No. 794,492. PATENTED JULY 11, 1905.

S. CRUMP.

METHOD OF MAKING ROLLERS.

APPLICATION FILED JAN. 5, 1904.

Fig. 1

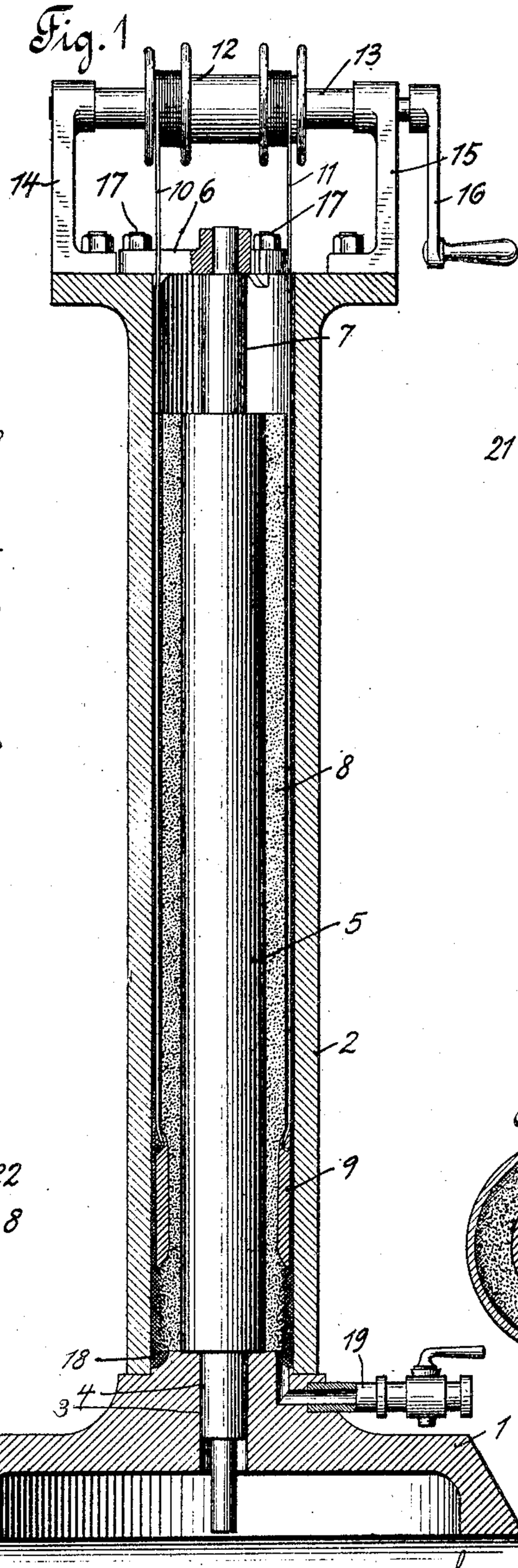


Fig. 2.

