MANIFOLD FOR PRINT CYLINDERS FOR MOUNTING EXPANDABLE SLEEVES THEREON

An air manifold that can be attached to a print cylinder to provide air for mounting expandable sleeves on the print cylinder. The means for attaching the manifold to the cylinder may be magnetic or mechanical.
<table>
<thead>
<tr>
<th>Code</th>
<th>Country</th>
<th>Code</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM</td>
<td>Armenia</td>
<td>GB</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>AT</td>
<td>Austria</td>
<td>GE</td>
<td>Georgia</td>
</tr>
<tr>
<td>AU</td>
<td>Australia</td>
<td>GN</td>
<td>Guinea</td>
</tr>
<tr>
<td>BB</td>
<td>Barbados</td>
<td>GR</td>
<td>Greece</td>
</tr>
<tr>
<td>BE</td>
<td>Belgium</td>
<td>HU</td>
<td>Hungary</td>
</tr>
<tr>
<td>BF</td>
<td>Burkina Faso</td>
<td>IE</td>
<td>Ireland</td>
</tr>
<tr>
<td>BG</td>
<td>Bulgaria</td>
<td>IT</td>
<td>Italy</td>
</tr>
<tr>
<td>BJ</td>
<td>Benin</td>
<td>JP</td>
<td>Japan</td>
</tr>
<tr>
<td>BR</td>
<td>Brazil</td>
<td>KE</td>
<td>Kenya</td>
</tr>
<tr>
<td>BY</td>
<td>Belarus</td>
<td>KG</td>
<td>Kyrgyzstan</td>
</tr>
<tr>
<td>CA</td>
<td>Canada</td>
<td>KP</td>
<td>Democratic People's Republic of Korea</td>
</tr>
<tr>
<td>CF</td>
<td>Central African Republic</td>
<td>KR</td>
<td>Republic of Korea</td>
</tr>
<tr>
<td>CG</td>
<td>Congo</td>
<td>KZ</td>
<td>Kazakhstan</td>
</tr>
<tr>
<td>CH</td>
<td>Switzerland</td>
<td>LI</td>
<td>Liechtenstein</td>
</tr>
<tr>
<td>CI</td>
<td>Côte d'Ivoire</td>
<td>LK</td>
<td>Sri Lanka</td>
</tr>
<tr>
<td>CM</td>
<td>Cameroon</td>
<td>LR</td>
<td>Liberia</td>
</tr>
<tr>
<td>CN</td>
<td>China</td>
<td>LT</td>
<td>Lithuania</td>
</tr>
<tr>
<td>CS</td>
<td>Czechoslovakia</td>
<td>LU</td>
<td>Luxembourg</td>
</tr>
<tr>
<td>CZ</td>
<td>Czech Republic</td>
<td>LV</td>
<td>Latvia</td>
</tr>
<tr>
<td>DE</td>
<td>Germany</td>
<td>MC</td>
<td>Monaco</td>
</tr>
<tr>
<td>DK</td>
<td>Denmark</td>
<td>MD</td>
<td>Republic of Moldova</td>
</tr>
<tr>
<td>EE</td>
<td>Estonia</td>
<td>MG</td>
<td>Madagascar</td>
</tr>
<tr>
<td>ES</td>
<td>Spain</td>
<td>ML</td>
<td>Mali</td>
</tr>
<tr>
<td>FI</td>
<td>Finland</td>
<td>MN</td>
<td>Mongolia</td>
</tr>
<tr>
<td>FR</td>
<td>France</td>
<td>MR</td>
<td>Mauritania</td>
</tr>
<tr>
<td>GA</td>
<td>Gabon</td>
<td>MW</td>
<td>Malawi</td>
</tr>
<tr>
<td>MX</td>
<td>Mexico</td>
<td>NE</td>
<td>Niger</td>
</tr>
<tr>
<td>NL</td>
<td>Netherlands</td>
<td>NO</td>
<td>Norway</td>
</tr>
<tr>
<td>NZ</td>
<td>New Zealand</td>
<td>PL</td>
<td>Poland</td>
</tr>
<tr>
<td>PT</td>
<td>Portugal</td>
<td>RO</td>
<td>Romania</td>
</tr>
<tr>
<td>RU</td>
<td>Russian Federation</td>
<td>SD</td>
<td>Sudan</td>
</tr>
<tr>
<td>SE</td>
<td>Sweden</td>
<td>SG</td>
<td>Singapore</td>
</tr>
<tr>
<td>SI</td>
<td>Slovenia</td>
<td>SK</td>
<td>Slovakia</td>
</tr>
<tr>
<td>SN</td>
<td>Senegal</td>
<td>SZ</td>
<td>Swaziland</td>
</tr>
<tr>
<td>TD</td>
<td>Chad</td>
<td>TG</td>
<td>Togo</td>
</tr>
<tr>
<td>TJ</td>
<td>Tajikistan</td>
<td>TT</td>
<td>Trinidad and Tobago</td>
</tr>
<tr>
<td>UA</td>
<td>Ukraine</td>
<td>UG</td>
<td>Uganda</td>
</tr>
<tr>
<td>US</td>
<td>United States of America</td>
<td>UZ</td>
<td>Uzbekistan</td>
</tr>
<tr>
<td>VN</td>
<td>Viet Nam</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TITLE

