F. H. HARTZELL.

ELECTROPLATING APPARATUS.

APPLICATION FILED APR. 22, 1919.

**1,388,337.** **Patented Aug. 23, 1921.**

3 SHEETS—SHEET 1.

Fig. 1.

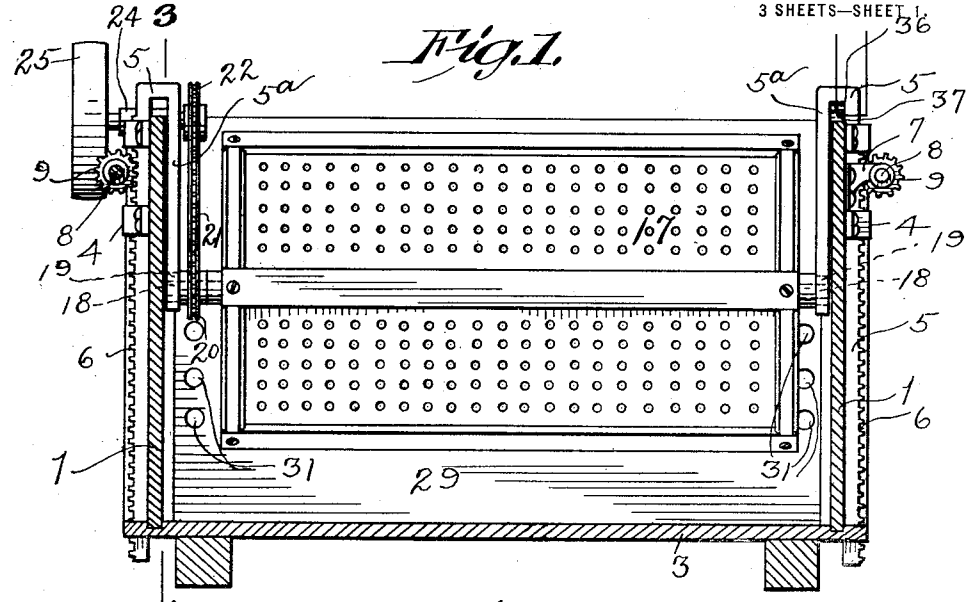
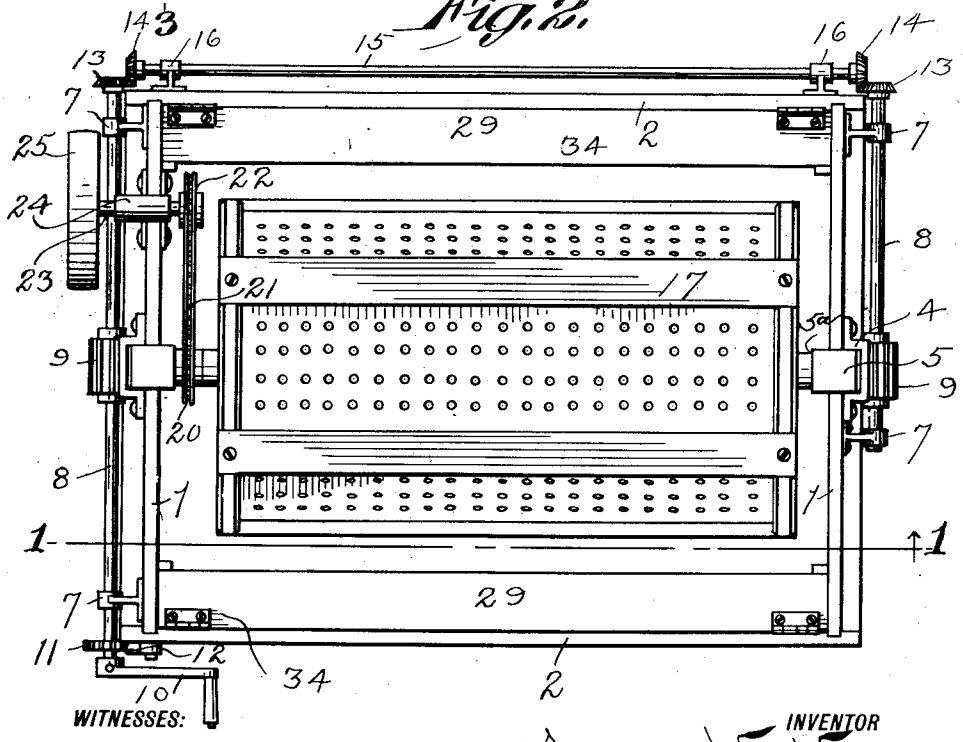



Fig. 2.




