

April 3, 1945.

A. A. EGLI ET AL

2,372,665

PROCESS FOR OBTAINING ETCHABLE DEPOSITS ON PRINTING CYLINDERS

Filed April 17, 1940

4 Sheets-Sheet 1

Fig 1

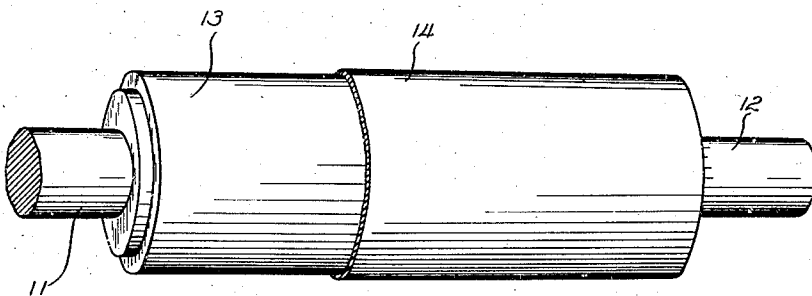
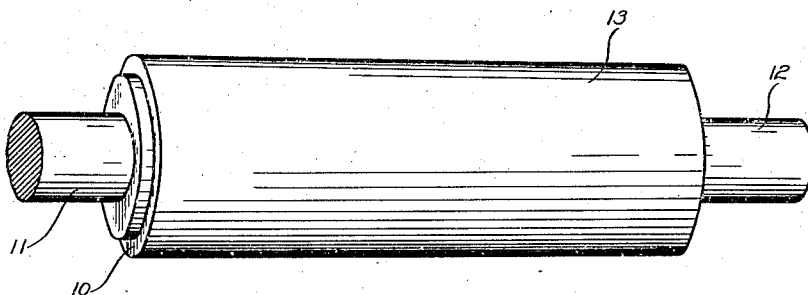


Fig 2

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Fig. 3

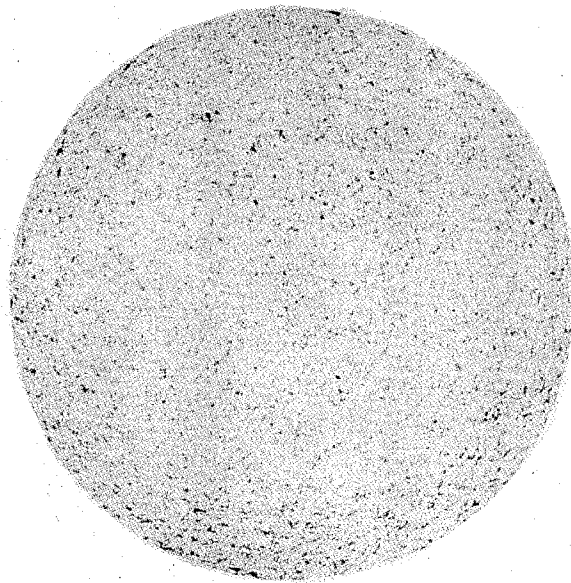
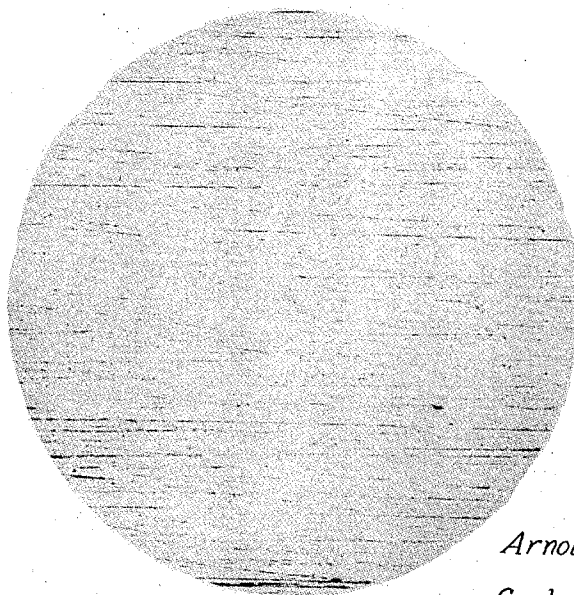