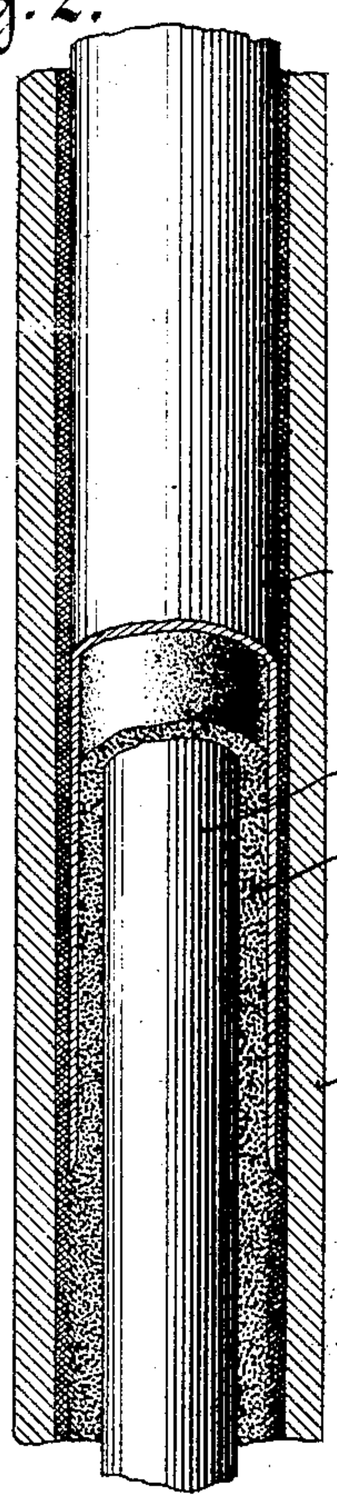


Fig. 3

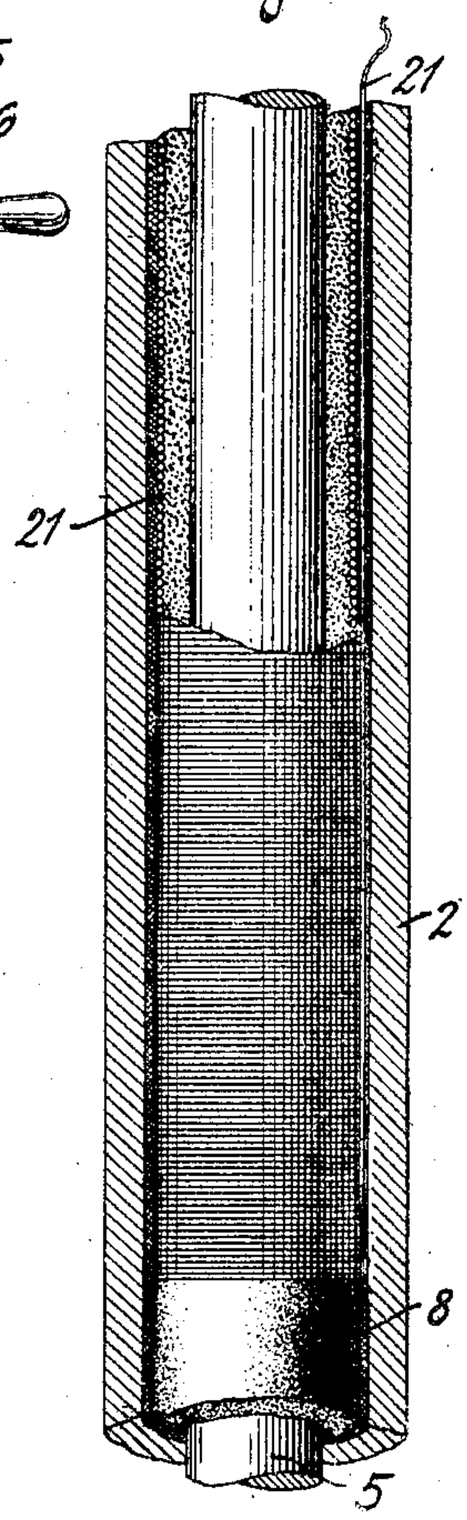


Fig. 4.

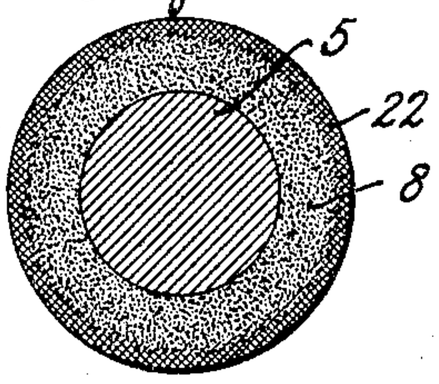
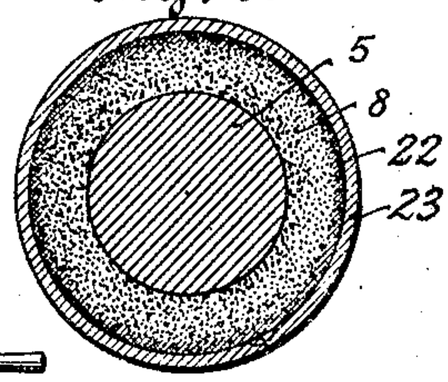


Fig. 5.



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No. 794,492. Patented July 11, 1905.

UNITED STATES PATENT OFFICE.

SAMUEL CRUMP, OF POUGHKEEPSIE, NEW YORK.

METHOD OF MAKING ROLLERS.

SPECIFICATION forming part of Letters Patent No. 794,492, dated July 11, 1905.

Application filed January 5, 1904. Serial No. 187,778.

To all whom it may concern:

Be it known that I, SAMUEL CRUMP, a citizen of the United States, and a resident of Poughkeepsie, in the county of Dutchess and State of New York, have invented a new and Improved Method of Making Rollers, of which the following is a specification.

My invention relates to a method of making rollers having soft resilient surfaces, and it is more especially applicable to the manufacture of inking-rollers for use in printing-presses.

In its broader aspects my invention is applicable to the manufacture of inking-rollers for use in both typographic and lithographic presses. In this application, however, the invention, while broadly claimed, will be more particularly described as applied to the manufacture of inking-rollers for use in typographic presses, and the invention will be specifically claimed as applied to that purpose, the specific claims for the invention as applied to the manufacture of inking-rollers for use in lithographic presses being made in a companion application.

