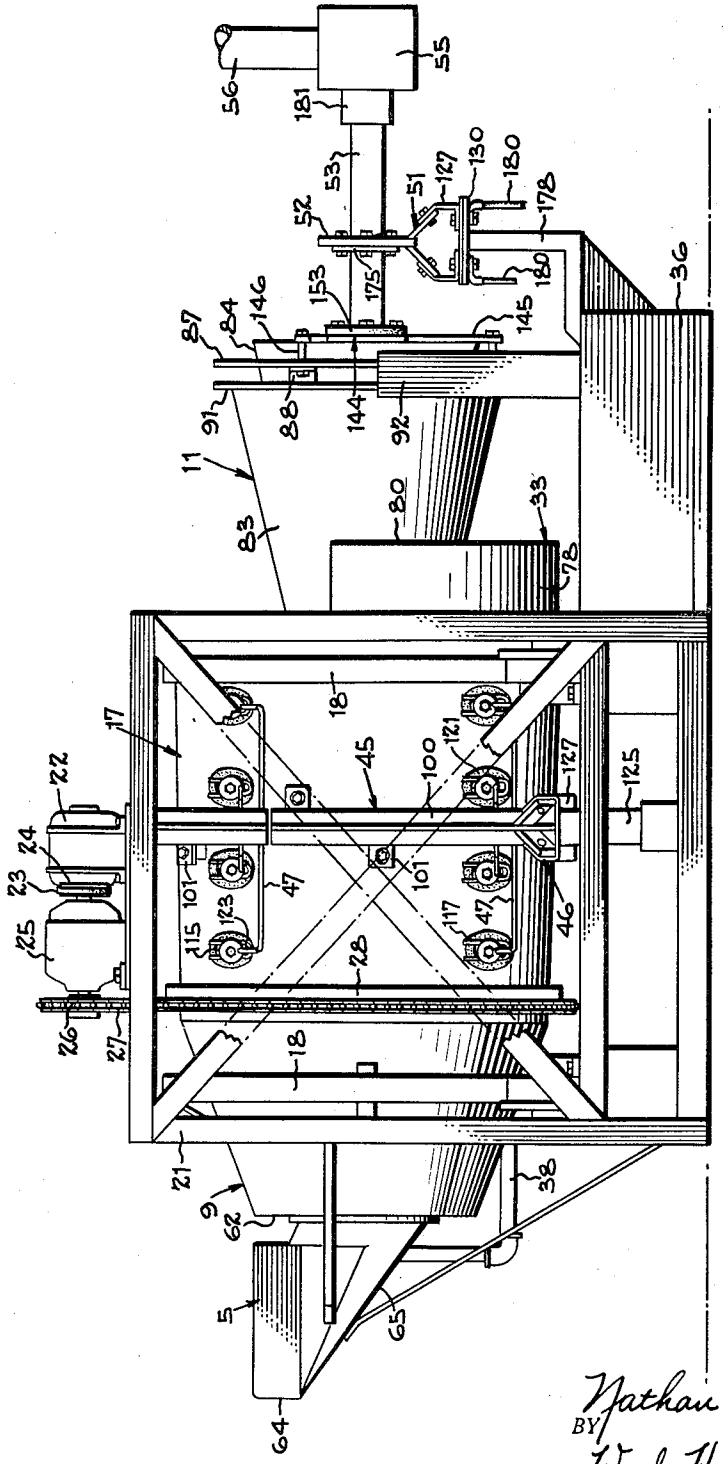

Fig. 3

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ELECTROPLATING MACHINE

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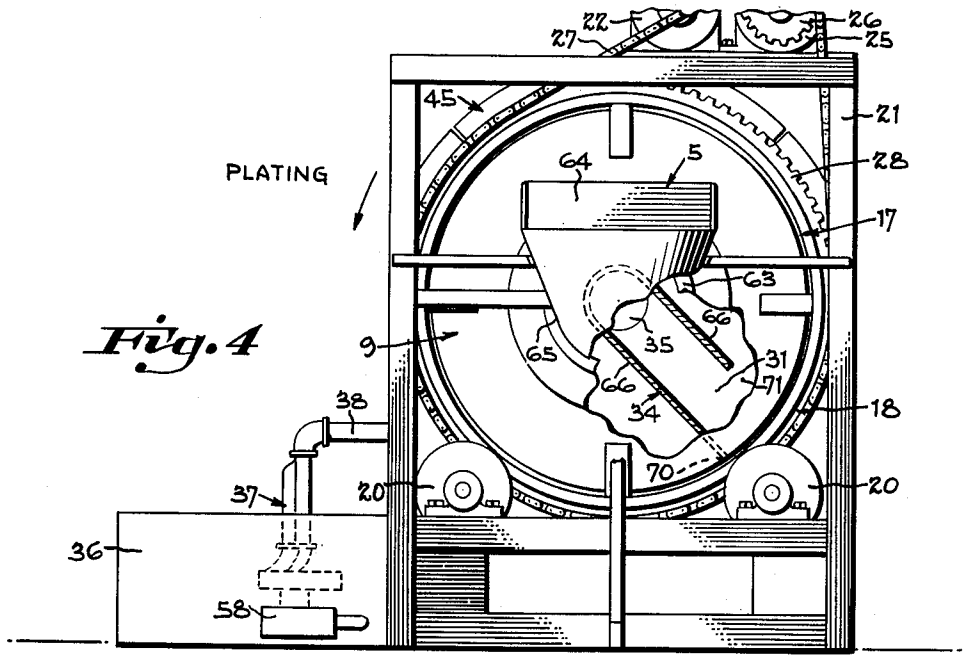

Fig. 4

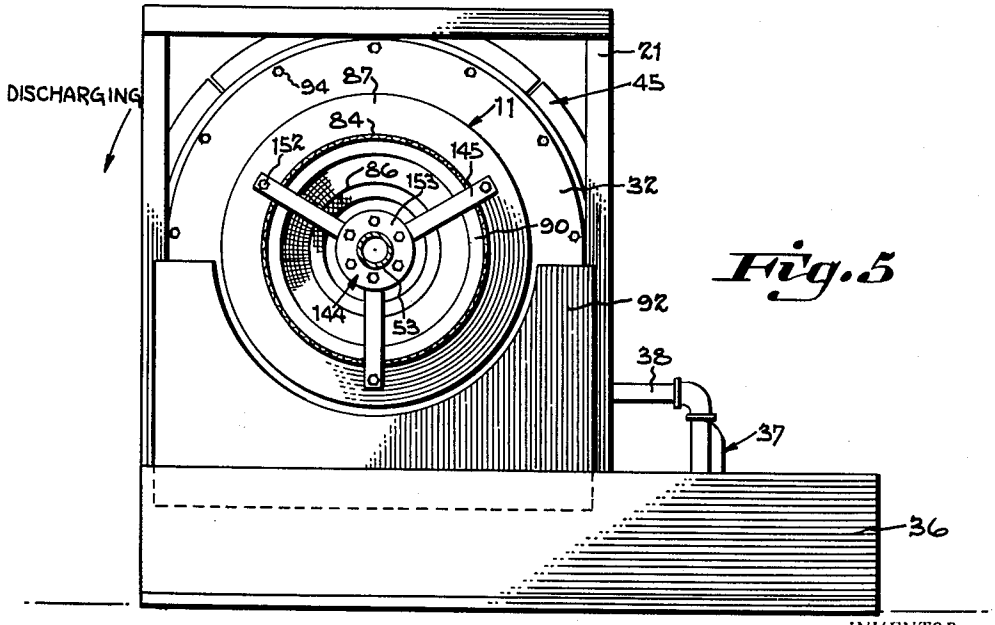

Fig. 5

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ELECTROPLATING MACHINE

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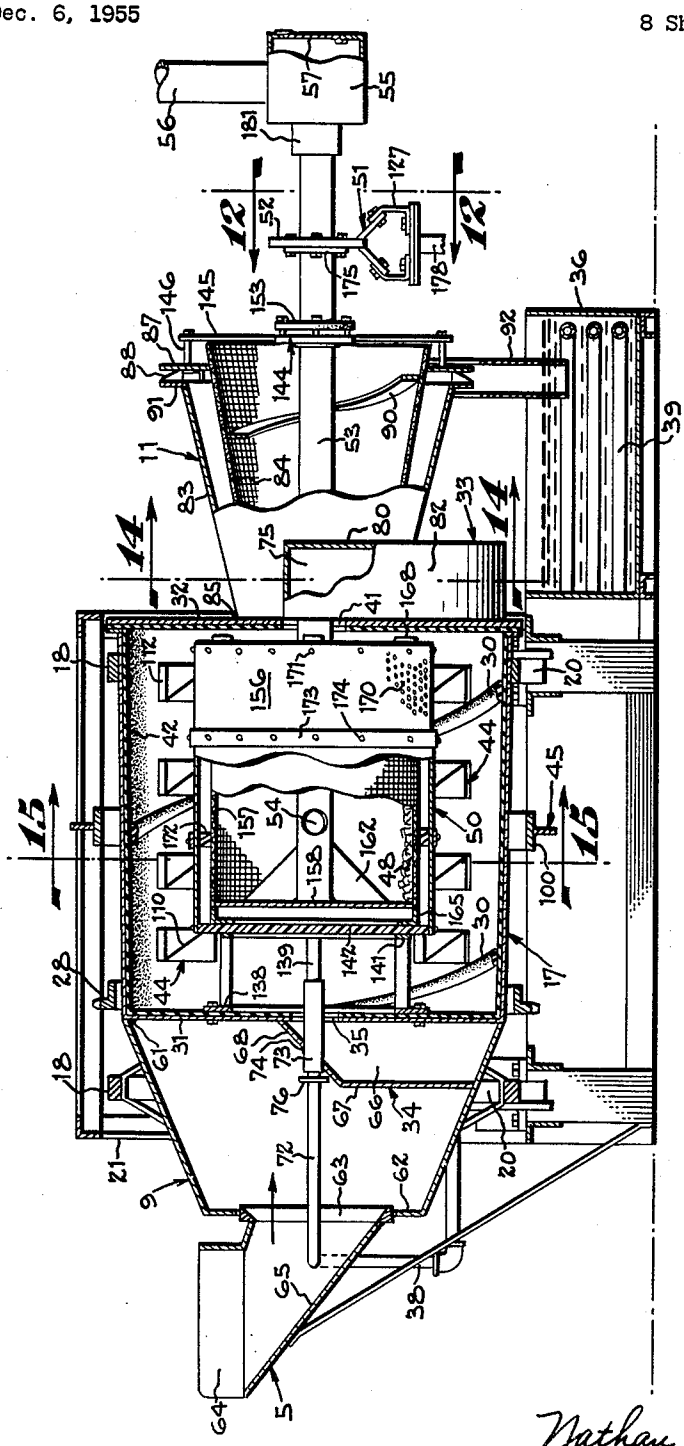

