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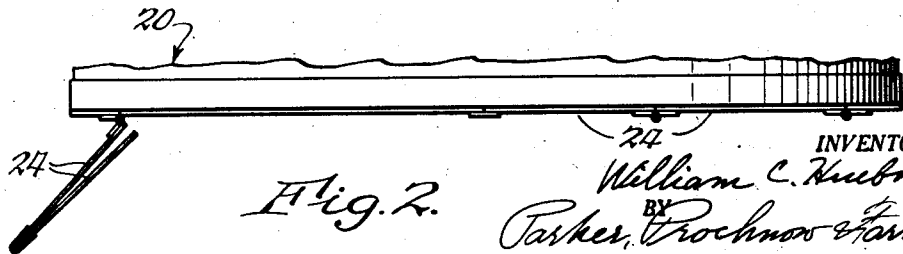
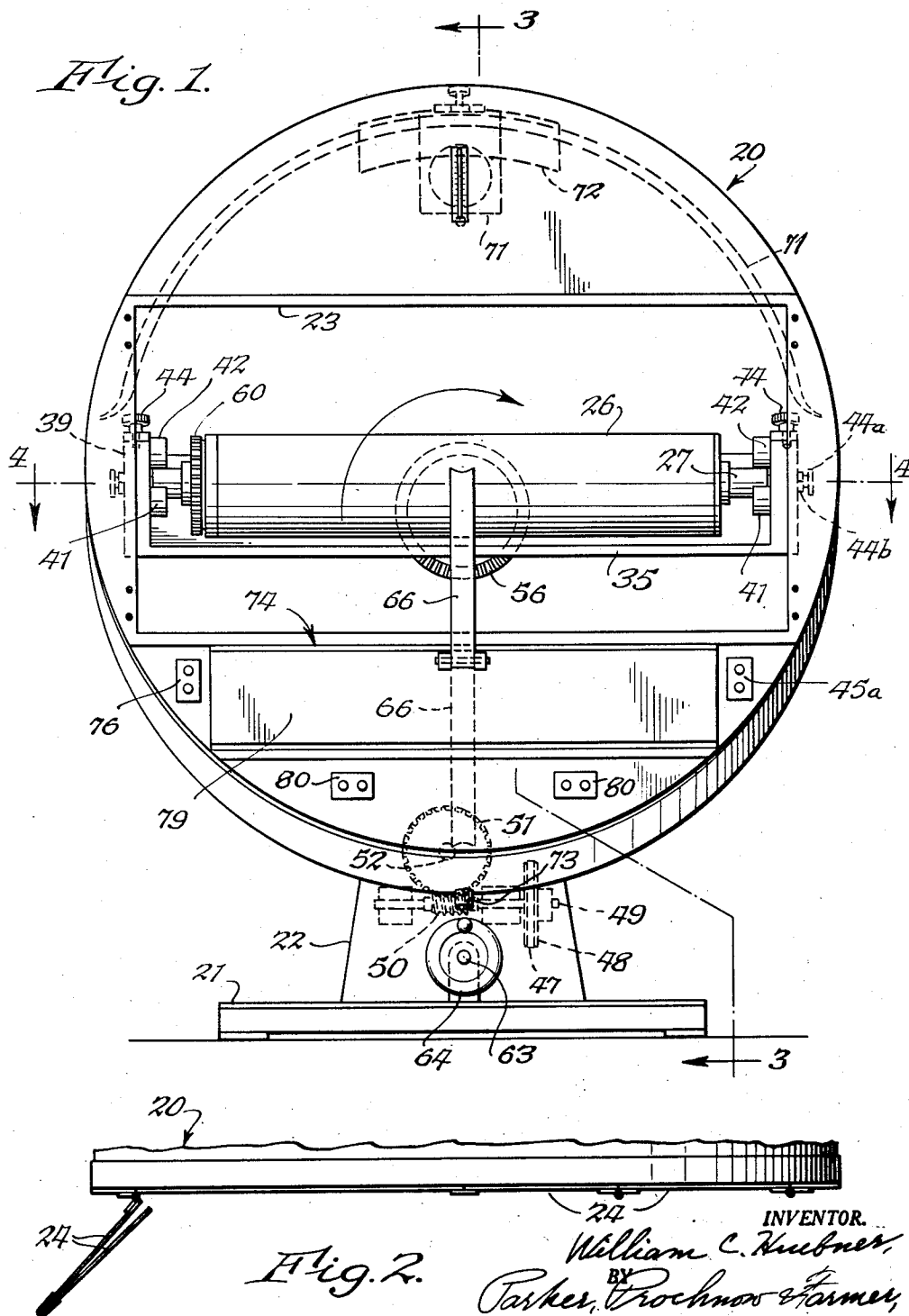
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APPARATUS FOR COATING CYLINDRICAL SURFACES

