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(71) Applicant: **Comexi, SA**
17457 Riudellots de la Selva (ES)

(72) Inventors:
• **Puig i Vilá, Jordi,**
Pol. Industrial de Girona
E-17457 Riudellots de la Selva (ES)

• **Sahun Peres, Jordi,**
Pol. Industrial de Girona
E-17457 Riudellots de la Selva (ES)
• **Roger i Colom, Pere,**
Pol. Industrial de Girona
E-17457 Riudellots de la Selva (ES)

(74) Representative: **Gislon, Gabriele**
Torner, Juncosa i Associats, S.L.
c/ Bruc, 21
08010 Barcelona (ES)

(54) **COMPOSITE SHAFT FOR PRINTING CYLINDER, COMPRISING HYDRAULIC SLEEVE-FIXING DEVICE**

(57) **SUMMARY**

Comprises first and second pieces (10, 20) which have end configurations (11, 21) for installation and guide and respective coupling configurations (14, 24) plug-in fit at the ends of a third, tubular piece (30) which defines an intermediate, cylindrical section (31), for attachment of liners (40). The hydraulic device comprises two expansible sleeves (50) situated on the first and second

pieces (10, 20) each with a circular cavity (51) connected to a longitudinal duct through the shaft containing a fluid capable of being subjected to pressure to make convex an external, deformable wall (52) of the sleeve. The longitudinal duct comprises first and second sections (12, 22) in the first and second pieces (10, 20) connected, by means of a flexible tube (60) located in the hollow interior of the third piece (30).

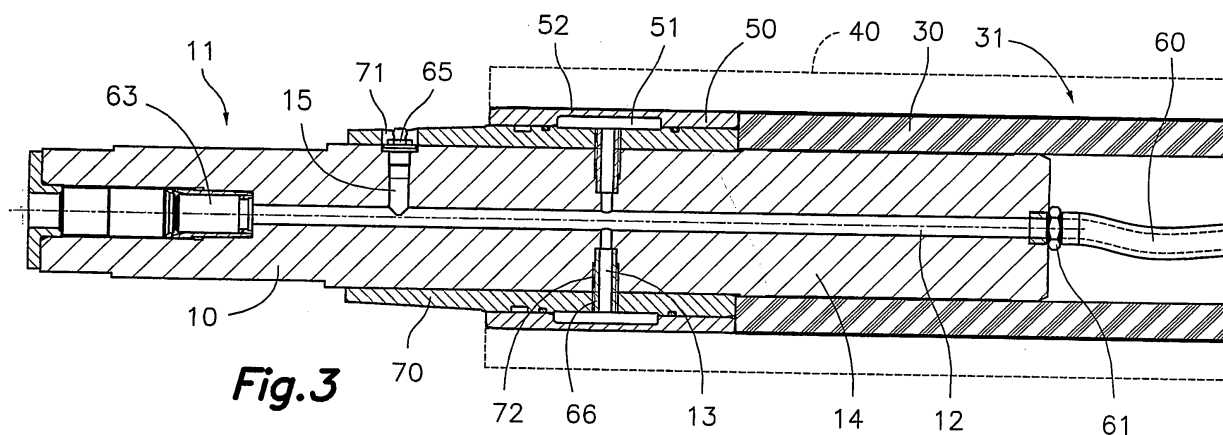


Fig. 3

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Description

Technical Field

[0001] This invention refers to a composite shaft for a printing cylinder fitted with a hydraulic liner attachment device which includes a container for pressurised fluid which connects with sleeves which can be expanded by pressure against an internal surface of the liner.

[0002] The shaft is for use generally in the field of printing and more specifically in flexographic printing.

