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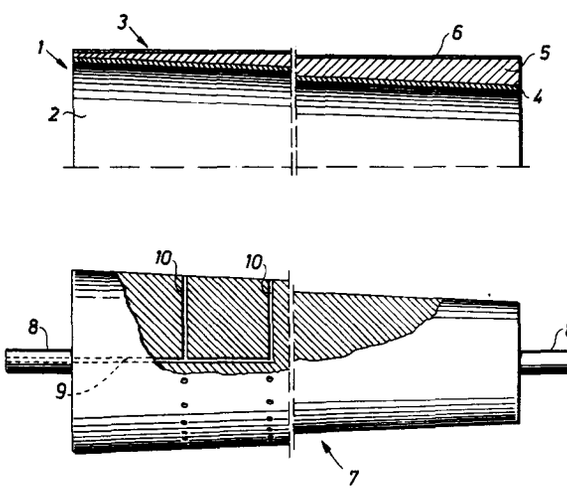
(54) Rotary printing cylinder.

(57) Rotary printing cylinders usually have the form of a steel cylinder, the surface of which is covered with a copper layer into which in transferring elements are engraved. Such printing cylinders are heavy, expensive to manufacture and can only be used for one printing pattern.

According to this invention it is suggested to avoid the above drawbacks by using a separate printing sleeve (1) with a cylindrical outer printing surface and a conical inner surface, which sleeve can be firmly applied onto a basic cylinder (7) the outer surface of which has a corresponding conical shape. To make the sleeve changing easier the basic cylinder is provided with ducts (10) emerging into the conical surface, through which ducts compressed air can be discharged into the space between the sleeve and the cylinder when the sleeve is mounted or dismounted.



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TETRA PAK INTERNATIONAL AB TP 479

ROTARY PRINTING CYLINDER

Rotary printing cylinders, e.g. for intaglio printing, are known and consist usually of a basic stell cylinder the surface of which is covered with a copper layer. The copper layer has a thickness of a few millimetre and in this layer are arranged the ink-transferring elements in the form of screen cells or screen depressions. The ink-transferring elements are engraved, etched or rolled into the copper layer which subsequently is covered with a thin layer of chromium in order to increase the wear resistance of the surface.

When e.g. packing material is printed in multicolour printing by the intaglio process a number of cylinders, usually four, are used for each decoration pattern. These cylinders are made with the special decoration engraved or in some other manner incorporated in the printing surface of the cylinders and the cylinders can therefore only be used for the particular decoration pattern. When the pattern is no longer to be used, the cylinders have to be discarded. On discontinuance in the printing of

a certain decoration pattern the cylinders are taken out of the printing machine and stored in separate racks until they are going to be used again.

It is evident that the utilization of cylinders of the afore-mentioned type involves a number of disadvantages. One disadvantage is of course that for each decoration pattern one or more printing cylinders are required, which are expensive to manufacture and tied to the particular decoration pattern. The handling of the printing cylinders is complicated, owing to the weight of the cylinders and owing to the risk of damage to the printing surface. When the cylinders are stored, strongly constructed racks are required which, owing to the risk of surface damage to the cylinders, must be constructed moreover with a good deal of non-utilized space.

It is an object of the present invention to overcome the aforementioned disadvantages and to provide a rotary printing cylinder which is appreciably simpler and less expensive in its handling and storage.

These and other objects have been achieved in accordance with the invention in that a rotary printing cylinder has been given the characteristic that it comprises a tapering basic cylinder and a printing sleeve which is supported by the basic cylinder and has an internal taper which corresponds to the taper of the basic cylinder, and an external cylindrical printing surface which carries the desired printing pattern. By this design of the rotary printing cylinder a single basic cylinder may be used for a number of printing sleeves with different pattern. In the event of interruption in the printing and storage of a certain decoration pattern, only the printing sleeve itself has to be stored, which means an appreciable simplification owing to the substantially lower weight and greater wieldability of the printing sleeve. Owing to the taper a secure fit of the printing sleeve on the basic cylinder in an accurate, reproducible position is assured.

A preferred embodiment of the arrangement in accordance with the invention has been given the further charac-

teristic that the printing sleeve has an inner layer of nickel and a copper layer located outside it. The design with a nickel layer and a copper layer makes possible a simple manufacture of the printing sleeve whilst at the same time imparting to the same sufficient firmness and stability of shape.

A further preferred embodiment of the arrangement in accordance with the invention has been given the further characteristic that the nickel layer as well as the boundary surface of the copper layer facing towards the cylinder are tapered and that the surface of the copper layer remote from the cylinder is cylindrical. Owing to this design the copper layer obtains and increasing thickness in the longitudinal direction of the printing sleeve, which makes possible the combination of a cylindrical outer printing surface and a tapered inner surface.