Fig. 4



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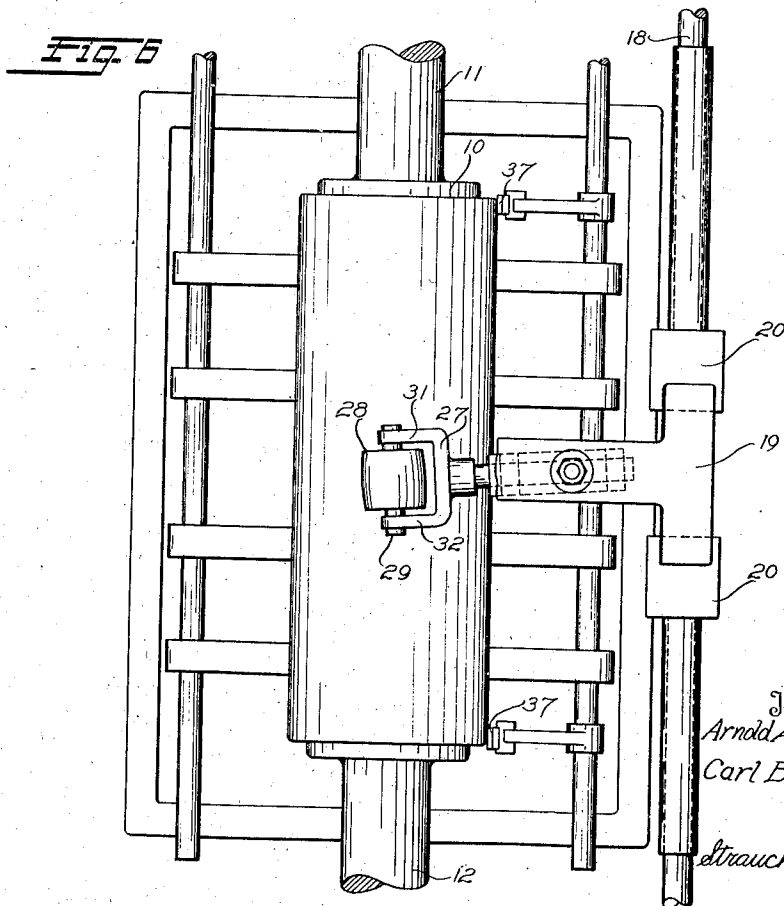
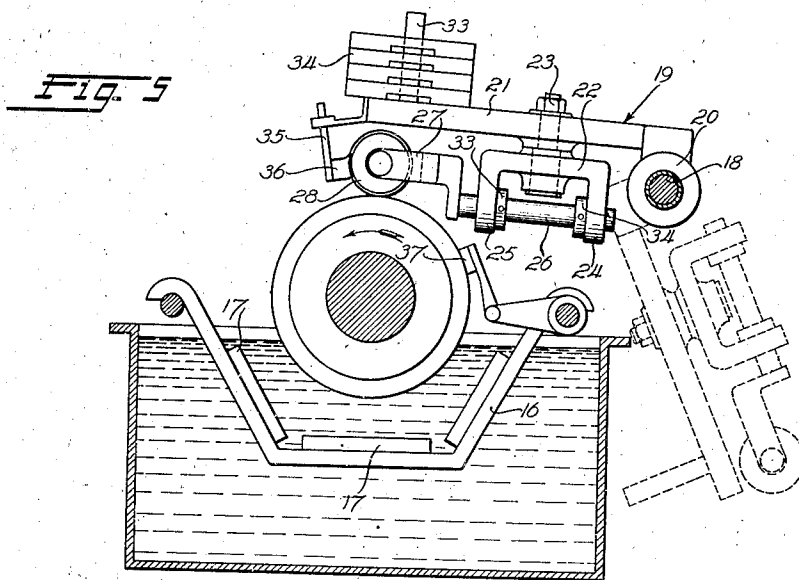
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Fig. 7