Manifold for Print Cylinders for Mounting Expandable Sleeves Thereon

BACKGROUND

The invention relates in general to the art of printing in which flexible printing plates are mounted on sleeves which are subsequently mounted on print cylinders in a printing press, and more particularly, it relates to a method and apparatus for readily mounting and dismounting the sleeves on the print cylinders. Such sleeves may also be useful as a roll cover where the surface of a cylindrical roll may need to be renewed or changed occasionally during the useful life of the roll.

In the printing industry, thin flexible printing "plates" are attached to sleeves that are readily and repeatably mounted and dismounted from the printing cylinders by using compressed air applied through holes on the surface of the cylinders. The sleeves must be inexpensive, lightweight, resistant to handling damage, and able to withstand several expansions and still reliably grip the print cylinder without slippage. An interference fit with the print cylinder is preferred. The sleeves should be expandable with the 50-100 psi air generally available in printing facilities and should expand sufficiently so they are easily slid over the print cylinder. The sleeves should have a wall thickness so as to not add too much to the diameter of the print cylinder and permit some leeway in the thickness of the printing plates used in existing printing machines. The air may be applied through small holes in the periphery of the print cylinder at one end or at intervals along its length. Typically, each print cylinder in use must have these holes provided and must have a way to deliver pressurized air to the holes. Many printers have not used expandable sleeves in the past and their print cylinders do not have such holes and air manifold delivery systems. This can be
a significant expense for a printer to adapt to this system if tens or hundreds of print cylinders are in use.

There is a need for a manifold that can be placed on a print cylinder lacking air supply holes to provide air for mounting expandable sleeves on cylinders. There is a need for a manifold that can be easily installed and removed from a cylinder so that one manifold can serve the needs for a large number of cylinders lacking air supply holes.

U.S. 3,146,709 to Bass et al. shows a printing mandrel for supporting a printing sleeve, with the mandrel having small apertures near the end of the mandrel and spaced longitudinally along the mandrel. The mandrel has a chamber within communicating with the apertures and a source of pressurized air. The air is distributed to the apertures by passing through the chamber, which now may have to pass safety codes for a pressure vessel. As the sleeve is pushed onto the end of the mandrel, the air pressure slightly expands the sleeve and provides a lubricating film of air as the sleeve is slid further along the mandrel. The air is then cut off, and the sleeve contracts into tight frictional contact with the outer surface of the mandrel. For printing mandrels not already having apertures, it is expensive to add them to all the mandrels needed in a large printing plant.