As rollers of the character referred to have heretofore been constructed it is usually necessary when the surface of the roller becomes worn to remove the entire body of the roller down to the metallic shaft or "stock," as it is commonly known, the part so removed comprising all the flexible or yielding part of the roller. In the case of inking-rollers used in typographic presses the entire yielding body of the roller usually consists of what is known in the trade as "roller composition"—to wit, a composition consisting principally of glue or other gelatinous substance and glycerin or of the gelatinous substance and molasses or similar saccharine matter. When the surface of the roller becomes impaired by use, it is necessary to remove the entire body of composition and replace it by a new body. Attempts have been made to substitute some other yielding substance for the interior part of the body of the composition, a comparatively thin layer of the surface being made of the composition. None of these attempts has been practically successful, however, for the reason that no method has heretofore been devised whereby the coating of composition could be firmly united with the basic layer and at the same time be given a perfect and uniform surface.

An object of the invention is to provide a method of making rollers of the character referred to whereby the roller may be provided with a surface layer or cover of the character desired which is uniform and true and which is also firmly secured to the interior or basic part of the roller and to provide also a method by which the surface layer or cover may be removed and renewed at slight expense and without the necessity of removing and renewing the interior or basic part of the roller.

Other objects of my invention will more fully appear from the following description.

I have found that by compressing the material forming the surface of a soft resilient body and releasing the compressed material so as to allow it to expand in the presence of a suitable coating material the coating may be evenly applied to the surface of the soft body and will adhere thereto with great tenacity. The theory is that the compression of the material forming the surface of the resilient body forces the air or part of it out of the surface pores, which are usually present in such material, and when the compressed material is released the pores open and absorb the coating material, thereby causing a firm union between the coating and the body. Where the surface of the body is roughened or the surface extent or porosity is increased, the union between the body and the coating is made still firmer. In carrying out my invention, therefore, a roller-base of compressible resilient material is provided, and the material forming the surface of the base is compressed and then released in the presence of a coating material. In accordance with the best practice the surface of the roller-base is roughened or its surface extent or porosity is otherwise increased. The base may be formed of any suitable soft resilient material, as soft vulcanized rubber, or a resilient fabric, such as felt. The material preferably used for the base or for its surface portion, at least, is a soft vulcanized-rubber compound known as "sponge-rubber," as this composition may

be given the desired degree of porosity. If preferred for any reason, however, the other materials mentioned or natural or vegetable sponge or printers' roller composition or other soft resilient material may be used. Where the material used does not have sufficient natural roughness or porosity, the surface porosity or roughness should be increased artificially. Where, for example, the base of the roller or its surface portion is made of sponge-rubber so molded that the surface of the rubber has little porosity, this surface may be and in accordance with the best practice is removed, so as to open the larger pores of the rubber near the surface of the base.

A simple way of removing or partly removing the air from the surface pores of the base is to compress the base or the material forming the surface of the base. This step, however, may be accomplished in any suitable way—as, for example, with a vacuum-pump. Some of the most convenient ways of removing the air from or rarefying the air in the surface pores of the base, so that the coating material may enter said pores, are hereinafter explained.

Any suitable coating material may be used, the material being varied in accordance with the particular purpose for which it is intended. Where the roller is to be used for inking typographic printing-surfaces, the coating is preferably made of the ordinary roller composition. Where the roller is to be used for inking lithographic printing-surfaces, the surface of the roller may be made of leather or other material suitable for that purpose, the material with which the base is coated being in that case used as a binding material between the compressible resilient base and the cover. The coating material in this case, moreover, in accordance with the best practice is such as will take up or compensate for any irregularities in the surface of the base or in the thickness of the cover and such as will also protect the material forming the base from the ink used on the rollers and from the ink solvent used in cleaning the rollers, as is more fully explained in my said companion application.

In order that my invention may be more fully understood, I have illustrated in the accompanying drawings, which are referred to herein and form a part hereof, a form of apparatus by which my invention may be carried out, together with certain modifications of said apparatus showing different ways of carrying out the step of compression and releasing the resilient base of the roller.

Of the drawings, Figure 1 is a vertical central section of an apparatus by which my invention or certain of the steps thereof may be carried into effect. Figs. 2 and 3 are detail views illustrating means other than that shown in Fig. 1 for compressing and releasing the base of the roller in the presence of the coating material. Fig. 4 is a transverse section of a roller constructed in accordance with my invention and adapted for use in typographic presses, and Fig. 5 is a similar view of a roller constructed in accordance with my invention and adapted for use in lithographic presses.

