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(54) **Manufacture of printing sleeves.**

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Two drawings entitled "Formzylinderkörper" and "Formzylindermantel" concerning a prior use in the form of a "Stahlstichdruckwerk" made publicly known in the period between nov.30,1971 and April 25, 1972.

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Description

This invention relates to printing rolls, and is especially applicable to rolls suitable for accepting photo-originating designs, such as used in the gravure or lithographic printing processes.

Conventionally, a gravure printing surface is provided by etching the surface of a metal printing roll. The production of the roll and the need to replace or discard it after use makes the process very expensive, and only suitable for relatively long printing runs.

In EP 0000410 there is disclosed a printing sleeve of tapered internal surface and parallel external surface. It has two or three layers of different metals all electrolytically deposited, the outer or middle layer resp. being ground to uniform outside diameter. This disclosure falls under Art. 54(3) EPC.

US-A-4024045 discloses the production of a simple metal sleeve by electrolytic deposition on a roller and its subsequent removal therefrom. The roller can be tapered to facilitate removal or the sleeve can be expandable by internal overpressure, and may have a chromium release coating.

We have previously proposed in BE-A 856427 improved methods of producing printing rolls, particularly for flexographic printing. A sleeve made of plastics material, preferably reinforced plastics material, is fitted onto a roll core which can be of metal construction. Thus, for different printing jobs different sleeves can be used with a common roll core. In order to assist in getting the sleeve on and off the core, the internal diameter of the sleeve is slightly larger at one end than the other, and the external diameter of the core is similarly slightly larger at one end than the other so that the sleeve can be slid partly onto the core before it wedges. The core is provided with apertures in that region which is initially covered by the sleeve and through which compressed air can be forced to slightly expand the sleeve so that it can be slid fully onto the core.

The present invention, however, provides a sleeve substantially as described in the foregoing paragraph, but made in novel manner entirely of metal so as to provide a conductive path from the inside to the outside of the sleeve to assist in electro-plating the outer surface of the sleeve.

More particularly, the invention provides a method of making such a sleeve, comprising taking a generally cylindrical mandrel the external diameter of which is slightly larger at one end than the other, and optionally having fluid outlet apertures in a region intermediate its ends, coating the outside surface of the mandrel with a release agent, applying non-electrolytically a first layer of metal over the outside surface of the mandrel, grinding the outside surface of the first metal layer to provide it with a uniform external diameter and electroplating an etchable second metal layer onto the first metal layer. Suitably at least one, and preferably both, of the metal layers are copper. It is particularly preferred that said second layer is copper. The outer surface of the second metal layer can be finished in conventional manner to provide a surface suitable for gravure printing. Such finishing may for example take the form of grinding, polishing and eventually etching to provide the imaged surface, and possibly flash chrome-plating to provide a more durable finish.

The first layer may be provided by spraying molten metal onto the outside surface of the mandrel, the fluid outlet holes having been masked beforehand. Alternatively, the first layer may be applied by straining a preformed metal sheet around the mandrel, with either a helical or a longitudinal butt seam, and welding the seam to secure the layer. In the case of a sprayed metal layer, the fluid outlet holes may be masked before or after application of the release agent, but preferably they are masked after, using metal shim, such as copper shim, which is thereby incorporated in the sprayed metal layer.

The metal sleeve is at some suitable point in the process removed from the mandrel. This may be done by applying fluid, for example air, under pressure to the apertures in the mandrel so as to slightly expand the sleeve and allow it to be withdrawn axially from the smaller diameter end. Removal from the mandrel may take place when the electro-plated layer has been fully finished. However, it may be desirable to mount the sleeve on different mandrels at different stages during the process ; for example for applying the first metal layer, for the electro-plating, and for the etching. In such a case, the sleeve can be removed, in the manner described, from the one mandrel and fitted onto the next mandrel by a process which involves sliding the sleeve over the mandrel until the fluid outlet holes are covered and then applying fluid under pressure to the fluid outlet holes to slightly expand the sleeve so that it can be slid fully onto the mandrel. However, if the sleeve is transferred from one mandrel to another between applying the first layer and the electro-plating application of the second layer, the first layer may not be sufficiently strong or resilient to withstand the fluid pressure without distortion, and other means may be needed for removing it from the first mandrel and fitting it to the second mandrel. This may be achieved by heating and cooling so as to take advantage of thermal expansion and contraction. The invention can be further understood by reference to the accompanying drawings wherein :

