Feb. 28, 1939. W. C. HUEBNER 2,148,558

METHOD AND APPARATUS FOR COATING CYLINDERS

Filed Sept. 7, 1937 5 Sheets-Sheet 1

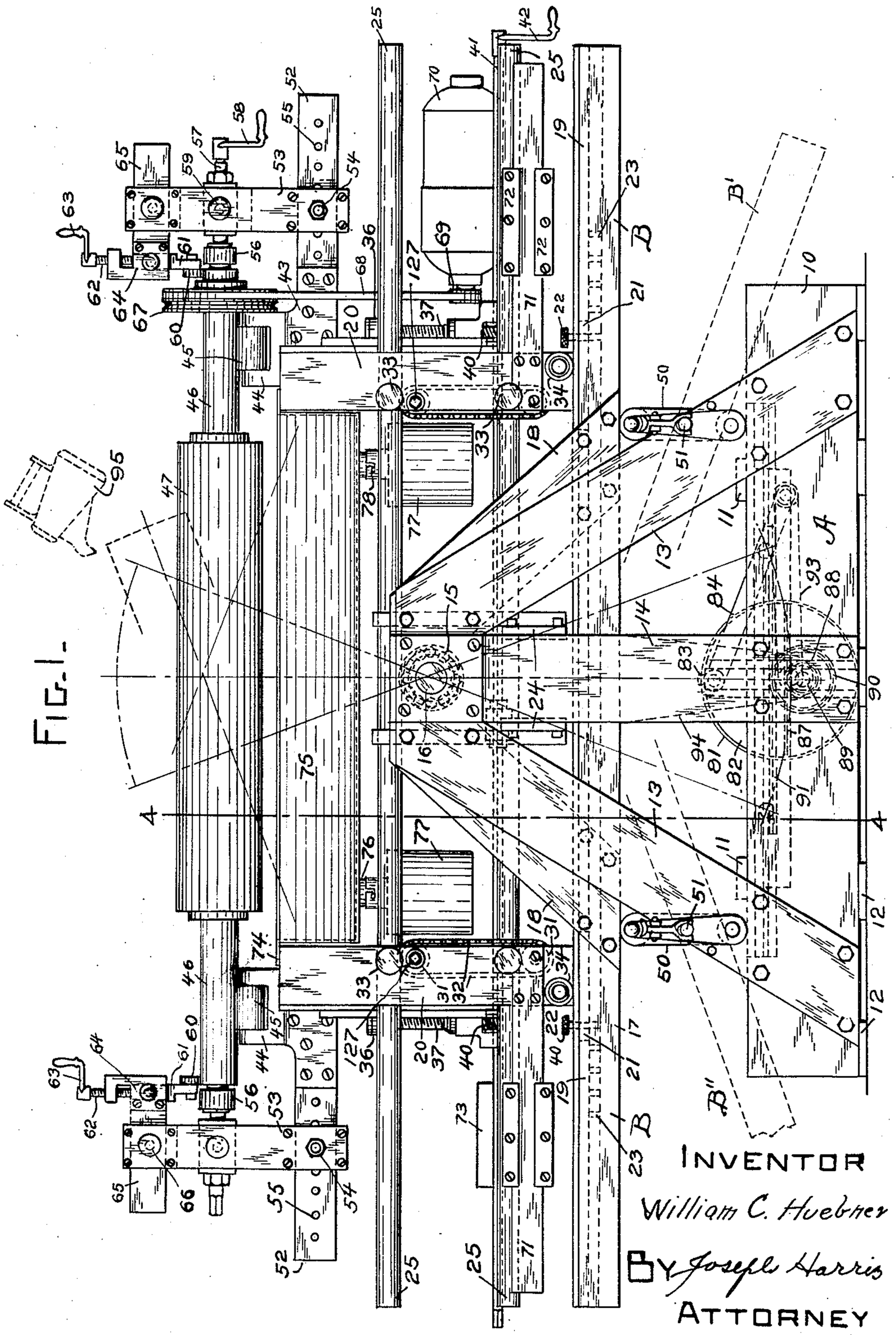

FIG. 1.

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METHOD AND APPARATUS FOR COATING CYLINDERS

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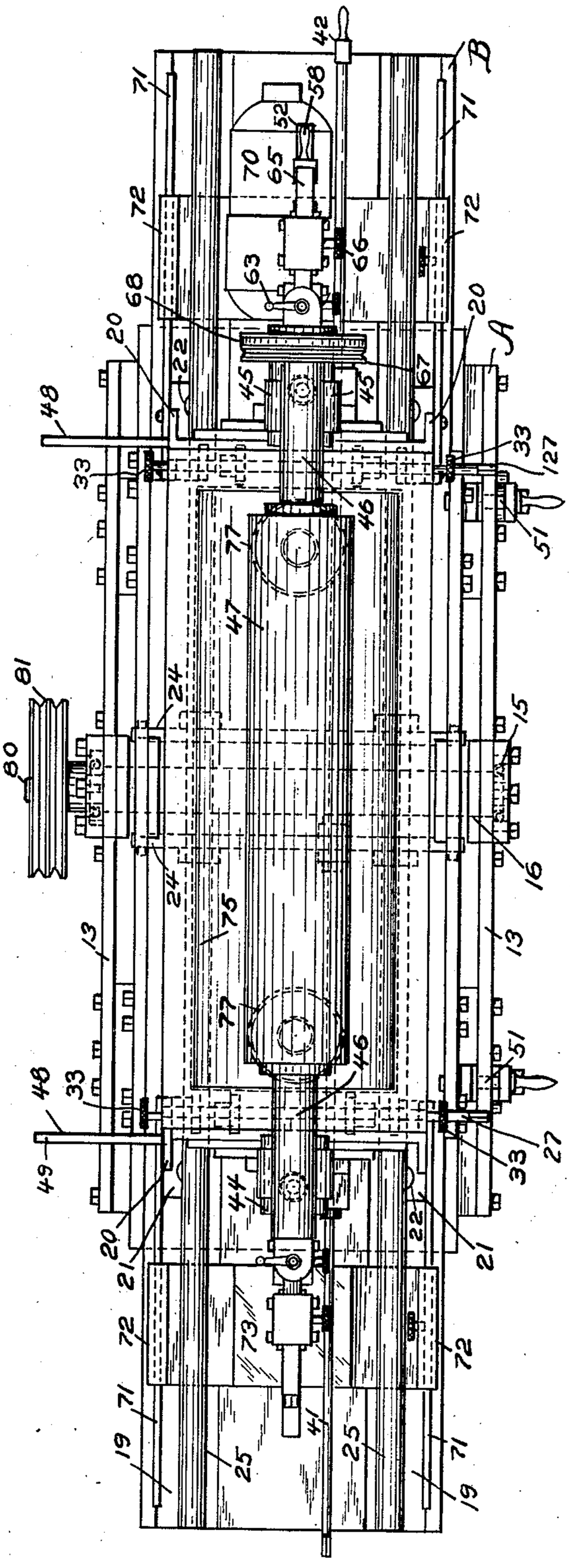

