(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
23 December 2010 (23.12.2010)

PCT

(10) International Publication Number
WO 2010/146040 A1

(51) International Patent Classification:
B41F 27/00 (2006.01) *B41F 33/00* (2006.01)

(21) International Application Number:
PCT/EP2010/058355

(22) International Filing Date:
15 June 2010 (15.06.2010)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
BO2009A000387 16 June 2009 (16.06.2009) IT

(71) Applicant *(for all designated States except US)*: **BIEFFEBI - SOCIETA' PER AZIONI** [IT/IT]; Via Frullo, 1, I-40050 GRANAROLO DELL'EMILIA, Frazione QUARTO INFERIORE (IT).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **SAMBRI, Stefano** [IT/IT]; Via Jussi, 117, I-40068 San Lazzaro Di Savena (IT).

(74) Agent: **MODIANO, Micaela**; Modiano & Partners, Via Meravigli, 16, I-20123 Milano (IT).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) **Title**: APPARATUS FOR CHECKING GEOMETRIC PARAMETERS OF PRINTING ASSEMBLIES CONSTITUTED BY FLEXOGRAPHIC PRINTING PLATES MOUNTED ON RESPECTIVE ROLLERS, BY FLEXOGRAPHIC PRINTING PLATES MOUNTED ON RESPECTIVE PRINTING PLATE SUPPORTING SLEEVES AND BY INKING ROLLERS/SLEEVES

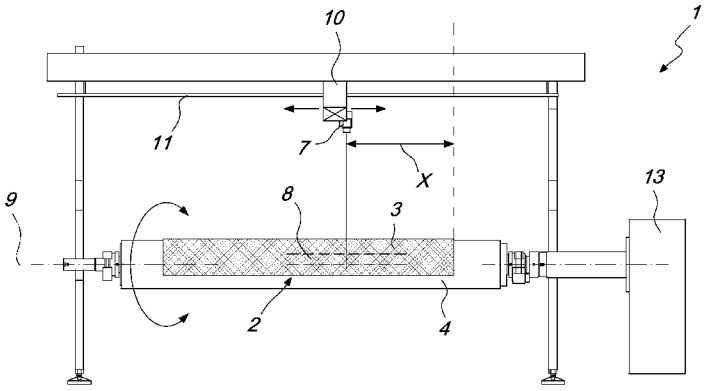

Fig. 1

(57) **Abstract**: Apparatus (1) for checking geometric parameters of printing assemblies (2) constituted by flexographic printing plates (3) mounted on respective rollers (4), by flexographic printing plates (3) mounted on respective printing plate supporting sleeves (5), and by inking rollers/sleeves (6), comprising at least one sensor (7), which is aligned, along a substantially tangential direction, with at least one portion (8) of the profile of the outer surface of the printing assembly (2) to be analyzed, and is designed to detect the shape of the outer surface of the printing plate (3), in the form of the actual radius of the assembly (2), mounted on the respective supporting element constituted by rollers (4), printing plate supporting sleeves (5) and inking rollers/sleeves (6).

WO 2010/146040 A1

APPARATUS FOR CHECKING GEOMETRIC PARAMETERS OF PRINTING ASSEMBLIES CONSTITUTED BY FLEXOGRAPHIC PRINTING PLATES MOUNTED ON RESPECTIVE ROLLERS, BY FLEXOGRAPHIC PRINTING PLATES MOUNTED ON RESPECTIVE PRINTING PLATE SUPPORTING SLEEVES AND BY INKING ROLLERS/SLEEVES

Technical field

The present invention relates to an apparatus for checking geometric parameters of printing assemblies constituted by flexographic printing plates mounted on respective rollers, by flexographic printing plates mounted on respective printing plate supporting sleeves, and by inking rollers/sleeves.

Background Art

In flexographic printing suitable printing plates are normally used which have to be mounted on respective rollers or sleeves (basically tubular bodies upon the outside surface of which it is possible to fix the printing plate). For the purposes of simplifying the terminology used in the present document, hereinafter the term "printing assembly" shall be used to identify the set of objects that is constituted by a roller or a sleeve upon which is fixed (with any fixing element) a flexographic printing plate or the element constituted by an inking roller or sleeve.

The techniques for mounting printing plates on respective supports (rollers or sleeves) can be controlled by position verification devices which can be semi-automatic (as described in EP 0 728 580 in the name of this same applicant) or completely automatic/virtual (as described in EP 1 666 251 in the name of this same applicant).

While the first type of device necessarily requires the printing of proof sheets to control the placement in register of the printing plate on the printing plate support, with the second type it is possible to mount the printing plates in register by using virtual computer software which, by using the work file, eliminates the need for the proof sheet with inks and

enables the operator to make exact comparisons of position and of the entire image between the pre-processed graphic reproduction of the image to be printed, made available on a digital memory medium, and the image of the printing plate mounted on the roller or on the printing plate supporting sleeve.

With recently developed plate mounters the necessity of a hardcopy proof sheet has thus been eliminated, which is useful for verifying the correct mounting position and the image in register, and a notable reduction has been achieved in the time necessary to program the positions of the printing plates and to execute the virtual proof sheet.

On the other hand, even with this type of device, it has not been possible to detect and store the geometric errors of printing plates (or rather, of the printing plate, of the printing plate support and of the assembly comprising printing plate plus printing plate support). Knowledge of these errors would guarantee a reduction in the time required for starting a print process because it would be possible to assess, in advance, the suitability and quality of printing of every printing assembly when mounting the printing plate.

The verification of errors of shape, geometry and thickness in mounting the printing assembly is therefore necessarily performed by means of proof sheets. The simplification introduced by automating the verification of respondence of the printing plate and its correct mounting with respect to a virtual image therefore limits the control activities to a first phase, at the end of which a proof sheet must in any case be printed to complete the check of the printing assembly.

Disclosure of the Invention

The aim of the present invention is to solve the above mentioned drawbacks, by providing an apparatus for checking geometric parameters of printing assemblies constituted by flexographic printing plates mounted on respective rollers, by flexographic printing plates mounted on respective

printing plate supporting sleeves, and by inking rollers/sleeves that is adapted to check the geometric and dimensional parameters of the printing assembly in order to identify it completely and univocally so as to verify its complete respondence to the usage requirements.

Within this aim, an object of the present invention is to provide an apparatus for checking geometric parameters of printing assemblies constituted by flexographic printing plates mounted on respective rollers, by flexographic printing plates mounted on respective printing plate supporting sleeves, and by inking rollers/sleeves that is adapted to check the dimensional and geometric deviation from the ideal dimensions and shape, which may be preset and/or stored, so as to control that such deviation is less than a predefined limit value for that type of printing assembly.