Fig. 6

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ELECTROPLATING MACHINE

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Fig. 8

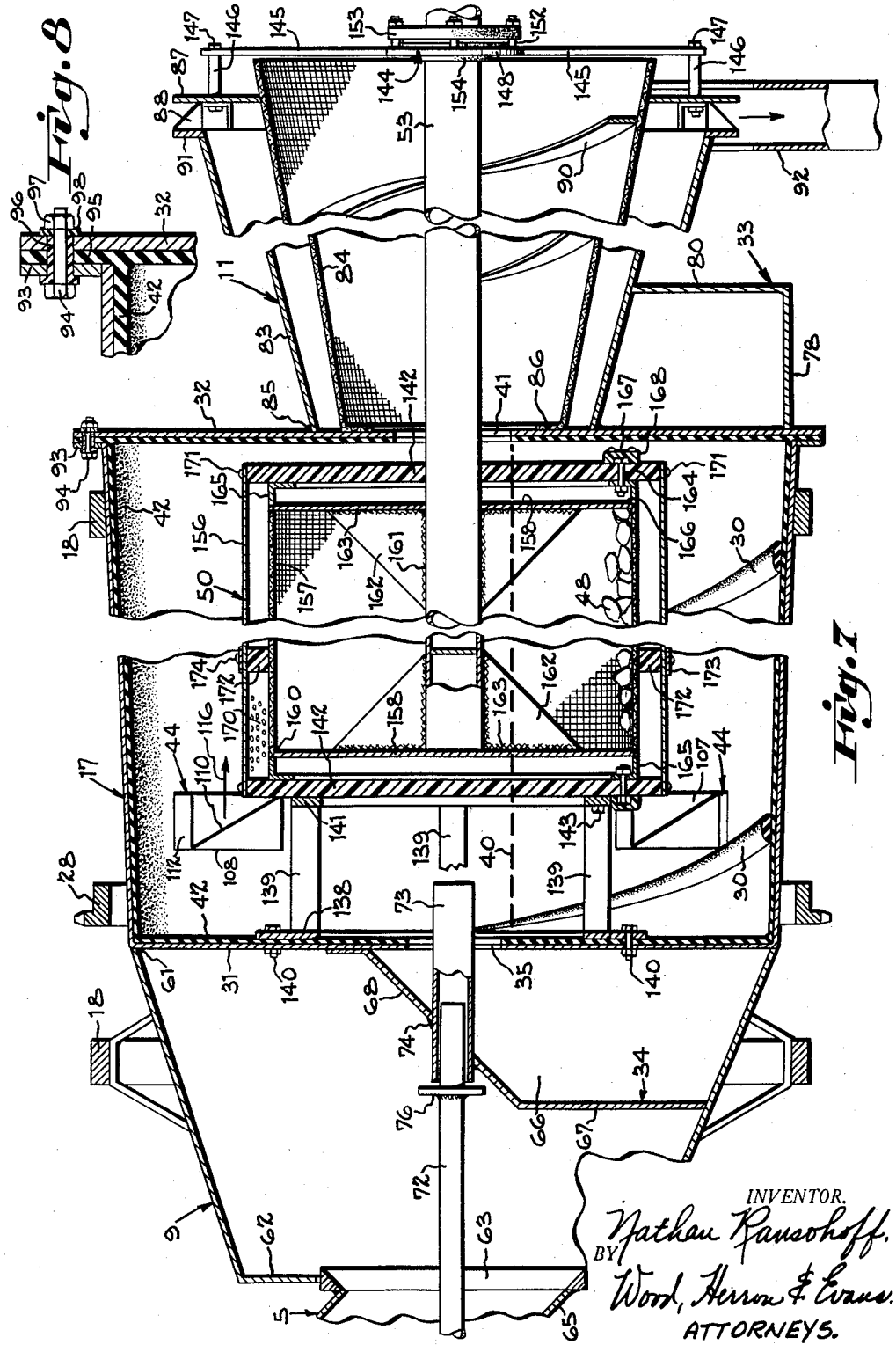

Fig. 7

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ELECTROPLATING MACHINE

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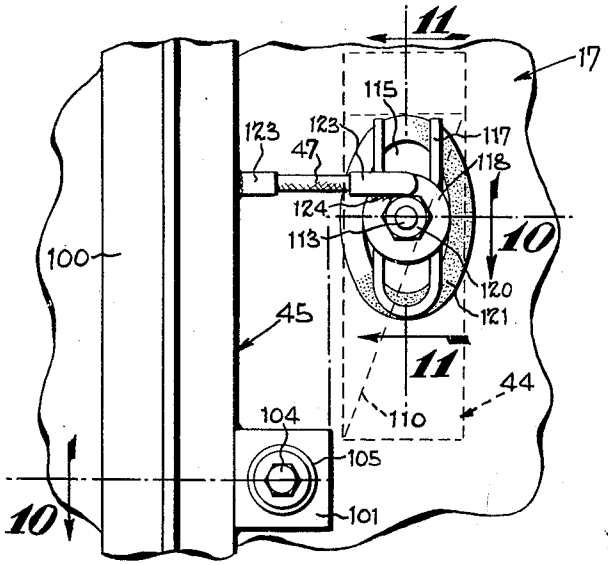

Fig. 9

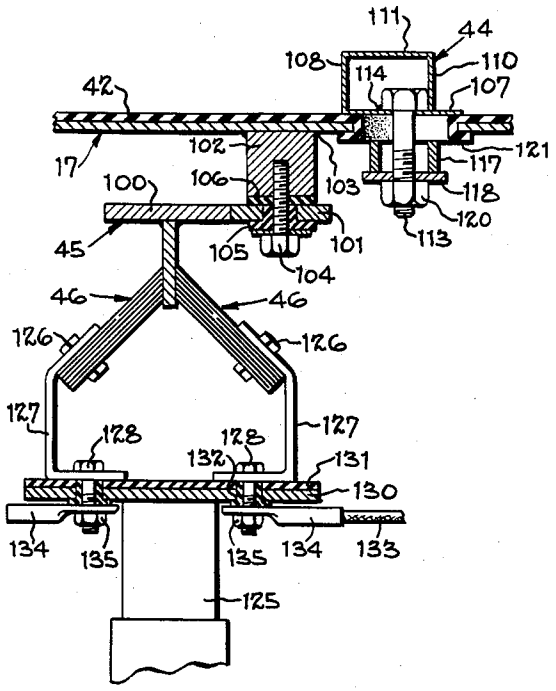

Fig. 10

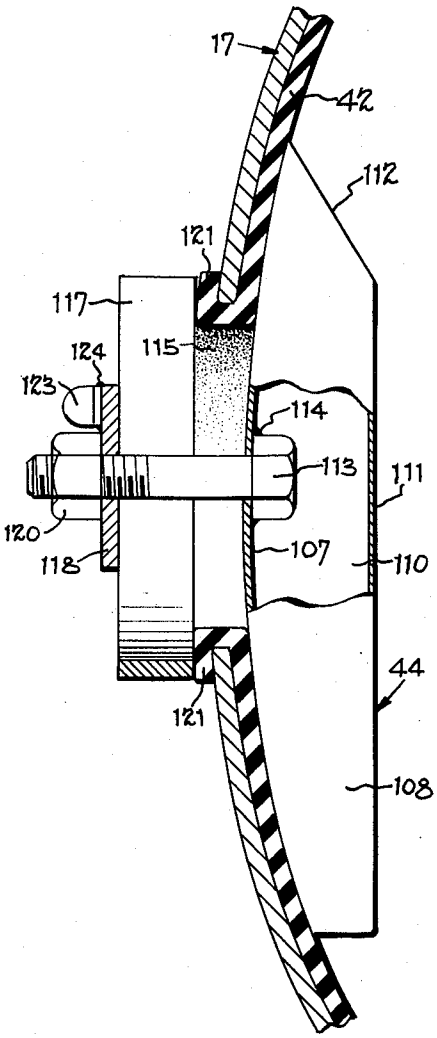

Fig. 11

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ELECTROPLATING MACHINE

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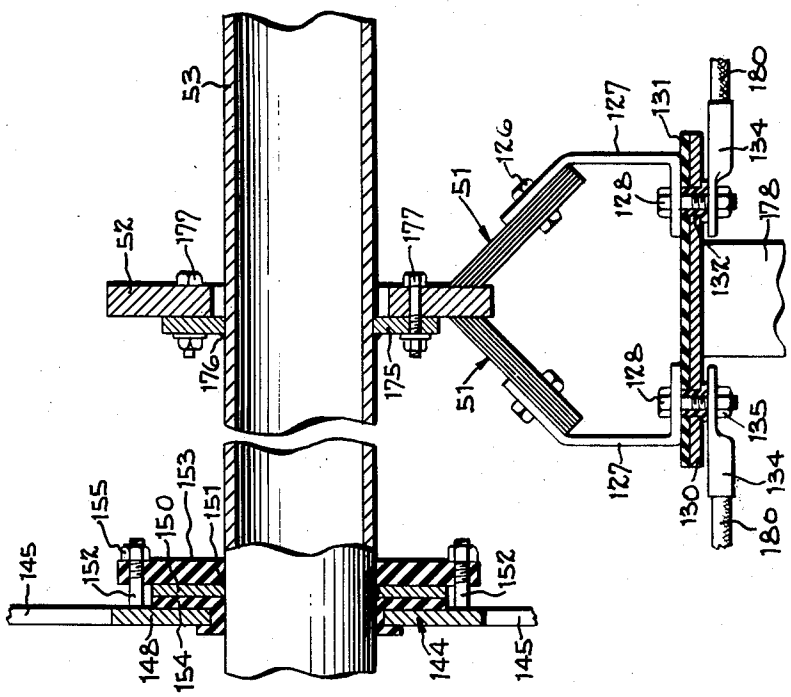