Background to the invention

[0003] In the printing field, for example in flexography, certain printing cylinders or rollers adapted to carry a block are well-known and widely used. In general, the roller comprises a steel shaft to which is attached an interchangeable printing-blockbearing liner. In order to hold the liner freely on the shaft a number of methods are known which generally use expansible pieces attached to the upper surface of the shaft and which can be distorted by fluid under pressure allowing them to be expanded against the inner surface of the liner. The fluid under pressure which may be oil or grease can be held in a closed circuit inside the shaft and a piston device can be operated from outside to apply pressure to said fluid.

[0004] The solid shaft made from a metal such as steel with two, stepped sections at each end which include configurations for mounting and guiding and an intermediate section for holding the liner which has an external diameter to fit the internal diameter of the liner is well known. On such a shaft the hydraulic device for attaching the liner is of the type which comprises a pair of expanding sleeves located at each end of the intermediate section. Each sleeve is equipped with a duct which connects to a hollow section along the length of the shaft which is filled with fluid capable of being pressurised and a deformable external lip with an external diameter equal, when at rest, to said diameter of the centre-section. The sleeve expands and its external diameter increases to slightly more than that of the intermediate section and the internal diameter of the liner as a result of the distortion resulting from the pressure of the fluid.

[0005] A drawback of this type of assembly is that the shaft, which is of steel, is extremely heavy. Furthermore, the machining of said longitudinal internal duct, which is relatively small and runs axially along the length of the shaft from one end to the other, is a difficult operation and highly skilled and therefore high in cost.

[0006] Patent number US-A-3378902 describes a detachable printing cylinder with hydraulic fixing means. The cylinder comprises a tubular roller and a pair of blocks which close off the ends of said roller. Said blocks have central apertures in which are mounted expansible collars adapted to receive and hold a shaft located coaxially to the roller which overhangs at each extreme be-

yond the blocks with shaft installation and guiding configurations. Between the external surface of the shaft and internal surface of the tubular roller is an empty space. Each expanding collar has a sleeve which fits over the shaft with a thicker section forming a socket in contact with the external wall of the block and a section capable of being pressurised and delimited by a thin wall, deformable by pressure and in contact with the external surface of the shaft. A ring fits over said section which is capable of being pressurised and which is fixed to it to define the limits of a hydraulic fluid chamber together with the thin wall connected to a device to deliver pressure mounted on the area of the socket. The device comprises a small piston moved from outside on a headless screw to generate pressure from the fluid in the hydraulic fluid chamber with which to distort the thin wall to exert force upon the spindle to hold it steady. A drawback of this assembly is that in order to attach or release the roller to or from the shaft it is necessary to operate individually on the collars fitted at each extreme of the roller.

Disclosure of the Invention

[0007] The previous and other drawbacks are overcome by this invention by using a composite shaft for the printing cylinder with a hydraulic device for attaching the liner of a type comprising two end sections with installation and guide configurations and a cylindrical intermediate section to hold the liner with an external diameter to fit the internal diameter of the liner and where said hydraulic fixing device is of the type comprising two expansible sleeves located at each extreme of the intermediate section, each provided with a circular cavity which connects with a longitudinal duct through the shaft containing fluid capable of being pressurised with an external wall which can be distorted and with an external diameter equal, when at rest, to said external diameter of the intermediate section and which is slightly greater than the external diameter of the intermediate section due to distortion resulting from the pressure of said fluid. The shaft of the present invention is characterised by the two end sections being located in first and second pieces each of which comprises a section of the longitudinal duct and upon each of which is mounted an expansible sleeve connecting with the respective first or second section of the longitudinal duct by means of at least one radial duct comprising said first and second pieces and their respective first and second coupling configurations capable of plugging into the fittings of a third, tubular element which defines the intermediate section with said first and second sections of the longitudinal duct connected by a flexible tube located inside said third piece. The first and second pieces are preferably made from metal such as steel and the third piece of a relatively light material composed of carbon fibre.

[0008] The first and second sections of the longitudinal duct, the flexible tube, the radial ducts and the circular cavities together form a hermetically closed container

completely filled with said fluid capable of being subjected to pressure and the first section of the longitudinal duct has an opening in the external end of the first piece and in said opening is installed a piston device able to be operated in order to apply pressure to said fluid.

