Jan. 1, 1929. 1,697,240

F. H. HARTZELL

ELECTROPLATING APPARATUS

Filed May 21, 1920 2 Sheets-Sheet 1

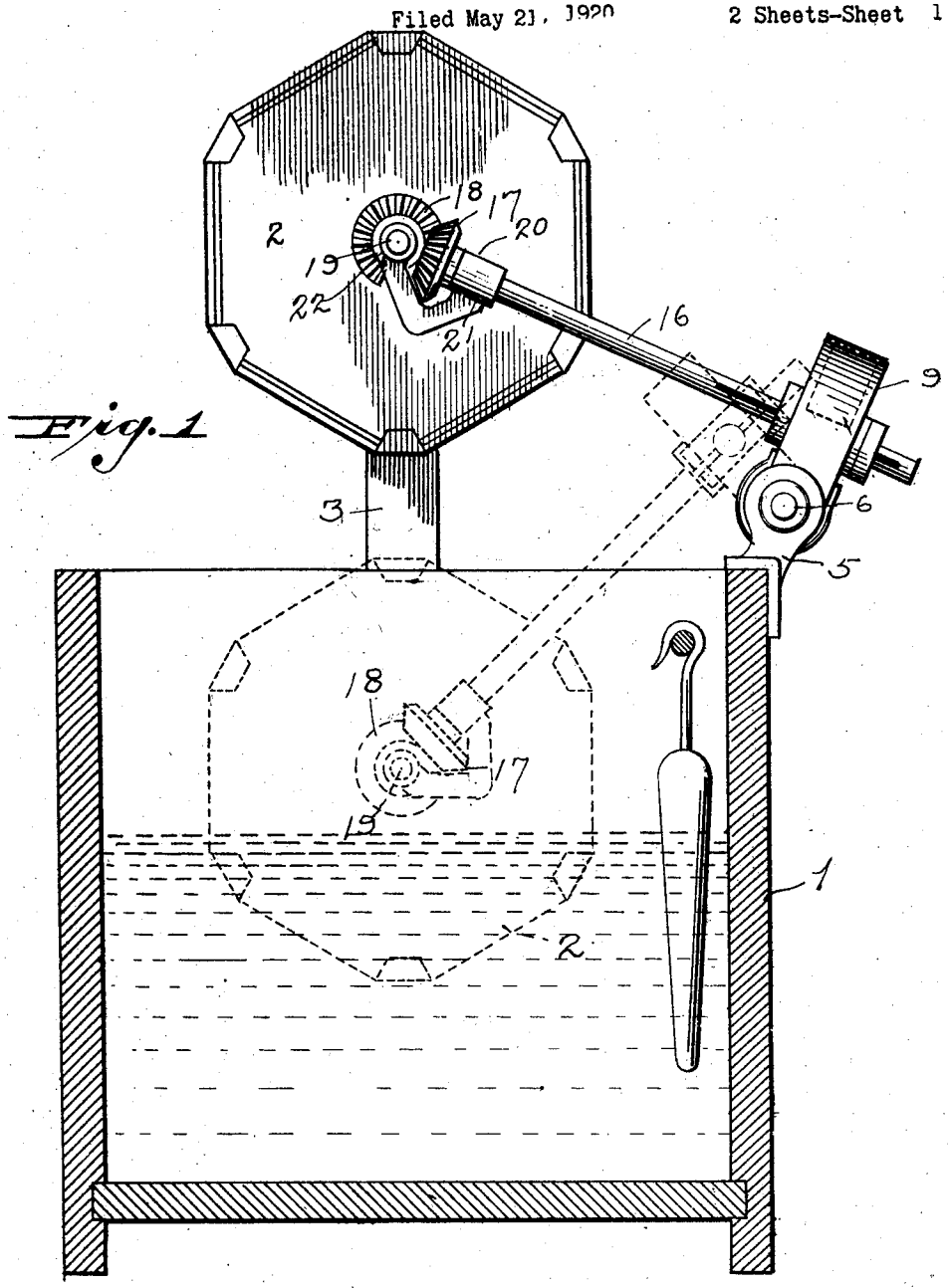


Fig. 1