Fig. 13

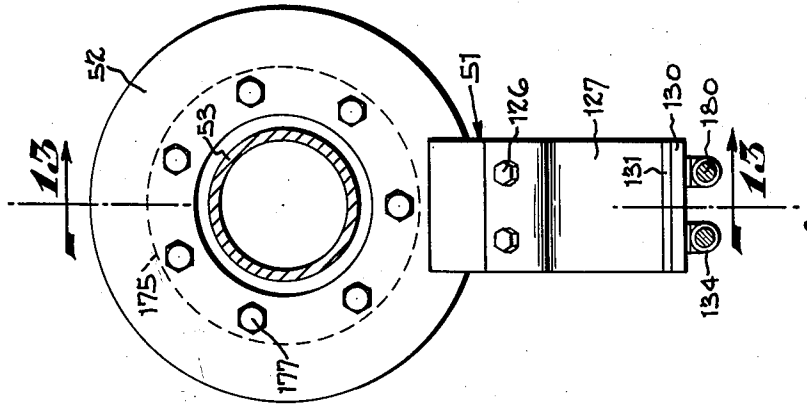

Fig. 12

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ELECTROPLATING MACHINE

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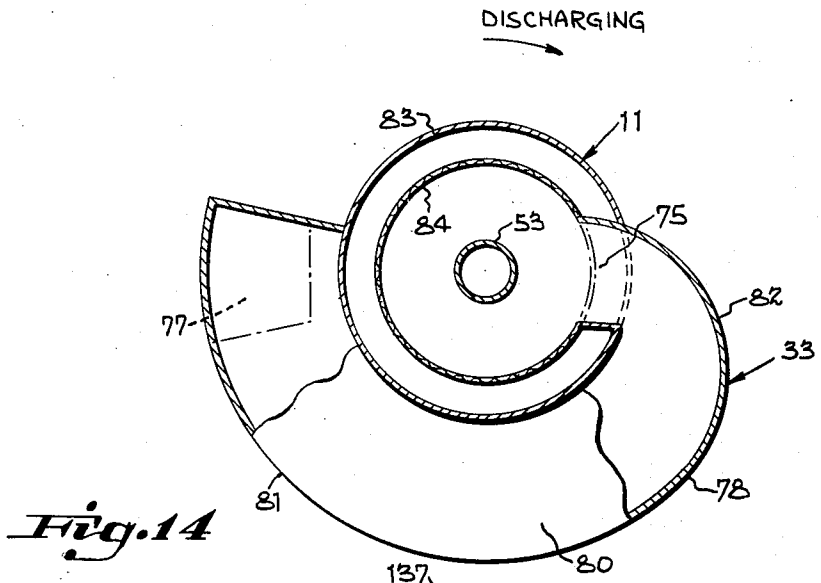

Fig. 14

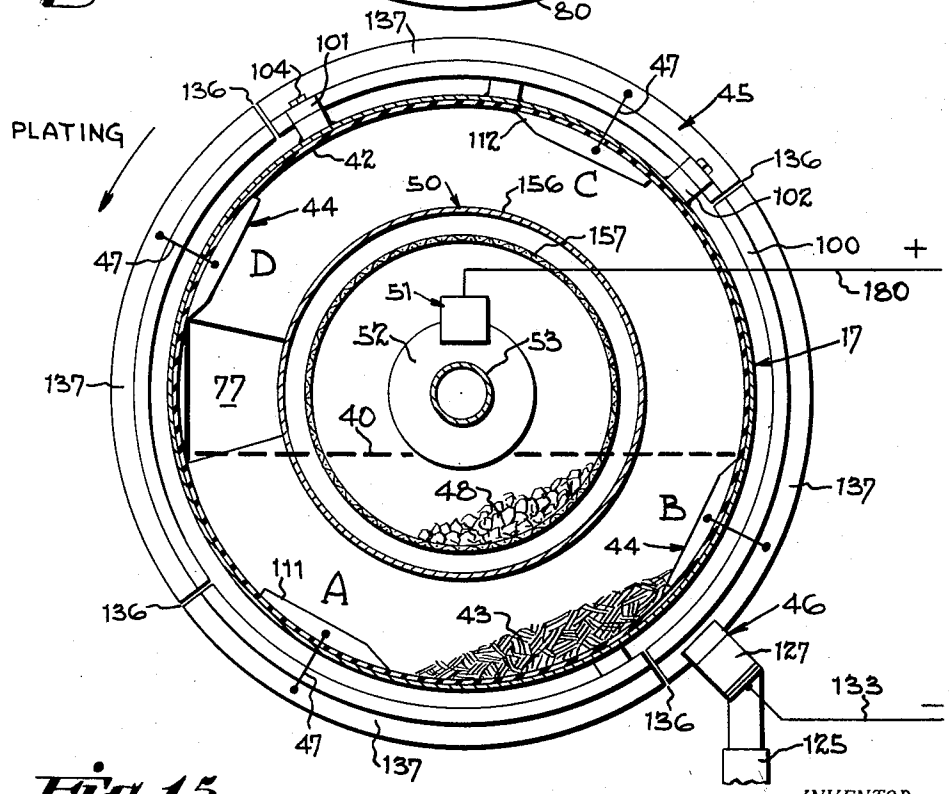

Fig. 15

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United States Patent Office 2,865,831
Patented Dec. 23, 1958

2,865,831

ELECTROPLATING MACHINE

Nathan Ransohoff, Cincinnati, Ohio, assignor to N. Ransohoff, Incorporated, Hamilton, Ohio, a corporation of Ohio

Application December 6, 1955, Serial No. 551,342

14 Claims. (Cl. 204—213)

This invention is directed to a machine for plating batches of metal parts in an electrolyte bath, utilizing loose metal fragments as the plating anodes.

One of the primary objects of the invention has been to reduce labor costs by providing a cyclic plating machine which plates the parts in relatively large batches and which charges the parts into the machine and discharges them from it, after plating, in a rapid convenient manner.

Another object has been to improve the quality of the plated parts by keeping the loose metal anode fragments and batch of loose parts in a constant state of rolling agitation in the plating bath during the plating cycle, thereby depositing the metallic film to a uniform thickness and quality upon all surfaces of the parts. Continuously agitating the anode fragments has the further advantage of dislodging the gas bubbles which forms upon them and of keeping them clean, thus creating ideal plating conditions.

The invention embraces a machine having a plating barrel rotating about a horizontal axis, and confining and agitating the parts to be plated, the metal anode fragments being carried loosely in a cylindrical anode basket mounted within the barrel on its horizontal axis and rotating in unison with it. An electrolyte bath is contained in the barrel, a portion of the rotating anode basket and anode fragments being continuously submerged in the bath and agitated, while the batch of parts or cathodes within the lower portion of the barrel are submerged in the bath and agitated beneath the metallic anode fragments. The anode side of the plating circuit is supplied directly to the anode basket and the cathode side is supplied to the metal parts through electrodes in the barrel but insulated from it, such that the circuit is completed from the anodes, through the electrolyte bath to the parts submerged in the bath.

A further object has been to improve the efficiency of the machine by providing the barrel with an insulating interior lining to support the batch of parts and to complete the cathode side of the plating circuit directly to the batch of parts in the barrel, thereby eliminating dilution or waste of electrical plating current and depositing the film only upon the batch of relatively moving parts in the rotating barrel.

According to this concept, cathode electrodes or buttons within the barrel are arranged in longitudinal rows, spaced radially from one another, the circuit being completed in sequence to the individual rows of cathode buttons by a segmental cathode ring and brush which completes the cathode circuit from the exterior of the barrel. This arrangement takes advantage of the rotary motion of the barrel to create a commutator action which energizes only the row of buttons which is in actual contact with the parts in the bottom of the barrel, while disconnecting those rows which are passing through the plating bath toward or from the batch of parts.

A further object has been to provide an anode basket structure which conducts the anode current to the metallic anode fragments within the basket, the basket and

associated parts being insulated from the batch of parts in the rotating barrel to prevent short circuits from the anode basket to the parts being plated.

More particularly, the anode basket includes a perforated external shell which is insulated but provides for the passage of the anode current from the anode fragments within the insulated shell, while preventing actual contact by the parts being plated. The metal anode fragments are confined in a cylindrical metal screen within the external shell and in electrical contact with the anode side of the circuit. The metal fragments within the basket are replenished from time to time through an anode tube projecting along the axis of rotation of the barrel to a point outside the barrel. The anode tube has the additional function of supporting the anode basket; of conducting the anode side of the circuit to the metal anode screen and to the metallic anode fragments within it; and of acting as a conduit for withdrawing from the interior of the basket and barrel, hydrogen and other gases generated as an incident to the plating action. For this purpose, the outer end of the tube is rotatably connected to an exhaust box and the end of the tube within the basket is provided with openings for the flow of gas and also for advancing the metal fragments from the open outer end of the tube to the anode screen within the basket.

The present invention is disclosed in relation to a batch-type plating barrel having a charging cone and scoop at one end and a discharge cone and scoop at its opposite end, so arranged that the metal parts to be plated are charged into the barrel during rotation in a plating direction and are discharged from the opposite end of the barrel during rotation in the opposite or discharge direction. The charging, discharging, and driving mechanism of the plating barrel are essentially disclosed in the several prior Ransohoff patents noted hereinafter, which are directed to tumbling mills, the same handling principles being utilized for charging and discharging the batches of parts as part of the batch plating cycle.

From the practical aspect, the present machine is built of steel parts suitably insulated from one another, as described in detail later. This construction has the advantage of providing sufficient strength to handle large, heavy batches of parts, utilizing comparatively small compact machine components.

The efficiency of the present machine is further increased by providing an electrolyte reservoir having a refrigerating system for controlling the temperature of the solution in the barrel, combined with a pumping and filtering system for continuously circulating clean solution through the plating barrel during a plating cycle. By keeping the bath at an optimum low temperature in this manner, the highest quality of plating treatment is obtained.

Various other features and advantages of the invention will be more fully apparent to those skilled in the plating art from the following detailed description of a preferred embodiment of the invention as disclosed in the drawings.

In the drawings:

Figure 1 is a diagrammatic plan view showing a battery of plating machines of the invention installed in a production line including surface treating machines for treating the parts before and after plating.

Figure 2 is a side elevation of the installation shown in Figure 1.

Figure 3 is a general side elevation of the plating machine.

Figure 4 is an end view looking toward the charging end of the machine, with parts broken away to show the charging scoop.

Figure 5 is an end view of the machine looking toward its discharge end.

Figure 6 is a longitudinal sectional view of the plating machine.

Figure 7 is an enlarged fragmentary sectional view similar to Figure 6, showing the internal parts in greater detail.

Figure 8 is an enlarged fragmentary sectional view taken from Figure 7, detailing the structure for insulating certain metallic parts of the machine from one another.

Figure 9 is an enlarged fragmentary side view of an external portion of the plating barrel taken from Figure 3, showing a portion of the cathode ring and its electrical connection with one of the cathode buttons or electrodes.

Figure 10 is a sectional view taken on the line **10—10** of Figure 9, further detailing the cathode ring, brush and button.