A further preferred embodiment of the arrangement in accordance with the invention has been given the further characteristic that the nickel layer has a thickness of 0.05 - 0.4 mm, preferably 0.1 mm. This thickness of the nickel layer has proved to be sufficient and allows a simple manufacture of the nickel layer by electrolytic application, which will be described in the following.

A further preferred embodiment of the arrangement in accordance with the invention has been given the further characteristic that the copper layer has a thickness of 0.1 - 3.0 mm.

A further preferred embodiment of the arrangement in accordance with the invention has been given the further characteristic that the basic cylinder has a diameter differential of 0.05 - 1 mm per metre length. This low taper has proved appropriate in order to obtain a secure fit of the printing sleeve on the basic cylinder and makes it possible to minimize the thickness of the copper layer.

A further embodiment of the arrangement in accordance with the invention has been given the further characteristic that the basic cylinder has a number of radial ducts which connect the surface of the cylinder with a

centrally located axial hole which opens out at the one end of the cylinder. The duct system makes possible the application of the printing sleeve to the basic cylinder with the help of a fluid under pressure, e.g. compressed air.

A further embodiment of the arrangement in accordance with the invention has been given the further characteristic that the axial holes open out in the cylinder surface mainly in the larger half of the tapering cylinder. Owing to this placing of the outlet of the holes in the cylinder surface the effect of the pressure fluid will be greatest in the end phase of the application of the sleeve to the basic cylinder, which is appropriate, since the resistance against the pushing on of the sleeve will then be greatest.

The arrangement in accordance with the invention will now be described in more detail with reference to the enclosed schematic drawing, wherein

Fig. 1 is a section through a printing sleeve according to the invention, and

Fig. 2 shows partly in section a basic cylinder according to the invention.

The printing sleeve 1 shown in Fig. 1 has a tapering centre hole 2 and a cylindrical outside 3. The printing sleeve 1 is made up of an inner layer 4 of nickel which layer has an even thickness of between 0.05 and 0.4 mm over the whole length of the sleeve. Outside the nickel layer 4 there is a copper layer 5, which layer is firmly attached to the nickel layer. The copper layer is of increasing thickness towards the end of the sleeve at which the taper has the smallest diameter. More particularly, the thickness of the copper layer 5 increases to such an extent that the thickness differential compensates the taper of the nickel layer so that the outside of the copper layer is cylindrical. The thickness of the copper layer varies typically between 0.1 and 3 mm. In the cylindrical outer surface of the copper layer the printing pattern is present, e.g. in the form of ink-transferring screen depressions, which,

however, are not visible in the drawing. After the screen depressions have been produced in the outer surface of the copper layer, the copper layer is covered in conventional manner with an outer shell 6 of e.g. chromium which serves to increase the resistance of the printing surface against the wear arising during printing when the doctor blade is in contact with the printing surface.

Fig. 2 shows a basic cylinder 7 in accordance with the invention. The basic cylinder is slightly tapered (for the sake of clarity the taper has been considerably exaggerated in the figures). Typical values for the taper of the cylinder are 0.05 - 1 mm reduction in diameter per metre cylinder length. The cylinder surface is ground and polished and possesses good smoothness and dimensional accuracy. At the two ends of the basic cylinder axle journals 8 are provided, which serve for the rotating support of the cylinder in the printing press. A hole 9 extending axially through the cylinder has been drilled through the one axle journal 8 and extends at least to the centre of the cylinder. From the axial hole 9 radial holes 10 extend in one or more planes to the surface of the cylinder 7 where they open out around the whole periphery of the cylinder.

When the printing cylinder in accordance with the invention is to be utilized, the printing sleeve 1 is applied to the basic cylinder 7 in that the sleeve with the large end of the tapering hole is pushed onto the small end of the basic cylinder, that is to say from right to left in Fig. 2. The fit between the hole and the outer surface of the cylinder is such that the sleeve, when it is in correct position, that is to say when it fully covers the surface of the basic cylinder, cannot be displaced by the forces which occur during the use of the cylinder. A strong gripping fit thus exists between the sleeve and the cylinder, and to make possible the pushing on of the sleeve the holes 9 and 10 provided in the basic cylinder in accordance with the invention are utilized.