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Fig. 4

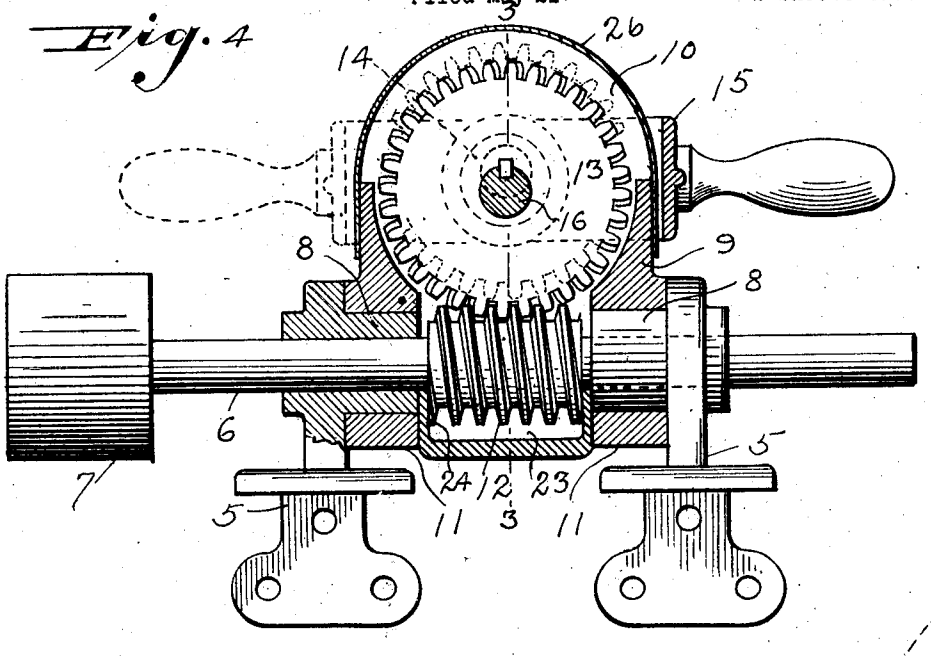


Fig. 2

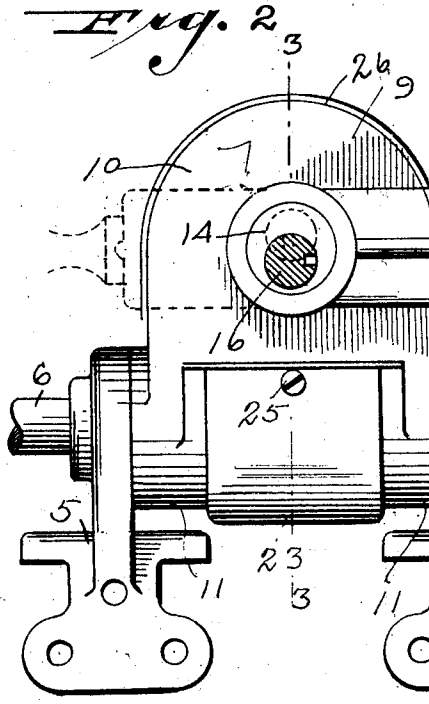
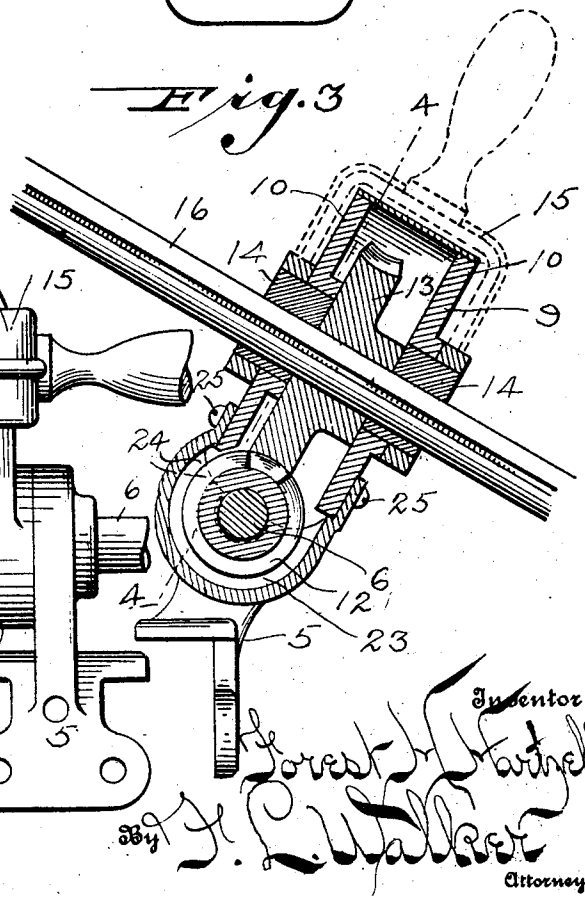