Another object of the present invention is to provide an apparatus for checking geometric parameters of printing assemblies constituted by flexographic printing plates mounted on respective rollers, by flexographic printing plates mounted on respective printing plate supporting sleeves, and by inking rollers/sleeves that can be simply mounted on a plate mounter device.

Another object of the present invention is to provide an apparatus for checking geometric parameters of printing assemblies constituted by flexographic printing plates mounted on respective rollers, by flexographic printing plates mounted on respective printing plate supporting sleeves, and by inking rollers/sleeves that can be simply mounted on a printing machine.

A further object of the present invention is to provide an apparatus for checking geometric parameters of printing assemblies constituted by flexographic printing plates mounted on respective rollers, by flexographic printing plates mounted on respective printing plate supporting sleeves, and by inking rollers/sleeves that has a low cost, is easily and practically implemented and safely applied.

This aim and these and other objects which will become better

apparent hereinafter are achieved by an apparatus for checking geometric parameters of printing assemblies constituted by flexographic printing plates mounted on respective rollers, by flexographic printing plates mounted on respective printing plate supporting sleeves, and by inking rollers/sleeves, characterized in that it comprises at least one sensor, which is aligned, along a substantially tangential direction, with at least one portion of the profile of the outer surface of the printing assembly to be analyzed, and is intended to detect the shape of the outer surface of the printing plate, in the form of the actual radius of the assembly, mounted on the respective supporting element constituted by rollers, printing plate supporting sleeves and inking rollers/sleeves.

Brief description of the drawings

Further characteristics and advantages of the invention will become better apparent from the detailed description that follows of a preferred, but not exclusive, embodiment of the apparatus for checking geometric parameters of printing assemblies constituted by flexographic printing plates mounted on respective rollers, by flexographic printing plates mounted on respective printing plate supporting sleeves, and by inking rollers/sleeves according to the invention, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a front elevation view of an apparatus for checking geometric parameters of printing assemblies constituted by flexographic printing plates mounted on respective rollers, by flexographic printing plates mounted on respective printing plate supporting sleeves, and by inking rollers/sleeves according to the invention;

Figure 2 is a front view of an apparatus for checking geometric parameters of printing assemblies constituted by flexographic printing plates mounted on respective rollers, by flexographic printing plates mounted on respective printing plate supporting sleeves, and by inking rollers/sleeves according to the invention, mounted on a plate mounter;

Figure 3 is a side view of a printing assembly constituted by a flexographic printing plate mounted on a respective roller;

Figure 4 is a front view of a printing assembly constituted by a flexographic printing plate mounted on a respective roller;

Figure 5 is in a schematic view of a functional block diagram of an apparatus for checking geometric parameters of printing assemblies constituted by flexographic printing plates mounted on respective rollers, by flexographic printing plates mounted on respective printing plate supporting sleeves, and by inking rollers/sleeves according to the invention, mounted on a plate mounter;

Figure 6 is a schematic front view of the functional diagram of a printing machine station on which at least one printing assembly is mounted;

Figure 7 is a schematic top view of the functional diagram of a printing machine station on which at least one printing assembly is mounted;

Figure 8 is a schematic front view of the functional diagram of a wheel printing machine on which at least one printing assembly is mounted.

Ways of carrying out the Invention

With reference to the figures, the reference numeral 1 generally designates an apparatus for checking geometric parameters of printing assemblies 2 constituted by flexographic printing plates 3 mounted on respective rollers 4, by flexographic printing plates 3 mounted on respective printing plate supporting sleeves 5, and by inking rollers/sleeves 6.

The apparatus 1 comprises at least one sensor 7, which is aligned, along a substantially tangential direction, with at least one portion 8 of the profile of the outer surface of the printing assembly 2 to be analyzed, and is designed to detect the shape of the outer surface of the printing plate 3 mounted on the respective supporting element constituted by the rollers 4, the printing plate supporting sleeves 5 and the inking rollers/sleeves 6. It is specified that the assembly 2 is normally axially symmetric (axis of symmetry 9) and can rotate about its axis of symmetry 9.

In substance the sensor 7 analyses and examines the outside surface of the printing assembly 2 by detecting the shape or the dimensions at some parts of particular interest. By analysing the printing assembly 2 in a direction of examination that is substantially tangential to the outside surface of such assembly, the sensor 7 basically probes the extent of the actual radius of the printing assembly 2, invalidated by the dimensional and geometric irregularities of all its components. Detection of this actual radius will enable its comparison with the theoretical radius in order to calibrate the positioning of the assembly 2 so as to minimise the effects of the irregularities on the products that will be printed with the assembly 2.

According to an embodiment of particular practical and applicative interest, the sensor 7 is an apparatus for acquiring images, such as a still camera, a video camera and the like. It should be emphasised that there are video cameras provided with optics and electronics that are capable of performing high magnifications of the detected images, without distortion (or in any case with levels of optical distortion of known extent). From the image it will thus be possible to detect, with certainty, the thicknesses of all the parts that are seen in profile. In particular, since the printing plate is normally transparent and/or partially transparent, it will be possible to detect the thickness of such printing plate and also of the components that are located under it. In general the important thing is to detect the value of the actual radius at each point examined, independently of the thicknesses of the individual components, even if in certain applications it may be advisable (and possible with the apparatus 1 according to the invention) to detect such thicknesses.

In order to guarantee a correct mounting of the printing plate 3 on the respective supporting element it is necessary that a layer of adhesive material 3a be interposed between them having a thickness that is specific and preset according to suitable design criteria. Such thickness can in any case be controlled by means of the sensor 7.

In any case the sensor 7 will be capable of detecting the value of the actual radius of the outside surface at that point, since it will acquire a signal (for example an image) tangentially at such surface, and by knowing the exact position of the axis of the assembly 2 and the exact position of the sensor 7, the detected signal can be easily correlated with the exact value of the actual radius at the point that is being operated on.

According to a particular embodiment of particular practical and applicative interest in the sector of printing machines and devices for mounting printing plates 3 (normally referred to as plate mounters), the sensor 7 can be coupled to a sliding block 10 which can slide along a rail 11 that is parallel to the pivoting and assembly axis 9 of the printing assembly 2.

The sliding of the sliding block 10 determines in such case the alignment of the sensor 7 with different and contiguous portions 8 of the printing assembly 2 for detecting the outside surface shape at each position of alignment (the detection is possible because the sliding block 10 slides on the rail so as to keep the sensor 7, the video camera according to the example cited above, facing the profile of the assembly 2). Maintaining this particular alignment (tangential alignment, rather than the typical radial alignment that is adopted with mechanical and optical diameter gauges) ensures that the area upon which the video camera will perform the acquisition of the image is that proximate to the plane that is tangential to the outside surface of the assembly 2, basically showing the shape, or the silhouette, of the assembly 2.