U.S. 4,089,265 to White et al. describes a tube end attachment for a print roll tube that aids the sliding of a sleeve onto the print roll tube already provided with holes along its length. The attachment is fitted to one end of the tube and includes an expandable seal device that can be expanded to press on the sleeve end and thereby stretch it. The system also requires a tube with a conical end, circumferential grooves in the tube outer surface and holes within the grooves, pressurized air supplied to the holes and the attachment from within the tube, and removable plugs for the holes. The plugs must be in place to block air flow through the uncovered holes when the sleeve is started on the tube, and must be progressively removed as the sleeve advances along the
tube. A lubricant is needed to reduce friction between the seal and the sleeve, which may be a PTFE spray or moist compressed air. Such a system is expensive for tubes not already having air holes, is cumbersome to use, and requires plugs and a lubricant as mounting aids.

U.S. 4,030,415 to Fellows describes the same system as the White patent, and suggests alternate sleeve mounting systems that use a closure cap, nut and rod; a moveable buttress and cap; and a vacuum jig. These alternate systems do not require holes in the surface of the print tube to expand the sleeve, but they require large fixtures that are cumbersome and difficult to use.

**SUMMARY OF THE INVENTION**

The invention involves process for installing an expandable sleeve on a cylinder, said sleeve having an inner diameter and said cylinder having an outer diameter sized to provide an interference fit between the sleeve and the cylinder. The process comprises the steps of:

- attaching and sealing a cylindrical manifold to one end of and in substantial axial alignment with the cylinder, the manifold having a peripheral surface with a diameter substantially equal to the outside diameter of the cylinder and having a plurality of orifices directed outwardly from the manifold;
- placing one end of the sleeve over the manifold and into engagement with said one end of the cylinder;
- introducing a flow of gas into said manifold and through said orifices under sufficient pressure to expand said sleeve; and
- sliding said sleeve onto said cylinder; and then stopping the flow of gas.

The apparatus comprises:

- a cylindrical manifold attached to one end of said cylinder, said manifold having a peripheral surface having a diameter substantially equal to the outer diameter of the cylinder, said manifold further having a plurality of orifices directed outwardly from said manifold;
means for attaching said manifold to said cylinder;
means for sealing the manifold to said one end
of the cylinder; and
means connected to said manifold to supply
pressurized gas to said orifices.
The peripheral surface of the manifold, preferably
is formed in a sloped length, a straight length, and a
chamfered length.
The orifices may be in the straight length of the
peripheral surface of the manifold or in the chamfered
length and in any event are directed outwardly from the
manifold.
The means for attaching the manifold to the
cylinder may comprise a clamp slideably attached to the
manifold, the clamp having holding screws for engaging a
shaft on the print cylinder, and pressing screws for
exerting an axial force between the clamp and the
manifold; or
the means for attaching may be a pair of bolts
passing through the manifold and engaging threaded holes
in the end of the print cylinder; or in the alternative,
the means for attaching may comprise magnet means
mounted in the manifold with the magnet means active
surface aligned with the mounting end for contacting the
end of the print cylinder.
The magnet means may be a permanent magnet
comprising curved laminated sections of magnet and steel
mounted in a magnetically insulated radial groove in the
mounting end.
The means for supplying pressurized air to the
holes comprises a chamber in the manifold in fluid
communication with the orifices and a quick connect air
fitting.
BRIEF DESCRIPTION OF THE FIGURES

Fig. 1 is a sectional view of a print cylinder and sleeve and a manifold in place for mounting the sleeve.

Fig. 2 is an enlarged view 2-2 of Fig. 1 showing details of the air flow adjacent the manifold.

Figs. 3A and 3B are sectional views and end views, respectively, of an alternate embodiment of the manifold of Fig. 1.

Fig. 4 is an isometric view of an alternate embodiment of the manifold.