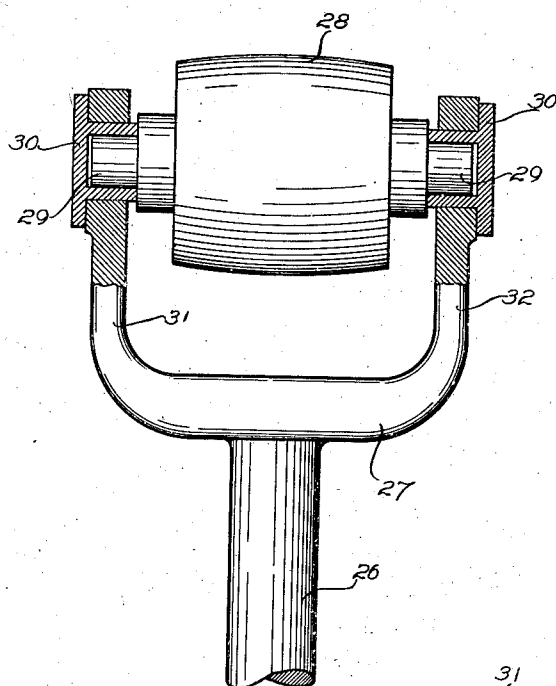


Fig. 8

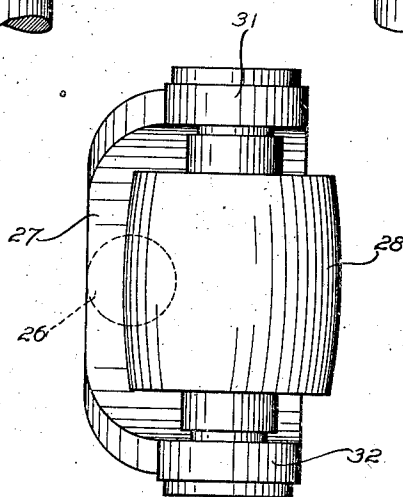
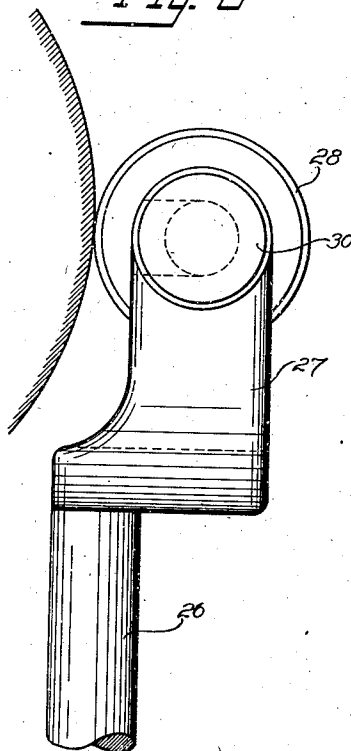


Fig. 9

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UNITED STATES PATENT OFFICE

2,372,665

PROCESS FOR OBTAINING ETCHABLE
DEPOSITS ON PRINTING CYLINDERSArnold August Egli, St. Gallen, Switzerland, and
Carl Bokenkamp, Hamburg, Germany

Application April 17, 1940, Serial No. 330,160

4 Claims. (Cl. 204—25)

The present invention relates to a printing roll for intaglio printing, and to a method of making such a roll without the necessity of costly polishing of the roll to produce a surface suitable for etching.

Intaglio printing rolls, as now customarily made, consist of a base cylinder provided with a removable shell having the printing image etched in the surface of the shell. The shell has a thickness just sufficient for a single etching. After the shell has served its purpose, it is removed from the base cylinder and replaced by another shell, which is in turn etched, in a manner well understood in the art, to provide it in turn with the desired printing image.

The printing shell is formed by electrolytically depositing copper on the cylindrical base, as the latter is rotated through an electrolyte solution, in a manner to produce as uniform a deposit of copper as is possible. It is customary to polish the surface of the cylindrical base to a high or mirror-like finish, and to then coat said surface with a layer that will prevent permanent adhesion of the electrodeposited copper to the base surface but that at the same time will permit the deposited copper to cling to the base surface with sufficient tenacity to prevent movement of the completed shell with respect to the base and to thus insure a temporary union between the shell and base at all points. Such a shell can be removed, after it has served its purpose, by slitting the shell and then stripping it from the base.

In spite of the high polish of the base on which the shell is deposited, and in spite of the fact that the copper deposit has a tendency to reproduce the base surface in its outer surface, the requirements of a surface suitable for etching are so exacting that, when the copper is deposited in the manner generally employed in the art, the shell does not have a surface sufficiently smooth and uniform to permit the formation of the printing image by etching its surface without first subjecting said surface to polishing operations, carried out after the expenditure of much time at a high labor cost, and with the use of expensive equipment and costly abrasives.

The average time consumed in preparing the surface of a printing roll provided with a removable shell of the character already described is about one and one-half hours, and the cost of preparing said surface so that it is suitable for etching has been conservatively estimated to be about sixteen dollars per cylinder.