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3 SHEETS—SHEET 2.

Fig. 3.

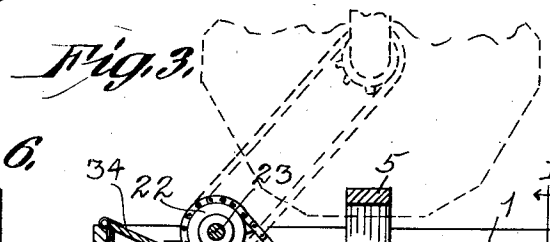


Fig. 6.

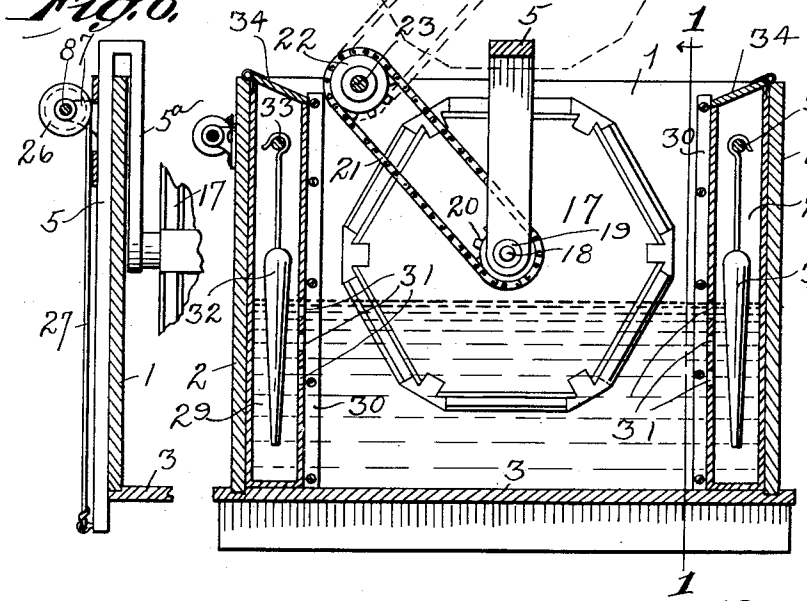



Fig. 7.

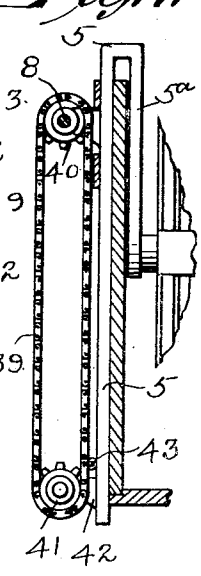



Fig. 4.

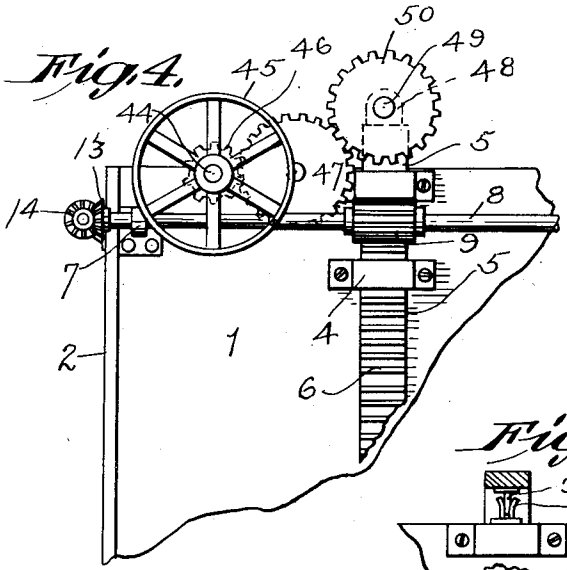



Fig. 5.