The sliding block 10 can move according to successive incremental steps of preset extent for alignment with corresponding positions of the assembly 2 at a preset mutual distance. If the sliding block 10 can move by discrete incremental steps, then the sensor 7 can be constituted by a video camera or by a still camera, irrespectively. The still camera will be activated to acquire the photographic image only in the instant when the sliding block

10 has stopped in one of the preset positions.

Similarly, the sliding block 10 can also move continuously for continuous detection, on the part of the sensor 7 (video camera), of the geometric/dimensional parameters of the printing assembly 2 in all the positions that are successively aligned with the sensor 7. In this case a video camera is clearly preferred over a still camera because continuous detection is much more practical with this type of sensor 7. However, the use of still cameras adapted to acquire a plurality of photographic frames in sequence is not excluded.

It is emphasised that the printing assembly 2 can rotate continuously about its axis 9 (as can be seen in the accompanying Figures). Therefore the sensor 7 will be designed to detect the geometric/dimensional parameters continuously (i.e. at each angular position reached by the assembly 2), and at each instant during the rotation of the assembly 2.

The rotation of the printing assembly 2 determines an angular movement α with respect to a starting reference (the corresponding angle α will be associated with each detection performed).

In this case an angular detection (as a function of an angle α) will be made continuously, which will make it possible to geometrically investigate each "ring" of the assembly 2 to find the extent of its actual radius and to be able therefore to compare it with the ideal radius (which also varies with the variation of the angle stemming from the shape of the flexographic printing plate 3 which is necessary for the impression of the image to be printed).

Alternatively, in order to obtain an incremental angular detection, the printing assembly 2 can rotate about its own axis 9 according to successive angular increments of preset extent ($\Delta\alpha$). The sensor 7 will thus be designed to detect the geometrical/dimensional parameters at each stop between successive incremental angular movements.

To rotate the assembly 2 there is a suitable movement apparatus 13 which is controlled in such a way as to determine precise rotations and to

make incremental steps ($\Delta\alpha$), even extremely small steps (these also optionally obtainable with high precision and resolution).

It is clear that by combining the movements of the sliding block 10, to which the sensor 7 is fixed, with respect to the rail 11 in the direction parallel to the axis 9 (corresponding to movements X) with the rotations of the assembly 2 about its axis 9 (corresponding to angular rotations of α extent) it is possible to investigate and detect every point of the surface of the printing assembly 2.

The apparatus 1, in a complete version and adapted to immediate industrial application, comprises a memory unit for collecting the geometric/ dimensional parameters detected. In particular, according to the embodiment shown in the accompanying Figures, the memory unit is comprised in the computer 12 mentioned previously.

The possibility is not excluded of directly including, on the roller 4 or on the sleeve 5, memory units that are connected to the computer 12 of the apparatus 1 during the detection phase. In this case the detected data will be stored on the unit installed on the roller 4 or on the sleeve 5.

When mounting the assembly 2 on the printing machinery 14 the data may be read from the memory unit of the processor present on the machinery and used to speed up the dimensional and geometric calibration operations of the printing components (the various different assemblies 2 present).

The apparatus 1, in order to facilitate the data transfer operations, comprises a component, such as a port and the corresponding cable, for connection and communication. These components will be associated with the computer 12 for storage and optional analysis of the detected data.

The apparatus 1 enables the detection, storage and transmission of the total errors and deviations from the ideal geometric conditions, with respect to nominal values, caused by:

a) machining tolerance of the roller 4 and the printing plate supporting

sleeve 5 with respect to values of circularity, concentricity, cylindricity and diameter;

b) tolerance in the thickness of the double-sided adhesive tape (which keeps the printing plate 3 on the respective printing plate support): such thickness may be different from spool to spool;

c) tolerance of the thickness of the printing plate 3.

Normally the correction of geometric printing errors is very expensive because they are detected visually, by attempts, manually on each roller or printing plate supporting sleeve of the printing machinery.

In relation to geometric printing errors of the printing plates 3 mounted on the rollers 4 or the printing plate supporting sleeves 5, the inking rollers/sleeves 6 also have to be registered (specifically, the inking rollers/sleeves 6 take the ink from the reservoir 17 and distribute it on the outside surface of the printing plate 3).

Registration of the rollers 4 or of the printing plate supporting sleeves 5 requires on average at least 10 minutes (during which time there is no production) and around 600 metres of printed material per proof which then has to be discarded.

The adoption of the apparatus 1 according to the invention makes it possible to compare the theoretical printing radius referred to the axis of rotation 9 with the actual surface radius of the printing plate 3 on all the points considered necessary of the circumference and of the width of the printing zones of the printing plates 3.

In the detection phase it is possible to verify, at various points, whether the actual radius of the printing plate 3 is greater than, equal to, or less than the circumference and the length with respect to the theoretical radius.

Whatever the result of the detection it must be kept in mind that the important points to be stored are those that have an actual radius value that is less than the theoretical radius value, as these points determine the amount

of movement of the axis 9 of the roller 4 (or the printing plate supporting sleeve 5) with respect to a counterpressure roller 15 or a central drum 16 which must be corrected on both sides directly on the printing machinery in order to obtain, without losing time, the complete printing of the printing plates 3 by exercising the minimum possible pressure.

The amounts of movement of the axis 9 of the printing roller 4 with respect to the counterpressure roller 15 or the central drum 16 can also be used to correct the movement of the axis 9 of the inking roller/sleeve 6.

With the same apparatus 1, as previously explained, it is also possible to control the inking rollers/sleeves 6 (known as ANILOX rollers/sleeves) which transfer the ink to the printing plates 3.

In this case the detected data can be stored and sent to the printing machinery to modify the position of the axis in relation to the geometric errors of the printing assembly 2 and the geometric errors of the inking roller/sleeve 6.

In order to manage the data from the "pre-printing geometric measurements" it is necessary to be able to recognise, with a code, all of the technical information relating to the use and printing characteristics of each printing assembly 2.

In relation to geometric printing errors of the printing plates 3 mounted on the rollers 4 or the printing plate supporting sleeves 5, the inking rollers/sleeves 6 also have to be registered (specifically, the inking rollers/sleeves 6 take the ink from a reservoir 17 and distribute it on the outside surface of the printing plate 3).