The apparatus illustrated in Fig. 1 comprises a mold consisting of a base 1 and a vertical cylinder 2, having a smooth interior cylindrical surface, said cylinder 2 being preferably removably mounted on the base 1. The base 1 is provided with a central opening 3, adapted to receive the end 4 of a roller-stock 5, so as to center the stock with relation to the inner surface of the cylinder 2. The upper end of the cylinder 2 is provided with a tripod 6, having a central opening adapted to receive the end 7 of the roller-stock, so as to center the upper end of the stock with relation to the inner cylindrical surface of the member 2. As so far described, this is the ordinary type of mold for casting printers' rollers. As shown, the roller-stock 5 is provided with a basic layer 8 of compressible resilient material, the diameter of said layer being somewhat less than that of the interior cylindrical surface of the member 2. To carry out the steps of removing the air from the surface pores of the basic layer 8 and replacing it with the coating material, a ring 9 is provided, said ring having an internal diameter somewhat less than the external diameter of the basic layer 8 and an external diameter somewhat less than the internal diameter of the cylindrical surface of the mold 2.

In accordance with the best procedure the ring is forced onto one end of the basic layer 8 of the roller. Then the roller is placed in the mold with the ring at the lower end, and the space between the basic layer 8 and the interior surface of the mold being filled with the coating material in liquid or semiliquid form, such as printers' roller composition in a molten condition, the ring is moved from the lower end of the mold upwardly, so as to pass along the basic layer 8 from one end to the other. This may be accomplished in any suitable way. As shown, a pair of light cables or chains 10 and 11 are connected at their lower ends to opposite sides of the ring 9 and at their upper ends to suitable means for pulling them upwardly, said means consisting in the construction shown of a windlass 12, the shaft 13 of which is journaled in suitable standards 14 and 15, fixed to the upper end of the cylinder 2, and is provided with a handle 16, whereby the windlass may be turned to draw the ring 9 upwardly. To resist the upward thrust of the roller during the operation of moving the ring thereover, the tripod 6 is preferably arranged to engage the shoulder on the end 7 of the roller-stock and is firmly secured, as by the bolts 17, to the upper end of the cylinder 2. As the ring 9

travels upwardly its upper end is caused to progressively remove the air from the surface pores of the basic layer 8 by compressing the material so as to close or partly close the pores, and at the same time the compressed material is progressively released and expanded or allowed to expand to its former dimensions as the lower end of the ring travels upwardly, and is thus expanded or allowed to expand, so as to open the surface pores in the presence of the liquid or semiliquid coating material. The coating material is thus caused to fill or partly fill the surface pores of the basic layer, and when the coating material hardens it will be firmly united with the surface of the basic layer. If the porosity of the basic layer be sufficient and of the best character, the coating material will by this method of its application become practically integral with the basic layer. While the air in the surface pores of the basic layer is forced by the upper end of the ring 9 out of the pores into the coating material, this is done progressively from the bottom of the mold upwardly, so that the air-bubbles thus formed are enabled to travel upwardly through the composition with the ring, so that there is little liability of the air-bubbles passing the ring and remaining in the coating below the ring, where they would be apt to form pockets or pin-holes in the surface of the completed roller.

The compression and expansion of the material forming the surface of the basic layer by the ring 9 is facilitated by rounding the inner edges of the ring at the top and the bottom thereof, as shown. In order that the basic layer may be reached throughout its entire length by the ring, the lower end of the ring should be allowed to project somewhat below the lower end of the basic layer, as by providing the base 1 of the mold with an annular recess 18 and by spacing the tripod 6 from the upper end of the basic layer 8 of the roller a distance equal to or greater than the vertical height of the ring 9. The expansion of the basic layer toward the inner surface of the mold and to a point close to that surface is an important feature of my invention, as by that operation the coating material, being by reason of its viscid nature slow to run in the thin space between the basic layer and the mold surface, is subjected to considerable pressure by the expanding basic layer and is thus caused to accurately conform to the mold-surface and to enter more perfectly into the pores of the basic surface. Where this expansion of the basic layer is progressive from the bottom of the mold upwardly, moreover, it serves to positively force any air-bubbles in the composition toward the top of the mold.