FIG. 2.

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METHOD AND APPARATUS FOR COATING CYLINDERS

Filed Sept. 7, 1937 5 Sheets-Sheet 3

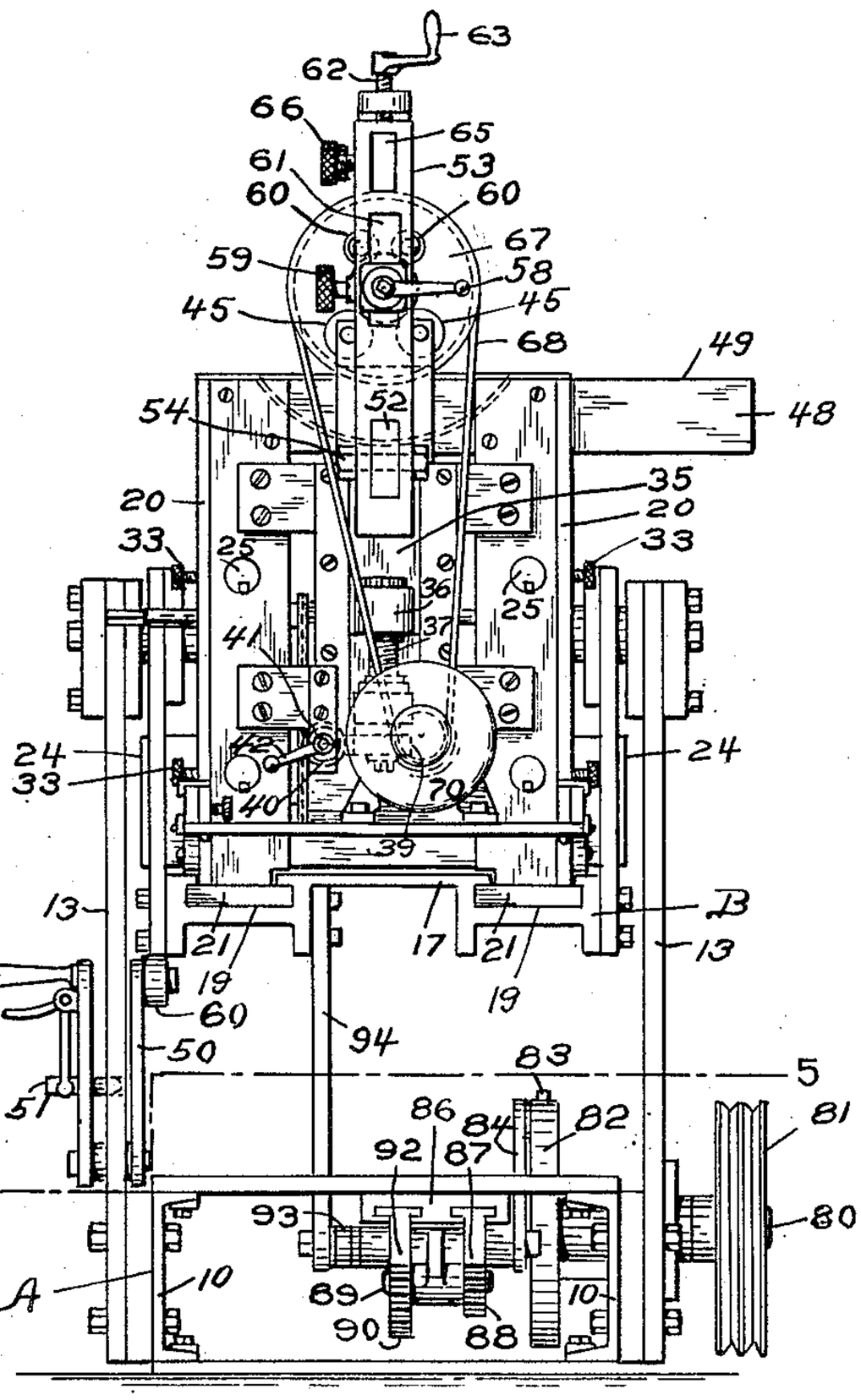

FIG_3_

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METHOD AND APPARATUS FOR COATING CYLINDERS

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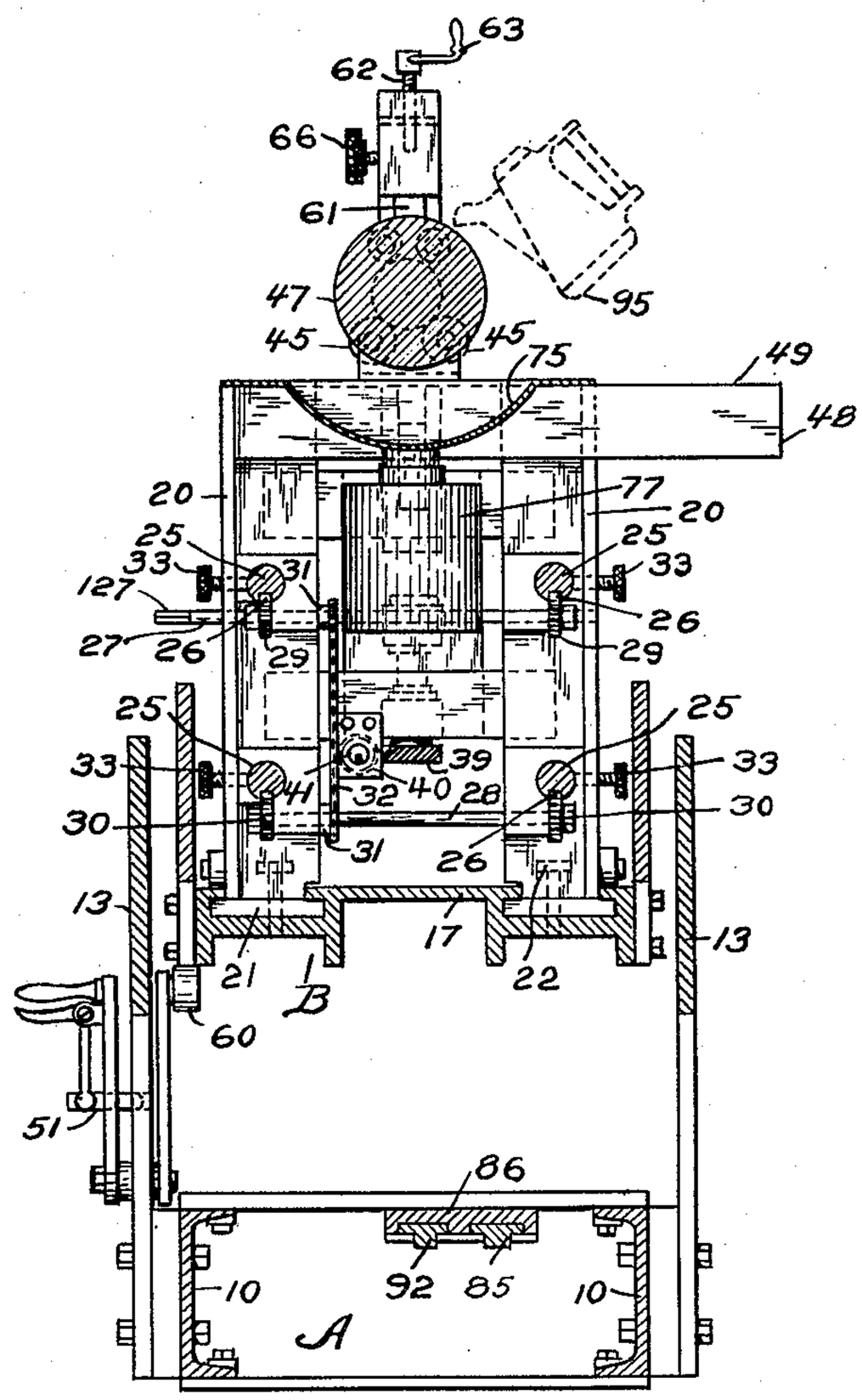