Figs. 1, 2 and 3 show diagrammatically in cross-section the stages in fitting a printing sleeve to a roll core ;

Fig. 4 shows a diagrammatically enlarged cross-sectional view of part of one embodiment of sleeve being produced according to the present invention ;

Fig. 5 shows a diagrammatically enlarged cross-

sectional view of part of a second embodiment of sleeve being produced according to the present invention ; and

Fig. 6 shows diagrammatically a cross-sectional side view through one end portion of a mandrel and sleeve at the electro-plating stage in an alternative procedure of the present invention.

Referring to Figs. 1 to 3, the sleeve 10 is made from a thermosetting resin, such as polyester or epoxy resin, reinforced with glass fibre, which is preferably spirally wound so as to provide hoop strength for the sleeve. The outside surface 12 of the sleeve is of uniform diameter, but the inside surface 14 has a very small taper from one end to the other. (This taper is greatly exaggerated in the drawing for the sake of clarity in explanation). The sleeve is removably mounted to a roll core 16, shown separately in Fig. 1, suitably made of steel, having an axle 18 for rotatably mounting the core. The outside surface of the core is similarly slightly tapered, and is dimensioned so as to allow the sleeve to be manually slid onto the core to rather more than half its length before the sleeve wedges on the core as shown in Fig. 2. An air supply passage 20 extends axially along the core and emerges at outlets 22 on the surface of the core about half way along its length. These outlets are thus covered by the sleeve at the point where the sleeve wedges onto the core. Compressed air is then applied through the passage 20 so as slightly to expand the sleeve and allow it to be completely slid onto the core, as shown in Fig. 3. The supply of air is then discontinued and the sleeve is then firmly fitted to the core.

Referring to Fig. 4 ; a steel mandrel 38 on which the sleeve is to be formed has the same general shape and construction as the roll core 16, but its outside diameter, point for point along its length, is very slightly less than that of the roll core to which the sleeve is eventually fitted. In this way, the sleeve thus produced will be slightly undersized with respect to the roll core, and will therefore be a tight fit on it. The mandrel has air outlets 22 about halfway along its length. In the first stage of construction, the outside surface of the mandrel is covered with a layer 39 of a silicone release agent. Then a strip or hoop of copper shim 40 is fitted around the mandrel so as to cover the outlets 22. Then a particulate copper composition is sprayed on to form a copper layer 41. This can be done by known techniques, for example by feeding copper rod or powder into a spraying head where a plasma electric arc melts it and forms minute droplets of molten copper which are protected from oxidation by an inert gas while they are sprayed onto the surface of the mandrel. The outside surface of this first layer is then ground so as to produce a uniform outside diameter (as compared with the slightly tapering outside diameter of the mandrel). Then the first copper layer is electro-plated to provide a second copper layer 42 of desired thickness, the outside surface of which is ground, polished, etched to produce the gravure printing surface, and finally flash chrome-plated.

The sleeve is removed from the mandrel by applying air under pressure to the outlets 22 which slightly expands the sleeve so that it can be withdrawn lengthwise from the narrower end of the mandrel.

Referring to Fig. 5 ; in this method, a similar mandrel 38 is used, and a silicone release agent applied to it. Then a thin sheet of copper 43 is strained around the mandrel so as to provide a butt joint 45 which is secured by plasma welding ; that is using a very narrow well-defined electric plasma arc flame produced from a tungsten tip with inert gas protection, to locally melt the copper along the seam and weld the two butting edges together. Thereafter this first copper layer is ground to produce a uniform external diameter, before electro-plating the second layer as previously described.

The all copper sleeves of this invention will generally have a somewhat smaller taper than the corresponding reinforced plastics sleeves referred to above. For example a taper of about 1 : 5000 might be appropriate for the sleeves one metre long.