The molten composition may be introduced into the mold in any desired way, as by partly filling the mold before the roller-stock, with its basic layer, is introduced therein, or by simply pouring the molten composition into the top of the mold after the roller-stock has been placed therein. If desired, however, the composition or coating may be introduced from the bottom of the mold, as by means of a valved pipe 19. When the composition or coating is introduced from the bottom of the mold, it may be introduced under pressure, as by a plunger working in a cylinder, and operated by hydraulic pressure or other power, and, if desired, the compressing-ring 9 may be moved along the roller-base by the pressure of the composition instead of by the windlass and cables. In this case the ring is made to fit the inner surface of the mold sufficiently close to prevent the composition from flowing past the ring under the pressure required to move the ring. The pressure of the composition will serve to drive it into the pores of the basic layer very thoroughly. The pressure will also serve to keep the basic layer in a compressed condition until the ring has traveled the full length of the roller. Then the pressure being released the compressed base will expand, and the force of this expansion will further drive the composition into the pores as they open. The surplus composition will be driven out of the space between the basic layer and the mold-surface, leaving a thin layer or coating firmly attached to the basic layer in a homogeneous condition. By this mode of procedure, moreover, the air removed from the pores of the basic layer does not enter the composition, so that there is no liability of defects in the coating from that source. When the air is removed or partly removed from the surface pores of the basic layer by means of a vacuum-pump, the upper end of the cylinder 2 is hermetically sealed, and after the air has been exhausted from the mold the coating material is preferably admitted from below, as by the valved pipe 19, and allowed to entirely fill the mold and bring the pressure therein back to that of the atmosphere or somewhat above the atmospheric pressure, so that where the basic layer 8 has been expanded by the air trapped therein it will be brought back to its normal dimensions by the pressure of the coating material, so that the space between the basic layer 8 when of normal size and the interior surface of the mold will be entirely filled with the coating material. An advantage of this method of removing the air from the surface pores of the basic layer of the roller and replacing it with composition is that the coating will be entirely free from air-bubbles and from the pin-holes produced thereby. Where the basic layer contains cells in which a gas is trapped, as in the case of sponge-rubber, moreover, the expansion of the basic layer resulting from the reduction in the pressure on the outside thereof opens the surface pores of the basic layer, so that the coating material may readily flow in.

Then when on the restoration of the pressure the basic layer contracts the surface pores tend to close on the coating material therein, and thus firmly hold the same.

The step of filling or partly filling the surface pores of a basic layer may be accomplished by expanding the basic layer from a natural condition in the presence of a coating material instead of from a compressed condition. This expansion may be accomplished in any suitable way. For example, the roller-base in the form of a tube may be introduced into the mold, the space between it and the mold filled with the coating material in liquid or semiliquid form, and then a roller-stock or other mandrel having a diameter somewhat larger than that of the bore of the base forced into and through said bore. This will cause the base to expand and the surface pores thereof to open and absorb the coating material. The surface of the base will be expanded also toward the walls of the mold, so as to strongly force the coating material into the pores of the base and leave the coating thin and in a perfect condition. Where the basic layer is expanded by forcing the roller-stock therein, the operation is facilitated by lubricating the stock with a liquid cement, which when it sets will firmly secure the base on the stock. Where a mandrel is used to expand the base in the mold, it may be removed when the roller has been removed from the mold and the base, with its coating, allowed to contract. The roller may then be secured to a suitable core or stock either in its contracted condition or in an expanded condition.

A modified form of the apparatus for carrying out the step of expanding the basic layer from a compressed condition in the presence of the coating material is illustrated in Fig. 2. In accordance with this modification the basic layer 8 of the roller is compressed, preferably before the roller is placed in the mold, by placing a tube 20, having an internal diameter somewhat less than the external diameter of the basic layer 8, over the entire length of said basic layer. In this way the air is removed from the surface pores of the basic layer before the same is placed in the mold. When the roller with the basic layer thus compressed is placed in the mold and the latter filled with the coating material, the tube 20 is drawn off, preferably in an upward direction, so as to progressively release the material forming the surface of the basic layer from its compressed condition from the bottom of the mold upwardly in the presence of the coating material. This manner of carrying out the step of filling the pores with the liquid coating material has the advantage that the air is not removed from the pores in the presence of the coating material, so that there is little or no liability of the formation of air-bubbles or pockets in the finished coating.

Another modification of the apparatus, whereby the air may be removed from the surface pores of the entire basic layer before the roller-stock is placed in the mold, is illustrated in Fig. 3. In accordance with this modification the basic layer 8 of the roller is wound throughout its length with a string 21 or a wire or a small chain, the same being applied under tension, so as to compress the surface of the basic layer to a suitable degree. After the stock with the basic layer thereon thus compressed is placed in the mold and the mold filled with the coating material the string is removed, preferably by unwinding it from the bottom of the mold upwardly, so that the compressed material of the basic layer is progressively released from the bottom of the mold upwardly in the presence of the coating material in liquid or semiliquid form.

While both of the modifications of the apparatus illustrated in Figs. 2 and 3 are less likely to form air-bubbles or pockets in the finished coating than is the apparatus illustrated in Fig. 1, each of the modifications has the disadvantage of being slower and more difficult to manipulate.