FIG_4_

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METHOD AND APPARATUS FOR COATING CYLINDERS

Filed Sept. 7, 1937 5 Sheets-Sheet 5

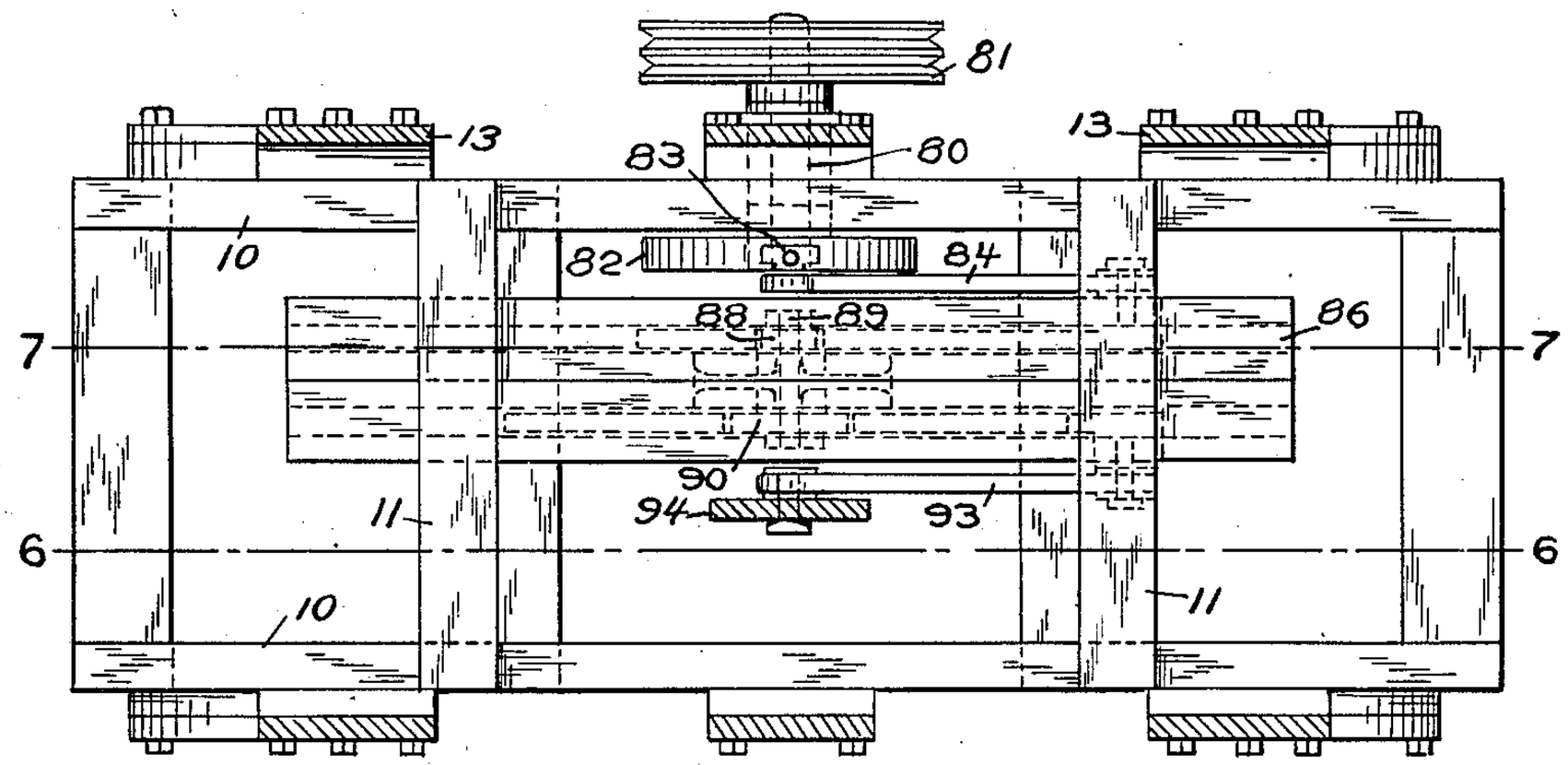

FIG. 5.

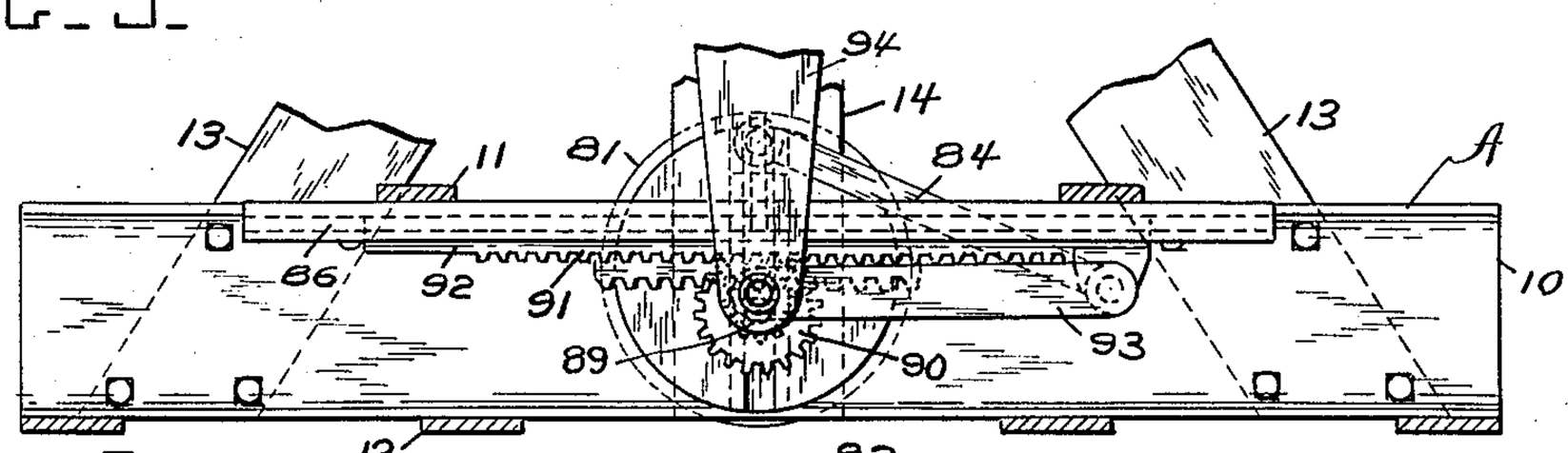

FIG. 6.

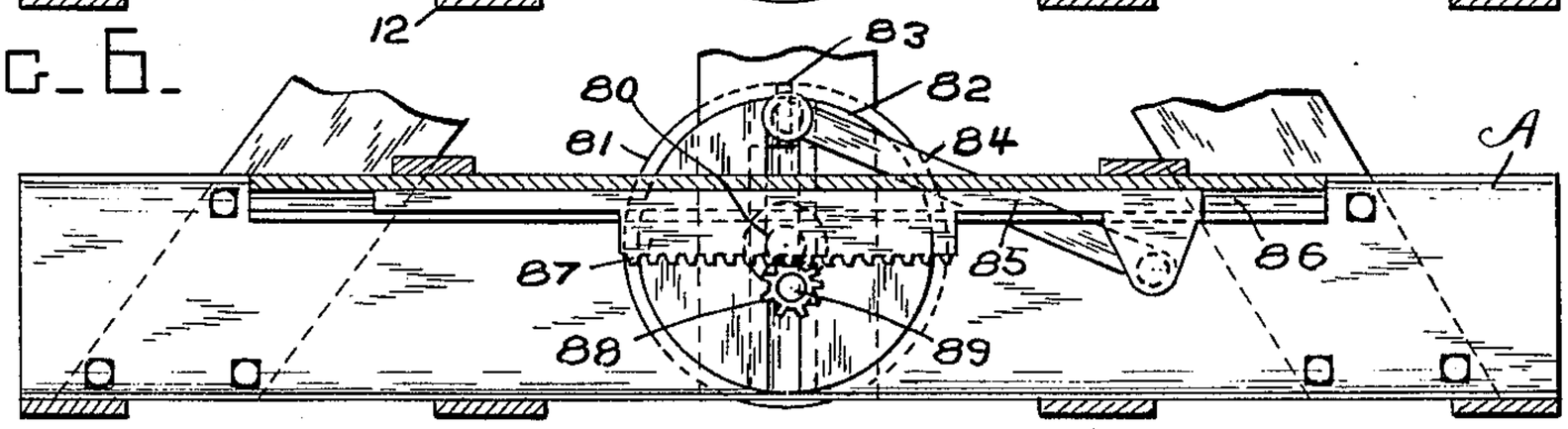

FIG. 7.