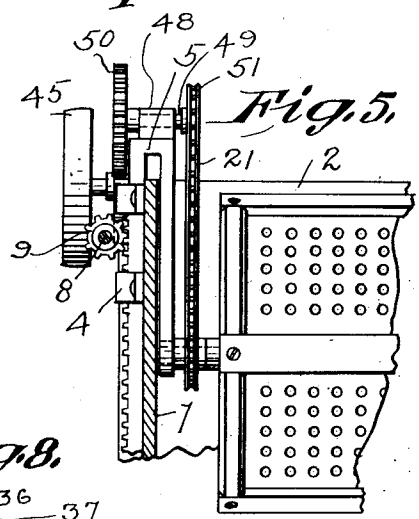
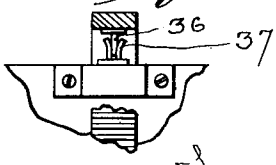



Fig. 8.




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3 SHEETS—SHEET 3.

Fig 9

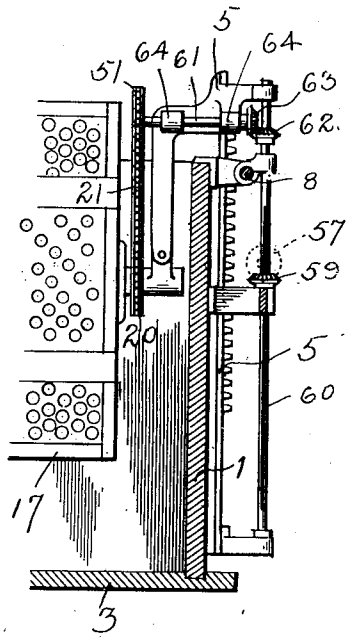



Fig 10

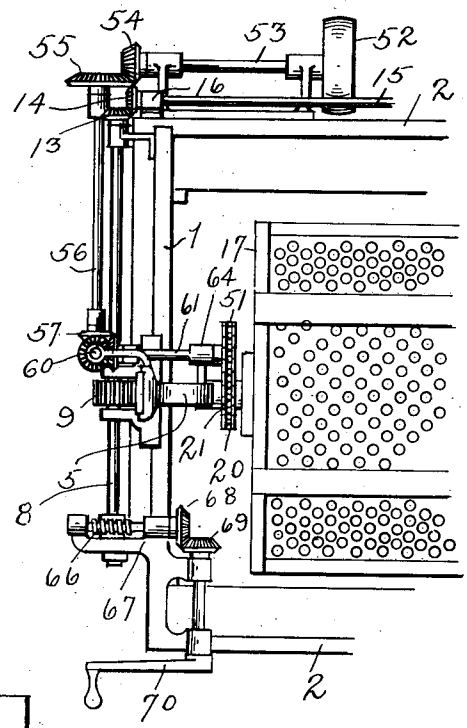
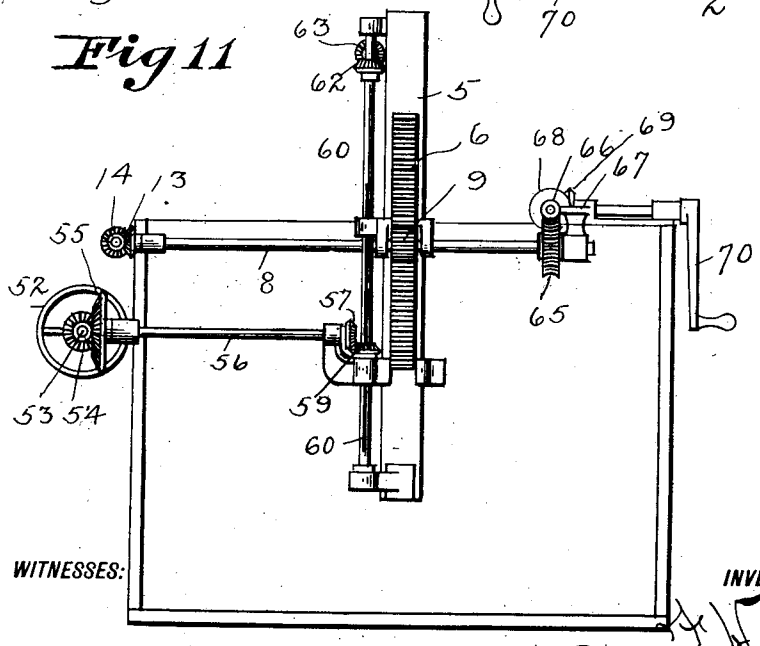



Fig 11




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# UNITED STATES PATENT OFFICE.