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3 Sheets-Sheet 1



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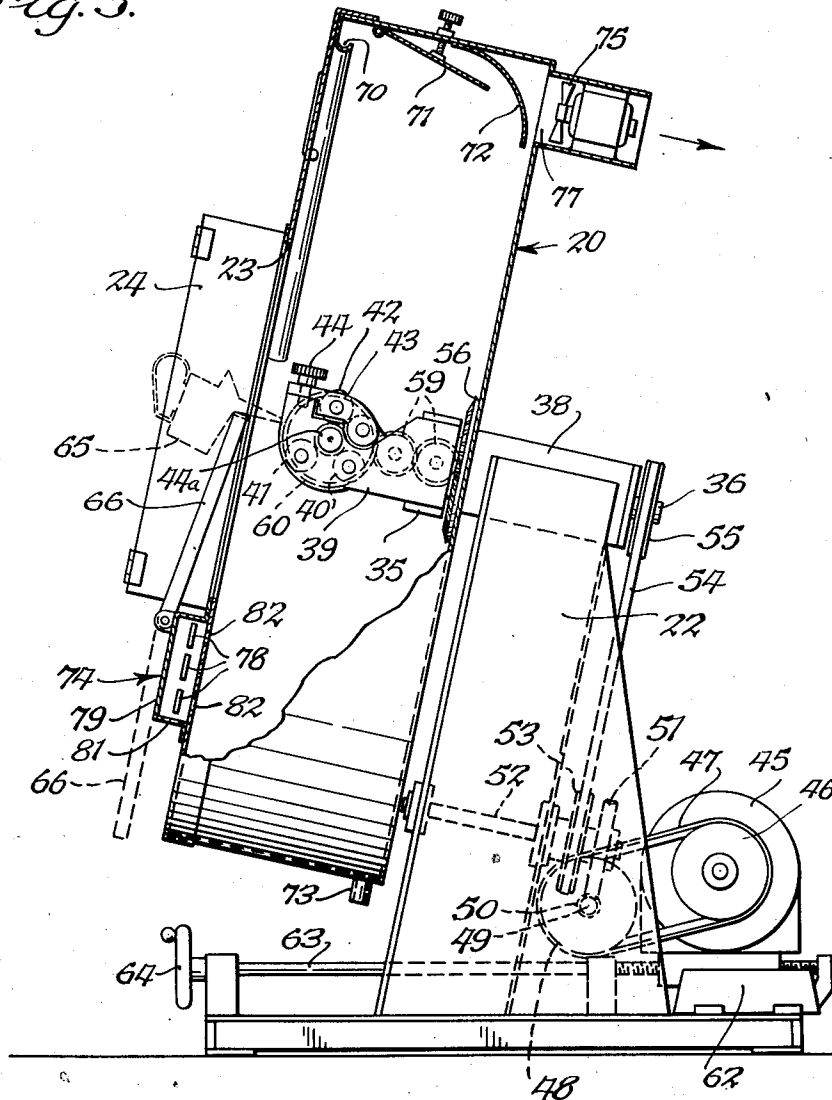
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Fig. 3.



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Fig. 4.