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Patented Feb. 28, 1939

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UNITED STATES PATENT OFFICE

2,148,558

METHOD AND APPARATUS FOR COATING CYLINDERS

William C. Huebner, New York, N. Y.

Application September 7, 1937, Serial No. 162,665

14 Claims. (Cl. 91—43)

This invention relates, generally, to improvements in method and apparatus for coating cylinders and, more particularly, the art of coating cylinders with light sensitive coatings or emulsions for use in rotogravure printing.

One object of the invention is to provide an improved method of applying to the cylindrical surfaces of cylinders, such as rotogravure cylinders, perfectly smooth, even coatings of uniform thickness throughout.

Another object of the invention is to provide an improved method of applying coatings of light sensitive solutions to the surface of cylinders, such as rotogravure cylinders, wherein a smooth, even, uniform distribution of the material is obtained by simultaneously combining, during the setting or congealing of the material, the flowing action of the material on the surface produced by rotating the cylinder about its own axis with the gravitational flowing action toward the ends of the cylinder produced by alternately positioning one end of the cylinder lower and then higher than the other end of the cylinder, as for instance, by bodily rocking or rotating the cylinder, as an entirety, about a horizontal axis transverse to the cylinder axis or by rocking or rotating the cylinder, as an entirety, about any axis inclined sufficiently with respect to the vertical as to produce the necessary endwise flow of the material on the cylinder.

A further object of the invention is to provide an improved method of applying coatings of light-sensitive material to the surfaces of cylinders as indicated in the two preceding paragraphs, such that variations in the two motions of rotation and rocking of the cylinder may be made as required to produce the most efficient results with coating materials having different characteristics.

Another object of the invention is to provide an economically and efficiently designed apparatus for carrying out the improved methods indicated in the preceding paragraphs.

Further specific objects of the invention are to provide an apparatus of the type indicated which may be readily adjusted to accommodate cylinders of different lengths and diameters, wherein the cylinders may be rotated at different speeds about the cylinder axes and bodily rocked or tilted variable amounts.

Other objects of the invention will more clearly appear from the description and claims hereinafter following.

In the drawings forming a part of this specification, Figure 1 is a front elevational view of a cylinder coating apparatus suitable for carrying out the improved process and incorporating the apparatus features of the invention. Figure 2 is a top plan view of the construction shown in Figure 1. Figure 3 is an end elevational view of the apparatus shown in Figure 1. Figure 4 is a vertical sectional view, corresponding substantially to the section line 4—4 of Figure 1. Figure 5 is a horizontal sectional view, corresponding substantially to the section line 5—5 of Figure 3 and Figures 6 and 7 are vertical sectional views corresponding to the section lines 6—6 and 7—7, respectively, of Figure 5.

Referring first to the apparatus embodiment of the invention as illustrated in the drawings, the same comprises, broadly, a main base or support A; and a carriage or cradle B.

The base A may be of any suitable construction of sufficient rigidity to support the heavy cylinders and operating parts. As shown, the base is built up of two longitudinally extending channels 10—10 connected at intervals therealong by upper and lower cross plates 11—11 and 12—12. Said base A is further provided, on each side thereof, with a triangular upright framework comprising diagonal members 13—13 and a central member 14, each of said side frames being provided, at the apex thereof, with a ball bearing, as indicated at 15, for a transverse spindle or shaft 16, by which is suspended the carriage B.

The carriage or cradle B, as shown, preferably comprises a horizontally extending bottom casting 17 which is suspended or supported from the heavy shaft or spindle 16 by diagonally disposed plates 18—18 arranged in pairs on opposite sides of the bottom casting 17. As best shown in Figures 3 and 4, the bottom casting 17 is formed, on its upper side, with longitudinally extending guideways 19—19 on opposite sides thereof. Horizontally adjustable back and forth in said guideways 19—19, are heavy built-up supports 20—20, each of which has flanged feet 21 received within the guides 19, as shown. The supports 20 are locked in adjusted position by any suitable means such as the pins 22 carried by the feet 21 and adapted to engage in any selected opening 23 of the bottom casting 17.

To facilitate adjustment of the supports 20 toward and from each other for the accommodation of cylinders of different lengths and to maintain proper alinement thereof, the following means are provided. Rigidly secured to the

carriage B adjacent the spindle or shaft 16 thereof, are transversely extending plates 24—24 in which are secured four bars 25—25 arranged in upper and lower pairs, as shown. Said bars 25 are extended to both sides of the center of the apparatus, and each is provided on its under side with a rack 26. As further evident from Figure 4, said bars 25 extend through the supports 20, the latter obviously being slidable back and forth with respect to said bars 25. Associated with each support 20 are two transversely extending shafts 27 and 28, the former carrying two pinions 29—29 cooperable with the adjacent racks 26 of the upper pair of bars 25, and the lower shaft 28 carrying similar pinions 30—30 cooperable with the racks of the lower pair of bars 25. The shafts 27 and 28 also carry sprocket gears 31 with which cooperates a sprocket chain 32 so that, when one of the shafts, as for instance, the shaft 27 as shown in Figure 4, is rotated by a crank handle applied to the suitably squared end 127 thereof, both shafts 27 and 28 will be rotated simultaneously and in the same direction to thereby adjust the support 20, as will be apparent. When the supports 20 have been adjusted to their desired position and locked by the pins 22, they are further secured against tilting or vibration by clamping screws 33—33 which engage the bars 25, as shown. To further facilitate the adjustment of the supports 20, each of the same may be provided with anti-friction rollers 34 at the bottom thereof riding upon suitable flanges of the base casting 17, as shown in Figures 1 and 4.