In another procedure of the present invention, the mandrel coated with a silicone release agent is heated to about 100°C above ambient temperature. An electrically conductive metal, preferably zinc, is sprayed onto the release coated mandrel to form a metal base sleeve. A typical wall thickness is of the order of 0.5 to 0.8 mm. The mandrel is heated in order to accept more easily the sprayed metal and also to assist in removing the metal base sleeve from the forming mandrel by contraction of the mandrel on cooling.

The metal base sleeve on the forming mandrel is then machined to a uniform external diameter and is ready for removal from the forming mandrel. The temperature of the mandrel in the meantime has cooled down and in order to remove the metal base sleeve its temperature is raised quickly and it is slid lengthwise off the forming mandrel. Air is not used at this stage for the removal of the metal base sleeve from the mandrel, particularly if the metal base sleeve is made of zinc, since zinc is too soft and the sleeve would be distorted.

The metal base sleeve 48 is expanded by heat and slid onto a plating mandrel 50 (Fig. 6). The ends of the sleeve extend beyond the body of the mandrel and are closed by end plugs 52, e.g. of acetal resin, with O-ring seals 54 to prevent the migration of the plating bath solution between the sleeve and the mandrel but allowing the end faces of the sleeve to be plated. For this purpose a gap 55 is left between the end faces and the plugs. The metal base sleeve is then plated with copper to a required thickness and is then ground to a finish diameter. The copper layer strengthens the sleeve to such an extent that the sleeve can be removed from the plating mandrel and

mounted and demounted from a printing roll core by compressed air as described above.

Claims

1. A printing sleeve for fitting to a printing roll one end of which is of slightly larger diameter than the other end, the sleeve being similarly dimensioned so that it can be mounted on the roll by sliding it on lengthwise until it covers fluid outlet openings in the roll intermediate the ends of the roll, applying fluid under pressure to the outlets to slightly expand the sleeve, and then sliding the sleeve the rest of the way onto the roll ; characterised in that the sleeve (10) is made entirely of metal and has which contacts the roll and has a cylindrical outermost surface, and an etchable electro-plated outer metal layer (42).

2. A printing sleeve according to claim 1 wherein both the inner layer and said electroplated layer are of copper.

3. A printing sleeve according to claim 1 wherein the inner layer is of zinc and said electro-plated layer is copper.

4. A method of making a printing sleeve for fitting to a printing roll one end of which is of slightly larger diameter than the other end, the sleeve being similarly dimensioned so that it can be mounted on the roll by sliding it on lengthwise until it covers fluid outlet openings in the roll intermediate the ends of the roll, applying fluid under pressure to the outlets to slightly expand the sleeve, and then sliding the sleeve the rest of the way onto the roll ; characterised in that the method comprises taking a generally cylindrical mandrel (38) the external diameter of which is slightly larger at one end than the other, coating the outside surface of the mandrel with a release agent (39), applying non-electrolytically a first layer (41, 43, 48) of metal over the outside surface of the mandrel, grinding the outside surface of the first metal layer to provide it with a uniform external diameter, and electro-plating an etchable second metal layer (42) onto the first metal layer.

5. A method according to claim 4 wherein said first layer is provided by spraying molten metal onto the outside surface of the mandrel.

6. A method according to claim 4 or claim 5 wherein the sleeve is removed from the mandrel by applying fluid under pressure to fluid outlet apertures in the mandrel to slightly expand the sleeve and allow it to be withdrawn axially from the smaller diameter end of the mandrel.

7. A method according to claim 5 wherein after applying the first metal layer (48) the sleeve is transferred from the first mandrel to a plating mandrel (50) at which the second layer is electro-plated.

8. A method according to claim 7 wherein the sleeve (48) is removed from the first mandrel by heating it to a higher temperature than the mandrel so that it expands relative to the mandrel and can be withdrawn axially therefrom.

9. A method according to claim 8 wherein the sleeve (48) is slid axially onto the plating mandrel (50) while at a relatively higher temperature so that it contracts to fit the plating mandrel (50) tightly on cooling.

10. A method according to any one of claims 7, 8 and 9 wherein the end portions of the sleeve (48) extend beyond the body of the plating mandrel (50), the ends of the sleeve being closed by members (52, 54) which seal against the inside surface of the sleeve, whereby the end faces of the sleeve (48) are exposed for plating.