Yet the best surface that can be produced in

the mode that is now conventional, and which has just been outlined, is characterized by minute scratches that are necessarily incident to the finishing operations performed on the roll surface. These scratches sometimes show even when the finest abrasive is used, when high grade intaglio printing is carefully examined. Said scratches, though minute in character, reduce the life of the shell and frequently the steel doctor blade, employed in scraping the excess ink from the roll seriously mars the surface before a long run is completed.

The present invention has for its primary object the provision of a printing roll having a removable shell, of a thickness sufficient for only a single etching, in which the shell surface is produced by rolling under some pressure without rubbing so as to be free of minute scratches.

Another object of the present invention is to provide an improved method of making a printing roll having a removable shell involving the rolling of the copper without rubbing as it is being deposited so as to avoid the need of polishing the shell after its deposit has been completed in order to provide an etchable surface.

Still another object of the invention is to provide an improved method of depositing a thin removable shell on a cylindrical base in which the surface of the metal is rolled progressively on helical lines thus avoiding rubbing or sliding of the roller on the deposited surface as it is formed.

This invention also aims to provide a method of making a printing roll having a thin removable shell in which the shell is rolled progressively as it is formed in reversed helical directions without sliding or rubbing of the roller along the surface of the shell during its formation.

Another object of the invention is to produce an improved printing roll by an agate roller, fed to and fro, and that rolls on the rotating cylinder in such a manner that its position and direction can adjust themselves freely and automatically, whereby a free rolling, as frictionless as possible, is afforded and any slipping, drawing or pushing of the agate roller on the cylinder surface is avoided.

Another object of the invention is to provide an improved method of rolling a shell of a printing roll by which the pressure on the roller is gradually increased during the electroplating, whereby a copper deposit is obtained which, after removal of the cylinder from the bath, needs only drying to be immediately etchable.

This application is a continuation-in-part of Serial No. 191,760, filed February 21, 1938, on which Patent No. 2,278,512 has been granted.

Still further objects of the invention will appear as this description proceeds with reference to the accompanying drawings in which:

Figure 1 is a perspective view of a cylindrical base designed to have a printing shell deposited and rolled thereon in accordance with the present invention.

Figure 2 is a perspective view of a printing roll of the present invention, an end portion of the shell being broken away, and the thickness of the shell being exaggerated.

Figure 3 is a micrograph showing a portion of the surface of the shell of a printing roll of the present invention enlarged 100 times.

Figure 4 is a like view of the surface of a roll made in accordance with the old conventional polishing method.

Figure 5 is a transverse section through an electroplating apparatus adapted for use in the production of a printing roll in accordance with the present invention, the roller being shown in two positions.

Figure 6 is a plan view of Figure 5 in which the weight carrying arm is broken away.

Figure 7 shows a shell roller with its holder in elevation.

Figure 8 is a side view; and

Figure 9 is a front view of the shell roller of Figure 7.

Like reference characters indicate like parts throughout the several figures.

The printing roll of the present invention is formed on a cylindrical base illustrated in Figure 1 and consisting of a cylindrical body 10 having trunnions 11 and 12 for mounting the roll in a press in the customary manner. The surface 13 of the base is polished to as high a degree as possible. The base is made of a diameter of about .012 inch less than the desired diameter of the finished roll. Copper is the preferred metal from which the surface 13 of the base is made. Preferably the base consists in an iron or aluminum core having copper deposited thereon to any desired thickness, the copper being then finished to bring the base to the proper diameter and until its surface has the high finish already referred to.

Upon completion of the finishing of the base, its surface is treated so as to prevent permanent adhesion of copper subsequently electro-deposited thereon to the base. The preferred mode of procedure to accomplish this is to swab the base surface with a solution of double sulphate of nickel and ammonium and sodium thio-sulphate in about equal proportions; or the base surface may be immersed in such solution. When the nickel solution comes in contact with the copper surface 13, there is a reaction reducing the nickel in the solution to metallic form, which nickel clings tenaciously to the copper base in an extremely thin layer. As soon as the copper surface is covered with nickel, the reaction ceases, thus insuring an absolutely uniform layer of nickel of extreme thinness. Said layer thus provides the base with a hard and durable surface without in any manner affecting the smoothness or finish of the surface 13.