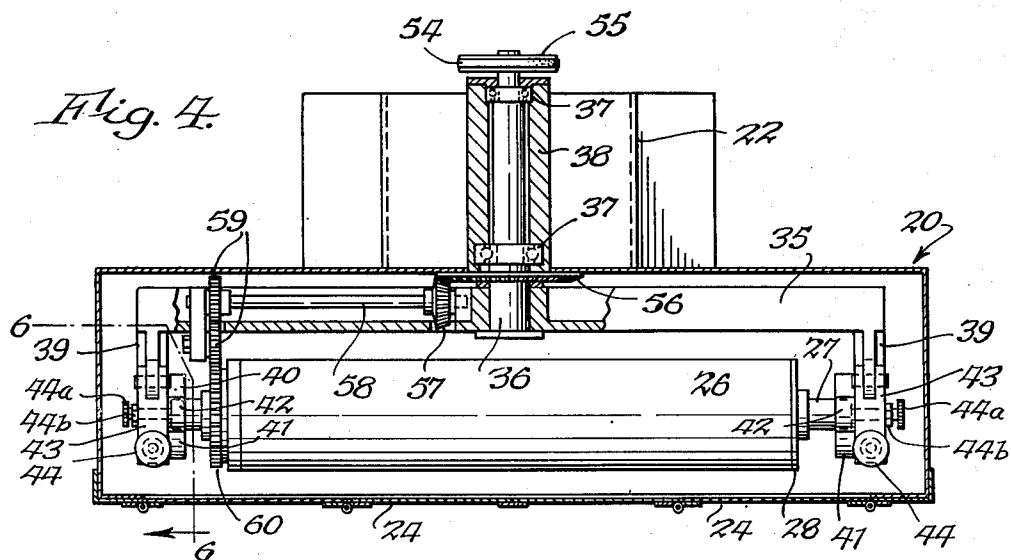


Fig. 5.

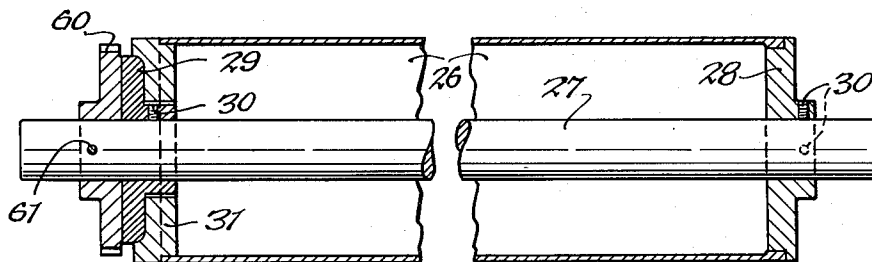
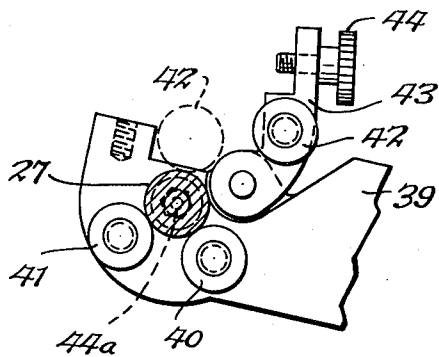


Fig. 6.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR COATING CYLINDRICAL SURFACES

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Application December 9, 1944, Serial No. 567,381

7 Claims. (Cl. 91—42)

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This invention relates to an apparatus for applying coatings on cylindrical surfaces, and more particularly to an improved apparatus for providing light-sensitive coatings on the cylinders or cylindrical printing surfaces of printing and photocomposing machines and the like. In the preparation of such surfaces, one of the difficult problems is the formation of an absolutely uniform and perfectly smooth light-sensitive coating on the cylindrical supporting surface. Tubular steel cylinders having their peripheral surfaces electroplated with copper, zinc or brass are often employed in producing such cylindrical printing elements, and after such electroplated surfaces are polished or grained, depending on the process by which the final images are to be printed, the plated cylindrical surfaces are coated with the light-sensitive material. Cylinders made of plastic or other suitable materials may be used for this purpose.

In either case the light-sensitive solutions or coating materials must be applied evenly or uniformly over all portions of the cylindrical surfaces, regardless of whether the coating is of a comparatively heavy, gelatinous nature or of a thinner nature, such as those used in making planographic printing surfaces. It is also essential that the coating, whether thick or thin, must be dried and hardened or set uniformly in order to ensure that the photographic prints, when developed, will be uniform and of the required high quality.