FOREST H. HARTZELL, OF DAYTON, OHIO.

## ELECTROPLATING APPARATUS.

1,388,337. Specification of Letters Patent. Patented Aug. 23, 1921.

Application filed April 22, 1919. Serial No. 291,893.

*To all whom it may concern:*

Be it known that I, FOREST H. HARTZELL, citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Electroplating Apparatus, (Case C,) of which the following is a specification.

My invention relates to electroplating apparatus of the rotary barrel type and particularly to means for supporting and driving the barrel and to improvements in the tank or vat in which the barrel is rotated.

The object of the invention is to improve the structure as well as the means and mode of operation of such devices, whereby they will not only be cheapened in construction, but will be more efficient in use, convenient in operation, economical and unlikely to get out of repair.

A further object of the invention is to provide improved hoisting apparatus or vertically movable supports for the rotary drum, together with driving connections whereby the drum may be rotated in different positions of adjustment.

A further object of the invention is to provide an improved form of vat or tank having separate removable anode chambers whereby any impurities precipitated will be conveniently collected and may be easily removed without the necessity of draining the tank.

With the above primary and other incidental objects in view as will more fully apper in the specification, the invention consists of the features of construction, the parts and combinations thereof, and the mode of operation, or their equivalents, as hereinafter described and set forth in the claims.

Referring to the drawings, Figure 1 is a longitudinal sectional view of the apparatus. Fig. 2 is a plan view thereof. Fig. 3 is a transverse sectional view on line 3—3 of Fig. 1, showing the elevated position of the drum by dotted lines. Figs. 4 and 5 are an end elevation and side elevation respectively of a modification of the drum driving mechanism. Fig. 6 is a detail view of a modification of the elevating means, employing a cable and winding drum. Fig. 7 illustrates a further modification thereof, employing a chain and sprockets. Fig. 8 is a detail view of the electrical contact automatically made and broken by the movement of the barrel. Figs. 9, 10 and 11 illustrate gear driving means for actuating the barrel in all positions of adjustment, and frame driven elevating means by which the barrel is held at various levels. In these views, Fig. 9 is a side elevation, Fig. 10 a top plan view, and Fig. 11 an end elevation of such driving and elevating means.

Like parts are indicated by similar characters of reference throughout the several views.

In constructing the apparatus there is employed a vat or tank comprising end walls 1, side walls 2 and bottom 3 of wood, slate, composition or any other suitable material interconnected in any suitable or convenient manner to form a leak-tight compartment. Mounted in suitable keepers or guides 4 on the outer faces of the end walls 1 of the tank are vertically movable inverted U-shaped or goose neck standards 5 one leg of which projects over the top of the end wall 1 and downward within the tank or vat. The outer leg of the standard or support reciprocates within the guides or keepers 4 and is preferably provided with a series of rack teeth 6. Mounted in suitable bearings 7 on the ends 1 of the tank are transverse shafts 8 each carrying a spur pinion 9 meshing with the rack teeth 6 of the reciprocatory standards 5. These shafts 8 at opposite ends of the tank may be interconnected by any suitable means in order that they will rotate in unison. In Fig. 2 one of the shafts 8 is shown provided with an operating crank or handle 10 at one extremity thereof by which the interconnected shafts 8 may be rotated to simultaneously elevate or lower the reciprocatory supporting standards 5. Secured to the shaft 8 adjacent to the crank handle 10 is a ratchet wheel 11 engaged by a pawl 12 to retain the shafts and supporting standards in their operative positions. In Fig. 2 each of the transverse shafts 8 is shown provided at one extremity with a bevel gear pinion 13 meshing with corresponding gear pinions 14 carried at each end of a longitudinally disposed shaft 15 mounted in suitable bearings 16 upon the sides 2 of the tank. By this means any movement given to one shaft 8 is transmitted to the second shaft, causing said shafts to rotate in unison. It will be understood that other driving connections such as chains, belts or

link connections may be provided in lieu of the gear shaft 15.