[0009] This assembly permits a lighter printing cylinder to be obtained with the same performance as a cylinder with a solid shaft and is substantially easier to manufacture especially where the drilling of the longitudinal duct is concerned as this one is made up of two short sections which are easy to drill located in the first and second pieces and completed by the flexible tube inside the third piece.

Short Description of the Drawings

[0010] These and other advantages and characteristics of the present invention are better understood from the following detailed description of an actual example with reference to the attached drawings in which;

Fig. 1 is a view of the length-wise section of a shaft for a printing cylinder with a hydraulic device for attaching the liner in accordance with the state of the art;

Fig. 2 is a view of the length-wise section of the printing cylinder composite shaft with hydraulic liner attachment device according to an actual example of the present invention; and

Fig.. 3 is a view of the length-wise section of an enlargement of a part of the shaft in Fig. 1.

Detailed description of actual examples

[0011] In Fig. 1 is shown a solid shaft for a printing cylinder with a hydraulic liner attachment device according to the state of the art which comprises a solid piece 80, made from metal such as steel with two stepped end sections 81,82, which have installation and guide configurations and an intermediate section 83, which is cylindrical and has an external diameter adapted to fit the internal diameter of the liners. The hydraulic liner attachment device comprises a pair of expansible sleeves 90 located at the respective ends of said intermediate section 83. Each sleeve 90 has a circular, internal cavity 91 connecting by means of radial ducts 84 with the longitudinal duct 85 of the shaft. The circular, internal cavities 91 of the sleeves 90 are delimited externally by external, deformable walls 92 with an external diameter equal, when at rest, to said external diameter of the intermediate section 83. The longitudinal duct 85 has an opening at one end of the shaft and is closed at the opposite end. The longitudinal duct 85, the radial passage-ways 84 and the circular cavities 91 form a container filled with fluid which can be subjected to pressure when the piston device 63 which is located at the mouth of the duct 85 is operated externally by means of an appropriate implement. An increase in fluid pressure in the chambers 91

due to operation of the piston device 63 produces a distortion or swelling in the deformable walls 92 of the sleeves 90, which exercise pressure against the internal diameter of the liner 40, holding it in position.

[0012] The state of the art solid shaft described in relation to Fig. 1 is very heavy and the longitudinal duct 85 difficult and expensive to machine.

[0013] We refer now to Figs. 2 y 3, which show the composite shaft for printing cylinder with hydraulic liner attachment device, object of the present invention. The new shaft is made up of first and second pieces 10, 20 which constitute the ends 11, 21 and a third, tubular piece 30, which constitutes the third, intermediate section piece 31. Said first and second pieces 10, 20 are solid and of metal such as steel whilst the ends 11, 21 have installation and guide configurations such as, for example, shaft or roller bearings, etc. Said third piece 30 constitutes a light, tubular element made from a composite material such as carbon fibre and the first and second pieces 10, 20 have, at their respective ends, first and second coupling configurations 14, 24, adapted to plug-in to the ends of the hollow interior of third piece 30.

[0014] The intermediate section 31 has a cylindrical exterior and is adapted to hold a detachable liner 40 (shown by means of lines drawn on the Fig.). For this purpose, the centre section 31 has an external diameter adapted to fit into the internal diameter of the liners 40 which allow them to slide along the external surface of the centre section 31 allowing them to be attached and removed. In fact, the centre section 31 of the shaft is slightly longer than piece 30 and includes middle sections of the respective first and second pieces 10, 20, where elements of the hydraulic liner attachment device described below are to be found in such a way that the rear sections of the liner 40 cover said elements in the centre sections of the first and second pieces 10, 20.