Heretofore, it has been customary in coating cylindrical surfaces with light sensitive materials to rotate the cylinder about its axis and to tilt or rock or rotate the same about an axis centrally between the ends of the cylinder and extending at an angle to the axis of the cylinder, while pouring the coating material in a liquid condition on the surface, for the purpose of utilizing the effects of gravity and centrifugal force in spreading and evening out the coatings, which have a tendency to become thicker at one or another portion of the cylindrical surface. If the cylinder rotates about its axis during its rotation in a horizontal plane, the coating becomes thicker towards the ends of the cylinder, due to centrifugal force acting on the coating before it sets. If the tilting or rocking motion is substituted for horizontal rotation, spinning or whirling, the tendency is for the coating to pile up thicker at the center of the cylindrical surface, and it tends to dry at the end portions of the surface faster than between the ends, because the tilting motion has very slight effect on the coating nearest the center of

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the rocking or tilting action. If the cylinder is set up with its axis in a vertical plane and rotated about its axis and also whirled or rotated in the vertical plane of its axis, the coating solution that is thrown off by centrifugal force can fall back on the surface of the cylinder and create spots and other defects.

Experience has shown that the previous procedure, in which the cylinder is rotated about its axis and rocked or tilted while pouring the coating solution on the cylinder, will operate successfully for comparatively thin coatings, but is not satisfactory for applying heavier coatings, such as are now contemplated, particularly for the thin, tubular cylinders that are to be prepared for use in printing by the electronographic process invented by me.

A primary object of my invention is to provide an improved apparatus for coating cylindrical surfaces which will obviate the known objections in previous methods and apparatus for the purpose, and will insure the production of smooth, uniform coatings on cylindrical surfaces.

This object is attained in part by pouring the coating material in liquid condition on the cylindrical surface to be coated while said surface is rotating about its own axis and is also simultaneously rotating, whirling or spinning in an inclined plane, preferably inclined upwardly and rearwardly from the vertical, about an axis extending at an angle to the axis of the cylindrical surface.

Another object of the invention is to provide a practical and efficient, novel apparatus which will enable cylindrical surfaces to be readily supplied with smooth, uniform coatings of varying characteristics within the control of the operator.

Additional objects of the invention are to produce a novel apparatus for coating cylindrical surfaces, having provision for the quick and easy mounting of tubular cylinders of various lengths and diameters upon a common shaft which is removably mounted for rotation in the apparatus; also to provide an apparatus which will ensure quick and uniform drying or setting of the coatings on the cylindrical surfaces; in which the speed of rotation of the cylindrical surfaces can be readily adjusted as required, depending upon the varying specific gravities or other characteristics of different coating solutions used, and by which the operator will have control at all times of the conditions necessary to produce satisfactory coated surfaces for printing by various processes from such surfaces, and will be enabled to meet a variety of conditions which heretofore

have not existed or have not been required in the coating of cylinders for use in orthodox printing presses or processes.

Further objects and advantages of the invention will appear from the following specification of the preferred method embodying the invention and the preferred apparatus embodiment thereof, shown in the accompanying drawings, and the novel features of the invention are set forth in the appended claims.

In said drawings:

Fig. 1 is a front elevation of a coating apparatus embodying the invention, the doors for the front door opening of the coating tank or chamber being left off to better show the parts within the tank.

Fig. 2 is a fragmentary plan view of the tank showing the doors in place with one door open and the other door closed.

Fig. 3 is a side elevation of the apparatus showing the tank partly in vertical section on line 3—3, Fig. 1.

Fig. 4 is a sectional plan view thereof on line 4—4, Fig. 1.

Fig. 5 is a longitudinal, sectional elevation of a tubular cylinder to be coated and its supporting shaft, removed from the apparatus.

Fig. 6 is a sectional elevation of the apparatus on an enlarged scale on line 6—6, Fig. 4.