Figure 11 is a sectional view taken on line **11—11** of Figure 9, further detailing the cathode button.

Figure 12 is an enlarged sectional view taken on line **12—12** of Figure 6, detailing the anode ring and brush structure.

Figure 13 is a sectional view taken on line **13—13** of Figure 12, further illustrating the anode ring and brush.

Figure 14 is a sectional view taken on line **14—14** of Figure 6, illustrating the spiral discharge tube leading from the plating barrel to the discharge cone.

Figure 15 is a diagrammatic view taken along line **15—15** of Figure 6, illustrating the electrical circuit and particularly the commutator action of the cathode ring for deenergizing the cathode buttons which are not in actual contact with the batch of parts.

GENERAL ARRANGEMENT

Referring to Figures 1 and 2, which illustrates a battery of batch plating machines of the invention installed for rapid production operation, the metal parts to be plated are treated in the pre-plating treatment machine indicated generally at **1** and after the pre-plating surface treatment, they are discharged from the treating machine selectively to one of the three plating machines indicated generally at **2**. As shown in the diagrams, the discharge cylinder **3** of the batch treating machine feeds directly to a receiver **4** which communicates with the charging hopper **5** of the central plating machine, while the conveyors **6—6**, preferably of the vibrating type, extend laterally in opposite directions from the central receiver **4** to points above the charging hoppers **5** of the endwise plating machines. The parts flow by gravity from the hoppers **5** into the charging cones **9** of the plating machines. Suitable control means (not shown) are provided for feeding the treated parts selectively to the three plating machines, either directly by way of receiver **4** or by way of the vibrating conveyors **6**.

The pre-plating treatment machine **1** preferably is of the automatic sequential type shown in the prior Patent No. 2,585,838 to Nathan Ransohoff. The work pieces are fed to the charging cone **7** of the treating machine by the power loader, indicated generally at **8**, having a lift hopper **10** which elevates the parts and discharges them into the charging cone **7**. It will be noted that the treating machine **1** is installed at an elevation above the plating machines to accommodate feeding the treated parts by gravity to the conveyors **6** and from the conveyors selectively to the charging hoppers **5** of the plating machines.

The purpose of the batch treatment machine is to prepare the surface of the work pieces or parts for the deposit of the plating film since any trace of grease or foreign material upon the surfaces of the parts will interfere with adhesion of the plating, or at least cause inferior results. During the cleansing treatment, the parts are agitated or tumbled within the rotating drum of the treating machine **1** and subjected to several liquid processing solutions which may be necessary to remove all grease, dirt, corrosion, or other surface film, exposing only the chemically clean metallic surfaces, suitably pickled or etched for the deposit of the plating film. After treatment, the treating drum is rotated in the discharge direction and the clean batch of parts is discharged into the receiver **4** to be directed to the selected plating machine which is then placed in operation.

It will be understood that the preliminary surface treating machine **1** operates preferably through an automatic cycle, sequentially administering the several chemical treatments to the batch of parts within it. The treatment requires substantially less time than the actual plating cycle, depending upon the thickness of the film to be deposited and other variable factors. In the present example, in which zinc plating is applied to small parts such as nails, three plating machines, served by a single pre-plating treatment machine, are kept in constant operation during the day's run, each plating machine being recharged with a freshly treated batch when its batch of plated parts is discharged. As explained later, the plating machines rotate in one direction during the plating cycle and are reversed to discharge the plated parts at the end of the plating cycle.

As shown in Figure 1, the discharge cone **11** of the central plating machine communicates directly with the charging hopper **12** of a continuous, after-plating treating machine **13**, while the discharge cone **11** of the two endwise plating machines feed upon the conveyors **14—14**, which extend inwardly to the charging hopper **12** of the after-plating machine. The charging hopper **12** communicates with the holding drum **15** of the final treating machine **13**. The discharge conveyors **14** preferably are of the vibrating type similar to the charging conveyors **6** and suitable control means (not shown) are provided for selective operation. Accordingly, the plated parts from the three plating machines are selectively charged into the continuous after-plating treating machine **13** either directly from the central plating machine or by way of the conveyors from the endwise plating machines.

The final treating machine **13** may be of the type shown in the prior Ransohoff Patent No. 2,288,742 which, in general, consists of a rotating drum having spiral vanes which transport the batch of parts from the holding drum **15** at a metered rate through a series of chemical treating, rinsing and drying zones, for example, rinse, bright dip, hot rinse, and dry, the parts being discharged in clean, dry condition ready to be packaged or shipped. At its discharge end, the machine includes a discharge drum **16** from which the treated parts are discharged in a continuous stream. The machine includes an exhaust fan **19** which withdraws noxious chemical fumes from the treatment zones to prevent contamination of the atmosphere. The capacity and speed of the final treating machine is such that the holding drum is capable of accumulating one or more batches of plated parts and of feeding the parts for continuous advancement through the treating zones as fast or faster than the preliminary batch treatment and batch plating of the parts.

It will be understood that the structure described above is intended as an example of one installation of the plating machines for rapid production and that the plating machines may be operated individually or in combination with other treating machines, according to plant requirements.

PLATING MACHINE

Mechanical arrangement

As best shown in Figures 3 to 5, the plating machine consists of a barrel or drum **17** rotating about a horizontal axis and having tracking bands **18** supported upon rollers **20** which are journalled in pairs at opposite sides of the barrel in a framework **21**. The plating barrel is rotated by an electrical motor **22** connected by a belt **23** to a variable speed pulley **24** of a gear reduction unit **25**. The reduction unit includes a sprocket **26** connected by a chain **27** to a ring sprocket **28** encircling the barrel.

The power unit preferably is mounted upon the top of framework 21 as shown in Figure 3.

The barrel has a slight taper outwardly from its charging cone 9 to its discharge end (Figures 6 and 7) and additionally includes a helical vane 30 for advancing the parts toward the discharge cone 11 during rotation in the discharge direction. The charging cone 9 is mounted directly upon the end wall 31 of the plating barrel and the parts to be plated are fed into the cone from the charging hopper 5 which is mounted upon a vertical portion of framework 21.

As described later in detail, the discharge cone 11 is mounted directly upon the end wall 32 of the plating barrel and the plated work pieces or parts are elevated from the rotating barrel by a spiral discharge tube 33 which leads to the small end of the discharge cone 11. The charging cone 9 includes a loading scoop 34 which elevates the fresh batch of parts from the cone through a charging opening 35 and in the end wall 31. During rotation of the barrel in plating direction, as indicated by the arrow in Figures 4 and 5, the loading scoop elevates the parts from the charging cone and advances them through the charging opening 35 of end wall 31 into the rotating barrel. During rotation in this direction, the spiral discharge tube 33 is ineffective to discharge the parts since it is rotating in reverse as indicated in Figure 14; however, upon reversal of the direction of rotation, as indicated by the arrow, the spiral discharge tube is rotating in a direction to pick up the parts from the barrel and elevate them upwardly to the discharge cone 11. According to the present disclosure, the liquid electrolyte solution is supplied from a tank 36 which resides beneath the barrel. The solution is circulated by means of a pump indicated generally at 37 which is interposed in the conduit 38 leading from the tank to the charging cone 9. The solution is maintained in the barrel approximately to the liquid level indicated at 40 in Figures 6 and 15 and may be circulated continuously to control the temperature of the solution within the barrel, during the plating cycle. In this event, the solution overflows by way of the overflow opening 41 and is recirculated as explained later. It will be noted in Figures 6 and 7, that the charging and overflow openings 35 and 41 are circular and concentric to the axis of rotation of the barrel and that the discharge opening 41 is sufficiently larger than the charging opening to control the level of the bath by overflow action, thus preventing excess solution from overflowing to the charging cone 9.

In order to control the temperature of the electrolyte solution, the solution tank includes coolant coils 39 (Figure 6) through which chilled water or refrigerant may be circulated. Suitable pumps, valves and other control means regulate the flow of coolant, but since these parts do not form an essential part of the invention, they have been omitted from the disclosure.

The mechanical feeding and discharge components of the plating machine so far described, follow generally the tumbling mill structure and principle of operation disclosed in the prior Ransohoff Patent 2,299,032. However, to round out the disclosure of the invention, the mechanical structure is disclosed in greater detail later in this specification.

PLATING APPARATUS GENERALLY

Referring to Figures 4 to 7, the plating barrel preferably is cylindrical and its interior surface is provided with a lining of rubber or other electrical insulating material as indicated at 42. The details of the barrel construction are explained later, but it will be understood at this point, that the purpose of the insulation is to limit the flow of the plating current to the parts within the barrel which are to be plated. The batch of work pieces, indicated generally at 43 in Figure 15, forms the cathode of the circuit and the circuit is completed from the exterior of the barrel to the sets of cathode buttons or shoes 44 in the barrel by way of the cathode ring indicated generally at 45. Power is supplied to the cathode ring by the cathode brushes indicated generally at 46 which are connected to the negative side of the rectifier or motor generator (not shown) which supplies the direct plating current. Ring 45 is electrically insulated from the barrel and the circuit is completed by way of conductors 47 (Figures 3 and 9) leading from the ring to the cathode shoes which are also insulated from the barrel.

As explained later in detail, the cathode ring is divided into a number of sectors insulated one from the other, and the cathode buttons are arranged in sets or rows extending lengthwise of the barrel, the individual buttons spaced from one another and with the longitudinal rows of buttons apart radially from one another. Each longitudinal row of shoes or buttons is in common electrical contact with a given segment of the cathode ring. This arrangement provides a commutator action which energizes only that set of cathodes which is in actual electrical contact with the batch of parts within the bottom portion of the rotating barrel, while those shoes which are wihin the electrolyte bath but not in electrical contact with the parts are deenergized (Figure 15).

In the present example, a zinc coating is applied to the parts, and the metal to be deposited consists of pieces of zinc, as indicated at 48 (Figure 15), which are confined in the anode basket indicated generally at 50. The basket is in the form of a perforated cylinder mounted upon the axis of rotation within the barrel. The anode basket is in electrical contact with the anode side of the circuit and is insulated from the barrel (cathode side) as explained later in detail. The anode current is supplied to the basket by the anode brushes indicated generally at 51 contacting the anode ring 52 which is mounted upon the outer end of a metal anode tube 53. The anode tube is in electrical connection with the metallic interior of the anode basket and projects outwardly through the discharge cone 11 (Figure 6). As shown in Figures 6 and 7, the lower portion of the anode basket, which contains the zinc anodes 48, is submerged in the electrolyte solution. The outside diameter of the anode basket is covered with a perforated insulating material as described later. The plating circuit is thus established by way of the anode brushes 51, tube 53, and basket 50 to the zinc anodes 48. From the zinc anodes, the circuit is completed through the electrolyte bath to the batch of parts 43, cathode buttons 44, and cathode ring 45 to the cathode brushes 46.