Fig. 3



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UNITED STATES PATENT OFFICE.

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ELECTROPLATING APPARATUS.

Application filed May 21, 1920. Serial No. 383,215.

This invention relates to power transmission apparatus for actuating a driven member or apparatus in various positions of adjustment to which the driven member or apparatus is movable in relation with and independent of the source of power or prime mover. While the mechanism has been herein shown and will be described in conjunction with an electroplating apparatus, to which it is particularly applicable, it is to be understood that the mechanism is not limited to this application or association, but may be utilized for actuating other movable apparatus from a stationary power shaft.

The object of the invention is to simplify the structure as well as the means and mode of operation of transmission mechanism of this character, and particularly the driving mechanism for electroplating barrels, or other elements having to and fro movement in addition to their rotation, whereby such mechanism will not only be cheapened in construction, but will be more efficient in use, positive in operation, easily controlled and unlikely to get out of repair.

A further object of the invention is to provide means by which the driven element may be continuously rotated throughout an extended path of reciprocatory movement, and to further provide means for easily and quickly disconnecting the driving mechanism at any point of adjustment of the driven apparatus or member.

A further object of the invention is to provide a universal driving connection in which the driver is capable of oscillatory adjustment during operation.

A further object of the invention is to provide improved means for connecting and disconnecting relatively movable driving and driven members, and to further provide an adjustment mounting for a worm gear mechanism.

With the above primary and other incidental objects in view as will more fully appear 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, Fig. 1 is an end elevation of an electroplating apparatus partly in section to which the present invention has been applied. Fig. 2 is a side elevation of the worm gear housing, and supporting trunnions therefor. Fig. 3 is a section on line 3—3 of Fig. 2. Fig. 4 is a section on line 4—4 of Fig. 3.

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

In Fig. 1 of the accompanying drawings, 1 is an electroplating tank, and 2 the electroplating barrel mounted for revoluble movement when submerged in the plating solution within the tank 1, and capable of being elevated out of the said tank. The plating barrel 2 has been shown in its elevated position, in solid lines, and in its lowered or operative position by dotted lines. Any suitable means may be used for raising and lowering the barrel 2. It is a common practice to raise and lower such plating barrel by a block and tackle suspended from the ceiling or from an overhead structure, but the barrel is preferably mounted in a suitable lifting apparatus such as illustrated in my co-pending application Serial No. 219,893, filed April 22, 1919, or an apparatus as disclosed in my issued Patent No. 1,276,649, dated August 20, 1918. The electroplating apparatus per se, and methods of raising and lowering the revoluble plating barrel, forms no part of the present invention, and has therefore, not been shown in detail. However, there is shown in Fig. 1 an upright or support 3, which may correspond with the vertically sliding upright or standard of the pending application before mentioned or the stationary standard of the patented construction.

Heretofore, various means of rotating the barrel 2 when in its lowered or operated position have been employed. In some instances, the barrel has been engaged by a drive belt, operated from a line shaft. In other instances, sprocket chains and driving gears usually comprising a gear rim secured to the barrel, and a driving pinion mounted upon the tank has been employed. As usually constructed, however, these driving devices were effective only when the barrel 2 is in its lowered or operative position, within the tank. Moreover, they were operative in only one position of the barrel, that is to say when it was submerged or lowered to a predetermined level. The present mechanism is designed to drive an electroplating barrel, or other revoluble apparatus, when adjusted to various levels, or at different points thruout a reciprocatory path of travel. The present mechanism is designed to rotate

the barrel not only when lowered within the tank, but also when elevated to its highest position in order to agitate and drain the plated articles within the barrel and also to rotate the barrel at any intermediate point thus enabling the barrel to be driven at any level or any degree of submergence in the plating solution within the tank.