Ansprüche

1. Druckhülse zum Aufschieben auf eine Druckwalze, deren eines Ende einen geringfügig größeren Durchmesser aufweist als das andere Ende, wobei die Hülse ähnlich dimensioniert ist, so daß sie auf der Walze angeordnet werden kann, indem sie in Längsrichtung auf dieselbe aufgeschoben wird, bis sie Auslaßöffnungen für ein Fluid verdeckt, die in der Walze zwischen den Enden derselben angeordnet sind, woraufhin ein unter Druck stehendes Fluid den Auslaßöffnungen zugeführt wird, um die Hülse geringfügig aufzuweiten, die sodann den Rest des Weges auf die Walze aufgeschoben wird, dadurch **gekennzeichnet**, daß die Hülse (10) vollständig aus Metall hergestellt ist und eine durch nicht-elektrolytisches Aufbringen auf einen Kern gebildete innere Metallschicht (41, 43, 48), welche die Walze berührt und eine zylindrische Außenfläche aufweist, und eine ätzbare elektrolytisch aufgebrachte äußere Metallschicht (42) umfaßt.

2. Druckhülse nach Anspruch 1, wobei sowohl die innere Schicht als auch die elektrolytisch aufgebrachte Schicht aus Kupfer bestehen.

3. Druckhülse nach Anspruch 1, wobei die innere Schicht aus Zink und die elektrolytisch aufgebrachte Schicht aus Kupfer ist.

4. Verfahren zur Herstellung einer Druckhülse, die auf eine Druckwalze aufschiebbar ist, deren eines Ende einen geringfügig größeren Durchmesser aufweist als das andere Ende, wobei die Hülse ähnlich dimensioniert ist, so daß sie auf der Walze aufgebracht werden kann, indem sie in Längsrichtung auf die Walze aufgeschoben wird, bis sie Auslaßöffnungen für ein Fluid verdeckt, die in der Walze zwischen deren Enden angeordnet sind, woraufhin ein unter Druck stehendes Fluid den Auslaßöffnungen zugeführt wird, um die Hülse geringfügig aufzuweiten, um sie den Rest des Weges auf die Walze aufzuschieben, **gekennzeichnet** durch die Verwendung eines im allgemeinen zylindrischen Kerns (38), dessen Außendurchmesser an einem Ende geringfügig grö-

ßer ist als am anderen Ende, Beschichten der Außenfläche des Kerns mit einem Antihaftmittel (39), nichtelektrolytisches Aufbringen einer ersten Metallschicht (41, 43, 48) auf die Außenfläche des Kerns, Schleifen der Außenfläche der ersten Metallschicht zur Erzielung eines gleichmäßigen Außendurchmessers und elektrolytisches Aufbringen einer ätzbaren zweiten Metallschicht (42) auf der Metallschicht.

5. Verfahren nach Anspruch 4, wobei die erste Schicht durch Aufsprühen von geschmolzenem Metall auf die Außenfläche des Kerns erhalten wird.

6. Verfahren nach Anspruch 4 oder 5, wobei die Hülse vom Kern abgenommen wird, indem ein unter Druck stehendes Fluid im Kern angeordneten Austrittsöffnungen zugeführt wird, um die Hülse geringfügig aufzuweiten, so daß sie von dem einen kleineren Durchmesser aufweisenden Ende des Kerns axial abgezogen werden kann.

7. Verfahren nach Anspruch 5, wobei die Hülse nach dem Aufbringen der ersten Metallschicht (48) vom ersten Kern auf einen Beschichtungskern (50) überführt wird, auf dem die zweite Schicht elektrolytisch aufgebracht wird.

8. Verfahren nach Anspruch 7, wobei die Hülse (48) vom ersten Kern abgenommen wird, indem sie auf eine höhere Temperatur als der Kern erhitzt wird, so daß sie relativ zum Kern expandiert und axial von diesem abgezogen werden kann.

9. Verfahren nach Anspruch 8, wobei die Hülse (48) axial auf den Beschichtungskern (50) aufgeschoben wird, während sie sich auf einer relativ höheren Temperatur befindet, so daß sie sich bei der Abkühlung zusammenzieht und an den Beschichtungskern (50) anschmiegt.