Pivotally mounted in the lower ends of the inner dependent legs 5ª of the reciprocatory standards is the revoluble tumbling barrel 17 in which the articles to be plated are placed. The barrel or drum 17 may be of any suitable or convenient construction. Inasmuch as the barrel or drum *per se* forms no part of the present invention and its particular construction is not essential to the operation of the apparatus forming the subject matter hereof the barrel or drum will not here be described in detail. However, for a detail description of a suitable drum reference is made to applicant's copending application of even date. It is to be understood, however, that any rotary drum may be employed. The drum 17 is supported in the pendant legs 5ª of the supporting standards by means of oppositely disposed trunnions 18 engaging in suitable bearings or bushings 19 located in said pendant legs 5ª. The bushings 19 are preferably of bronze or some other wear resistant electrically conductive material. Mounted upon one of the trunnions 18 intermediate the end of the barrel or drum 17 and the supporting leg 5ª is a sprocket wheel 20 connected by a drive chain 21 with a similar sprocket 22 carried upon a drive shaft 23. The drive shaft 23 is mounted in suitable bearing sleeves 24 supported upon the end wall 1 of the tank and carries at its outer end a drive pulley 25. It will be understood that the rotation of the drive pulley 25 and shaft 23 upon which the pulley is carried will cause the rotation of the barrel or drum 17 in its supporting bearings in the pendant legs 5ª. It will be seen that this driving connection will be maintained throughout the range of adjustment of the barrel and supporting standards. While the drive chain will be comparatively tight at each limit of vertical movement of the barrel or drum and will possess more or less slack at various intermediate points, such slack will not necessarily be objectionable. The purpose of rotating the barrel or drum 17 after being elevated from the tank or vat is to thoroughly drain the electrolyte from the plated articles therein. This is particularly desirable when plating articles having cavities or recesses therein which serve to collect the electrolyte. By rotating the barrel or drum and tumbling the articles therein, after their removal from the vat any cup-shape or recessed articles are emptied and thoroughly drained before their discharge from the drum or barrel. Being tumbled and drained immediately above the vat, all drainings of electrolyte are returned to the vat. In detail view, Fig. 6 there is shown a modification of the hoisting or elevating means in which the rack teeth 6 are omitted from the standards 5 and a drum or reel 26 is mounted upon the transverse shaft 8 in lieu of the driving pinion 9. A flexible cable or chain 27 is attached at one end to the lower end of the reciprocatory standard 5 and engaged at its opposite end upon the reel or drum 26. The rotation of the reel or drum upon the rotation of the shaft 8, serves to wind the flexible cable or chain 27 thereupon and so draw the standards 5 upward, elevating the drum or barrel out of the tank.

Located on each side of the vat or tank adjacent to the side walls 2 and parallel with the barrel or cylinder are movable anode compartments 29 vertically movable in guides or channels formed by strips 30 secured to the end walls 1. The inner or adjacent walls of the removable compartments 29 are provided with pluralities of holes or openings 31 through which the electrolyte or plating fluid has free circulation between the interior of the anode compartments and the tank or vat. The holes or perforations 31 do not extend entirely to the bottom of the compartments 29, but the lower portions of the adjacent walls are unperforated thereby forming in the bottoms of the compartments 29 receiving chambers for sludge or impurities which may be precipitated. This precipitate being collected in the bottoms of the compartments 29 is easily and readily removed by the removal of such compartments without the necessity of draining the entire tank or vat. Furthermore the compartments 29 prevent the anodes 32 suspended from the conductors or anode rods 33 from being splashed with electrolyte as the barrel is rotated. The evaporation of moisture or electrolyte splashed upon the anodes and conductor rods 33 forms a deposit thereon or causes corrosion which retards the passage of current and seriously impairs the efficiency of the apparatus. By the use of the compartments 29 which inclose the anodes and their connections these parts are fully protected against any fluid which may be dripped or splashed upon the electrical connections during the operation of raising or lowering the barrel or drum and during its rotation in the vat. The electrical conductors are thus kept clean and in perfect working order, thereby insuring high efficiency. For convenient examination of the anodes or replacement as may be necessary, the compartments 29 are preferably though not necessarily provided with hinged covers 34 affording access to the anodes and their electrical connections. The opposite side of the electric circuit is connected with the contact bars within the drum or barrel 17 through a switch which is automatically opened and closed by the movement of the standards 5. Referring to Figs. 1 and 8,