In Fig. 4 a transverse section of a finished roller is illustrated. In this figure 5 represents a section of the stock, 8 a section of the basic layer, and 22 a section of the coating, the latter being integrally united with the basic layer, as indicated. Where the roller is to be used in typographic presses, the coating forms the outer surface of the roller and preferably consists of printers' roller composition. Where the roller is to be used in lithographic or planographic presses, the coating, if it forms the cover, will be made of a material suitable for that purpose. Lithographic rollers, however, are preferably provided with a cover of leather. In this case the coating for the basic layer then serves as a cement to secure the cover to the basic layer. In accordance with best construction, moreover, the coating serves also to take up or to assist in taking up irregularities in the outer surface of the basic layer and in the inner surface or in the thickness of the cover and also to protect the basic layer from the ink and ink solvents used on the roller.

A transverse section of a lithographic roller is illustrated in Fig. 5. In this figure 5 represents the stock; 8, the basic layer; 22, the layer of coating material, and 23 a leather cover. The leather covers of lithographic rollers are necessarily provided with one or more longitudinal seams, as indicated at 24. In order that the exterior surface of the leather cover of the roller may be truly cylindrical and accurately centered with the stock, the leather cover with its seam innermost is placed in a cylindrical mold, as in the member 2 of Fig. 1, and is forced into close contact with that mold in any suitable way, as by the method set forth in my application, Serial

No. 163,373, filed June 27, 1903. The roller-stock 5, with its basic layer 8, is then placed in the mold, and the space between it and the leather cover is filled with a suitable coating material. I preferably use printers' roller composition for this material; but there may be used other suitable resilient flexible material which will not be destroyed by the ink or the ink solvent used on the roller and which will serve to protect the basic layer from the ink or the ink solvent used on the roller where that base is of a material which is apt to be attacked by the ink or ink solvent. The surface of the basic layer is then treated, as hereinbefore described, to cause a firm union between it and the coating material, and, if desired, a similar treatment may be applied to the inner surface of the leather coating. The surface of the leather, however, usually has so much natural roughness and porosity that the coating material will sufficiently adhere thereto without special treatment.

My invention also contemplates the removal of the coating and of the coating and cover where a separate cover is used and the removal of the coating without removing the basic layer of the roller and then applying a new coating or a new coating and cover, as the case may be. In order that the coating may be removed from the basic layer and from the surface pores thereof, the coating is preferably formed of soluble material and of a material which is soluble in some substance which will not affect the material of which the basic layer is formed. Where the basic layer is formed of spongy rubber and the coating of printers' roller composition, the latter may be readily removed from the basic layer and from the surface pores of the basic layer by soaking the coated roller in water, the water, if necessary, being heated to facilitate the operation, or steam may be used, or if the coating has become quite hard the roller may be boiled in alkali. The cover of a lithographic inking-roller, which cover is secured to the basic layer by a coating of printers' roller composition or of other gelatinous substance, may be removed in the same way. The basic layer not being injured by the water or other solvent, the solvent may be removed from the surface pores thereof and a new coating or a new coating and cover applied thereto in the manner hereinbefore described.

One of the chief defects in rollers the entire yielding body of which is made of printers' roller composition is that the rollers become so heated in use, especially in warm weather and in high-speed presses, that the composition softens and loses its elasticity. If not carefully watched, such rollers often become so warm that they lose their shape and are ruined. In any event the rollers have to be frequently changed, thus causing serious delays, especially in newspaper-offices, where time is of the utmost importance in getting out the editions. I have observed that the surface portions of these composition rollers are so toughened or "cured" by contact with the materials of which printing-inks are composed, and particularly by contact with the linseed-oil varnish used in most inks, that those portions do not readily melt at the temperature developed in the rollers in use. By my invention this defect of the composition rollers is entirely removed. The basic layer may be and preferably is formed of some material which is not affected by heat. Where a spongy rubber is used, moreover, the air contained in the roller renders the roller a poor conductor of heat. The surface layer or coating of roller composition is made so thin that it soon becomes toughened or cured throughout its entire mass by contact with the ink or the linseed-oil varnish therein, so that rollers constructed in accordance with my invention may be run at a much higher temperature, and consequently at a much higher speed, than ordinary composition rollers.

The filling of the surface pores of the base has a special advantage in that the surface of the roller is given the permanent elasticity of the base, so that it will not take permanent set when resting in contact with another surface, as will a roller having a body of roller composition, and at the same time when the coating is used as the cover of the roller the surface has the characteristics of the composition—to wit, that tackiness or affinity for ink known as "suction," freedom from attack by the ink or ink solvents, &c. A roller having a leather or other cover the cover may receive the permanent elastic support of the base and the latter at the same time be thoroughly protected and the two firmly united at every part by the coating.

It is to be understood that my invention in its broader aspects is not limited to the precise steps or modes of procedure herein set forth, as many changes may be made therein without departing from the main principles of the invention or without sacrificing its chief advantages.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The method of making rollers, which consists in providing a roller-base of soft resilient material, said base having a porous surface and expanding the material forming the surface of said base in the presence of a coating material.