10. Verfahren nach einem der Ansprüche 7, 8 und 9, wobei die Endbereiche der Hülse (48) über den Körper des Beschichtungskerns (50) hinausragen und die Enden der Hülse durch Teile (52, 54) verschlossen sind, die gegen die Innenfläche der Hülse abdichten, wodurch die Endflächen der Hülse (48) zum elektrolytischen Beschichten freigelegt sind.

Revendications

1. Un manchon d'impression pour s'ajuster à un rouleau d'impression dont une extrémité est d'un diamètre légèrement plus grand que l'autre extrémité, le manchon étant similairement dimensionné, de façon qu'il puisse être monté sur le rouleau en glissant sur celui-ci longitudinalement jusqu'à ce qu'il couvre les orifices de sortie de fluide dans le rouleau, en appliquant du fluide sous pression aux sorties pour dilater légèrement le manchon et en glissant le manchon suivant le reste du parcours sur le rouleau, caracterisé en ce que le manchon (10) est fait entièrement en métal et a une couche interne en métal (41, 43, 48) qui a été formée par application non électrolytique sur un mandrin, et laquelle est en contact avec le rouleau et a une surface extrême externe cylindrique, et une couche métallique externe (42) déposée par galvanoplastie et susceptible d'être gravée à l'acide.

2. Un manchon d'impression selon la revendication 1, dans lequel la couche interne et ladite couche déposée par galvanoplastie sont toutes deux en cuivre.

3. Un manchon d'impression selon la revendication 1, dans lequel la couche interne est en zinc et ladite couche déposée par galvanoplastie est du cuivre.

4. Un procédé de fabrication d'un manchon d'impression pour s'ajuster à un rouleau d'impression, dont une extrémité est d'un diamètre légèrement plus grand que l'autre extrémité, le manchon étant similairement dimensionné, de façon qu'il puisse être monté sur le rouleau en le glissant sur celui-ci longitudinalement jusqu'à ce qu'il couvre des orifices de sortie de fluide dans le rouleau entre les extrémités du rouleau, en appliquant du fluide sous pression aux sorties pour dilater légèrement le manchon et puis en glissant le manchon sur le reste du parcours sur le rouleau ; caractérisé en ce que le procédé consiste à prendre un mandrin généralement cylindrique (38) dont le diamètre extérieur est légèrement plus grand à une extrémité qu'à l'autre, à enduire la surface extérieure du mandrin avec un agent séparateur (39), à appliquer non électrolytiquement une première couche de métal (41, 43, 48) sur la surface extérieure du mandrin, à rectifier par meulage la surface extérieure de la première couche métallique pour lui donner un diamètre extérieur uniforme et à déposer, par électrodéposition, une seconde couche de métal (42), susceptible d'être gravée à l'acide, sur la première couche de métal.

5. Un procédé selon la revendication 4, dans lequel ladite première couche est réalisée en pulvérisant du métal fondu sur la surface extérieure du mandrin.

6. Un procédé selon la revendication 4 ou la revendication 5, dans lequel le manchon est enlevé du mandrin en appliquant du fluide sous pression aux orifices de sortie de fluide dans le mandrin pour dilater légèrement le manchon et lui permettre d'être retiré axialement de l'extrémité à diamètre plus petit du mandrin.

7. Un procédé selon la revendication 5, dans lequel, après l'application de la première couche de métal (48), le manchon est transféré du premier mandrin à un mandrin de placage (50) sur lequel la seconde couche est déposée par galvanoplastie.

8. Un procédé selon la revendication 7, caractérisé en ce que le manchon (48) est enlevé du premier mandrin en le chauffant jusqu'à une température plus élevée que le mandrin, de sorte qu'il se dilate relativement au mandrin et puisse être retiré axialement de celui-ci.

9. Un procédé selon la revendication 8, dans lequel le manchon (48) est glissé axialement sur le mandrin de placage (50) pendant qu'il est à une température relativement plus élevée, de sorte qu'il se contracte pour s'ajuster de façon serrée, en se refroidissant, sur le mandrin de placage (50).