DETAILED DESCRIPTION OF THE FIGURES

Fig. 1 shows a print cylinder 10 having an impermeable surface 12, end caps at each end, such as end cap 14 at end 16, and trunnions at each end, such as trunnion 18 at end 16. An expandable print sleeve 20 is shown in the process of being expanded and mounted on the cylinder. Attached to the end 16 of the cylinder is a manifold 22 that has a peripheral surface with a straight length 24 that is about 0.5-1.0" greater in diameter than the diameter of the print cylinder impermeable surface 12. The length 24 extends from a leading edge 26, that would be first encountered by a sleeve being mounted in the direction of arrow 27, to a trailing edge 28. The manifold has a row of orifices, such as orifices 30 and 32 that are located 0.5-1.0" from the leading edge 26. These orifices may be located in the length 24 or preferably they are in chamfered length 34 as shown in Fig. 1. When located in the chamfered surface, the orifices are angled away from the leading edge 26 and are angled toward the direction the sleeve 20 is moving when being mounted. The orifices are in fluid communication with a manifold chamber 31 that is connected to a source of pressurized air 33 through appropriate fittings and line 35 and a passage 37 in the manifold. The air is directed through orifices 28 and 30 to act on the sleeve to expand it and lubricate it as it is mounted on the print cylinder.

The manifold has a mounting end 36 opposite the leading edge 26. The mounting end has a surface 38
perpendicular to the cylindrical surface 24 and parallel
to the outer surface of end cap 14 with which it is in
contact. Surface 38 contains a sealing means 40 for
sealing against the outer surface of end cap 14. The
sealing means consists of a groove 42 and an "O"-ring
44. The sealing means is located close to the impermeable
surface 12 of the print cylinder 10 so there is little
area on the mounting end 36 for the sleeve mounting
pressure to act which would urge the manifold away from
the end of the print cylinder. That is, the effective
outer sealing diameter 45 of the "O"-ring 44 should be
about 0.2" - 2.0" less than the diameter of the
impermeable surface 12 of the print cylinder.

The manifold 22 includes a means for attaching or
pressing and holding the mounting end 36 of the manifold
against the outer surface of end cap 14. It is common for
the end cap 14 of many print cylinders to be made from
steel, which is machined perpendicular to impermeable
surface 12 to provide an outer surface of the end cap,
which is a flat sealing surface and a surface engageable
by a magnet. The pressing must compress the "O"-ring seal
44 so it is in sealing engagement with the outer surface
of the end cap. The holding must oppose the forces of the
pressurized air acting on the mounting end of the manifold
between the effective sealing diameter of the sealing
means and the diameter of the cylindrical surface 24. The
pressing and holding means of Fig. 1 comprises a magnetic
means which is an electromagnet 46 mounted in an annular
groove 47 in the mounting end 36 of the manifold. The
electromagnet may be held in place in the groove with a
potting epoxy or the like. The magnetically active
surface 48 of the magnet means is aligned with the surface
38 of the mounting end 36. The electromagnet is
magnetically insulated from the remainder of the manifold
so its magnetic force is concentrated at surface 38.
Making the surrounding manifold material of aluminum
serves to magnetically insulate the magnet means. The
electromagnet may be energized by a wire 50 going to a
source of electrical power 52.
The manifold 22 has an opening 54 that allows it to be fitted over the trunnion 18. To attach the manifold 22 to the print cylinder 10, the cylinder is removed from the press and the end of trunnion 18 is made available. The manifold is slid along trunnion 18 until the mounting end 36 is in contact with the outer surface of end cap 14. The air line 35 and wire 50 are passed through sleeve 20 which is loosely held adjacent the trunnion 18. The line 35 and wire 50 are connected to pressure source 33 and electrical power source 52, respectively. When electrical power is applied to electromagnet 46, it firmly attaches manifold 22 to end cap 14. The sleeve can now be pressed over length 23 a short distance until the leading end 56 of sleeve 20 covers orifices 28 and 30. At this point, the pressurized air passing through the orifices expands the sleeve so it can be easily pushed onto the cylinder.