If desired, subsequent permanent adhesion of the copper deposited on surface 13 of the base may be prevented in other ways though that already described is preferred. For example, the copper surface 13 may be simply rubbed with

an oily cloth so as to cover the surface 13 with a film of oil that is effective to prevent permanent adhesion of copper subsequently deposited to the surface 13, though such treatment does not enhance the hardness and durability of said surface adapting it for the removal and reception of a number of shells in succession without injury, and for this reason is not preferred.

After the surface 13 of the base has been coated with nickel, it is mounted in an electroplating apparatus, such as illustrated in Figures 5 to 9, inclusive, and a copper shell 14 deposited thereon in a manner hereinafter described. The shell 14, upon completion, has a thickness only sufficient for a single etching. A thickness of .006 inch is the preferred thickness of the shell. The surface appearance of the shell deposited in accordance with the present invention, in a manner about to be described, is illustrated in Figure 3. It has a smoothness far superior to that obtainable by the polishing of a copper shell produced upon a rotating base cylinder by ordinary methods; that is, by methods not involving the progressive rolling of the copper as it is formed. It is free of the fine lines, resulting from polishing, that are present in rolls produced after laborious polishing operations and which appear in shells made in accordance with present commercial practice, as shown in Figure 4 of the drawings. The surface produced by the present invention, illustrated in Figure 3, is best suited for etching a printing image therein without any polishing of said surface that would scratch the rolled surface.

A preferred form of apparatus for producing the rolled printing shell 14 will now be described.

The anode holders 16 with the anodes 17 therein are arranged in a trough 15 containing an electroplating bath of the usual formula. The base cylinder 10 dips partly into the bath as a cathode, and is rotated in the direction of the arrow (Fig. 5). A screw shaft 18 is regularly driven by means not shown, and turns alternately to the right and left. The slide 19, carried by the shaft 18, is slowly moved to and fro by virtue of the threaded engagement of the nuts 20, secured to said slide with the shaft 18.

The speed of rotation of the base cylinder 10 and the displacement of the slide on the shaft 18 are preferably so correlated that the sidewise displacement or shift of the smoothing roller upon each single rotation of the cylinder amounts to about four-fifths of the width of the path of contact of the roller with the base cylinders.

Between the ends of the arm 21 of slide 19, a roller support 22, in the form of a yoke, is pivotally secured for free rotation about bolt 23. Journalled in the arms 24 and 25 of the yoke 22 is a spindle 26, having a further yoke 27 rigidly secured to one end in offset relation to the axis of the spindle as illustrated. An agate roller 28, slightly crowned and optically ground to a mirror-like finish, as illustrated in an exaggerated manner in the drawings, has trunnions 29 journalled for free rotation in bushings 30 mounted in openings in the arms 31 and 32 of yoke 27. The grinding of the roller 28 in an accurate manner is of considerable importance to avoid imperfections in the rolled deposit. Preferably, the radius of the crown of the roller is approximately 480 millimeters.

The spindle 26 is held from endwise movement by collars 33 and 34, abutting against the inside of arms 24 and 25 of yoke 22. The spindle may thus be readily adjusted endwise by shifting the

position of said collars in order that the roller 28 may be disposed so as to be vertically above the axis of rotation of cylinder 19 regardless of variations in diameter of said cylinder. It will be understood that any other mechanism may be employed to adjust the spindle 26 in an endwise direction.

At the end of the arm 21, a spindle 33 is provided for the purpose of holding pierced weights 34 selectively placed on said spindle. The offset in the spindle 26 is so formed that the axis of the spindle is tangent to the cylinder or as nearly so as possible, as illustrated.

It will be observed that the roller is mounted for free rotation about its own axis, and that the axis of the roller is free to shift about the axis of spindle 26, and also about the axis of the pivotal mounting provided by the bolt 23. Accordingly, no restrictions are inherent in the roller mounting that will prevent the roller from automatically assuming a slight angle as it is shifted endwise of the cylinder by movement of the slide 19 to which it is secured.

The displacement of the slide 19 causes the roller 28 resting on the rotating cylinder to roll in a helical line on the cylinder. If the axis of the roller were held parallel to the axis of the cylinder, the roller could then not roll without slipping or rubbing along the cylinder surface. By so mounting the roller that its axis can freely shift in all directions according to this invention, automatic adjustment of the roller in the direction of its rolling takes place. A change of direction of the slide occurs at the two ends of the cylinder but the result of this is merely to cause the axis of the roller to be materially shifted and the roller will then roll over the cylinder in a reversed helical direction. The same action occurs with cylinders of different diameters. Large cylinders produce merely, for the same displacement of the slide 19, a smaller angle of inclination than smaller cylinders. In accurately adjusting itself automatically at the cylinder ends, the spindle 26 is rocked about the bolt 23.