Each end support 20 has vertically adjustable thereon, a heavy crosshead 35 mounted in suitable guides. Each crosshead 35 has a nut section 36 with which cooperates an adjusting screw 37 swiveled in a bracket 38 secured to the support 20. At their lower ends, the adjusting screws 37 are provided with preferably herring bone gears 39 which cooperate with corresponding gears 40—40 splined to a longitudinally extending shaft 41 journaled in said cross plates 24 and extending loosely through suitable openings in the end supports 20. As will be evident, upon rotation of the shaft 41 as by a crank 42 applied at either end thereof, the two crossheads 35 are simultaneously and equally adjusted either up or down regardless of the adjusted positions of the end supports 20.

Each of the cross heads 35 has secured thereto, at the top, a heavy bracket 43. The latter is formed with a pair of upright forked bearings 44—44 for two supporting rollers 45—45 on which is adapted to be rotatably supported the usual trunnions 46—46 of a cylinder 47 such as used in rotogravure and as illustrated in the drawings, and the cylindrical surface of which is adapted to be coated in accordance with the present invention.

As understood by those skilled in the art, such cylinders are quite heavy, sometimes weighing several thousand pounds, and the same must be handled with extreme care in order to prevent injury to the surfaces thereof. To facilitate insertion of such heavy cylinders into coating apparatus of the present invention and to remove the same therefrom, each of the heavy end supports 20 is provided with a laterally extended heavy arm 48, the upper surface 49 of which is flush with the upper surface of the corresponding support 20. When inserting a roller in the improved apparatus, the trunnion supporting rollers 45 will be adjusted downwardly so as to lie below the level of the top surface of the support 20 and corresponding ledge 49. The cylinder is then deposited on the ledges 49 and rolled to a position in line with the pairs of trunnion supporting rollers 45, whereupon the latter are elevated so as to lift the cylinder trunnions up above the level of the supporting ledge and ready for rotation, as hereinafter described. During the insertion and removal of the cylinders from the coating machine, the cradle or carriage B will be rigidly held against oscillation about its spindle 16, by the supporting locks 50 which are pivoted to the side frame of the base A and adapted to be brought under the carriage base casting 17 and temporarily held there by the hand controlled locking pins 51 which engage in suitable openings in the inclined plates 13. Ordinarily, the locks 50 will be dropped down so as to permit tilting or rocking of the carriage B, as hereinafter described.

Each of the brackets 43 is provided also with a heavy rigid arm 52 extending endwise therefrom parallel to the axis of the cylinder 47. Slidably mounted on each of the arms 52 is an upstanding, heavy, preferably built-up post 53 adapted to be securely locked in any adjusted position on the arm 52, as by means of the bolt 54, entered through any one of a series of holes 55.

Each post 53 is provided with an endwise adjustable end thrust bearing indicated conventionally at 56 adapted to engage the end of the corresponding trunnion 46 of the cylinder and adjustable toward and from the same by a horizontal adjusting screw 57 by any suitable means such as the crank 58. Each end thrust bearing is retained in its adjusted operative position as by the set screw 59 carried by the post 53.

Each of the posts 53 is additionally provided with a safety lock in the form of two rollers 60—60 mounted on a block 61 vertically adjustable, as by adjusting screw 62 and crank 63, in a guide 64 disposed at the inner end of a plate 65 horizontally adjustable in the post 53 and adapted to be secured in adjusted position as by the clamping screw 66.

In carrying out the invention, the cylinder 47 is rotated during the application of the coating material thereto and the setting thereof, this being accomplished preferably by temporarily securing a grooved pulley 67 to one of the cylinder trunnions 46 and with which cooperates a driving V-belt 68 driven from a pulley 69 carried by the rotor of a variable speed electric motor 70. The latter is endwise adjustably mounted on a pair of arms 71—71 rigidly secured to the corresponding end support 20. As will be apparent from inspection of Figure 1, the motor 70 is adapted to be locked in any adjusted position by tightening up the guide plates 72—72 associated with the motor.

To counterbalance the weight of the motor 70 in any adjusted position of the latter, the other end support 20 is provided with a similar pair of rigid arms 71—71 and which has endwise adjustable thereon a heavy counterweight 73 adapted to be secured in any adjusted position in a manner similar to that of the motor 70.

Detachably supported on the upper ends of the end supports 20, as by the end flanges 74 is a trough 75. As will be understood, the latter is one of an interchangeable series of different length, dependent upon the length of any cylin-

der being coated at a particular time. The trough 75 is provided, adjacent each end thereof, with a drain spout 76 to which is detachably connected a collector drip pan as by the bayonet joint indicated at 78. The pans 77 obviously prevent spilling or splashing of any drained off surplus coating material during the rocking of the carriage, as hereinafter described.

From the preceding description of the apparatus, it will be evident that the carriage or cradle B is so constructed that it is adapted to accommodate cylinders 47 of both different length and different diameters. It is further evident that when a cylinder is in the apparatus, the same may be rotated about its own axis from the motor 70 at any desired speed to which the said motor may be set and the cylinder is prevented both from endwise shift and from becoming displaced from the trunnion supporting rollers 45, by the end thrust bearings 56 and safety locking rollers 60. It will also be seen that the construction and arrangement of the parts of the carriage or cradle B are such that the entire weight may be delicately balanced about the spindle or shaft 16 so that, in actual practice, said carriage or cradle B may be easily oscillated, tilted or rocked about the axis of the spindle 16 by hand to the opposite inclined positions, as shown by the dotted lines B' and B'' in Figure 1.