Describing the coating apparatus as illustrated in the drawings, 20 represents a tank or casing which forms the coating and drying chamber within which the cylinder to be coated is mounted and manipulated during the formation of the coating thereon. Preferably, this casing is of generally cylindrical and relatively shallow form and is supported in an upright position with its opposite, circular walls or ends inclined upwardly and rearwardly at an angle of about 15 degrees to the vertical, by a suitable frame or support, which may comprise a horizontal base 21 and a standard or pedestal 22 rising therefrom, on and at the front of which the casing is mounted. The casing is provided with a relatively large front door opening 23 through which the cylinder to be coated may be placed in and removed from the coating chamber, and with suitable doors 24 for closing this opening. Double folding doors are shown hinged at the opposite sides of the door opening, and each having hinged leaves or sections adapting the doors to be folded back at opposite sides of the door opening so that the doors, when open, will occupy small space at opposite sides of the casing and not interfere with the ready mounting of the cylinder in the coating chamber and its removal therefrom.

26 represents the cylinder to be coated which, as shown, is tubular and removably mounted on a central shaft 27 which extends centrally through the cylinder tube and has circular disks or heads 28 and 29 secured on the shaft in position to engage and support opposite ends of the cylinder tube. These cylinder heads may be of different diameters and suitably secured on the shaft, as by set screws 30, which permit adjustments of the heads lengthwise on the shaft, as required to accommodate cylinder tubes of different diameters and lengths and enable the removal of one of the heads, as 28, for removing the cylinder tube from and mounting it on the shaft, or replacing one tube by another. The cylinder tube shown is provided at one end with an annular filler piece 31 adapted to encircle the hub of the head 29 with a peripheral flange

of the end piece 31 surrounding and seated on the periphery of the head 29. The other end of the cylinder tube may be formed to surround and seat on the periphery of the removable head 28 against a peripheral shoulder thereon, so that the tube may be held firmly between the opposite heads when the head 28 is secured in position on the cylinder shaft.

The cylinder shaft 27, with the cylinder tube secured thereon, is adapted to be rotatably and removably mounted on a cylinder support or yoke 35 which is arranged to rotate in an upright plane within the coating chamber, which plane is preferably inclined upwardly and rearwardly at approximately the same angle to the vertical as the end walls of the coating chamber. Said yoke is provided midway between its ends with or is suitably secured to a shaft 36 which projects rearwardly from the yoke through an opening in the rear wall of the casing 20 and is journaled to rotate freely in suitable bearings 37 in a bearing housing 38 on the frame standard 22. At its opposite ends yoke 35 is provided with forwardly projecting arms or members 39 on which the cylinder shaft 27 is adapted to be removably journaled at its opposite ends to adapt the cylinder 26 secured on the shaft to rotate about its axis on said yoke. Preferably, for this purpose, each arm 39 of the yoke has a group of bearing rollers 40, 41 and 42, suitably mounted to rotate on and projecting inwardly from the yoke arm. Each end of the cylinder shaft 27 is adapted to rest on and be confined in place by the rollers of one group, which form rolling bearings for the end of the shaft. One roller 42 of each group is mounted, as by a bracket 43 suitably pivoted on the adjacent yoke arm, to adapt the roller 42 to be shifted toward and from the end of the shaft for holding it in bearing engagement with the other rollers 40 and 41, or out of the way, to permit removal of the shaft 27 from its roller bearings on the yoke. This pivoted bracket may be releasably held in position with its roller 42 in bearing and confining engagement with the cylinder shaft by suitable means, such as a thumb screw 44 swivelled on the end of the pivoted bracket and adapted to be screwed into a threaded hole in a lug or part on the yoke arm. The shaft 27 may be centered in the yoke and held against shifting endwise in its bearing rollers by suitable means, such as adjustable end thrust screws 44a passing through threaded holes in the yoke arms and engaging opposite ends of the shaft. These screws may be locked in adjusted positions as by lock nuts 44b.