Experience has shown that hindrances to free rotation are likely to produce a vibration of the roller and a hammered effect on the deposited copper.

An arm 35 depending from the slide carries a sponge 36 which contacts the roller 28 in order to collect any particles of dust or the like that might slightly mar the cylinder if permitted to remain on the roller.

Stationary stones 37 may be provided to act on both ends of the cylinder, such stones serving to prevent blister formations at the edge of the cylinder and to smooth these edges.

The shell 14 is produced by the apparatus just described, as an example, in the following manner:

The base cylinder, after it has been provided with the preferred nickel layer in the manner already described, is mounted in the electroplating apparatus and rotation of the cylinder initiated, the slide 19 at such time occupying the position shown in dotted lines in Figure 5 of the drawings. The electric circuit is closed and the slide 19 is then swung to its full line position of Figure 5 and the agate roller is adjusted to contact with the cylinder surface at a point vertically above its axis. The resultant of the forces acting on the roller at this time, to wit, the rotation of the cylinder and the slow shifting of the slide carrying the roller, causes the latter to assume a position in which its axis extends transversely to the

helical path of contact of the roller with the cylinder. As the rotation of the cylinder and the movement of the slide continues, it will be seen that the rollers rolls progressively over the cylinder surface, without sliding or rubbing of said surface, the periphery of the roller contacting with the cylinder surface on a helical path.

When the roller reaches the end of the cylinder, its reciprocatory movement is reversed and the resultant of the forces then acting on the roller causes the latter to automatically shift the roller axis so that said axis again extends transversely across the reversed helical path of the contact of the roller with the cylinder surface. It will thus be seen that the copper shell is rolled progressively as it is formed, resulting in a dense, smooth deposit having a surface suitable for etching the printing image therein.

When the roller is first placed upon the base cylinder, no weight is placed on the stem 33. After 10 to 15 minutes a 15 pound weight is preferably applied to said stem. A further 15 pound weight is then preferably added every 15 minutes until 5 weights are added, the current density being such and the characteristics of the apparatus being arranged so as to build up a shell at the rate of approximately .004 inch of thickness per hour. Preferably the width of the roller portion that contacts the cylinder is one-fourth inch, and as already pointed out the reciprocation of the slide 19 is slow enough so that the contact areas lap on each revolution.

After the shell has been etched and used, it is removed from the base cylinder, as already stated, and a new shell is electrodeposited thereon.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. The method of producing a printing roll having a surface suitable for etchings which comprises electrodepositing a thin shell of metal to a depth of approximately .006 inch upon a smooth base roll having a surface finished to facilitate stripping of the deposited metal from the roll, and rolling said deposited metal under pressure as the thickness thereof is built up, using no pressure other than the weight of the roller and its carriage for the first coating of approximately .001 inch of deposited metal and increasing said rolling pressure by approximately fifteen pounds for each increase in thickness of approximately .001 inch of the deposited metal.

2. In a method of making a printing roll having a removable smooth, dense metal coating of a thickness suitable for etching and printing, the steps of providing a rotating base cylinder having a smoothly finished cylindrical surface, electrodepositing metal for forming said coating on said smooth surface, providing a roller in rolling contact with said deposited metal coating, and moving said roller for progressively rolling said deposited coating under pressure in overlapping areas on a substantially helical path along said cylinder as said metal is being deposited while maintaining the axis of rotation of said roller in

such transverse relation to said path as to insure substantially only rolling contact between said deposited coating and said roller and substantially prevent frictional rubbing between said deposited coating and said roller as the latter moves in said path.

3. In the method of making a printing roll defined in claim 2, the steps of increasing the rolling pressure after a predetermined thickness of said metal has been deposited on said surface, and further increasing said rolling pressure as the thickness of said deposited coating increases.

4. In the method defined in claim 2, the step of reversing the movement of said roller each time it reaches an end of a predetermined longitudinal travel along said cylinder so as to provide progressive rolling of said deposited metal in substantially helical overlapping areas in reverse directions.

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