there is provided within the bight of the goose neck standards 5 a contact 36 engaging and coacting with a double blade 37 suitably mounted upon the edge of the tank or vat somewhat in the manner of an ordinary knife switch. The switch member 37 mounted upon the tank is connected with the source of electrical energy while the switch member 36 carried within the bight of the standards 5 is connected either to the pendant legs $5^a$ of said standards or preferably by a separate electrical connection or wire with the bearing bushing 19 from which the current passes to the barrel or drum trunnion 18 and thence to the contact strips within the barrel. The construction is such that whenever the barrel or drum is elevated the electrical connection is automatically opened and upon the return of the barrel or drum to the vat the connection is automatically closed.

In Fig. 7 there is shown a further modification of the hoisting apparatus in which a sprocket chain 39 passes over a sprocket wheel 40 mounted upon the transverse shaft 8 in lieu of the gear pinion 9 and also over an idler sprocket 41 mounted in a suitable bracket 42 attached to the end of the tank. This chain 39 is interconnected at 43 with the lower end of the reciprocatory hoisting standard 5 whereby as the shaft 8 and sprocket 40 carried thereby are rotated, the chain 39 is caused to elevate said standard 5 to lift the drum or barrel 17 from the tank or vat. It will thus be obvious that sundry means of actuating the standards 5 may be employed.

In Figs. 4 and 5 is shown a modification of the driving mechanism which, however, only serves to operate the drum or cylinder when in lowered or operative position. In this construction a drive shaft 44 carries a drive pulley 45 and also a gear pinion 46 meshing with an idler gear 47 mounted upon the side of the tank. Mounted in suitable bearings 48 upon the standards 5 is a stub shaft 49 carrying at one end a gear wheel 50 meshing with the idler gear 47 and at its opposite end a sprocket wheel 51 connected with the barrel or drum 17 through the drive chain 21 before referred to. In this construction the gear wheels 47 and 50 are disengaged one from the other upon the upward movement of the supporting standards 5 and are reëngaged upon the return of said standards.

Figs. 9 to 11, inclusive, disclose a preferred form of construction somewhat similar to that shown in Fig. 5, but which affords constant driving connections throughout all positions of adjustment.

In this construction the driving power is applied to the pulley 52 mounted upon a driven shaft 53 which is connected by a bevel or miter gears 54—55 with a countershaft 56 mounted in suitable bearing upon the end of the tank. It is obvious that, if so desired, this shaft 56 might be extended and the driven pulley 52 mounted directly upon the shaft 56. The shaft 56 carries a bevel pinion 57 meshing with a similar pinion 59 which is splined upon a vertical shaft 60 mounted in suitable bearings carried by the vertically moving rack whereby the shaft 60 will reciprocate in unison with the rack or standard 5. Thus as the rack or standard is reciprocated to raise or lower the drum or barrel the shaft 60 slides to and fro through the gear pinion 59 but at all times maintains driving engagement therewith. At its upper end the shaft 60 drives a lateral shaft 61 by means of bevel pinions 62—63. This shaft 61 is mounted in bearing 64 on the reciprocatory standard 5 and carries at its inner end the sprocket 51 connected by the sprocket chain 21 with the barrel or drum sprocket 20 by which the drum is rotated as before described. The sliding engagement of the shaft 60 and the gear 59 maintains a constant driving connection by which the drum is rotated in all positions of adjustment.