The adoption of the apparatus 1 according to the invention makes it possible to compare the theoretical printing radius referred to the axis of rotation 9 with the actual surface radius of the printing plate 3 on all the points considered necessary of the circumference and of the width of the printing zones of the printing plates 3.

In the detection phase it is possible to verify, at various points,

whether the actual radius of the printing plate 3 is greater than, equal to, or less than the circumference and the length for the theoretical radius.

Whatever the result of the check it must be kept in mind that the important points to be stored are those that have an actual radius value that is less than the theoretical radius value, as those points permit the operator to assess the result of the mounting and to verify the suitability of the printing assembly to be applied to a determined print process.

In order to manage the data from the "pre-printing geometric measurements" it is necessary to be able to recognise, with a code, all of the technical information relating to the use and printing characteristics of each printing assembly 2.

The apparatus 1 is normally applied to a plate mounter 20 (as shown in Figure 2) that is adapted to mounting the printing plates 3 in register, but, as specified previously and shown in Figure 1, it can be incorporated in a completely dedicated structure, thus constituting an autonomous machine.

According to a particular embodiment, the detection sensor 7 can be connected by means of a flexible cable to its controller 21, which can communicate by means of special software with the computer 12 of the plate mounter 20 via ports 22 (USB and RS-232C).

The apparatus 1 for geometric detection also makes it possible to provide digital information for each printing plate supporting sleeve 5 via the computer of the plate mounter 20. As already mentioned, this information can also be stored directly on memory units that are comprised in the printing assembly 2 under examination.

The possibility is not excluded of reading the information contained in the memory unit installed in the printing assembly by means of wireless connections (electromagnetic links, such as frequency modulation, infrared and the like).

The scope of the present invention is considered to include within it any unit (plate mounter 20) for mounting the flexographic printing plates 3

that comprise an apparatus 1 for controlling geometric parameters of printing assemblies 2 constituted by flexographic printing plates 3 mounted on respective rollers 4, by flexographic printing plates 3 mounted on respective printing plate supporting sleeves 5, and by inking rollers/sleeves 6 in conformance with what is described above. Solely for the purposes of providing an applicative example, note that Figure 2 refers to such possible application of the apparatus 1 to a plate mounter 20 (unit for mounting flexographic printing plates 3).

Similarly, the scope of the present invention is considered to also include within it any printing machine that comprises an apparatus 1 for checking geometric parameters of printing assemblies 2 constituted by flexographic printing plates 3 mounted on respective rollers 4, by flexographic printing plates 3 mounted on respective printing plate supporting sleeves 5, and by inking rollers/sleeves 6. Solely for the purposes of providing an applicative example, note that Figures 6, 7 and 8 refer to such possible application of the apparatus 1 to a machine for printing and they describe the details of such machine to identify the permitted operations following the adoption of the apparatus 1 according to the invention.

The procedure for detecting the geometric parameters of printing assemblies 2 constituted by flexographic printing plates 3 mounted on respective rollers 4, by flexographic printing plates 3 mounted on respective printing plate supporting sleeves 5, and by inking rollers/sleeves consists in a first phase a) of detecting the value of the actual radius of the printing assembly 2 at a predetermined distance X, along the axial direction 9, from the end of the assembly 2 and at a predefined angular position α of the assembly 2 with respect to a reference angular position. A second phase b) performs a comparison of the detected value of the actual radius with the value of the theoretical, ideal radius, so determining the extent of the movement and the coordinates relating to it, i.e. overall the coordinates of the point of detection, i.e. the axial distance X and the angular position α, the

actual radius detected and the movement from the theoretical radius, for a plurality of points of the printing assembly 2.

The apparatus 1 makes it possible to control the geometric errors of the printing plates 3 mounted on the rollers 4 or the printing plate supporting sleeves 5.

It could also make it possible to store the detected data and optionally transmit such data to the operator. In this way the operator could use such data in the phase of assessing the result of mounting the printing plate, for a final check of the printing assembly 2.

The invention, thus conceived, is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims. Moreover, all the details may be substituted by other, technically equivalent elements.

For example it should be noted that the apparatus 1 according to the invention can comprise at least one management and control device that is designed to check the correct positioning of the flexographic printing plate 3, mounted on the respective roller 4, on a respective printing plate supporting sleeve 5 and on other similar supports.

In this case, the management and control device will be provided with a memory unit that is designed to store the image file of the printing plate 3 (for example the file with which the printing plate 3 was created or, more generally, a file that describes the image of the file under standard conditions of positioning, dimensions and proportions), and provided with at least one element for the acquisition of the image of the printing plate 3 (in this case too it can be a video camera, a still camera or other element that is generally adapted to acquire an image) on the corresponding support, and with a screen (for example the screen of a personal computer or a dedicated video screen) for superimposing the image acquired by such element with the image of the file and for checking the perfect juxtaposition of such images.

The correct juxtaposition of the two images (the real, acquired image

and the virtual image of the file) corresponds to a correct mounting and positioning of the printing plate 3.

In this case, therefore, the apparatus 1 will be able to detect the extent of the thickness of an assembly 2 that has been previously mounted and correctly placed and which therefore will not be subject to further errors caused, for example, by bad placing/mounting of the printing plate 3.

In the embodiments illustrated, individual characteristics shown in relation to specific examples may in reality be interchanged with other, different characteristics, existing in other embodiments.

In addition, it should be noted that anything found to be already known during the patenting process is understood not to be claimed and to be the subject of a disclaimer.

In practice the materials employed, as well as the dimensions, may be any according to requirements and to the state of the art.

The disclosures in Italian Patent Application No. BO2009A000387 from which this application claims priority are incorporated herein by reference.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

CLAIMS

1. An apparatus for checking geometric parameters of printing assemblies (2) constituted by flexographic printing plates (3) mounted on respective rollers (4), by flexographic printing plates (3) mounted on respective printing plate supporting sleeves (5), and by inking rollers/sleeves (6), characterized in that it comprises at least one sensor (7), which is aligned, along a substantially tangential direction, with at least one portion (8) of the profile of the outer surface of the printing assembly (2) to be analyzed, and is designed to detect the shape of the outer surface of the printing plate (3), in the form of the actual radius of the assembly (2), mounted on the respective supporting element constituted by rollers (4), printing plate supporting sleeves (5) and inking rollers/sleeves (6).

2. The apparatus according to claim 1, characterized in that said sensor (7) is an apparatus for acquiring images, such as a still camera, a video camera and the like.