As best shown in Figure 6, the pieces of zinc 48 are charged into the anode basket through the metal anode tube 53 which includes one or more openings 54 at its inner end portion communicating with the interior of the basket. The pieces of zinc which may be of any shape, irregular or otherwise, are placed in the tube from its outer end which communicates with the exhaust box 55. The exhaust casing is connected by a duct 56 to a suitable exhaust fan (not shown) and is utilized to withdraw from the plating barrel the hydrogen gas which is generated during the plating cycle. The exhaust box includes a door 57 providing access to the end of the tube for placing the pieces of zinc into the open end of the tube which extends into the box. The pieces may be advanced to the openings 54 by a suitable ramrod or other means. Upon dropping through the opening 54, the zinc anodes naturally distribute themselves lengthwise of the basket as a consequence of its rotary motion.

It will be understood at this point, that the entire barrel, anode basket and tube rotate as a unit while the plating current is supplied by way of the anode and cathode rings from the stationary brushes. The rotary movement of the barrel which is controlled by adjusting the motor drive, keeps the work pieces in a constant state of agitation and thereby causes the plating film to be deposited uniformly upon all the surfaces. The rotary mo-

tion also keeps the zinc anodes distributed uniformly throughout the length of the anode basket, and cleanses and dislodges the gas bubbles from them; the agitation of the anodes thus contributes further to the quality of the metallic deposit upon the parts. By way of example, in zinc plating small parts such as nails, a speed of four or five revolutions per minute of the barrel and basket is found to be suitable.

According to the present example, a plating current of approximately 18 volts, at approximately six amperes per pound of parts, has been found best suited for zinc plating nails and similar small parts. For optimum results, the temperature of the electrolyte or plating bath is maintained between 70 and 100 degrees F. This temperature range provides a desirable brightness of finish and maximum plating speed; at temperatures above 100 degrees F., the increased temperature impairs the quality of the finish.

In addition to the cooling system, the circulatory system for the electrolyte preferably includes means for filtering out foreign materials which may become entrained in it. For this purpose, a filtering unit, indicated diagrammatically at **58** in Figure 4, may be inserted in the pump conduit **38**. The filter may be of any approved commercial design and has not been disclosed in detail.

CHARGING AND DISCHARGING DETAILS

Referring to Figures 4 and 6, the charging cone **9** has its large end welded as at **61** to the end wall **31** of the plating barrel and rotates as a unit with the barrel. The outer or small end of the cone is provided with a vertical flange or lip **62**, and the loading hopper **5** has its delivery end **63** projecting into the opening delineated by the lip. The charging opening of the cone is concentric with the axis of rotation of the barrel and the open end **63** of the hopper, which is circular, is concentric to the charging opening. The upper receiving end **64** of the hopper is open to receive the parts to be treated and its bottom wall **65** is inclined downwardly to feed the parts by gravity into the charging cone. It will be noted that the downward slope of the rotating cone causes the parts naturally to flow downwardly toward the end wall **31** of the plating barrel.

The parts are lifted from the lower portion of the charging cone by the rotating loading scoop **34**, which as shown in Figure 4, comprises spaced side walls **66—66** welded to the end wall **31** of the barrel, and an outer wall **67** having an inclined endwise portion **68** leading to the charging opening **35**. One side wall **66** extends outwardly to the periphery of the cone as at **70**, while the opposite side wall **66** terminates inwardly from the periphery of the cone so as to delineate a work pick-up opening **71**. It will be noted in Figure 4 that the pick-up opening **71** faces in the plating direction of rotation, as indicated by the arrow, such that the parts flow into the opening as the scoop rotates through the batch of parts and, during continued rotation, flow downwardly into the upwardly rotating scoop to be deflected by the inclined wall **68** through the charging opening **35** into the barrel. The scoop charges a portion of the batch of parts upon each rotation until the entire batch is advanced into the barrel during several turns of the barrel in the plating direction.

After the parts are charged in, the source of plating current is activated to provide the flow of plating current while the rotation of the plating barrel is continued in the same direction. The metallic film is then deposited upon the work pieces while they are in a state of gentle agitation in the bottom portion of the rotation barrel. The treatment is continued for a period lasting from ½ to 1½ hours, or until the desired thickness or quality of plating is obtained. At the end of the cycle, the barrel is rotated in the opposite or discharge direction (Figure 14) to discharge the parts and thereafter the plating circuit may be opened.

It is to be noted at this point that the conduit **38**, which circulates the electrolyte solution from the tank passes through the side wall of the charging hopper **5** and has an extension **72** projecting inwardly toward the barrel upon the axis of rotation of the barrel, the extension **72** being stationary. The solution is conveyed to the interior of the tank by a nozzle **73** passing through the inclined wall **68** of the charging scoop and welded to the wall as at **74** (Figure 7). The nozzle **73** has inside diameter greater than the outside diameter of the extension **72** and is telescopically fitted over the end portion of the extension. Accordingly, the nozzle rotates with the charging scoop relative to the conduit extension and conveys the liquid solution into the interior of the barrel. A washer **76** is welded to the stationary conduit extension **72** adjacent the rearward end of the nozzle to deflect into the charging cone any liquid solution which may spurt outwardly from the outer end of the nozzle. Liquid which may be deflected into the cone is picked up by the loading scoop and elevated with the parts into the barrel.

It will be noted in Figure 7, that the charging opening **35** is sufficiently larger than the nozzle to form an annular opening for the passage of small parts. If larger parts are to be plated, the charging scoop and opening are made proportionately larger to accommodate them.

Upon reversal of the direction of rotation to discharge the plated parts (Figure 14), the parts advance toward the discharge end of the barrel in response to its outward slope, the movement being augmented by the helical bead **30** and also by the plowing action of the cathode buttons **44** as explained later. The helical bead or vane **30** preferably is formed of rubber and is generally semi-circular in cross section. It is secured to the inside diameter of the barrel and has a lead which advances parts toward the discharge end when the barrel is rotating in the discharge direction. Upon approaching the end wall **32** of the barrel, the parts are elevated to a work delivery opening **75** in the discharge cone **11** by the spiral discharge tube **33**. As shown in Figure 7, the discharge tube resides on the exterior side of end wall **32**, the end wall having pick-up opening **77** located at the periphery of the barrel.

The spiral discharge tube **76** consists of a side wall **78** concentric with the discharge cone **11** and forming a passageway having an outer wall **80** spaced from the end wall of the barrel. The parts within the barrel pass into the pick-up opening **77** as the opening passes through the batch of parts. It will be noted in Figure 14 that the portion of the spiral discharge tube which is delineated by the side wall **78** and cone **11** is generally concentric to the barrel as at **81**, and that the trailing end portion, which leads to the opening **75** in the discharge cone **11** is spiral as at **82**, so as to elevate the parts and discharge them into the cone as a consequence of its rotary motion in discharge direction. Thus, upon each rotation of the barrel, a portion of the batch of parts enters the pick-up opening **77** and is delivered to the cone, the operation continuing until all of the parts are delivered from the barrel to the cone. It will be noted that during rotation in the plating direction (Figures 4 and 15), the discharge tube is ineffective, since any parts which may pass into the pick-up opening **77** are ejected back to the barrel upon continued rotation.

Referring to Figure 7, the discharge cone consists of an external sheet metal shell **83** and an internal screen **84** spaced inwardly and concentric with the exterior shell. The small end of the shell is secured by welding as at **85** to the end wall **32** of the barrel. The small end of the screen includes a flange **86**, likewise secured to the end wall.

The outer end of the screen is held in spaced relationship to the shell by a ring **87** which is attached by brackets **88** to the outer end of the cone. The inside diameter of the screen includes a relatively high vane

90 which spirals outwardly toward the discharge end of the cone during rotation in discharge direction.

The delivery end 82 of the spiral discharge tube 33 passes through the exterior shell 83 and communicates with the delivery opening 75 of the screen, such that the discharged parts pass to the screen and are advanced outwardly by the spiral vane 90 to its open discharge end.

During the discharge cycle, the spiral discharge tube 33 naturally picks up a quantity of solution along with the parts upon each discharge rotation. The solution discharges into the screen 84 with the work, then flows through the screen and downwardly in the exterior shell 83, from the outer end of the shell back to the tank. As best shown in Figure 7, the outer end of the cone includes a flange or lip 91 spaced inwardly from the ring 87 which supports the outer end of the screen. The lip and ring thus delineate a passageway for controlling the flow streams of liquid draining from the barrel. To prevent loss of the liquid, the spaced flanges project downwardly into the open end portion of the splash guard 92. The splash guard has its lower end communicating with the solution tank 36. It will be understood at this point that the solution which is discharged with the parts is replaced by operation of the pump 37 through nozzle 73. It will also be understood, that if it is necessary to maintain circulation during the plating cycle to control temperature, the excess solution overflows by way of opening 41 and returns to the tank by way of the discharge cone and splash guard as described above.

PLATING BARREL DETAILS

As explained earlier, the interior of the plating barrel has a rubber lining 42 to electrically insulate the parts from the barrel in which they are confined. As best shown in Figure 7, the lining extends from the internal periphery of the barrel and across the end walls 31 and 32 to the charging opening 35 and overflow opening 41. To insulate the discharge cone 11 and discharge tube 33, which at times may be charged by contact with the parts in the barrel, the end wall 32 is insulated from the barrel proper. For this purpose, the rearward end of the barrel includes a flange 93 and the end wall 32 overlies the flange and is secured to it by screws 94. For insulating purposes, the rubber lining 42 extends outwardly and is interposed between the end wall and flange as at 95. The screws 94 are also insulated from the end wall and flange as detailed in Figure 8. This structure is typical throughout the machine, consequently, the structure of Figure 8 is representative of all insulated joints. As shown, an insulating bushing 96, having a head, surrounds the screw and its head to insulate it from the end wall and flange. The nut 97 is insulated from the end wall by an insulating washer 98.

The cathode ring 45 is insulated from the exterior metallic surface of the barrel as best shown in Figures 9 and 10. As shown, the ring is formed of copper or similar material and is welded or brazed upon a band 100 which forms a mounting base for the ring. A series of lugs 101 extend outwardly in staggered relation from opposite sides of the band and are spaced radially from one another. The lugs are brazed or otherwise attached to the band and support it spaced outwardly from the barrel but concentric with it. Each lug 101 is anchored upon the barrel by a mounting block 102 welded as at 103 to the barrel. A screw 104 passes through each lug and is threaded endwisely into the mounting block. A headed bushing 105 formed of insulating material, surrounds the screw 104 and insulates the screw from the lug. A washer 106 also formed of insulating material, is disposed between the lug and mounting block. The bushing and washer insulates the lugs and cathode ring from the barrel and secures it rigidly in position.