In Figs. 10 and 11 there is also shown in lieu of the operating handle 10 and ratchet 11 for elevating the standards, a worm gear drive for the elevating mechanism. This driving mechanism comprises a worm gear 65 mounted on the shaft 8 and engaged by a worm 66 mounted in a suitable bearing bracket 67. Upon the stem or shaft of the driving worm 66 is mounted a bevel gear 68 meshing with a similar gear on the crank shaft 69 which is manually actuated by the crank 70. The barrel or drum when loaded becomes quite heavy. The worm drive elevating mechanism enables the lifting of the heavily loaded barrel or drum with minimum effort. Furthermore, the apparatus will be automatically maintained in any adjusted position by the interconnection of the worm drive elements.

Claims for the particular shaft and gear driving connection, illustrated in Figs. 9 to 11, are made in applicant's co-pending application Serial No. 383,215.

While the present invention has been herein described as applied to electroplating operation *per se*, it is to be understood that the invention is applicable to other operations or processes in which materials are to be tumbled in rotary drums or it may be applied to the operation of rumbles generally. Moreover the invention is used in connection with the electro-plating process for polishing operations. Heretofore it has been the practice to tumble the plated articles in a closed barrel or container in which is placed a quantity of cleansing or polishing material such as a soap emulsion or like preparation. The foreign material removed in the proc-

ess is thus held in the closed container and is constantly agitated among and around the articles being cleaned. My improved process of cleansing or polishing articles consists in employing the apparatus heretofore described or apparatus of like character, including the perforated drum instead of employing an imperforate container or barrel, and filling the tank with a cleansing or polishing solution in which the perforated barrel containing the articles operated upon, is rotated. By this method, the foreign material and particles detached will be deposited through the perforations of the barrel to the bottom of the tank instead of being agitated in close association with the articles. The articles to be cleaned are thus maintained in comparative clean solutions which will not necessitate frequent changes, and the cleansing and polishing operations are materially facilitated.

From the above description it will be apparent that there is thus provided a device of the character described, possessing the particular features of advantage before enumerated as desirable but which obviously is susceptible of modification in its form, proportion, detail construction or arrangement of parts, without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statutes, the invention has been described in language more or less specific as to certain structural features, it is to be understood that the invention is not limited to any specific details, but that the means and construction herein described comprise but one mode of putting the invention into effect, and the invention is therefore claimed in any of its possible forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention, what I claim is:—

1. In an electroplating apparatus of the character described, the combination with a vat, a revoluble drum, and actuating means therefor, of vertical reciprocatory supporting standards by which the revoluble drum is supported, and means for reciprocating said standards.

2. In an electroplating apparatus of the character described, the combination with a vat, a revoluble drum, and actuating means therefor, of a pair of inverted U-shaped or goose neck standards straddling the opposite walls of the vat with the inner legs of which the drum is engaged, and actuating means engaging the outer legs of the standards to vertically move said standards and the drum carried thereby.

3. In an electroplating apparatus of the character described, the combination with a vat, a revoluble drum, and actuating means therefor, of vertically movable supporting standards for said drum, parallel revoluble shafts, one pertaining to each standard, interconnecting means between each shaft and the corresponding standard, and interconnecting means between said shafts whereby the shafts are driven in unison to actuate the reciprocatory standards.

4. In an electroplating apparatus of the character described, the combination with a vat, a revoluble drum, and actuating means therefor, of a pair of reciprocatory gear racks, upon which said drum is supported, revoluble gear pinions engaging the racks, and means to rotate the pinions to actuate the gear racks to vary the elevation of said drum.

5. In an electroplating apparatus of the character described, the combination with a vat, a revoluble drum, and actuating means therefor, of a pair of vertically movable gear racks, suspension members extending within the vat and connecting the revoluble drum with said gear racks, actuating pinions for said gear racks, and means for driving said gear pinions in unison.

6. In an electroplating apparatus of the character described, the combination with a vat, a revoluble drum, and actuating means therefor, of a pair of reciprocatory standards mounted upon opposite walls of the vat, pendant arms carried by said standards and extending within the vat, in which said revoluble drum is journaled, and means for reciprocating said standards in unison to raise and lower said drum.

7. In an electroplating apparatus, the combination with a vat, a revoluble drum therein, means for raising and lowering the drum, of driving means for the drum operative to drive the drum in different positions of adjustment.

8. In an electroplating apparatus, the combination with a vat, a revoluble drum therein, means for raising and lowering the drum, of driving means for the drum adapted to maintain its operative engagement throughout the range of vertical adjustment of the drum.