Fig. 2 shows an enlarged view of the sleeve expansion as the leading end 56 starts onto print cylinder 10. Initially, the sleeve leading end 56 encounters sloped length 23 adjacent the leading edge 26 of manifold 22. The sleeve must be forced over edge 26 and along the short section of surface 24 until it covers orifices, such as 32. It has been found that if the orifices are between 0.5" and 1.0" from the edge 26, the initial mounting force is kept within reason. As soon as the peripheral row of orifices, such as 32, are covered, the pressure of the air exiting the orifices acts on the sleeve to expand it and reduce the mounting force. The pressure develops in the annular space 58 bounded by the sleeve 20 on one side; the impermeable surface 12, seal 44, and manifold surface 24 on the other side; the leading edge of the sleeve 56 at one end; and the constricted space 60 between the unexpanded sleeve and leading edge 26 at the other end. Since the constricted space 60 is smaller than the space 62 at the leading end 56 of the sleeve, the dominant airflow is toward the leading end 56. This acts to lubricate the sleeve as it moves along surface 12, and it provides a cushion of pressurized air along the entire length of the sleeve as it is being mounted without the need for
additional holes in the impermeable surface to supply air along the length of the sleeve.

Figs. 3A and 3B show an alternative magnet arrangement for the manifold 22. The electromagnet is replaced with two permanent magnet segments 64 and 66 mounted in groove segments 68 and 70, respectively. The magnet segments are made up of laminations of arcuate strips of steel and flexible magnet strips. One lamination that has been found to work well is illustrated referring to magnet 64, which is a steel strip 72, a magnet strip 74, a steel strip 76, another steel strip 78, a magnet strip 80, and a steel strip 82. The steel strips concentrate the magnetic fields and enhance the holding force of the magnet. The flexible magnetic strips can be obtained from the Jobmaster Magnet Company in _____,____.

A strength of 6 flux oersteds is preferred when the strip is about 0.5" wide, about 0.06" thick and about 5.0" long in each groove. This will provide enough force to press the seal 44 tightly against the outer surface of the end cap 14 to effective a pressure seal, and to hold the manifold against the pressure developed on the mounting end outboard of the effective sealing diameter. Between the groove segments are threaded holes 84 and 86 that are used to insert bolts to jack the magnet away from the outer surface of the end caps 14 when the magnet is holding the manifold in place. Once a small gap is created by the jacking bolts, the manifold can be easily removed by hand for use on another print cylinder.

Referring to Figs. 3A and 3B, another embodiment of the pressing and holding means may be bolts attaching the manifold to the end cap 14. The magnets 64 and 68 and grooves 68 and 70 can be eliminated and the threaded holes 84 and 86 replaced with unthreaded holes 88 and 90. The outer surface of the end cap 14 can be modified to include two threaded holes aligned with holes 88 and 90 and the manifold can be firmly bolted to the end cap.

Fig. 4 shows still another embodiment of the manifold utilizing another embodiment of a pressing and holding means. The manifold 92 comprises a ring element
94, similar to manifold 22 of Fig. 1 but without the electromagnet 46 and annular groove 47; and a clamp 96 that acts as the pressing and holding means. Attached to the back end 98 of ring 94 are tabs 100, 102, and 104 having slots, such as slot 106 in tab 102. Bolts, such as shoulder bolt 108, pass through the slots and engage threaded holes in clamp 96. The bolts do not tightly engage the tabs against clamp 96, so ring 94 can still slide axially on clamp 96 within the clearance between the slots and bolts. Clamp 96 has a bore 110 that is a close clearance fit over the diameter of trunnion 18 of print cylinder 10. The clamp 96 has threaded holes 112, 114, and 116 for thumb screws for holding the manifold on the trunnion 18 (Fig. 1). The manifold has abutments 118, 120, and 122 with threaded holes 124, 126, and 128, respectively, that are aligned with the tabs 100, 102, and 104, respectively, on the ring 94. Thumb screws in holes 124, 126, and 128 bear against the respective tabs to press the ring toward the end surface of end cap 14 for effecting a seal. Tube 130 in ring 94 is in communication with the manifold chamber 31 and peripheral orifices 30 and 32 (Fig. 1).