[0015] In order to attach a liner 40 in position on the shaft, an already known hydraulic device is incorporated which includes a pair of expansible sleeves 50 situated on the respective ends of said intermediate section situated 31, actually on the central parts of the first and second pieces 10, 20. Each of said expansible sleeves 50 is provided with a circular internal cavity 51 which connects, by means of one or more radial ducts 13, 23, with the longitudinal duct 12, 22, of the shaft 60. The circular cavities 51, radial ducts 13, 23 and longitudinal duct 12, 22, 60 together form a hermetically closed container filled with a fluid capable of being subjected to pressure such as oil or grease. This circular cavity 51 is delimited by an external, deformable wall 52 which has a diameter, when at rest, equal to the internal diameter of the liner 40. As a result of a distortion in the external wall 52 caused by an increase in the fluid pressure in said longitudinal duct 12, 22, 60, the external diameter of the external wall 52 becomes slightly greater than the internal diameter of the liner 40 and, as a consequence, the liner 40 is held in position on the shaft.

[0016] The longitudinal duct 12, 22, 60 runs practically

from one end to the other of the shaft and is made up of three sections. The first section 12 of the longitudinal duct is made up of a perforation which passes axially through the first piece 10 with openings in each end, a second section 22 of the longitudinal duct is made up of a blind, axial perforation in the second piece 20 open at the internal end and a third, centre section is made up of a flexible tube 60 located in the hollow interior of the third piece 30 which connects the first and second sections 12, 22 of the longitudinal duct of the first and second pieces. The flexible tube 60 is connected by its ends to the openings of the first and second sections 12, 22 of the longitudinal duct situated at the respective internal ends of the internal longitudinal duct of the first and second pieces 10, 20 by means of a pair of connecting devices 61, 62.

[0017] Said closed container is made up of the first and second sections 12, 22 of the longitudinal duct, the flexible tube 60, the radial ducts 13, 23, and the circular cavities 51. In the opening of the first section 12 of the longitudinal duct at the external end of the first piece 10 is mounted a conventional piston device 63, which is operated externally by means of a tool to apply or release pressure on said fluid. With this, by a single operation the expansible sleeves 50 located on the opposing ends of the central area 31 are operated to attach or release the liner 40. The second section 22 of the longitudinal duct is closed off inside the second piece 20, and has a radial passageway 26 that connect second section 22 of the longitudinal duct, close to said closed off end, with the exterior. In this radial passageway 26 a drainage valve 64 is installed. In another radial passageway 15, which connects the first section 12 of the longitudinal duct of the first piece 10 with the exterior, an inlet valve 65 is installed which is used to introduce fluid into the interior of the container. Clearly, the radial passageways 15, 26, and the drainage 64 and inlet 65 valves, may be situated in other positions with the same results.

[0018] The second piece 20 has a section adjacent to the second coupling configuration 24 with an external diameter larger than the external diameter of the second coupling configuration 24, forming a step 25 which provides a butt for a second end of the third piece 30. This larger diameter section provides an external support surface for the second expansible sleeve 50. The external diameter of the first coupling configuration 14 is the maximum diameter of the first piece 10, so that the third, tubular piece 30 may be inserted from the end of the shaft which corresponds to the first piece 10 passing along it up to the second end of the third piece 30 is connected by plug-in to the second coupling configuration 24 until forming a butt with said step 25. On the middle part of the first piece 10, adjacent to the first coupling configuration 14, a sleeve adaptor 70 which makes a butt for the first end of the third piece 30, holding it between the first and second pieces 10, 20. Preferably, the sleeve adaptor 70 is firmly fixed by, for example, heat anchoring (by heat expansion) to the first piece 10, and the internal surface

of the ends of the third piece 30 is fastened, for example, by adhesion to the external surfaces of the first and second coupling configurations 14, 24. The sleeve adaptor 70 also provides an external holding surface for the other expansible sleeves 50, and includes one or more perforations 72 which coincide in position and diameter with opening or openings of the one or more radial perforations 13, so that said perforation 72 and at least a section of the radial duct 13 together form a screw hole into which a sleeve is screwed 66 that seals off the radial perforation 13 at the joint between the sleeve adaptor 70 and the first piece 10. As a result, the sleeve adaptor 70 has a perforation 71 which coincides with the opening of the radial passageway 15 to allow access to said inlet valve 65.