Thus, the cylinder 26 is removably mounted to rotate about its axis on the support or yoke 35 which, in turn, is mounted to rotate in the coating chamber in an inclined plane in which the axis of the cylinder lies or with which it is parallel, so that in the coating operation the cylinder is adapted to be rotated both about its own axis and also to be simultaneously rotated, whirled or spun end over end in a plane parallel to or coincident with the plane of the axis of the cylinder. The drive means shown for thus rotating the yoke and simultaneously rotating the cylinder about its axis on the yoke, comprise an electric motor 45 controlled by a suitable switch 45a, and connected by a belt 47 and pulleys 46, 48 to a countershaft 49 which is geared, as by a worm 50 and worm wheel 51 to a shaft 52 suitably journaled on the frame standard 22 and connected by a pulley 53 and belt 54 to a pulley 55 secured on the rear end of the shaft 36 of the yoke. A

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bevel gear 56, which may be fixed inside the casing 20 to the rear wall of the casing or to the inner end of the bearing housing 38, meshes with a bevel pinion 57 on a shaft 58 which extends lengthwise of the yoke 35 and is suitably jour-
 nalled thereon and is operatively geared, as by a suitable gear train 59, with a pinion 60 secured on one end of the cylinder shaft 27. This pinion 60 may be formed as an integral part of the head 29 of the cylinder, or may be a separate part
 10 separately secured adjustably, as by a set screw 61 on the cylinder shaft. In the rotation of the yoke with its shaft 36, the pinion 57 rolls around the stationary bevel gear 56 in mesh with its teeth, and thus the pinion 57, its shaft and gear
 15 train 59 are driven and rotate the cylinder about its axis on the yoke.

Any other suitable drive mechanism for producing said combined motion of the cylinder 26, that is rotation about its own axis on the yoke, and rotation of the cylinder with the yoke, may be employed, but preferably a drive mechanism is used which is capable of adjustment to vary the speed of motion of the cylinder, as may be best
 20 suited, depending upon the particular nature or characteristics of the coating solution being used, to ensure a smooth, even coating of uniform thickness. In the drive mechanism shown, the belt and pulleys connecting the motor 45 with the
 25 countershaft 49 schematically represent a change speed mechanism of known type in which the speed is changed by adjusting the motor toward and from the countershaft. For this purpose, the motor base is shown as slidably adjustable in a
 30 suitable guide 62 on the frame base 20, and may be adjusted by means of a shaft 63 having an adjusting screw connection with the motor base, and provided at its front end with an operating
 35 hand wheel 64, which is located in convenient reach of the operator or at the front of the apparatus.

In the use of the apparatus for performing my improved coating process, the operator preferably pours the coating material in a liquid condition or as a solution from a spouted cup or receptacle
 40 65 on the surface of the cylinder at its middle portion while the cylinder is being rotated both about the axis and with the yoke in the coating chamber. A rest or support 66 is preferably provided on which the operator may rest and steady
 45 the receptacle while pouring the solution therefrom. The rest or support 66 shown, is hingedly mounted at the bottom of the front door opening 23 of the casing to swing from an inoperative
 50 position in which it hangs down out of the way, to an upstanding position, shown by full lines in Fig. 3, in which its upper end is located to position the spout when resting thereon so as to direct
 55 the flowing solution onto the surface of the cylinder at a spot slightly above the front middle portion of the cylinder surface when the cylinder is horizontal. The solution thus poured on the
 60 cylinder will be caused to spread out uniformly circumferentially around and outwardly to the ends of the peripheral surface by the combined effects of centrifugal force, due to the rotation of
 65 the cylinder, and gravity, due to the inclination of the plane in which the cylinder rotates. The whirling or rotation of the cylinder with the yoke 35 will throw solution off of the ends of the cylinder by centrifugal force against the surrounding
 70 circular wall of the coating chamber, from the upper portion of which it will flow downwardly on the inner surfaces of the chamber walls into