The cathode shoes or buttons 44 preferably are formed of sheet metal as shown in Figures 10 and 11, and are seated upon the rubber lining 42 within the barrel. Each button is generally box-like and consists of a rectangular base plate 107 having one parallel side wall 108 and a second side wall 110 which is inclined to form a generally triangular body having a top wall 111 and a downwardly inclined end wall 112. During the plating cycle, the buttons move in a direction indicated by the arrow (Figure 15) such that the downwardly inclined end wall 112 provides a plowing action as it passes through the batch of parts in the lower portion of the rotating barrel.

Each shoe 44 includes a bolt 113, having its head welded as at 114 to the base plate 107. The bolt projects outwardly through a hand hole 115 and anchors the shoe in position as explained later. As best shown in Figure 3, the barrel is provided with a series of hand holes, one for each shoe, the arrangement being such that the shoes or buttons may be inserted through the hand holes and anchored in position from the exterior of the barrel.

During rotation of the barrel in the discharge direction, as indicated by the arrow in Figures 7 and 14, the apex of the triangular shoe forms the lead in the direction of travel; consequently, the angular side wall 110 acts as an inclined plane to urge the parts in the discharge direction indicated by the arrow 116. Thus, the inclination of the side wall 110 corresponds with the lead of the helical vane 30 to aid in advancing the parts toward the discharge end of the barrel.

As best shown in Figure 9, each hand hole is oval in shape and its major axis of greater than the width of the cathode shoe, while its minor axis is longer than the height of the shoe. This permits the shoes to be inserted through the hand hole from the exterior of the barrel with the width of the button generally parallel to the major axis of the hole, grasping the shoe by the end of the screw 113. The shoe is then secured in place by slipping in the position the U-shaped retainer 117 which spans the major axis of the hand hole. A washer 118, which has a diameter greater than the spacing of the limbs of the retainer, is then slipped upon the outer end portion of the screw and secured in position by a nut 120, thus clamping the shoe against the rubber lining of the barrel. The base plate 107 of the shoe, being clamped firmly against the rubber lining 42, provides a water-tight seal, the base plate completely overlying the opening 115 as shown in broken lines in Figure 9.

To provide electrical insulation for the button, the lining 42 extends about the margin of the hand hole as at 121, overlying its external margin, such that the opposite ends of the U-shaped retainer seat upon the rubber and are electrically insulated from the metal barrel.

The cathode current is supplied to the shoe by an electrical cable 47 having its terminal 123 secured as at 124 to the washer 118. The opposite end of the cable includes a similar terminal 123 which is secured as at 124 to the band 100 of the cathode ring 45 to complete the circuit to the shoe. As explained in detail below, respective cables extend from each sector to the individual cathode shoes of each row to provide the commutator action.

As best shown in Figures 10 and 15, the cathode brushes 46 are supported upon a standard 125 rising upwardly from the frame work 21 of the machine. As shown in the diagram, the brushes reside along a radial line which is inclined at an angle of approximately 45 degrees from a perpendicular line passing through the axis of the barrel. The relationship of the rows of cathode shoes and ring segments, and the angular position of the brushes, disconnects or deenergizes the row of shoes, indicated at A, which is descending through the bath, and energizes only the row of shoes B, which is actually in contact with the parts. It will also be seen that the rows of shoes C and D above the bath are also deenergized or deactivated.

As explained earlier, the cathode ring is secured to the barrel by the mounting blocks 102 which are in staggered relationship on opposite sides of the band 100. In order

to provide the commutator action, the band **100** and the ring **45** is interrupted at four equidistant points about its circumference, as indicated at **136**, thus dividing it into four sectors **137** which are electrically insulated from one another. Each sector **137** is individually attached to the barrel by a series of the insulated mounting blocks **102**, and each sector is connected to a given row of cathode shoes **44** by a series of cables **47** extending from the sector to the individual shoes of the row (Figures 3, 9 and 15).

It is to be noted at this point that the angular disposition of the cathode brushes **46** permits the barrel and cathode ring to rotate in either direction (plating or discharge) without interference or excessive brush wear.

The construction of the cathode and anode brush supports are similar; however, the details are best shown in Figures 12 and 13 in connection with the anode brushes. Referring to the cathode brushes shown in Figure 10, two opposed brushes **46—46**, engage the opposite sides of the cathode ring **45**. The brushes are mounted by screws **126** upon respective brackets **127—127** which in turn, are secured by screws **128** to a mounting plate **130**. The mounting plate is carried upon the upper end of standard **125**. The brushes and their brackets are insulated from the mounting plate by a sheet of insulating material **131** interposed between the base plate and brackets. As detailed in Figure 13, an insulated bushing **132**, surrounding the shank of each screw **128**, insulates the screw and its nut from the mounting plate. Current is supplied to the cathode brushes (Figure 10) by the electrical cables **133** which lead from the cathode side of the power supply. The terminals **134** of the cables are attached to the screws **128** and clamped in position by nuts **135**. The headed bushing **132** insulates the screw from the mounting plate, the circuit being completed through the screws **135—135** to the brackets **127—127** and their opposed brushes **46—46** by the respective cables **133—133**.

ANODE BASKET DETAILS

As noted earlier, the anode basket **50** is in the form of a cylinder mounted upon the axis of rotation of the barrel and rotating in unison with the barrel (Figure 7). The forward end of the basket is supported upon a series of brackets **139** anchored to the forward end wall **31** of the barrel, while the rearward end of the basket is supported by the anode tube **53**. It will be understood that the basket is completely insulated from the barrel and associated parts which constitute the cathode side of the circuit. For mounting purposes, the brackets **139** include a bolting ring **138** seated against the rubber lining **42** of the barrel and secured in position by the screws **140** passing through the wall of the barrel and ring. The screws are insulated from the bolting ring by means of insulating bushings or washers as previously described with reference to Figure 8. The opposite end of the brackets **139** are joined to a second bolting ring **141**, which is attached to the end wall disk **142** of the basket by screws **143**.

The end of the anode tube **53**, which supports the opposite end of the basket, is rigidly supported by a spider **144** having radial arms **145** which are attached to the metal ring **87** of the discharge cone (Figures 5 and 7).

The arms are spaced outwardly from the flange by respective spacer sleeves **146** attached by screws **147** passing through the sleeves. The spider includes a central boss **148** which embraces and supports the outer end of the anode tube but which is insulated from it. For this purpose, (Figure 13), a mounting flange **150** is welded to the tube as at **151**. The boss has a series of spaced mounting screws **152** welded to it and is electrically insulated from the tube and its mounting flange by a washer **153** formed of hard insulating material which has an inner bore embracing the tube. A second insulating washer **154**, is interposed between the boss and mounting flange. The screws pass through the washer **153** and include nuts **155** which clamp the washer and boss against the mounting flange. This structure firmly secures the spider to the tube and insulates them from one another.

Referring to Figure 7, the basket proper consists of perforated external insulating shell **156** and an internal metal screen **157** spaced inwardly from the insulating shell and concentric with it. The inner cylindrical screen includes opposite end walls **158–158** formed of sheet metal in the form of disks. The outer edges of the disks **158** are welded as at **160** to the edges of the cylindrical screen and the disks are welded as at **161** to the anode tube. The end wall disks **158** are reinforced by the triangular gussets **162** residing within the basket and welded as at **163** to the tube and end wall disks.

The outer insulating shell of the basket includes the pair of end wall disks **142**, which are formed of insulating material such as plastic or the like. The end wall disks are secured to the internal metal basket by screws **164** passing through the disks **142** and anchored in the metal mounting rings **165–165** at opposite ends of the basket. The mounting rings are rightangular in cross section and their inner edges are welded as at **166** to the metal end wall disks **158**. The screws **164** which secure the outer wall disks in position have their exposed heads **167** enclosed by caps **168** formed of insulating material.

The cylindrical insulating shell **156** of the basket is formed of plastic material perforated as at **170** and having its outer ends attached as at **171** to the periphery of the outer end wall disks **142**. The intermediate portion of the outer cylindrical shell is reinforced by spacer rings **172** formed of plastic material spaced apart from one another along the length of the basket between the external shell and internal screen. Each spacer ring includes an exterior metal band **173** encircling the outside shell of the basket and attached to the spacer rings by screws as at **174**.

The purpose of the external insulating shell **156** of the anode basket is to prevent short circuits between the parts being plated and the metallic screen **157** which confines the anodes. By way of example, in plating small parts of elongated shape, such as nails, or parts having slender projections, the slender parts, in a state of agitation, have a tendency to contact the metal screen, thus momentarily short circuiting the plating current. The spacing of the insulating external shell **156** and size of its apertures eliminates this action and provides reliable operation.

From the foregoing, it will be observed that the anode current from the anode brushes **51** flows through the tube **53** to the cylindrical screen **157** and to the zinc anodes **48**. It will also be noted that the spider **144** and brackets **137**, which support the basket relative to the barrel, completely insulate the anode basket from the barrel which supports it. The plating current thus passes from the zinc anodes through the perforations in the external shell **156** and through the bath to the batch of parts.

The anode ring **52** is carried upon a mounting disk **175** which is welded or brazed as in **176** to the outer end portions of the anode tube **53** (Figure 13). The ring is secured to the flange by the mounting screws **177**. The anode brushes **51–51** are mounted in opposed angular relationship similar to the cathode brushes and, as shown in Figure 3, are supported upon the standard **178** rising from the solution tank. Electrical cables **180—180** supply the anode current to the two brushes. The brushes are supported by brackets **127** which are mounted upon the standard **178**. In the present example, the brushes are disposed along a perpendicular line passing through the axis of rotation of the anode tube. The two cables energize both brushes as described earlier with reference to the cathode circuit. Except for the position of the brushes and size of the anode ring, the anode brush arrangement is similar to the cathode brush structure previously described, therefore further description is omitted.

As shown diagrammatically in Figure 6, the outer end of the anode tube **53**, which is open, passes into the exhaust box **55**, which includes gland **181** permitting the

tube to rotate but providing an air seal. A suction conduit 56 leading to an exhaust fan (not shown), provides the exhaust suction. The fan has sufficient capacity to provide a constant flow of air into the open end of the charging cone as indicated by the arrow in Figure 6. This prevents the accumulation of gases, such as hydrogen, which are generated during the plating process. The mixture of air and gas is withdrawn from the interior of the barrel and basket through one or more openings 54 of the anode tube. As noted earlier, the zinc anode fragments are fed into the basket by way of the anode tube and through the opening 54 into the basket. For this purpose, the rear wall of the exhaust box 55 is provided with a removable door 57 which provides access to the open end of the anode tube within the box.