The application of the sleeve to the basic cylinder

takes place, as mentioned previously, in that the sleeve is pushed onto the basic cylinder commencing at the small end of the same. Owing to the taper of the hole 2 and of the cylinder 7 the pushing on is relatively easy at the beginning, but when the front end of the sleeve has passed the centre of the basic cylinder, the pushing begins to become sluggish and is finally practically impossible. At this stage the sleeve has been pushed onto the cylinder to such an extent that its front end has passed at least the first line of holes 10. The axial hole 9 is now connected, via the axle journal 8 through which extends the axial duct, to a source of compressed air, and compressed air under a pressure of preferably about 10 kg/cm^2 is allowed to flow now through the hole 10 onto the tapered surface of the printing cylinder 7. The air is discharged into the space between the inner surface of the printing cylinder and the cylinder surface and reduces the friction so that further pushing on of the sleeve is made possible until the sleeve has proper contact with the shell surface of the cylinder and sits firmly in correct position on the cylinder, that is to say covers the total shell surface of the cylinder. The connection of the duct 9 to the source of compressed air is broken and the sleeve sits immovably on the shell surface.

After the printing process the printing sleeve can be removed from the basic cylinder by an opposite procedure, that is to say compressed air is applied again via the ducts 10 into the space between the inner surface of the printing sleeve and the outer surface of the basic cylinder, as a result of which a negligible expansion of the printing sleeve takes place at the same time as an air cushion is formed which prevents friction and makes possible the withdrawal of the printing sleeve from the basic cylinder. If the printing sleeve is to be reused on later occasions it is now simple to store it, e.g. in a protective tube of any suitable material. The basic cylinder can be used again immediately after the removal of the printing sleeve for printing in combination with a new printing sleeve

with a different decoration pattern.

The manufacture of the printing sleeve in accordance with the invention can take place in the following manner. A matrix cylinder with an accurately ground tapering outer surface, which has a taper corresponding to the taper on the basic cylinder which is intended for use, is coated electrolytically with nickel so that a layer of the desired thickness is obtained. The nickel is then removed from the matrix cylinder through heating, which releases stresses built up in the nickel. After the nickel sleeve, which has a thickness of preferably 0.1 mm, has been removed from the matrix cylinder, the sleeve is applied to a further steel cylinder where it is copper-plated so that it obtains a copper layer of the desired thickness. The copper layer is then ground cylindrically, whereby it is essential that the copper layer should be of such a thickness, that after the grinding sufficient thickness remains at its thinnest end to allow the subsequent engraving of screen depressions to the required depth. After the engraving of the decoration pattern into the cylinder surface, the same is covered with a further layer of chromium which raises the wear resistance of the cylinder surface.

Owing to the electrolytic build-up of the nickel shell on the matrix cylinder a surface is obtained in the tapering hole 2 which, on the assumption that the matrix cylinder is polished to good accuracy, does not require any further machining. The taper also corresponds exactly to the taper of the matrix cylinder.

It is of course also possible within the scope of the concept of the invention to manufacture the printing sleeve in a different manner and of different material. A printing sleeve can be produced for example in that a taper-ground steel matrix is formed by turning, deep-drawing or some other method. After grinding cylindrical of the outer surface, the decoration or the screen depressions are engraved directly into the copper sleeve.

In the term rotary printing cylinder is included

in accordance with the invention also the type of cylinders by means of which pattern of folding lines, so-called crease lines are imprinted on a web of e.g. paper. In this application of the printing cylinder the cylinder is coated electrolytically with a hard metal layer, e.g. chromium or tungsten. Subsequently the required pattern of crease rules can be produced by e.g. etching.

When the printing sleeves are not is use they can be stored in paper sleeves or plastic tubes. The sleeve can possibly be protected by a simple plastic hose which is slipped onto the sleeve. In case of such storage it is appropriate to prevent any deformation of the sleeve by means of a rigid plastic tube located inside the sleeve.

Large savings in cost are made possible by the invention, since the number of cylinders can be appreciably reduced. The required number of printing sleeves, which corresponds to the previous number of cylinders, can be manufactured considerably more cheaply than complete printing cylinders manufactured in one piece. Printing sleeves are simple to store, transport and handle.

CLAIMS

1. A rotary printing cylinder, c h a r a c t e r i z e d i n that it comprises a tapering basic cylinder (7) and a printing sleeve (1) which is supported by the basic cylinder and has an internal taper which corresponds to the taper of the basic cylinder and an external cylindrical printing surface (3) which carries the desired printing pattern.

2. A rotary printing cylinder in accordance with claim 1, c h a r a c t e r i z e d i n that the printing sleeve (3) has an inner layer (4) of nickel and a layer (5) of copper located outside it.

3. A rotary printing cylinder in accordance with claim 2, c h a r a c t e r i z e d i n that the nickel layer (4) as well as the boundary surface of the copper layer (5) facing towards the cylinder (7) are tapered and that the surface of the copper layer (5) remote from the cylinder is cylindrical.

4. A rotary printing roller in accordance with claim 2 or 3, c h a r a c t e r i z e d i n that the nickel layer (4) has a thickness of 0.05 - 0.4 mm, preferably 0.1 mm.