[0019] To aid in the placing and removal of the liners, the third piece 30 and possibly the expansible sleeves 50 may have an external covering made from a friction-resistant material. Alternatively, the third piece 30 may have an external covering of metal, preferably steel, which combines the necessary friction-resistance with hard-wearing.

[0020] It should also be pointed out that, according to another embodiment not shown, the composite shaft has only one expansible sleeve 50 at one end of the intermediate section 31 to attach the liner 40. Preferably, this single expansible sleeve 50 is located in a middle area of the first piece 10, in which case the longitudinal duct is formed solely from the first section 12, which has and interior end closed off in the first piece 10, omitting the second section 22 of the longitudinal duct in the second piece 20 and the flexible connecting tube 60. However, in certain applications, it may be necessary for the sole expansible sleeve 50 to be in a middle zone of the second piece 20, in which case the longitudinal duct will be made up of, as in the case of the two sleeves shown in Figs. 2 y 3, by the first and second sections 12, 22 of the first and second pieces 10, 20 and the flexible connecting tube 60 between both placed in the hollow interior of the third piece.

[0021] Above embodiments are purely illustrative and are not limiting since an expert in the field would be able to introduce numerous modifications and variations without leaving the range of the present invention as outlined in the accompanying claims.

Claims

1. Composite shaft for a printing cylinder with a hydraulic liner attachment device of a type comprising two end sections (11, 21), with installation and guide configurations and a cylindrical intermediate section (31) for attaching liners (40), said intermediate section having an external diameter adapted to fit into the internal diameter of the liners (40), and said hydraulic liner attachment device being of a kind comprising two expansible sleeves (50) located on the respec-