2. The method of making rollers, which consists in providing a roller-base of soft resilient material, compressing the material forming the surface of said base, and expanding the compressed material in the presence of a coating material.

3. The method of making rollers, which consists in providing a roller-base of soft resilient material, said base having a roughened surface,

compressing the material forming the surface of said base, and expanding the compressed material in the presence of a coating material.

4. The method of making rollers, which consists in providing a roller-base of soft resilient material, said base having a porous surface, removing air from the pores of said basic surface, and replacing the removed air with a coating material.

5. The method of making rollers, which consists in providing a roller-base of soft resilient material, said base having a porous surface, compressing the material forming the surface of said base, and expanding the compressed material in the presence of a coating material.

6. The method of making rollers, which consists in placing a roller-stock provided with a basic layer of soft resilient material in a mold, and expanding the material forming the surface of said basic layer in the presence of a coating material in said mold.

7. The method of making rollers, which consists in placing a roller-stock provided with a basic layer of soft resilient material in a mold, and expanding the material forming the surface of said basic layer from a compressed condition in the presence of a coating material in said mold.

8. The method of making rollers, which consists in placing a roller-stock provided with a basic layer of soft resilient material in a mold, said basic layer having a porous surface, removing air from the pores of said basic surface, and replacing the removed air with a coating material in said mold.

9. The method of making rollers, which consists in placing a roller-stock provided with a basic layer of soft resilient material in a mold, said basic layer having a porous surface, removing air from the pores of said basic surface, and progressively replacing the removed air with a coating material in said mold.

10. The method of making rollers, which consists in placing a roller-stock having a basic layer of soft resilient material thereon in a mold, filling the space between said basic layer and the mold with a coating material in liquid or semiliquid form, and releasing the material forming the surface of said basic layer from a compressed condition in the presence of said coating material.

11. The method of making rollers, which consists in placing a roller-stock provided with a basic layer of soft, resilient material in a vertical mold, filling the space between said basic layer and the mold with a coating material in liquid or semiliquid form, and progressively releasing from the bottom of the mold upwardly the material forming the surface of said basic layer from a compressed condition in the presence of said coating material.

12. The method of making rollers, which consists in placing a roller-stock provided with a basic layer of soft resilient material in a vertical mold, said basic layer having a porous surface, removing air from the pores of said basic surface, and progressively replacing the removed air from the bottom of the mold upwardly with a coating material in liquid or semiliquid form.

13. A step in the method of making a roller provided with a base of compressible resilient material, which step consists in expanding the material forming the surface of said base in the presence of a coating material.

14. A step in the method of making a roller provided with a base of compressible resilient material, which step consists in progressively expanding the material forming the surface of said base in the presence of a coating material.

15. A step in the method of making an inking-roller provided with a basic layer of compressible resilient material, said basic layer having a porous surface, which step consists in removing the air from the pores of said basic surface in the presence of a roller-composition.

16. The method of making rollers, which consists in placing a roller-stock provided with a basic layer of compressible resilient material in a mold, and compressing the material forming the surface of said basic layer in the presence of a coating material in said mold.

17. The method of making rollers, which consists in placing a roller-stock provided with a basic layer of compressible resilient material in a mold, and progressively compressing the material forming the surface of said basic layer in the presence of a coating material in said mold.

18. The method of making rollers, which consists in placing a roller-stock provided with a basic layer of compressible resilient material in a vertical mold, and progressively compressing from the bottom of the mold upwardly the material forming the surface of said basic layer in the presence of a coating material in said mold.

19. The method of making rollers, which consists in placing a roller-stock provided with a basic layer of compressible resilient material in a mold, said basic layer having a porous surface, and removing the air from the pores of said basic layer in the presence of a coating material in said mold.

20. The method of making rollers, which consists in placing a roller-stock provided with a basic layer of compressible resilient material in a vertical mold, said basic layer having a porous surface, and filling the space between said basic layer and the mold with a coating material in liquid or semiliquid form, removing the air from the pores of said basic layer, and progressively filling said pores from the bottom of the mold upwardly with the coating material in said mold.

21. The method of making rollers, which consists in placing a roller-stock provided with

a basic layer of compressible resilient material in a vertical mold, said basic layer having a porous surface, filling the space between said basic layer and the mold with a coating material in liquid or semiliquid form, and progressively compressing and releasing from the bottom of the mold upwardly the material forming the surface of said basic layer in the presence of said coating material.

22. The method of making rollers, which consists in placing a roller-stock provided with a basic layer of compressible resilient material in a mold, filling the space between said basic layer and the mold with molten printers' roller composition, and releasing the material forming the surface of said basic layer from a compressed condition in the presence of the molten composition in the mold.