Mounted in suitable bearing brackets 5 secured to the side of the tank 1, or which may be for convenience mounted upon an adjacent wall or other structure, is a longitudinally disposed main drive shaft 6, which comprises the prime mover of the apparatus. This drive shaft 6 may carry a pulley 7 or be otherwise operatively connected with a suitable source of power. The bearing brackets 5 are provided with inward projecting bosses or trunnions 8 upon which is pivotally mounted for oscillatory movement concentric with the main shaft 6, a worm gear housing 9. This worm gear housing 9 comprises two semicircular walls 10 spaced one from the other, and formed integral with spaced bearing bosses 11, within which the trunnions 8 engage. Secured upon the drive shaft 6 within the housing 9 intermediate the bearing bosses 11, and consequently intermediate the brackets 5 is a worm 12, which intermeshes with and drives a worm wheel 13 mounted within the main portion of the housing 9 intermediate the side walls 10. Concentrically mounted for revoluble adjustment in the side walls 10 are two bushings 14 alined one with the other and fixedly engaged with the arms of a bifurcated hand lever 15. The hand lever 15 straddles the housing 9 and by its oscillation to and fro the bushings 14 are rotated in their bearings in the side walls 10 of the housing 9. Eccentrically mounted in the bushings 14 for both longitudinal sliding movement and revoluble movement therein is a power transmission shaft 16. The shaft 16 carries intermediate the side walls 10 and bushings 14 the worm gear 13 before mentioned, which is splined upon the shaft 16, whereby the shaft is rotated in unison with the worm gear, but is capable of a sliding movement in a longitudinal direction thru said gear, while maintaining driving connection therewith. The power transmission shaft 16 being eccentrically mounted in the rotary bushings 14 is shifted laterally to and from the worm upon oscillation of the hand lever 15, carrying with it the worm gear 13, which is thus moved into and out of mesh with the driving worm. This adjustment of the worm and worm wheel, by which the operating parts are connected and disconnected, is best illustrated in Fig. 4 in which the worm wheel and control lever are shown in operative position in solid lines, and in their inoperative or disconnected position by dotted lines.

The power transmission shaft 16 may be connected in any suitable or desired manner with the driven member or apparatus. However, for application to an electroplating apparatus, as shown in the drawings, the power transmission shaft 16 is provided at its extremity with a beveled gear 17 meshing with a corresponding bevel gear 18 carried fixedly upon the trunnion shaft of the plating barrel 2. These gears 17 and 18 are held in mesh one with the other, and the transmission shaft 16 in its proper radial relation with the trunnion 19 of the plating barrel 2, by a connecting bracket 20, having formed thereon right angle bearing sleeves 21 and 22 for the power transmission shaft 16 and the barrel trunnion 19 respectively. The rotation of the bearing bushings 14 in the housing 9 gives to the power transmission shaft 16 a lateral deflection, which is not compensated for by the oscillation of the shaft and connecting bracket 20 about the trunnion 19. That is to say, the vertical differential movement of the shaft 16 into and out of operative position in relation with the driving worm is compensated for by the pivotal movement of the bracket 20 about the trunnion 19. However, in effecting this vertical movement the shaft is given a slight lateral movement incident to the rotation of the bearing bushing 14. To accommodate the shaft thru this movement and compensate for the lateral deflection, the bearing of the shaft 16 in the sleeve 21 of the bracket 20, is comparatively loose, or what is known to mechanics as " a sloppy fit". The deflection of the shaft at the bearing point in the sleeve 21 will be very slight.