- tive ends of said intermediate section (31) and each with a ring-shaped internal cavity (51) connecting with a longitudinal duct (12, 22, 60) of the shaft containing a fluid which can be subjected to pressure and an external, deformable wall (52) with a diameter, that when at rest, equals to said internal liner diameter (40) and slightly greater, when distorted by the pressure of said fluid than the internal diameter of the liner (40), **characterised by** said end sections (11, 21) being located on a first and second pieces (10, 20) which also respectively have first and second coupling configurations (14, 24) adapted to plug-in to the ends of a third, tubular piece (30) which forms, at least in a greater part, the centre section (31), where said longitudinal duct comprises first and second sections (12, 22) formed respectively in the first and second pieces (10, 20) and connected to each other, by means of a flexible tube, (60) located in the hollow interior of said third piece (30), where said expansible sleeves (50) are mounted, each on one of the first or second pieces (10, 20) and connecting with the respective first and second section (12, 22) of the longitudinal duct by means of at least one radial duct (13, 23).
2. The shaft, according to claim 1, **characterised by** its external diameter in the first coupling configuration (14) is the maximum diameter of the first piece (10), and where, on a section adjacent to the first coupling configuration (14) is mounted a sleeve adaptor (70) which provides a butt for the first end of the third piece (30) and an external surface for attaching one of the expansible sleeves (50).
 3. Shaft, according to claim 2, **characterised by** the second piece (20) having a section adjacent to the second coupling configuration (24) with a diameter greater than the external diameter of the second coupling configuration (24), forming a stair (25) which provides a butt for the second end of the third piece (30) and an external surface for attaching one of the expansible sleeves (50).
 4. Shaft, according to claim 3, **characterised by** the first and second sections (12, 22) of the longitudinal duct having a pair of openings at the respective internal end of the first and second pieces (10, 20) and said flexible tube (60) is connected by its ends to said openings of the first and second sections (12, 22) of the longitudinal duct by a pair of connection devices (61, 62).
 5. Shaft, according to claim 4, **characterised by** the first and second sections (12, 22) of the longitudinal duct, the flexible tube (60), the radial ducts (13, 23), and the ring-shaped cavities (51) together forming an hermetically closed container filled with said fluid capable of being subjected to pressure, and the first section (12) of the longitudinal duct having an opening in the external end of the first piece (10) and in said opening is fitted a piston device (63) capable of being activated to apply pressure to said fluid.
 6. Shaft, according to claim 5, **characterised by** the second section (22) of the longitudinal duct having a closed end inside the second piece (20), and a radial passageway (26) in which is fitted a drainage valve (64) which connects to the second section (22) of the longitudinal duct near to the closed-off end with the exterior.
 7. Shaft, according to claim 5, **characterised by** the first piece (10) comprising a radial passageway (15) which connects the first section (12) of the longitudinal duct with the exterior and in said radial passageway (15) is fitted an inlet valve (65) for introducing the fluid.
 8. Shaft, according to claim 7, **characterised by** said sleeve adaptor (70) having hole (71) coinciding with the opening of the radial passageway (15) to give access to the inlet valve (65).
 9. Shaft, according to claim 2, **characterised by** said sleeve adaptor (70) having at least one hole (72) coinciding with the opening of the at least one radial duct (13), which has equal diameter, said hole (72) and at least a section of the radial duct (13) form together a threaded hole into which is introduced a ring-shaped sleeve (66) sealing a joint between the sleeve adaptor (70) and the first piece (10).
 10. Shaft, according to claim 2, **characterised by** said sleeve adaptor (70) being shrunk fit into the first piece (10).
 11. Shaft, according to claim 1, **characterised by** the third piece (30) is made of a material consisting of carbon fibre .
 12. Shaft, according to claim 11, **characterised by** the third piece (30) being covered by a layer of a low friction and high wear resistant material.
 13. Shaft, according to claim 11, **characterised by** the third piece (30) being covered by a layer of a metallic material chosen from a group including steel.
 14. Shaft, according to claim 11, **characterised by** the expansible sleeves (50) being covered by a low friction resistant material layer.
 15. Composite shaft for printing cylinder with hydraulic liner attachment device of a type comprising two end sections (11, 21), with installation and guide configurations and a cylindrical intermediate section (31),

for attaching liners (40), with an external diameter adapted to fit into the internal diameter of the liners (40), and where said hydraulic liner attachment device is of a type comprising an expansible sleeve (50) located at one end of the intermediate section (31) and with a ring-shaped internal cavity (51) connected to the longitudinal duct (12) of the shaft containing a fluid capable of being subjected to pressure and a deformable external wall (52) with an external diameter equal, when at rest, to said internal diameter of the liner (40) and slightly greater when distorted by pressure from said fluid than the internal diameter of the liner (40), **characterised by** said end sections (11, 21) being defined on a first and second pieces (10, 20) which besides have respective first and second coupling configurations (14, 24) adapted to plug-in to the ends of a third tubular piece (30) which forms, at least in the greater part, the intermediate section (31), where said longitudinal duct (12) comprises a blind axial duct in the first piece (10) and where said expansible sleeve (50) is fitted onto the middle part of the first piece (10) connecting with said longitudinal duct (12) by means of at least one radial duct (13).

16. Composite shaft for printing cylinder with hydraulic liner attachment device of a type comprising two end sections (11, 21), with installation and guide configurations and an intermediate, cylindrical section (31), for holding the liners (40), with an external diameter adapted to fit the internal diameter of the liners (40), where said hydraulic liner attachment device is of a type which comprises an expansible sleeve (50) situated at one end of said intermediate section (31) and has a circular internal cavity (51) connecting with a longitudinal duct (12, 22, 60) of the shaft containing a fluid capable of being subjected to pressure and a deformable external wall (52) with an external diameter equal, when at rest, to said internal diameter of the liner (40) and slightly greater, when distorted by pressure from said fluid, than the internal diameter of the liner (40), **characterised by** said end sections (11, 21) being defined in first and second pieces (10, 20) which besides have respective first and second coupling configurations (14, 24) adapted to fit the plug-ins of the ends of a third, tubular piece (30) which marks out, in great part, the intermediate section (31), where the longitudinal duct comprises first and second sections (12, 22) respectively formed on the first and second pieces (10, 20) and connected to each other by means of a flexible tube (60) located in the hollow interior of a third piece (30), and said expansible sleeve (50) is mounted on the second piece (20) and connecting with the respective second section (22) of the longitudinal duct by means of a radial duct (23).