Although the present disclosure is made in relation to a zinc plating operation, it will be understood that the machine may be utilized in electroplating materials other than zinc, using the appropriate anode materials and electrolyte solution.

Having described my invention, I claim:

1. An electroplating machine comprising a plating barrel rotatable about a generally horizontal axis in plating and discharge direction, said barrel having opposite end walls, said end walls having central openings generally concentric with said horizontal axis, one of said openings providing drainage and delineating the liquid level of a plating bath in the barrel, the barrel adapted to contain a batch of parts in the presence of a plating bath, cathode means within the barrel conducting the cathode side of a plating circuit to the batch of parts, an anode basket mounted within the barrel rotatable therewith and adapted to contain a batch of metallic anode pieces, means conducting the anode side of the plating circuit to said batch of anode pieces, the anode basket being generally concentric to the said horizontal axis of rotation and having a periphery passing through the level of a plating bath delineated by said central opening, whereby the plating circuit is completed from the batch of anode pieces to the batch of parts through the plating bath with the anode pieces and parts maintained in a state of agitation within the rotating barrel during the plating operation, a charging cone having a charging scoop mounted on one end wall of the barrel and communicating with the central opening thereof, said charging scoop advancing parts to be plated through said central opening into the plating barrel during rotation thereof in plating direction, and a discharge tube mounted on the opposite end wall of the plating barrel and communicating with the interior of the barrel at the periphery thereof, said discharge tube discharging the plated parts from the barrel during rotation thereof in said discharge direction after the plating operation is completed.

2. An electroplating machine comprising a plating barrel mounted for rotation about a generally horizontal axis in plating and discharge directions and adapted to agitate a batch of parts in the bottom portion thereof, said plating barrel having opposite end walls, at least one of said end walls having a drainage opening generally concentric with said horizontal axis of rotation, said end walls confining a liquid plating bath therein at a liquid level delineated by said drainage opening, the interior surface of the barrel having an insulating lining supporting the batch of parts, a plurality of cathode shoes mounted in the barrel and insulated therefrom, said shoes being elongated in the direction of rotation of the barrel and having contact surfaces rising from the said insulating lining, commutator means electrically connected to the cathode shoes and energizing the same sequentially during passage of the shoes through the batch of parts during rotation of the barrel and deenergizing the same thereafter, a metallic anode basket mounted in the barrel on the axis thereof rotating with the barrel and arranged to confine a batch of anode pieces for agitation during rotation of the barrel, said anode basket having a periphery passing through the level of a liquid bath delineated by said central opening, a perforated insulating shell surrounding the anode basket in spaced relation thereto, and means conducting the anode side of the plating circuit to the metallic anode basket, the plating circuit being completed from the batch of anode pieces to the batch of parts in the barrel through a plating bath in the barrel, whereby the batch of anode pieces and parts are agitated during the plating operation.

3. An electroplating machine comprising a plating barrel mounted for rotation about a generally horizontal axis and having an internal insulating lining, said barrel having opposite end walls, at least one of said end walls having a drainage opening generally concentric with said horizontal axis and thereby delineating the liquid level of a plating bath confined in the barrel, the barrel arranged to agitate a batch of parts to be plated in the bottom portion thereof, means supplying plating liquid to the plating barrel, whereby the plating bath overflows said drainage opening during a plating operation, a plurality of cathode shoes mounted within the barrel and spaced from one another, the cathode shoes being insulated from the interior surface of the barrel and passing sequentially through the batch of parts during rotation of the barrel, a commutator mounted upon the axis of the barrel and rotatable therewith, said commutator electrically connected to the individual cathode shoes within the barrel, brush means contacting the commutator and supplying the cathode side of a plating circuit thereto, said brush means being located in a position to energize the cathode shoes sequentially as each shoe approaches the batch of parts and passes therethrough during rotation of the barrel and to deenergize each shoe after passing through the batch of parts, and an anode container mounted within the barrel substantially on the axis of rotation thereof and arranged to confine and agitate a batch of anode pieces during rotation of the barrel, said anode container being generally concentric to said horizontal axis of rotation and having a periphery passing through the level of a plating bath delineated by said drainage opening, and means conducting the anode side of the plating circuit to said batch of anode pieces whereby the plating circuit is completed from the anode pieces to the batch of parts through the plating bath in the barrel, with the anode pieces and parts maintained in a state of agitation during a plating operation.

4. An electroplating machine comprising a plating barrel mounted for rotation about a generally horizontal axis and having an internal insulating lining, the barrel arranged to agitate a batch of parts to be plated in the bottom portion thereof, said barrel having opposite end walls for confining a liquid plating bath in the barrel, liquid level control means maintaining a plating bath in the barrel at a level below said horizontal axis, a plurality of cathode shoes mounted within the barrel and spaced from one another, the cathode shoes being insulated from the barrel and passing sequentially through the batch of parts thereon during rotation of the barrel, said shoes being elongated in the direction of rotation of the barrel and providing a plowing action during passage of the shoes through the batch, a cathode ring mounted upon the exterior surface of the barrel, said cathode ring having a plurality of ring segments insulated from one another and from the plating barrel and electrically connected to the individual cathode shoes within the barrel, brush means contacting the cathode ring and supplying the cathode side of a plating circuit to the ring, said brush means being located in a position to energize a segment and the cathode shoe thereof as the shoe approaches the batch of parts and passes therethrough during rotation of the barrel and denergizing the said shoe after passing through the batch of parts, an anode container mounted within the barrel generally concentric to the horizontal axis of rotation, said container having a periphery passing through a liquid level of the plating

bath as delineated by said liquid level control means, and means connecting the anode side of a plating circuit to said anode container, whereby the plating circuit is completed from the anode container through a plating bath to the parts which are in contact with the cathode shoes within the barrel.

5. An electroplating machine comprising a plating barrel mounted for rotation about a generally horizontal axis and having an internal insulating lining adapted to contain a liquid plating bath, said barrel having liquid level control means communicating therewith for maintaining a liquid plating bath therein at a level below said horizontal axis, the barrel arranged to agitate a batch of parts to be plated in the bottom portion thereof, a plurality of cathode shoes mounted within the barrel and spaced from one another, the cathode shoes being insulated from the barrel and passing sequentially through the batch of parts during rotation of the barrel, said shoes being elongated in the direction of rotation of the barrel and providing a plowing action during passage through the batch of parts, a cathode ring mounted upon the exterior surface of the barrel, said cathode ring having a plurality of ring segments insulated from one another and from the plating barrel and electrically connected to the individual cathode shoes within the barrel, brush means contacting the cathode ring and supplying the cathode side of a plating circuit to the ring, said brush means being located in a position to energize a segment and the cathode shoe thereof as the shoe approaches the batch of parts and passes therethrough during rotation of the barrel and deenergizing the said shoe after passing through the batch of parts, an anode container mounted within the barrel substantially on the axis of rotation thereof and arranged to confine and agitate a batch of anode pieces during rotation of the barrel, said anode container, said anode container having a periphery residing outwardly from said axis of rotation and beyond a plane at which said control means maintains the liquid level of a plating bath in the barrel, and means conducting the anode side of the plating circuit to said batch of anode pieces whereby the plating circuit is completed from the anode pieces to the batch of parts through the plating bath in the barrel, with the anode pieces and parts maintained in a state of agitation during a plating operation.

6. An electroplating machine comprising a plating barrel mounted for rotation about a generally horizontal axis, and adapted to agitate a batch of parts in the bottom portion thereof, said plating barrel having end walls for confining a liquid plating bath therein, said barrel having liquid level control means communicating therewith and maintaining a liquid plating bath in the barrel at a level below said horizontal axis of rotation, the interior surface of the barrel having an insulating lining supporting the batch of parts, a plurality of cathode shoes mounted in the barrel, said shoes being seated upon the insulating lining of the barrel and having contact surfaces rising from the insulating lining, said contact surfaces extending lengthwise in the direction of rotation of the barrel, commutator means electrically connected to the cathode shoes and energizing the same sequentially during passage of shoes through the batch of parts during rotation of the barrel and deenergizing the same thereafter, a metallic anode basket mounted in the barrel on the axis thereof rotating with the barrel and arranged to confine a batch of anode pieces for agitation during rotation of the barrel, said anode basket having a periphery passing through a plane corresponding to a liquid level maintained by the said control means of the barrel, a metallic anode tube connected to the metallic anode basket and extending outwardly from one end of the barrel along said axis of rotation, insulated support means attaching the tube to the barrel, whereby the tube supports the anode basket, and brush means contacting the anode tube and supplying the anode side of the plating circuit to the anode pieces through said tube and metallic anode basket, whereby a plating circuit is completed from said anode pieces, through a plating bath in the barrel to the parts which are in contact with said cathode shoes during rotation of the barrel.

7. An electroplating machine comprising a plating barrel mounted for rotation about a generally horizontal axis, and adapted to agitate a batch of parts in the bottom portion thereof, said plating barrel having forward and rearward end walls confining a liquid plating bath therein at a liquid level below said horizontal axis, the interior surface of the barrel having an insulating lining supporting the batch of parts, said forward wall including means for charging parts into the barrel during rotation thereof in a charging direction, said rearward wall including means for discharging parts from the barrel during rotation thereof in a discharging direction, a plurality of cathode shoes mounted in the barrel and insulated therefrom, commutator means electrically connected to the cathode shoes and energizing the same sequentially during passage of shoes through the batch of parts during rotation of the barrel and deenergizing the same thereafter, a metallic anode basket mounted in the barrel on the axis thereof rotating with the barrel and arranged to confine a batch of anode pieces for agitation during rotation of the barrel, said basket having one end attached to the forward end wall of the barrel and insulated therefrom, said basket having a periphery generally concentric with said horizontal axis and passing through the liquid level confined in the barrel by said end walls, a metallic anode tube having an end projecting into the opposite end of the metallic anode basket and extending outwardly from the rearward end wall of the barrel along said axis of rotation, said tube in electrical connection with the anode basket, insulated support means attaching the tube to the barrel, whereby the tube supports the anode basket with the tube and basket insulated from the barrel, and electrical means contacting the anode tube and supplying the anode side of the plating circuit to the anode pieces through said tube and metallic anode basket, whereby the plating circuit is completed from said anode pieces through said plating bath to the parts which are in contact with the cathode shoes of the barrel.