3. The apparatus according to claim 1, characterized in that a layer of adhesive material (3a) is interposed between said printing plate (3) and the respective element to which it is fixed, chosen among the roller (4), the printing plate supporting sleeve (5) and the inking rollers/sleeves (6), said sensor (7) being optionally adapted also to detect the thickness of said layer of adhesive material (3a) in addition to detecting the actual radius of the assembly (2).

4. The apparatus according to claim 1, characterized in that said sensor (7) is coupled to a sliding block (10), which can slide along a rail (11) that is parallel to the pivoting and assembly axis (9) of the printing assembly (2), the sliding of said sliding block (10) producing the alignment of said sensor (7) with different and contiguous positions of said printing assembly (2) in order to detect the parameters at each position.

5. The apparatus according to claim 2, characterized in that said sliding block (10) can move according to successive incremental steps of

preset extent for alignment with corresponding positions of the assembly (2) at a preset mutual distance.

6. The apparatus according to claim 2, characterized in that said sliding block (10) can move continuously for continuous detection, on the part of said sensor (7), of the geometric/dimensional parameters of the printing assembly (2) in all the positions that are successively aligned with said sensor (7).

7. The apparatus according to claim 1, characterized in that said printing assembly (2) can rotate about its own axis (9) with continuity, said sensor (7) being designed to detect the geometric/dimensional parameters continuously and at each instant during the rotation of said assembly (2).

8. The apparatus according to claim 1, characterized in that said printing assembly (2) can rotate about its own axis (9) according to successive angular increments of preset extent, said sensor (7) being designed to detect the geometrical/dimensional parameters at each stop between successive incremental angular movements.

9. The apparatus according to one or more of the preceding claims, characterized in that it comprises a component, such as a port (22) and the corresponding cable, for connection and communication with a computer (12) for optional analysis of the data for control.

10. The apparatus according to one or more of the preceding claims, characterized in that it comprises at least one management and control element designed to check the correct placement of the flexographic printing plate (3), mounted on the respective roller (4), on a respective printing plate supporting sleeve (5) and on other similar supports, said element being provided with a memory unit designed to store the file of the image of the printing plate (3), with at least one element for the acquisition of the image of the printing plate (3) on the corresponding support, and with a screen for superimposing the image acquired by said element with the image of the file and for checking the perfect juxtaposition of said images that corresponds to

correct mounting and positioning of the printing plate (3), said apparatus (1) detecting the variation of the thickness of an assembly (2) previously mounted with the correct positioning.

11. A unit for mounting flexographic printing plates, characterized in that it comprises an apparatus (1) for controlling geometric parameters of printing assemblies (2) constituted by flexographic printing plates (3) mounted on respective rollers (4), by flexographic printing plates (3) mounted on respective printing plate supporting sleeves (5), and by inking rollers/sleeves (6) according to one or more of the preceding claims.

12. A printing machine, characterized in that it comprises an apparatus (1) for each printing assembly (2), which is composed of the components (6), (16) and (17), for the control of geometric parameters of printing assemblies (2) constituted by flexographic printing plates (3) mounted on respective rollers (4), by flexographic printing plates (3) mounted on respective printing plate supporting sleeves (5), and by inking rollers/sleeves (6) according to one or more of claims 1 to 9.