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the lower portion of the chamber. Within the upper, front portion of the chamber is provided a transversely concaved conductor or gutter 70
 75 which extends or curves downwardly from a point above the front door opening 23 of the coating chamber to opposite sides of the door opening. This conductor will catch solution which may splash and spread forwardly on the upper
 80 portion of the circular wall of the chamber and direct it to opposite sides into the lower portion of the chamber. An adjustable hinged deflector plate 71 in the upper portion of the coating chamber serves, by appropriate adjustment thereof, to
 85 direct the solution which is thrown upwardly against it, to the gutter 70, and a curved deflector wall 72 in the upper rear corner portion of the coating chamber functions to direct the solution which flows rearwardly on the top portion of
 90 the circular wall, downwardly onto the inner surface of the rear wall of the chamber. Thus, any solution which is thrown off of the cylinder, in its rotation in the chamber, is prevented from dropping back onto the surface of the cylinder and spotting or otherwise impairing the smooth-
 95 ness and uniformity of the coating thereon. The solution collecting in the lower portion of the casing may escape therefrom through suitable drain pipes 73.

After the coating solution has been poured on and spread over the peripheral surface of the cylinder by the combined rotary motions there-
 100 of, as described, the front doors of the casing are closed and the motion of the cylinder continued for causing the solution to properly dry and set on the surface of the cylinder. In order to facilitate this drying and setting operation, the apparatus is preferably provided at the lower front
 105 portion of the casing 20 with an air heater 74 and at the upper rear portion of the casing with a motor driven fan 75 controlled by a suitable switch 76, for circulating air through the heater, in which the air is heated, and thence upwardly
 110 through the coating chamber around and over the cylinder, to the exhaust opening 77 at the top of the coating chamber. The heater shown for this purpose comprises suitable electrical heating elements 78 which may be arranged in series within a hood 79 mounted on the front wall of the main casing 20 and controlled by suitable
 115 switches 80. An air inlet opening 81 at the bottom of the heater hood and holes 82 in the front wall of the main casing enable the fan to draw air over and around the heating elements in the hood to heat it and then through the holes 82
 120 into the coating chamber in which it passes over and around the cylinder 26 rotating in the coating chamber to the exhaust opening at the top of the coating chamber.

An important factor in properly coating cylindrical surfaces is the ability to vary or control the speed of rotation of the surface both
 125 about its axis and in the inclined plane during application of the coating solution to the surface, so that the speeds may be regulated to conform to the varying natures of the light-sensitive coating solutions used. Where the specific gravity of the solution is heavy, the surface should rotate slower, while if the solutions are thin, the speed of motion of the surface should be faster.
 130 The speed control means 64 is located so that the operator can have at all times control of the conditions needed to produce satisfactory coated cylindrical surfaces for printing from such surfaces by various processes and, in fact, to meet
 135 a variety of conditions required in the coating of

such surfaces. The temperature of the air can also be regulated by appropriate control of the air heater by means of its series heating elements and control switches, so as to obtain drying conditions appropriately coordinated with the speed of rotation of the cylindrical surface and the particular nature of the coating solution being used, to ensure perfect coatings.

It has been found that the rotation of the cylindrical surface in a plane inclined substantially as described results in most successful coating because, for one reason, the solution thrown off during the rotation does not fall back on the surface and create spots or other defects in the coating. Another important reason for the described inclined plane of rotation of the cylindrical surface is that it enables the most effectual application of the coating solution to the surface to ensure proper coating thereof. The operator is thereby enabled to pour an unbroken or continuous stream of the solution on the rotating cylindrical surface slightly above its center of rotation, and as a result, the solution is spread from the center towards the ends of the surface, and the rotation of the surface about its axis permits the solution to flow evenly over every portion of the surface at about the same speed, which ensures a uniform coating over the entire surface without thick portions at its center or at its ends. This would not be possible with the cylinder set in a vertical or a horizontal plane because the solution would have to be forced onto the surface and would result in air bubbles and gaps in the flow, which would produce spotty and uneven coatings.

I claim as my invention:

1. An apparatus for coating cylinders, comprising a support for a cylinder to be coated mounted for rotation in a substantially upright plane which is inclined somewhat upwardly and rearwardly from the vertical, means for mounting said cylinder to rotate about its axis on said support with the axis of the cylinder parallel with said inclined plane, drive mechanism for rotating said support in said inclined plane and simultaneously rotating said cylinder about its axis on said support, and means for directing the pouring of the coating material in liquid condition on the front middle portion of the surface of the cylinder while it rotates about its axis and in said inclined plane.