8. An electroplating machine comprising a plating barrel rotatable about a horizontal axis and having opposite end walls, said end walls including means communicating with the barrel and maintaining a liquid plating bath at a level below said horizontal axis, said barrel and end walls having an internal insulating lining and adapted to contain a batch of parts and a liquid plating solution with the parts and solution insulated from the barrel, cathode means within the barrel conducting the cathode side of a plating circuit to the batch of parts, said cathode means being insulated from the barrel, a generally cylindrical metallic anode basket mounted within the barrel and insulated therefrom, the anode basket rotatable with the plating barrel upon the said horizontal axis and adapted to contain a batch of metallic anode pieces, an insulating shell surrounding the anode basket, an open metallic anode tube secured to the metallic anode basket, the tube having an opening communicating with the interior of the basket and having an opposite end portion projecting outwardly from the barrel, said anode tube electrically insulated from the plating barrel and electrically connected to the metallic anode basket, means conducting the anode side of the plating circuit to the portion of the tube projecting from the barrel and to said batch of anode pieces, whereby the plating circuit is completed from the batch of anode pieces to the batch of parts through the plating solution with the anode pieces and parts maintained in a state of agitation within the rotating barrel during the plating operation, said anode tube having an opening in the outer portion thereof providing a conduit for conveying anode

pieces from said opening through the tube and through the opening which communicate with the interior of the anode basket.

9. An electroplating machine comprising a plating barrel rotatable about a horizontal axis and having opposite end walls including control means communicating with the barrel and maintaining a liquid plating solution at a level below said horizontal axis of rotation, said barrel and end walls having an internal insulating lining and adapted to contain a batch of parts and a liquid plating solution with the parts and solution insulated from the barrel, cathode means within the barrel conducting the cathode side of a plating circuit to the batch of parts, said cathode means being insulated from the barrel, a generally cylindrical metallic anode basket mounted within the barrel and insulated therefrom, the anode basket rotatable in unison with the barrel about said horizontal axis and adapted to contain a batch of metallic anode pieces, an insulating shell surrounding the anode basket, an open metallic anode tube secured to the metallic anode basket, the tube having an opening communicating with the interior of the basket and having an opposite end portion projecting outwardly from the barrel, said anode tube electrically insulated from the plating barrel and electrically connected to the metallic anode basket, means conducting the anode side of the plating circuit to the portion of the tube projecting from the barrel and to said batch of anode pieces, whereby the plating circuit is completed from the batch of anode pieces to the batch of parts through the plating solution with the anode pieces and parts maintained in a state of agitation within the rotating barrel during the plating operaiton, said anode tube having an opening in the outer portion thereof, and an exhaust conduit connected to said opening and withdrawing gases from the plating barrel and anode basket through the opening of the tube which communicate with the interior of the anode basket

10. A batch-type electroplating machine comprising, a plating barrel rotatable about a generally horizontal axis in a forward plating direction and in a reverse discharge direction, the barrel adapted to contain a batch of parts and a liquid plating bath, said barrel having a forward end wall and a rearward end wall, said forward end wall having a central charging opening, said rearward end wall including a drainage opening delineating the level of a liquid plating bath in the barrel, said level being below the said horizontal axis, cathode means within the barrel conducting the cathode side of an electrical plating circuit to the batch of parts in the barrel, an anode basket mounted within the barrel and rotatable therewith about said horizontal axis, said anode basket adapted to contain a batch of metallic anode pieces, means connecting the anode side of an electrical plating circuit to a batch of anode pieces in the basket, the anode basket having a periphery greater than the said drainage opening, whereby a portion thereof passes below the level of a plating batch delineated by said drainage opening, the plating circuit being completed from a batch of anode pieces in the basket, through the plating bath to a batch of parts in the barrel, a parts charging device mounted on the forward end wall of the plating barrel, the charging device confining a batch of parts to be plated and including a one-way parts feeding element rotating with the barrel, said feeding element extending generally at a tangent from one side of said central opening and presenting a surface which leads from said charging device to said opening during rotation of the barrel in said forward plating direction, the feeding element thereby contacting and advancing the parts from the charging device through said central opening into the barrel during rotation thereof in said forward plating direction, and a one-way discharge tube mounted on the rearward end wall of the barrel, said rearward end wall having a parts discharge opening adjacent the periphery of the barrel, said discharge tube having one end communicating with said discharge opening, said opening

forming the leading end of said discharge tube upon rotation of the barrel in said reverse discharge direction, said discharge tube curving about said horizontal axis and including a delivery opening substantially on the opposite side of said horizontal axis, whereby the parts are discharged through said discharge tube during rotation of the barrel in reverse discharge direction.

11. A batch-type electroplating machine comprising a plating barrel rotatable about a generally horizontal axis in a forward plating direction and in a reverse discharge direction, the barrel adapted to contain a batch of parts and a liquid plating bath, said barrel having a forward end wall and a rearward end wall, said forward end wall having a central charging opening, said rearward end wall including a drainage opening delineating the level of a liquid plating bath in the barrel, said level being below the said horizontal axis, cathode means within the barrel conducting the cathode side of an electrical plating circuit to the batch of parts in the barrel, an anode basket mounted within the barrel and rotatable therewith about said horizontal axis, said anode basket adapted to contain a batch of metallic anode pieces, means connecting the anode side of an electrical plating circuit to a batch of anode pieces in the basket, the anode basket having a periphery greater than the said drainage opening, whereby a portion thereof passes below the level of a plating batch delineated by said drainage opening, the plating circuit being completed from a batch of anode pieces in the basket, through the plating bath to a batch of parts in the barrel, a parts charging device mounted on the forward end wall of the plating barrel, the charging device confining a batch of parts to be plated and including a one-way parts feeding element rotating with the barrel and communicating with said central opening, said one-way feeding element extending forwardly from the central opening in the direction of rotation of the barrel in plating direction and thereby advancing the parts from the charging device through said central opening into the barrel, and a one-way discharge tube mounted on the rearward end wall of the barrel, said rearward end wall having a parts discharge opening adjacent the periphery of the barrel, said discharge tube having one end communicating with said discharge opening, said opening forming the leading end of said discharge tube upon rotation of the barrel in said reverse discharge direction, said discharge tube extending across said horizontal axis and including a parts delivery opening substantially on the opposite side of said horizontal axis, whereby the parts are discharged through said discharge tube during rotation of the barrel in reverse discharge direction.

12. A batch-type electroplating machine comprising, a plating barrel rotatable about a generally horizontal axis in a forward plating direction and in a reverse discharge direction, the barrel adapted to contain a batch of parts and a liquid plating bath, said barrel having a forward end wall and a rearward end wall, said forward end wall including a central charging opening generally concentric with said horizontal axis of rotation, control means communicating with the barrel maintaining a liquid plating bath in the barrel at a level below said horizontal axis, cathode means within the barrel conducting the cathode side of an electrical plating circuit to the batch of parts in the barrel, an anode basket mounted within the barrel and rotatable therewith about said horizontal axis, said anode basket adapted to contain a batch of metallic anode pieces, means connecting the anode side of an electrical plating circuit to a batch of anode pieces in the basket, the anode basket having a periphery which passes through the level of a bath as maintained by said control means, whereby the plating circuit is completed from a batch of anode pieces in the basket, through a plating bath to a batch of parts in the barrel, a parts charging cone mounted on the forward end wall of the plating barrel, the charging cone confining a batch of parts to be plated and including a

one-way parts feeding element rotating with the barrel, said feeding element extending generally at a tangent from one side of said central opening and presenting a surface which leads from said charging cone to said opening during rotation of the barrel in said forward plating direction, the feeding element thereby contacting and advancing the parts from the charging cone through said central opening into the barrel during rotation thereof in said forward plating direction, and a one-way discharge element mounted on the rearward end wall of the barrel, said rearward end wall having a parts discharge opening adjacent the periphery of the barrel, said discharge element having an end communicating with said discharge opening, said opening forming the leading end of said discharge element upon rotation of the barrel in said reverse discharge directions, said discharge element extending at least partially across said horizontal axis and including a delivery opening substantially on the opposite side of said horizontal axis, whereby the parts are discharged through said discharge element during rotation of the barrel in reverse discharge direction.

13. In an electroplating machine having a rotatable plating barrel adapted to contain a batch of parts and a liquid plating bath and having an anode basket mounted within the barrel and rotatable therewith, said basket providing the anode side of a plating circuit; means for conducting the cathode side of a plating circuit to the parts within said barrel comprising, a cathode shoe, said shoe being elongated and having a pair of side walls, a top wall, and a forward wall, said plating barrel having an opening therein, said opening being greater in size than height and width of said shoe, whereby said shoe is adapted to be inserted endwisely from the exterior of the barrel through said hand hole, an attachment element projecting outwardly from said shoe and hand hole, said shoe residing within said barrel with the forward wall thereof located at the leading end of the shoe in the direction of rotation of the barrel, whereby said shoe passes lengthwise through a batch of parts at the lower portion of the barrel during rotation thereof, and a detachable retainer element on said attachment element, said retainer element seated against the external periphery of the barrel and clamping the shoe against the internal surface of the barrel, and means conducting the cathode side of a plating circuit to said shoe, whereby a plating circuit is completed from the said anode basket, through a plating bath in the barrel to the parts in contact with the cathode shoe during advancement of the shoe through the parts in the barrel.

14. In an electroplating machine having a rotatable plating barrel adapted to contain a batch of parts and a liquid plating bath and having an anode basket mounted within the barrel and rotatable therewith, said basket providing the anode side of a plating circuit; means for conducting the cathode side of a plating circuit to the parts within said barrel comprising, a cathode shoe, said shoe being elongated and having a pair of side walls, a top wall, and a forward wall which inclines downwardly and forwardly from said top wall, said plating barrel having an opening which is greater in size than the height and width of said shoe, whereby said shoe is adapted to be inserted endwisely from the exterior of the barrel through said hand hole, an attachment element projecting outwardly from said shoe through said hand hole, said shoe residing within said barrel with the inclined forward wall thereof located at the leading end of the shoe in the direction of rotation of the barrel, whereby said inclined end wall creates a plowing action during passage of the shoe through a batch of parts at the lower portion of the barrel during rotation thereof, and a detachable retainer element on said attachment element, said retainer element spanning the hand hole and seated against the periphery of the barrel adjacent the edges of the said hand hole, the retainer element clamping the shoe against the internal surface of the barrel, and means conducting the cathode side of a plating circuit to said shoe, whereby a plating circuit is completed from said anode basket, through a plating bath in the barrel to the parts in contact with the cathode shoe during advancement of the shoe through the parts in the barrel.

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