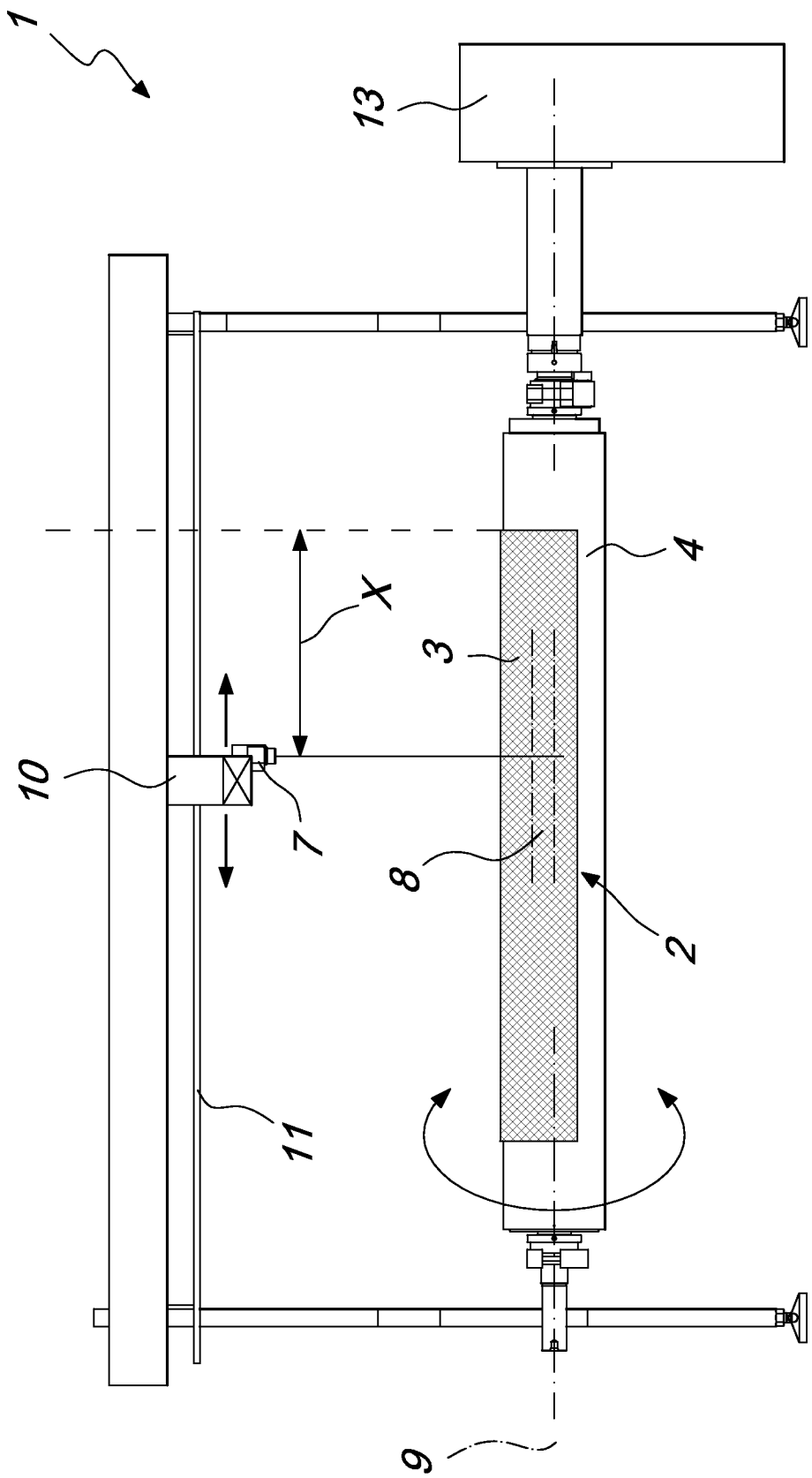

Fig. 1

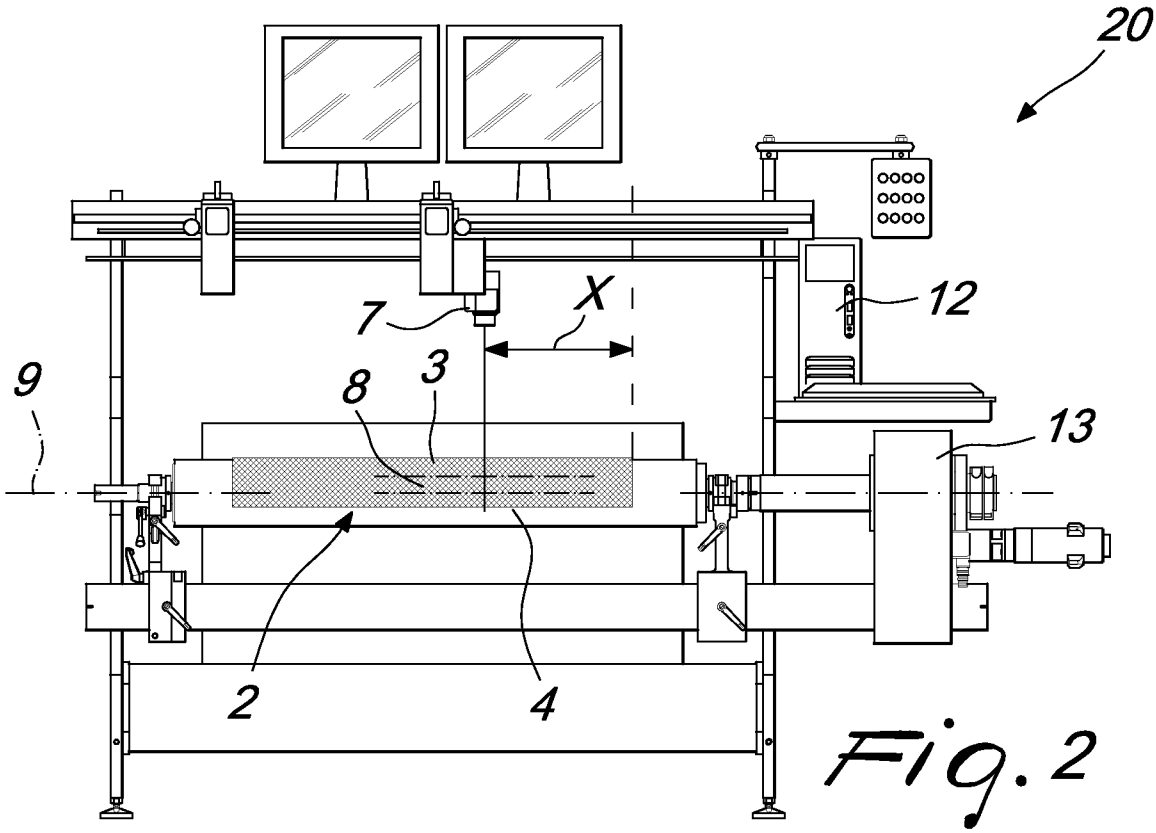

Fig. 2

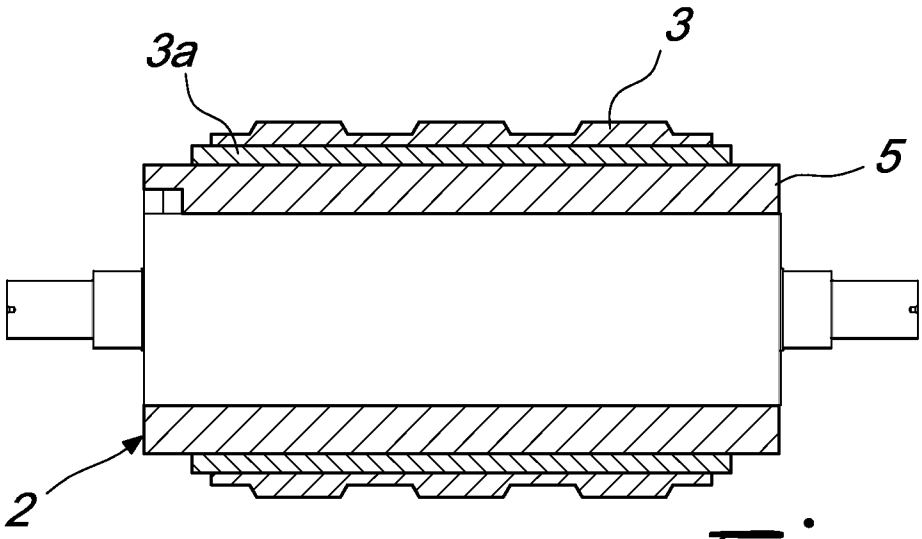

Fig. 3

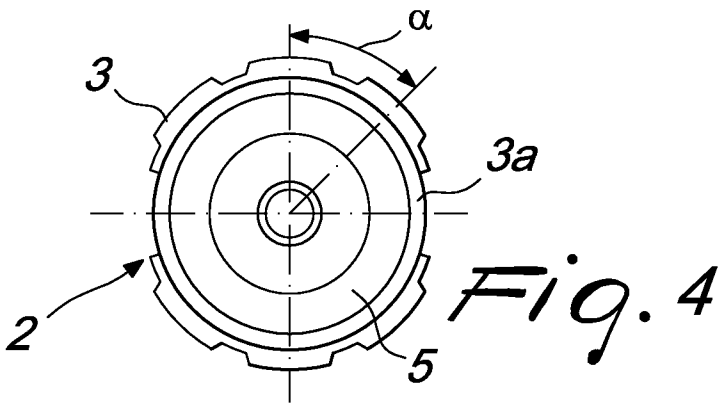

Fig. 4

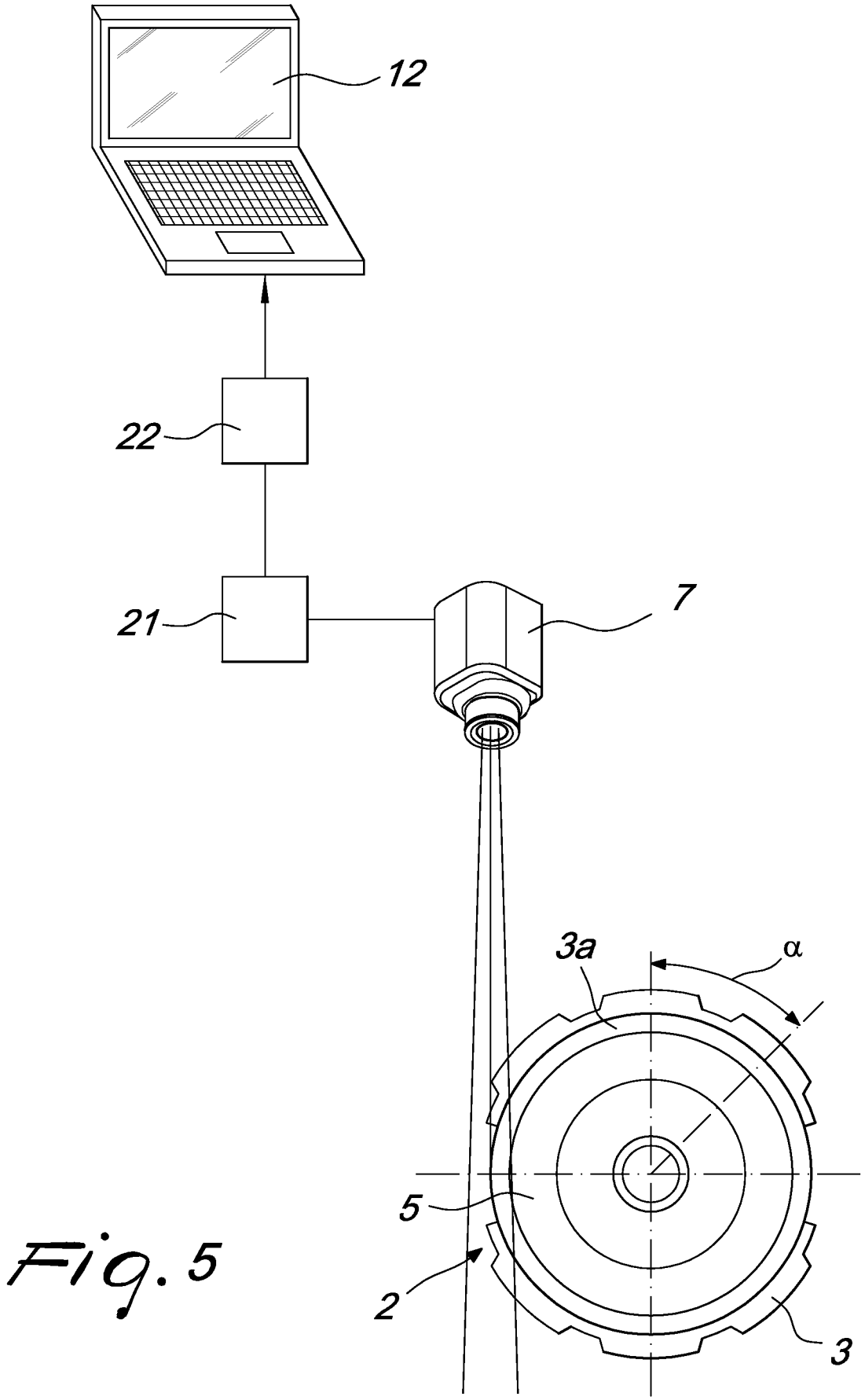

Fig. 5

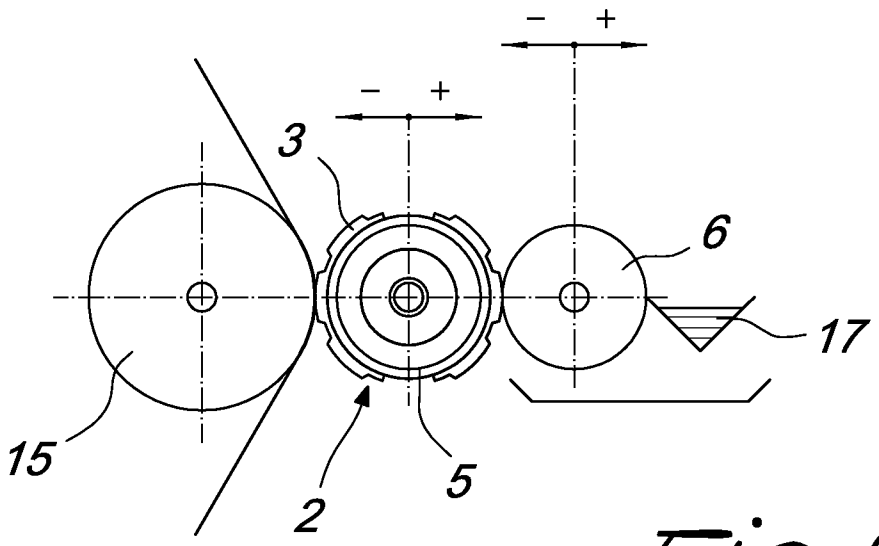

Fig. 6

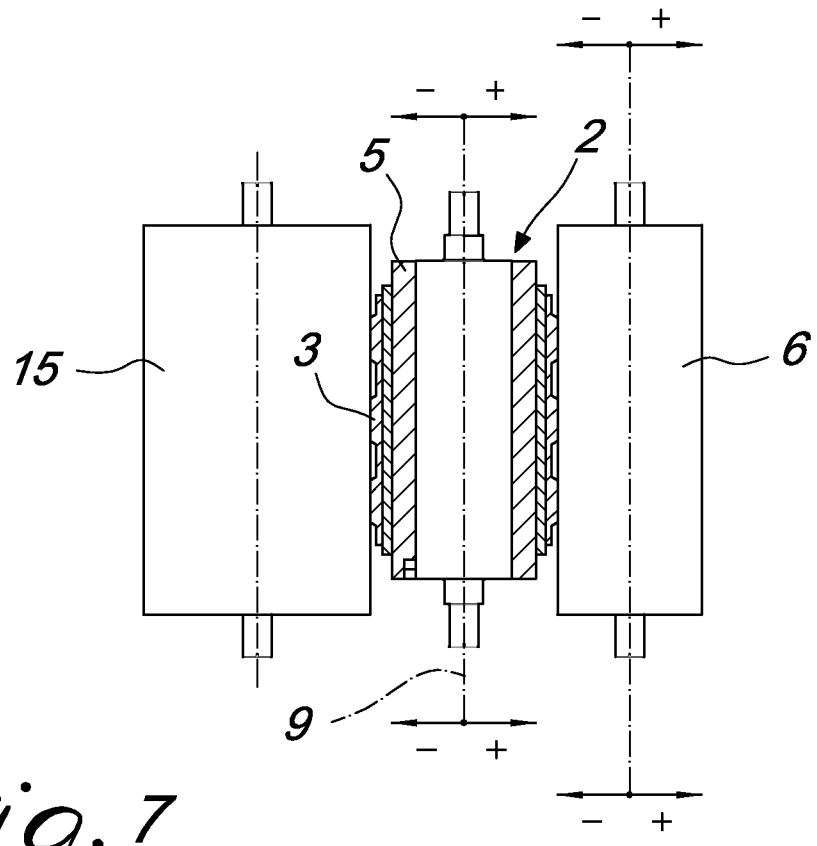

Fig. 7

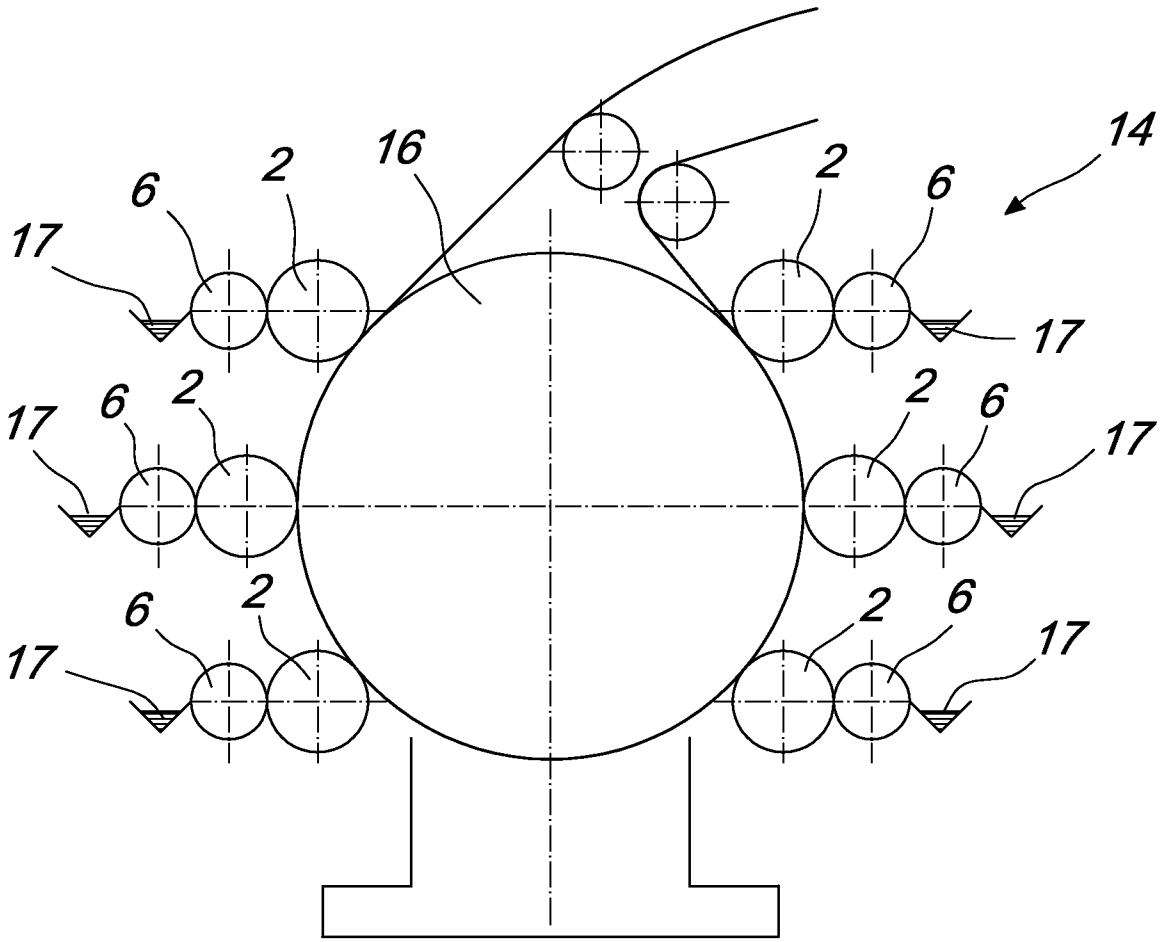

Fig. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/058355

A. CLASSIFICATION OF SUBJECT MATTER
INV. B41F27/00 B41F33/00
ADD.

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)
B41F

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 916 102 A (FISCHER & KRECKE GMBH & CO KG [DE]) 30 April 2008 (2008-04-30) paragraphs [0039] - [0043]	1,4-8, 11,12