It is, however, sometimes desirable to provide a mechanical drive for rocking or tilting the carriage or cradle B definite variable amounts and for that purpose, the following means may be employed. Journaled in the base A, at one side thereof, is a shaft 80 to one end of which is secured a grooved driving pulley 81 and at its other end a crank arm disk 82. As will be evident, the pulley 81 may be driven from any suitable outside source of power, not illustrated. Radially adjustably connected to the disk 82, as by a crosshead and adjusting screw 83, is one end of a pitman 84. The opposite end is pivotally connected to a bar 85 horizontally slidably mounted in a suitable guide 86 carried by the base A. Said bar 85 is provided with a rack 87 cooperable with a relatively small diameter pinion 88 carried by a short shaft 89. Said shaft 89 carries a somewhat larger pinion 90 which cooperates with a second rack 91 on a bar 92 also horizontally slidably mounted in the guide 86. Said bar 92 has pivotally connected thereto one end of a link 93 which has its other end pivotally connected to the lower end of an arm 94 dependent from and rigid with the carriage B. With the mechanism just described, it is obvious that the angle of rock or tilt of the carriage or cradle B may be adjusted by adjusting the connection between the pitman 84 and the disk 82 and further, by varying the speed of the drive pulley 81, the period of rock or oscillation may be correspondingly varied as desired.

With particular reference to the method aspects of the present invention, the cylinder to be coated is first mounted in the apparatus as hereinbefore described. The cylinder is then rotated by starting the motor 70 and the carriage B then preferably tilted from the horizontal and so maintained during the application of the coating material, in liquid form, to the cylindrical surface of the cylinder. The coating material may be applied to or deposited on the cylinder in any desired manner, but preferably by pouring the same by hand as from the spout indicated conventionally at 95. The operator will preferably begin the pouring at the upper end of the cylinder and gradually work toward the lower end, it being evident that the coating material would thus be applied in a more or less helical manner, due to the rotation of the cylinder during the pouring step. Surplus coating material will drip off the lower end of the cylinder into the trough 75. The duration of the draining step will vary in accordance with the viscosity of the coating material being applied, but will ordinarily be for about five to ten seconds. The carriage with the cylinder therein is then tilted so as to lower the opposite end of the cylinder and allow surplus material to drip and drain off from the then lower end. This evens out the coating over the entire surface.

When the draining off of the surplus material has been completed, the carriage with the cylinder still therein and being rotated about its own axis, is tilted or rocked back and forth either by hand or mechanically by the means heretofore described. The combined rotation of the cylinder about its own axis and bodily tilting about the horizontal transverse axis, is continued during the setting or congealing of the coating material, thus producing an even, smooth and uniformly thick coating on the cylinder surface when ultimately dried or set. The flowing action of the coating material induced by the rotation of the cylinder about its own axis, combined with the alternate gravitational flowing action toward opposite ends of the cylinder alternately, while the coating material is still sufficiently fluid to be acted upon by gravity, smooths out all valleys and ridges and prevents the formation or accumulation of any bells or beads of the material at any point on the surface of the cylinder.

As will be appreciated by those skilled in the art, the coating materials applied will vary greatly in viscosity, speed of setting and other characteristics, and these variable factors, combined with the variable factors of diameters of cylinders will require different speeds of rotation and different periods of oscillation or rocking to obtain the best results for any particular set of conditions. For an average size cylinder and an average light sensitive coating material, actual practice has shown that a satisfactory degree of tilt from the horizontal is approximately 25° and that the period of combined rotation and tilting for the smooth setting of the material will vary from above five to ten minutes. A satisfactory speed of rotation of the cylinder about its own axis may be anywhere from about 20 R. P. M. to about 40 R. P. M., dependent upon the diameter of the cylinder.

Obviously, many variations may be used in carrying out the invention without departing from the spirit thereof. Although the coating material is preferably applied while the cylinder is in an inclined position, obviously the coating material may be applied when the cylinder is maintained in horizontal position or while being slowly tilted about a transverse axis. Obviously, also, the cylinder may be tilted or rocked about a transverse axis to angles less than or very much greater than hereinbefore indicated and illustrated in the drawings. Particularly will the extreme angle of inclination or tilt be greater if the coating material is of unusual thickness or viscosity. In some instances, the cylinder may be tilted to the extreme amount where the axis thereof is extended vertically and the cylinder alternately positioned with first one end down and then the other. Essential features of the process are the

simultaneous combined rotation of the cylinder and the bodily movement of the cylinder about either a horizontal or any other non-vertical axis transverse to the cylinder axis in such manner and to such extent for each particular cylinder and coating material that first one end of the cylinder and then the other end thereof is, with sufficient frequency, lowered below the center of mass of the cylinder sufficiently for gravity to induce a gravitational flow or distribution of the material alternately toward opposite ends of the cylinder while being simultaneously rotated and while the coating material retains sufficient fluidity to respond to such combined motions.

Although there has herein been shown and described what is now considered the preferred manner of carrying out the invention, the same is merely illustrative and not by way of limitation. All changes and modifications are contemplated that come within the scope of the claims appended hereto.

What is claimed is:

1. The herein described improvement in the method of coating a cylindrical surface of a cylinder with coating material, which includes: depositing a quantity of the material, while in a liquid flowable condition, on the cylindrical surface of the cylinder; and distributing the material over the cylindrical surface in a smooth and uniform layer by rotating the cylinder about its own axis and, while so rotating the cylinder, also changing the position of the cylinder as an entirety by repeatedly positioning one end alternately below and then above the opposite end and thus induce gravitational flow of the material on the surface of the cylinder alternately first toward one end and then toward the other end of the cylinder until the material sets.