In operation, the main shaft carrying the worm drives the worm gear 13, which in turn drives the transmission shaft 16 from which power is transmitted thru the bevel gears 17 and 18 to the plating barrel. The plating barrel 2 may be raised and lowered while this driving connection is maintained without in any way interfering therewith. During the vertical adjustment of the barrel into or out of the tank 1, the driving mechanism including the power transmission shaft 16 and the housing 9 with the worm wheel enclosed therein, oscillates about the main shaft 6, while at the same time the shaft 16 has a reciprocatory movement thru the housing 9 and worm wheel 13 to compensate for the differential movement of the parts. That is to say while the driving apparatus oscillates, about the power shaft as a center, the barrel 2 instead of traveling in an arcuate path concentric with this power shaft travels in a straight line, and hence the transmission shaft 16 recedes thru the housing and gear during a portion of the movement of the barrel, and is withdrawn therethru during the remainder of the movement. However, thru the slide connection of the worm wheel and shaft, the driving engagement is constanly maintained. During this adjustment, the worm wheel 13 oscillates concentrically about the drive

worm without changing its engagement or relation therewith. It is only by the reversal of the hand lever thereby rotating the eccentric bearings for the shaft 16 that the worm wheel is lifted out of engagement with the main drive worm.

To provide for ample lubrication, of the worm gear a detachable oil reservoir 23 is provided intermediate the bearing lugs 11 of the housing 9. This reservoir is formed concentric with the main drive shaft, and center of oscillation of the housing 9, and is provided with end walls 24, which are notched to extend on opposite sides of the main drive shaft, as shown in dotted lines in Fig. 3. This reservoir is detachably connected to the housing 9 by attachment screws 25, which permit its removal for inspection of the worm gear, and for replenishing of the oil supply. An arcuate rim 26 of sheet metal is fitted about the periphery of the housing 9, to close the intermediate space between the side walls 10. This rim is likewise removable for inspection of the worm gear wheel, and other parts. By means of the oil reservoir 23 and the rim 26, the gear is wholly enclosed and the operator and others are protected from injury thereby.

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, proportions, detail, construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

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

Having thus described my invention, I claim:

1. A construction wherein a revoluble member is mounted for shifting movement to various operative positions at different distances from its main driving element, characterized by a drive shaft mounted in stationary bearings, a worm gear carried thereby, an oscillatory mounting capable of swinging movement concentric with said drive shaft, a worm gear wheel revolubly carried in said mounting and actuated by the worm upon the drive shaft in different positions of swinging movement of the mounting, a power transmission shaft operatively connected with the gear wheel for rotary movement in unison therewith but capable of longitudinal sliding movement in relation therewith to compensate for the to and fro movement of the driven member, and an operative connection between the power transmission shaft and the driven member.

2. In a variable driving mechanism of the character described, a worm, a worm gear actuated thereby, an oscillatory mounting for the worm wheel movable concentrically in relation with the worm whereby the intermeshing engagement of said members is maintained thruout such oscillatory movement means for shifting the actuated gear into and out of mesh with the driving worm in various positions of oscillatory adjustment of such driven gear and its mounting, and power transmission elements connected with said worm and worm wheel.

3. A variable driving mechanism of the character described wherein a revoluble plating drum or the like is rotated in various positions of shifting movement transversely in relation with its axis of rotation, characterized by a worm, a worm gear normally meshing therewith, an oscillatory support for the worm gear swinging concentrically in relation with the worm, and an eccentric revoluble mounting for said worm gear in said support adapted by its oscillation to shift the worm wheel into and out of mesh with said worm independent of the swinging adjustment of the support.

4. A construction wherein a revoluble plating drum or the like is movable to and fro through a prescribed path of travel non-concentric with a stationarily located driving member, characterized by an oscillatory supporting member, a drive shaft concentric with the axis of the oscillatory support, a second shaft mounted in said support for rotary, longitudinal and lateral shifting movement, and intermediate driving connections by which the rotary movement is transmitted from one shaft to the other, and independent of which the longitudinal movement is effected to compensate for the differential movement of the drum or the like, said connections being engaged and disengaged by said lateral shifting movement, and means to effect such movements.

In testimony whereof, I have hereunto set my hand this 18th day of May A. D. 1920.

FOREST H. HARTZELL.