2. An apparatus for coating cylinders, comprising a casing forming an enclosing chamber for a cylinder to be coated, a support for the cylinder mounted in said chamber to rotate in a substantially upright plane which is inclined somewhat upwardly and rearwardly from the vertical, means for mounting said cylinder to rotate about its axis on said support with the axis of the cylinder parallel with said inclined plane, drive mechanism for rotating said support in said inclined plane and simultaneously rotating said cylinder about its axis on said rotating support, and means for directing the pouring of the coating material in liquid condition on the front middle portion of the surface of said cylinder while it rotates about its axis and in said inclined plane.

3. An apparatus for coating cylinders, comprising a stationary casing forming a generally cylindrical relatively shallow coating chamber in which a cylinder to be coated is mounted for rotation and which stands in a position with its opposed circular walls substantially upright, a cylinder support mounted to rotate in said casing in a plane inclined upwardly and rearward-

ly at a relatively small angle to the vertical, means for mounting the cylinder to rotate about its axis on said support with the axis of the cylinder parallel with said inclined plane, drive mechanism for rotating said support in said inclined plane and simultaneously rotating said cylinder about its axis on said rotating support, and means for directing the pouring of the coating material in liquid condition on the front middle portion of the surface of said cylinder while it rotates about its axis and in said inclined plane.

4. An apparatus for coating cylinders, comprising a casing forming an enclosing chamber for a cylinder to be coated, a support for the cylinder mounted in said chamber to rotate in a plane inclined at a relatively small angle to the vertical, means for mounting said cylinder to rotate about its axis on said support with the axis of the cylinder parallel with said inclined plane, drive mechanism for rotating said support in said inclined plane and simultaneously rotating said cylinder about its axis on said rotating support, means for directing the pouring of the coating material in liquid condition on the midlength portion of the surface of said cylinder while it rotates about its axis and in said inclined plane, means for regulating the speed of rotation of said cylinder and said support, means for circulating air in said chamber over the cylinder during said rotations of the cylinder, and means for regulating the temperature of said air for controlling the drying and setting of the coating on the cylinder, said speed and temperature regulating means including actuating elements located in convenient reach of an operator positioned for controlling the pouring of the coating material.

5. An apparatus for coating cylinders according to claim 3, including an arched conducting trough arranged in the upper portion of the said chamber substantially parallel with and adjacent its front wall which catches coating liquid thrown off of said cylinder by centrifugal force and directs the liquid away from the cylinder into the lower portion of said chamber.

6. An apparatus for coating tubular cylinders, comprising a cylinder support mounted to rotate in a plane inclined at a relatively small angle to the vertical, a cylinder shaft removably mounted to rotate about its axis on said support with the axis of the shaft parallel with the plane of rotation of said support, cylinder heads by which said tubular cylinder is mounted at its ends on said shaft, said heads being adjustable lengthwise on said shaft for longitudinally centering cylinders of different lengths on said support and one of said heads being removable from said shaft when said shaft is removed from said support to enable removal of the tubular cylinder, mechanism for rotating said cylinder support and rotating said cylinder shaft about its axis on said support, means for directing the pouring of the coating material in a liquid condition on the middle portion of said tubular cylinder while it rotates about its axis and with said support, and a generally cylindrical casing providing an enclosing chamber for said cylinder.

7. An apparatus for coating cylinders, comprising a support for a cylinder to be coated mounted for rotation in a substantially upright plane inclined upwardly and rearwardly at a relatively small angle to the vertical, means for mounting said cylinder to rotate about its axis on said support with the axis of the cylinder parallel with said inclined plane, drive mechanism

for rotating said support in said inclined plane and simultaneously rotating said cylinder about its axis on said support, said cylinder rotating bodily end over end with said support through complete revolutions about a center midway between the ends of the cylinder, the coating material being poured in liquid condition from a container and directed onto the front midlength portion of the surface of said cylinder, while the cylinder rotates about its axis and end over end in said inclined plane.

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