2. The herein described improvement in the method of coating a cylindrical surface of a cylinder with coating material, which includes: depositing a quantity of the material, while in a liquid flowable condition, on the cylindrical surface of the cylinder; and distributing the material over the cylindrical surface in a smooth and uniform layer by simultaneously combining the flowing and spreading action produced on the coating material produced by rotating the cylinder about its own longitudinal axis with repeated gravitational flowing action lengthwise of the cylinder first toward one end and then toward the other end of the cylinder until the material sets.

3. The herein described improvement in the method of coating a cylindrical surface of a cylinder with coating material, which includes: depositing a quantity of the material, while in a liquid flowable condition, on the cylindrical surface of the cylinder; and distributing the material over the cylindrical surface in a smooth and uniform layer by simultaneously rotating the cylinder about its own axis and bodily rocking the cylinder about a non-vertical axis extending transversely of the cylinder's own axis, thereby simultaneously combining the centrifugal flowing of the material around the cylinder with a gravitational flowing of the material alternately in opposite directions lengthwise of the cylinder.

4. The herein described improvement in the method of coating the cylindrical surface of a cylinder with a light-sensitive coating material, which includes: applying a quantity of the material, while in liquid condition, over the cylindrical surface of the cylinder and then simultaneously rotating the cylinder about its own axis to circumferentially distribute the material and bodily rocking the cylinder about a horizontal axis transverse to the cylinder axis to distribute the material alternately endwise of the cylinder until the material is set.

5. The improved method of coating a cylinder with a coating material which includes: rotating the cylinder about its axis and, while so rotating, depositing a quantity of the material over the cylindrical surface; while continuing the rotation of the cylinder, positioning the cylinder with one end lower than that of the other for a short interval of time to induce a flow of the material toward the lowered end and draining off surplus material; while still continuing the rotation of the cylinder, positioning the cylinder with the opposite end down for a short interval of time to thereby reverse the flow of the material toward said opposite end and draining off surplus material at said then lower end; and thereafter simultaneously rotating the cylinder about its axis and continuously moving the cylinder bodily to position one end thereof alternately above and below the other end of the cylinder, until the material is set.

6. The herein described method of coating the cylindrical surface of a cylinder with light-sensitive material which includes: rotating the cylinder about its own axis while in an inclined position and applying coating material to the surface while so inclined and rotating; while so rotating, draining off surplus material from one end and thereafter bodily reversing the position of the cylinder so as to bring the opposite end down and draining surplus material from said last named end; and thereafter simultaneously combining the rotative movement of the cylinder about its own axis with a continuing rocking of the cylinder about a horizontal transverse axis to thereby combine the centrifugal flowing and gravitational flowing alternately toward opposite ends of the cylinder.

7. In a cylinder coating apparatus, the combination with a base; of a carriage having means for mounting the cylinder thereon to rotate about its own axis; means for rotating a cylinder about its own axis when so mounted on said carriage; and means movably connecting said carriage to said base to allow one end of the cylinder mounted on said carriage being alternately positioned lower and then higher than the other end of the cylinder.

8. In a cylinder coating apparatus, the combination with a base; of a carriage having means for mounting a cylinder thereon to rotate about its own axis; means for rotating a cylinder about its own axis when so mounted on said carriage; and means pivotally connecting said carriage to said base, axis of the pivot means being transverse to the cylinder axis and located intermediate the end planes of the cylinder and disposed at such an angle to the vertical that, when the axis of the cylinder is appreciably displaced in either direction from the horizontal by displacement of the carriage about its pivot, gravity will be effective in producing movement of liquid coating material on the cylinder toward the then lower end of the cylinder.

9. In a cylinder coating apparatus, the combination with a carriage; of means on said carriage for rotatably supporting and rotating a cylinder about its own axis while on said carriage; and means movably supporting said carriage to pivot about a non-vertical axis located intermediate the ends of the carriage and extending transversely to the cylinder axis.

10. In a cylinder coating apparatus, the combination with a carriage; of means on said carriage for rotatably supporting and rotating a cylinder about its own axis while on said carriage; means movably supporting said carriage to pivot about a non-vertical axis located intermediate the ends of the carriage and extending transversely to the cylinder axis; and means for moving said carriage about said pivot to alternately raise and lower one end of the cylinder above and below the horizontal.

11. In a cylinder coating apparatus, the combination with a base; of a carriage pivotally supported from said base, the axis of the pivot extending non-vertically and located intermediate the ends of the carriage; cylinder trunnion supports on said carriage, located on opposite sides of said pivotal axis, said supports being relatively adjustable toward and from each other to accommodate cylinders of different length; and means for rotating a cylinder when mounted on said supports and in any angular position of the carriage about its said pivot.

12. In a cylinder coating apparatus, the combination with a base; of a carriage; means pivotally connecting the carriage to said base, the axis of said means extending horizontally; means on said carriage for rotatably supporting a cylinder; and means for rotating a cylinder when mounted on said carriage.

13. In a cylinder coating apparatus, the combination of a base; of a carriage; means pivotally connecting the carriage to said base, the axis of said means extending horizontally; means on said carriage for rotatably supporting a cylinder; means for rotating a cylinder when mounted on said carriage; and means for imparting a rocking motion to said carriage, said last named means being adjustable to vary the extent of rocking motion of the carriage.

14. In a cylinder coating apparatus, the combination with a base; of a carriage; cylinder trunnion supports mounted on said carriage and adjustable thereon to vary the distance therebetween; a motor mounted on said carriage and adapted to rotate a cylinder supported thereon; means, also mounted on and bodily movable with the carriage, for catching coating material drained off from the cylinder; and a horizontally disposed spindle pivotally connecting said carriage to the base, said spindle being located intermediate said trunnion supports of the carriage.

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