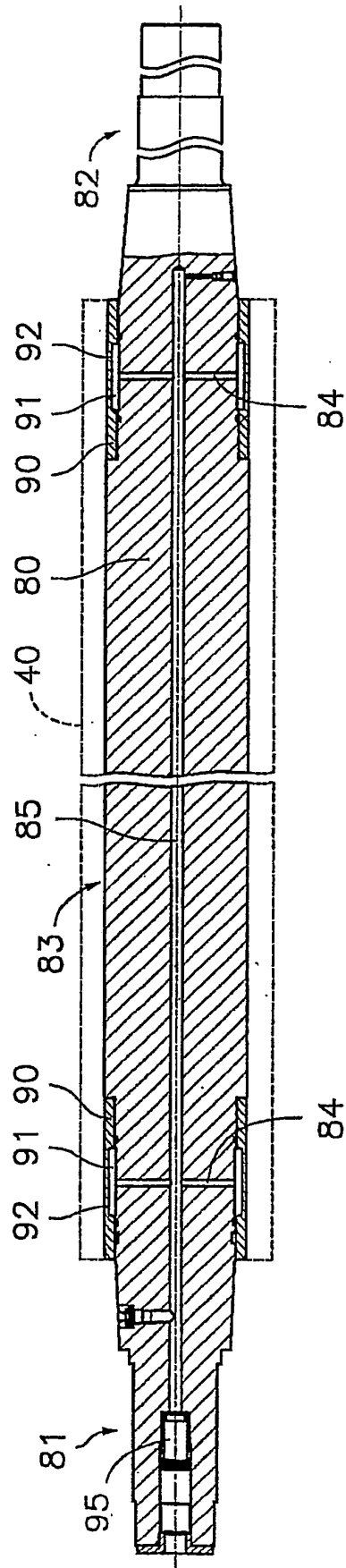
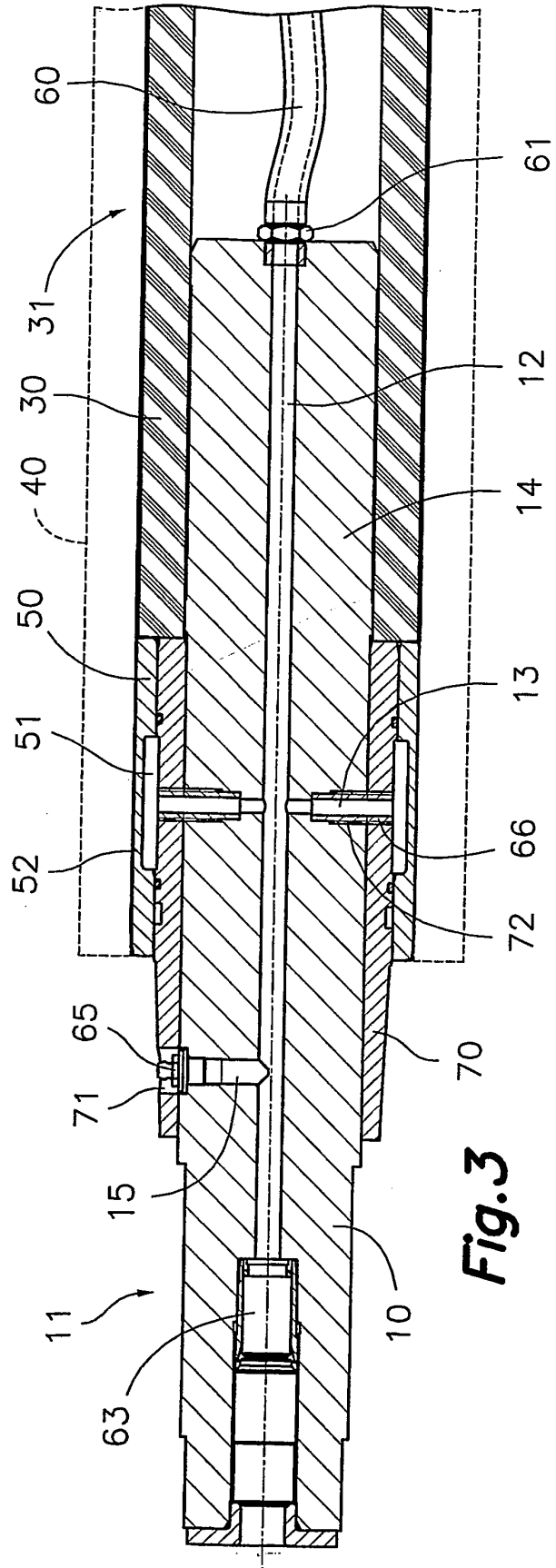
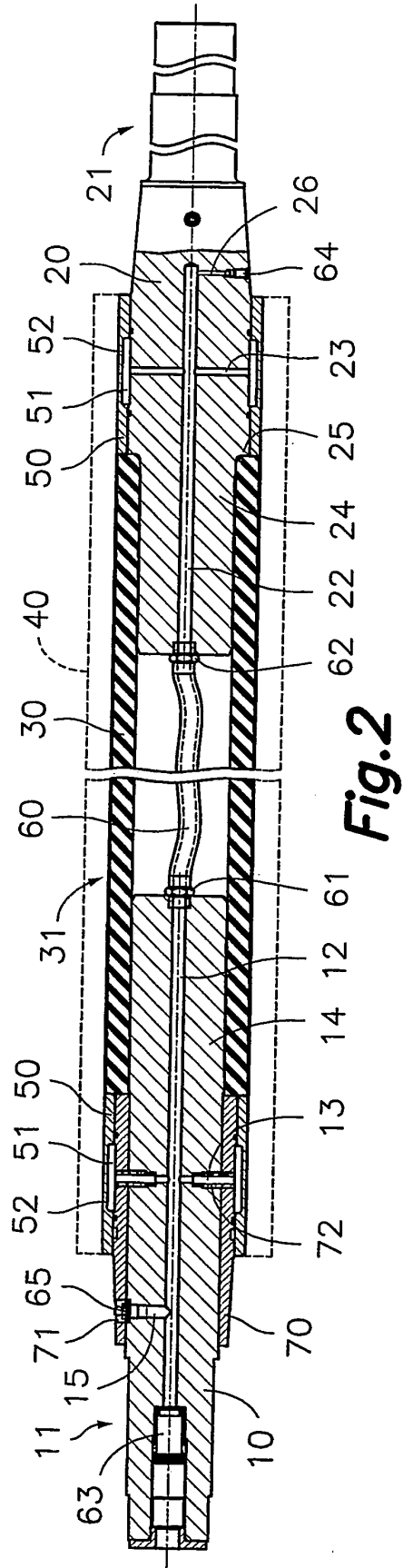


Fig. 1 Estado de la Técnica



INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES 03/00509

A. CLASSIFICATION OF SUBJECT MATTER		
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B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC ⁷ 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)		
CIBEPAT, EPODOC, WPI, PAJ		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
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Date of the actual completion of the international search		Date of mailing of the international search report
12 December 2003 (12.12.03)		08 January 2004 (08.01.04)
Name and mailing address of the ISA/ S.P.T.O.		Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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