5. A rotary printing cylinder in accordance with anyone of claims 2, 3 or 4, c h a r a c t e r i z e d i n that the copper layer (5) has a thickness of 0.1 - 3 mm.

6. A rotary printing cylinder in accordance with anyone of the preceding claims, c h a r a c t e r i z e d i n that the basic cylinder (7) has a diameter differential of 0.05 - 1 mm per metre length.

7. A rotary printing cylinder in accordance with anyone of the preceding claims, c h a r a c t e r i z e d i n that the basic cylinder (7) has a number of radial ducts (10) which connect the surface of the cylinder with a centrally located axial hole (8) which opens out at the one end of the cylinder.

8. A rotary printing cylinder in accordance with claim 7, c h a r a c t e r i z e d i n that the radial holes (10) open out in the cylinder surface mainly in the larger half of the tapering cylinder.

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Fig. 1

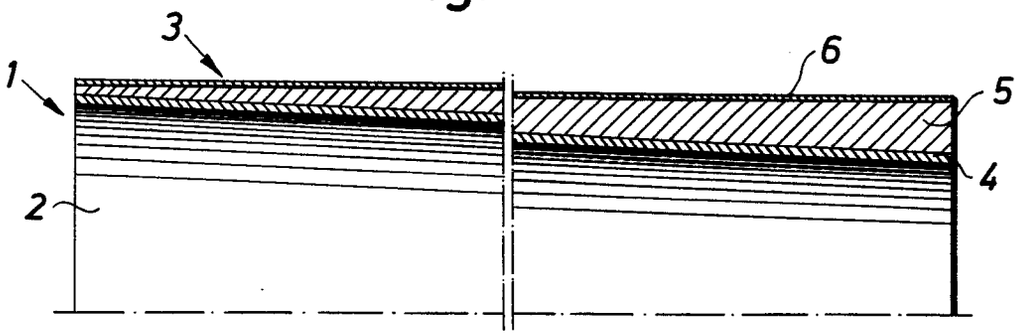
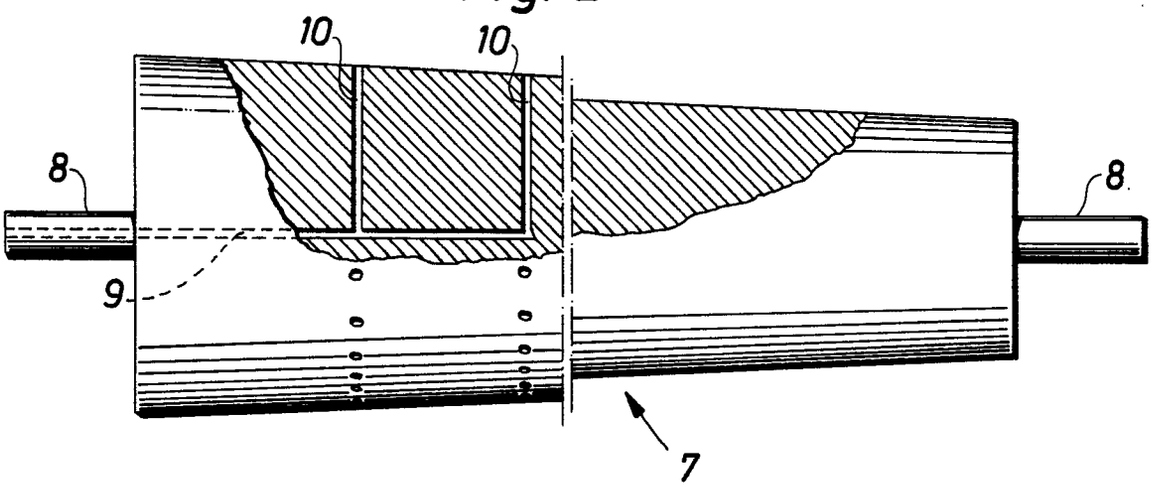


Fig. 2



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EUROPEAN SEARCH REPORT

Application number

EP 78 40 0071

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	DE - B - 1 097 452 (ABELL) * Column 2, line 28 to column 3, line 2; figures *	1
	GB - A - 289 836 (EGLI) * The complete description *	1
	DE - A - 2 700 118 (STRACHAN) * Page 7, line 20 tot page 10, line 23; figures *	1,7
	US - A - 3 146 709 (WEST-ESSEX) * Column 1, line 70 tot column 3, line 71; figures *	7

CLASSIFICATION OF THE APPLICATION (Int. Cl.²)

B 41 F 13/10

TECHNICAL FIELDS SEARCHED (Int.Cl.²)

B 41 F 13/08
B 41 F 13/10
B 41 C 1/18
B 41 N 1/20
B 41 N 1/16

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25-09-1978	LONCKE

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