9. In an electroplating apparatus, the combination with a vat, a revoluble drum therein, means for raising and lowering the drum, of driving means for the drum adapted to rotate the drum when the lattr is elevated above the vat.

10. In an electroplating apparatus, a vat, a revoluble drum normally positioned therein, hoisting means for the drum, and flexible driving means maintaining operative engagement with the drum throughout its range of adjustment under the influence of the hoisting means.

11. In an electroplating apparatus, the combination of a vat, a revoluble drum normally positioned therein, means for rotating

the drum, an anode suspended within the vat, and a removable collecting receptacle for impurities precipitated from said anode.

12. In an electroplating apparatus, the combination of a vat, a revoluble drum normally positioned therein, means for rotating the drum, an anode within the vat, and a removable compartment within the vat to receive the precipitates deposited from said anode.

13. In an electroplating apparatus, the combination of a vat, a revoluble drum normally positioned therein, means for rotating the drum, an anode, and a removable compartment intercommunicating said vat inclosing said anode to collect the precipitate deposited therefrom.

14. In an electroplating apparatus, the combination of a vat, a revoluble drum normally positioned therein, means for rotating the drum, an anode suspended in said vat, and a perforated wall in said vat extending from above the fluid level to the bottom thereof intermediate the anode and the drum.

15. In an apparatus of the character described, a vat, a revoluble drum therein, vertically reciprocatory supporting standards for said drum, means to reciprocate the standards and driving connections for rotating the drum carried by the standards.

16. In an apparatus of the character described, a vat, a revoluble drum movable into and out of the vat, means for movably supporting said drum and driving means for the drum movable therewith whereby the drum may be rotated in different positions of adjustment.

17. In an apparatus of the character described, a vat, a revoluble drum, vertically movable standards, from which the drum is revolubly suspended, a longitudinally movable revoluble shaft movable in unison with the standard, a driving member with which the shaft is slidingly engaged, and a driving connection between said shaft and the drum.

18. In an apparatus of the character described, a vat, a revoluble drum therein, vertically reciprocatory supports for the drum, a rotary actuating shaft for said supports and a worm gear drive mechanism for said shaft, whereby the supports will be automatically held in their adjusted positions.

19. In an apparatus of the character described, a vat, a drum therein, adjusting means therefor including a reciprocatory rack, a gear pinion actuating the rack and a worm gear driving mechanism for said gear pinion, substantially as specified.

20. In an apparatus of the character described, a vat, a revoluble drum, means for movably supporting the drum for vertical adjustment into and out of the vat, a relatively fixed drive shaft, a drive wheel carried thereby, a driven wheel carried by the drum, and a drive belt connecting the driving and driven wheels operatively connecting the driving and driven wheels as the drum approaches the opposite limits of its vertical adjustment.

21. In an apparatus of the character described, a vat, a revoluble drum, means for movably supporting the drum for vertical adjustment into and out of the vat, a relatively fixed drive shaft, a sprocket carried thereby, a second sprocket operatively connected with the drum, and a drive chain connecting said sprockets throughout the range of adjustment of said drum.

22. The herein described process of cleaning or polishing articles by tumbling them in a perforated rotary drum or barrel the lower portion of which is submerged in a body, of cleansing or polishing solution in a vat, which substantially covers the articles within the drum or barrel to be cleaned or polished, whereby the particles of foreign material detached during the tumbling operation will be deposited through the perforations of the drum or barrel to the bottom of the vat.

23. In an electroplating apparatus the combination with a vat, means for supporting therein articles to be plated, and an anode of a removable receiver extending beneath the anode to collect precipitates deposited therefrom.

24. In an electroplating apparatus, the combination with a vat, means for supporting therein articles to be plated, and an anode of a compartment inclosing said anode, having intercommunicating passages for the electrolyte between said compartment and the main chamber of the vat, said intercommunicating passage being located in spaced relation above the bottom of the compartment.

In testimony whereof I have hereunto set my hand this 31st day of March, A. D. 1919.

FOREST H. HARTZELL.

Witnesses:
E. E. DUNCAN,
ADELLA SHANNON.