10. Un procédé selon l'une quelconque des revendications 7, 8 et 9, dans lequel les portions extrêmes du manchon (48) s'étendent au-delà du corps du mandrin de placage (50), les extrémité du manchon étant fermées par des éléments (52, 54) qui s'appliquent de façon étanche contre la surface intérieure du manchon, grâce à quoi les faces extrêmes du manchon (48) sont exposées pour le placage.

FIG. 1

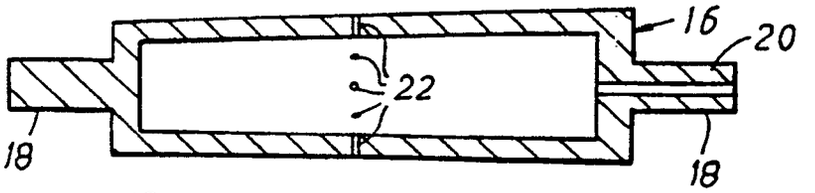

FIG. 2

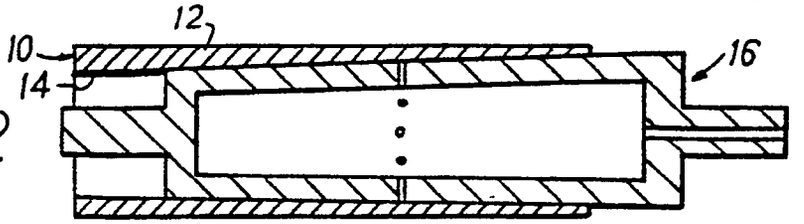

FIG. 3

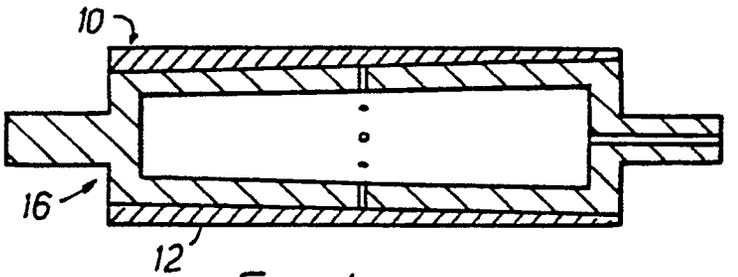

FIG. 4

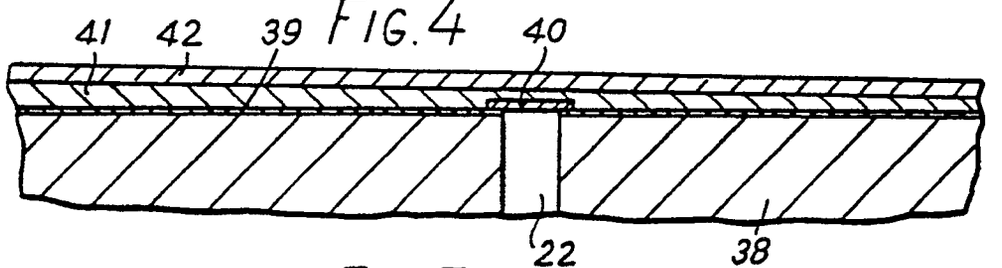

FIG. 5

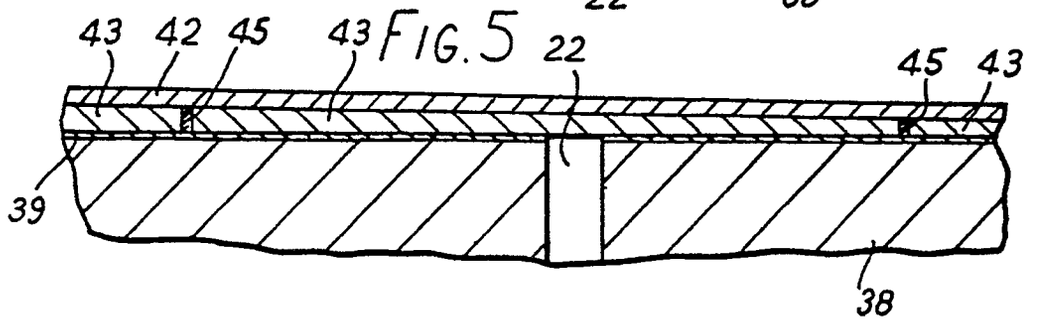

FIG. 6