23. The method of making rollers, which consists in placing a roller-stock provided with a basic layer of compressible resilient material in a vertical mold, said basic layer having a porous surface, filling the space between said basic layer and the mold with printers' roller composition in a molten condition, and progressively releasing from the bottom of the mold upwardly the material forming the surface of said basic layer from a compressed condition in the presence of the molten composition.

24. The method of making rollers, which consists in molding a basic layer of sponge-rubber on a roller-stock, compressing the material forming the surface of said basic layer, and releasing the compressed material in the presence of a coating material.

25. The method of making rollers, which consists in molding a basic layer of sponge-rubber on a roller-stock, removing the surface of said molded basic layer so as to open the pores thereof, and removing the air from the pores so opened in the presence of a coating material in liquid or semiliquid form.

26. The method of making rollers, which consists in molding a basic layer of sponge-rubber on a roller-stock, removing the surface of said basic layer to open the pores thereof, compressing said basic layer to remove the air from the opened pores, and releasing the basic layer so compressed in the presence of a coating material in liquid or semiliquid form.

27. The method of making rollers, which consists in molding a basic layer of sponge-rubber on a roller-stock, removing the surface of said basic layer to open the pores thereof, placing said roller-stock with its basic layer in a vertical mold, and progressively filling the opened pores of the basic layer from the bottom of the mold upwardly with a coating material in a liquid or semiliquid condition.

28. The method of making rollers, which consists in molding a basic layer of sponge-rubber on a roller-stock, removing the surface of said basic layer to open the pores thereof, placing said roller-stock with its basic layer in a mold, filling the space between said basic layer and the mold with a coating material in liquid or semiliquid form, removing the air from the opened pores of said basic layer, and filling said pores with the coating material in said mold.

29. The method of making rollers, which consists in molding a basic layer of sponge-rubber on a roller-stock, removing the surface of said basic layer to open the pores thereof, placing said roller-stock with its basic layer in a vertical mold, filling said mold with a coating material, progressively removing the air from said pores from the bottom of the mold upwardly, and progressively filling said pores from the bottom of the mold upwardly with the coating material in the mold.

30. The method of making rollers, which consists in molding a basic layer of sponge-rubber on a roller-stock, removing the surface of said basic layer to open the pores thereof, placing said roller-stock with its basic layer in a mold, filling the space between the basic layer and the mold with printers' roller composition in a molten condition, removing the air from the opened pores, and filling said pores with the molten composition.

31. The method of making rollers, which consists in molding a basic layer of sponge-rubber on a roller-stock, removing the surface of said basic layer to open the pores thereof, placing said roller-stock with its basic layer in a mold, filling the space between said basic layer and the mold with printers' roller composition, and filling said opened pores with the molten composition by a progressive action from one point on the surface of the basic layer toward another point.

32. The method of making rollers, which consists in molding a basic layer of sponge-rubber on a roller-stock, removing the surface of said basic layer to open the pores thereof, placing said roller-stock with its basic layer in a vertical mold, filling the space between the basic layer and the mold with printers' roller composition in a molten condition, and progressively compressing and releasing from the bottom of the mold upwardly the surface of the basic layer to remove the air from the opened pores and replace it with the molten composition.

33. The method of renewing rollers provided with a basic layer of compressible resilient material and a coating, which method consists in removing the coating from the basic layer, compressing the material forming the surface of said basic layer, and releasing the compressed material in the presence of a coating material in liquid or semiliquid form.

34. The method of renewing rollers provided with a basic layer of compressible resilient material, said layer having a porous surface, and a coating the material of which extends into the pores of said basic surface,

which method consists in removing the coating from the basic layer and from the surface pores thereof, and filling said pores with a coating material in liquid or semiliquid form.

35. The method of renewing rollers provided with a basic layer of compressible resilient material, said base having a porous surface and a coating extending into the pores of said basic surface, which method consists in dissolving the coating material out of the surface pores of the basic material, removing the solvent from said pores, and filling said pores with a new coating material in liquid or semiliquid form.

36. The method of making rollers which consists in providing a roller-base of compressible resilient material, compressing the material forming the surface of said base, releasing the compressed material in the presence of a coating material soluble in a substance which will not injuriously affect the base of the roller, then when the coating has become useless dissolving the coating, removing the solvent from the base, compressing the material forming the surface of the base and releasing the compressed material in the presence of a new coating material in liquid or semiliquid form.

37. The method of making rollers which consists in providing a roller-base of compressible resilient material, said base having a porous surface, removing the air from the pores of said basic surface, filling said pores with a coating material which is soluble in a substance which does not injuriously affect the material of the base, then dissolving the coating material out of the surface pores of the base, removing the solvent from said pores and filling said pores with a new coating material in liquid or semiliquid form.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

SAMUEL CRUMP.

Witnesses:
EDWIN SEGER,
JOHN O. GEMPLER.