A	EP 1 666 251 A (BIEFFEBI SPA [IT]) 7 June 2006 (2006-06-07) cited in the application paragraph [0025]	1
A	EP 1 060 884 A (BIEFFEBI SPA [IT]) 20 December 2000 (2000-12-20) paragraph [0021]	1
A	US 2006/005728 A1 (NEUFELD RICHARD [CA] ET AL) 12 January 2006 (2006-01-12) paragraph [0065]	1

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 August 2010	01/09/2010

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Diaz-Maroto, V

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/058355

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 97/39893 A (LEADER ENGINEERING FABRICATION [US]; LEADER CHARLES B JR [US]; COX CHA) 30 October 1997 (1997-10-30) page 20, line 4 - line 7	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2010/058355

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1916102 A	30-04-2008	AT 459470 T	15-03-2010
		CN 101641214 A	03-02-2010
		CN 101594995 A	02-12-2009
		ES 2339691 T3	24-05-2010
		US 2008141886 A1	19-06-2008
EP 1666251 A	07-06-2006	BR PI0505356 A	11-07-2006
		CN 1781704 A	07-06-2006
		KR 20060061920 A	08-06-2006
		MX PA05012976 A	06-06-2006
		US 2006117973 A1	08-06-2006
EP 1060884 A	20-12-2000	IT B0990311 A1	11-12-2000
US 2006005728 A1	12-01-2006	WO 2007019677 A1	22-02-2007
		CN 101242954 A	13-08-2008
		EP 1915255 A1	30-04-2008
		JP 2009505143 T	05-02-2009
WO 9739893 A	30-10-1997	AU 711032 B2	07-10-1999
		AU 4190797 A	12-11-1997
		CA 2252500 A1	30-10-1997
		DE 69717993 D1	30-01-2003
		DE 69717993 T2	17-07-2003
		DK 907511 T3	14-04-2003
		EP 0907511 A1	14-04-1999