In operation (referring to Figs. 4 and 1), the manifold 92 is placed over the trunnion 18 and slid forward until it abuts the end surface of end cap 14 on the print cylinder. The thumb screws in holes 112, 114, and 116 are tightened to hold the clamp on the trunnion. The thumb screws in holes 124, 126, and 128 are then tightened to urge the ring toward the end surface of end cap 14 and press the seal 44 against the end surface to effect a pressure seal. The air pressure can now be applied to the orifices in ring 94 through tube 130, and the sleeve can be mounted on the print cylinder.
What is Claimed is:

1. A process for installing an expandable sleeve on a cylinder, said sleeve having an inner diameter and said cylinder having an outer diameter sized to provide an interference fit between the sleeve and the cylinder, said process comprising the steps of:
   attaching and sealing a cylindrical manifold to one end of and in substantial axial alignment with the cylinder, said manifold having a peripheral surface with a diameter substantially equal to the outside diameter of the cylinder and having a plurality of orifices directed outwardly from the manifold;
   placing one end of the sleeve over the manifold and into sealing engagement with said one end of the cylinder;
   introducing a flow of gas into said manifold and through said orifices under sufficient pressure to expand said sleeve;
   sliding said sleeve onto said cylinder; and then stopping the flow of gas.

2. An apparatus for installing an expandable sleeve onto a cylinder, said sleeve having an inner diameter and said cylinder having an outer diameter to provide an interference fit between the sleeve and cylinder, said apparatus comprising:
   a cylindrical manifold attached to one end of said cylinder, said manifold having a peripheral surface having a diameter substantially equal to the outer diameter of the cylinder, said manifold further having a plurality of orifices directed outwardly from said manifold;
   means for attaching said manifold to said one end of said cylinder;
   means for sealing said manifold to said one end of said cylinder; and
   means connected to said manifold to supply pressurized gas to said orifices.
3. The apparatus as defined in claim 2, said peripheral surface having sloped, straight, and chamfered lengths.

4. The apparatus as defined in claim 3, said chamfered length having said orifices.

5. The apparatus of claim 2, wherein the means for attaching comprises a clamp slideably attached to the manifold, the clamp having holding screws for engaging the print cylinder, and pressing screws for exerting an axial force between the clamp and the manifold.

6. The apparatus of claim 2, wherein the means for attaching is a pair of bolts passing through the manifold and engaging threaded holes in the end cap of the print cylinder.

7. The apparatus of claim 2, wherein the means for attaching comprises magnet means mounted in the manifold with the magnet means active surface aligned with the mounting end for contacting the end of the cylinder.

8. The apparatus of claim 2, wherein the means for supplying pressurized air to the orifices comprises a manifold chamber in fluid communication with the orifices and a quick connect air fitting connected to a source of pressurized air.
FIG. 2
**INTERNATIONAL SEARCH REPORT**

**INTERNATIONAL application No.**

PC1/US 95/16938

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC6: B41F 27/10
According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B41F, B41N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US, A, 4089265 (W.P. WHITE ET AL), 16 May 1978 (16.05.78), column 4, line 44 - line 61; column 5, line 27 - line 30, figure 2</td>
<td>1,2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>US, A, 5072504 (W.L. THOMPSON), 17 December 1991 (17.12.91), figures 1-4, abstract</td>
<td>1-8</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C. See patent family annex.

Date of the actual completion of the international search: 21 May 1996

Date of mailing of the international search report: 18.06.96

Name and mailing address of the ISA:

European Patent Office, P.O. Box 3818 Patentlaan 2
S-1230 HV, Brussels
Tel.: 32-2-338.20.00, Fax: 32-2-338.20.55

Authorized officer:
Pia Hegele
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td>US-A- 4089265</td>
<td>16/05/78</td>
<td>DE-A- 2542748</td>
<td>15/04/76</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP-A- 51063708</td>
<td>02/06/76</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GB-A- 1483371</td>
<td>17/08/77</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US-A- 4030415</td>
<td>21/06/77</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US-A- 5062193</td>
<td>05/11/91</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO-A, A- 9101845</td>
<td>21/02/91</td>
</tr>
</tbody>
</table>