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(54) **Device for supplying foil to be used in a printing process to a printing press**

(57) A device (2) for supplying foil (3) to be used in a printing process to a printing press (1) comprises a unit (11) for supporting at least one coil (10) of the foil (3). This coil supporting unit (11) may comprise two shafts for supporting two coils (10) of the foil (3), wherein the shafts are mounted on a rotatably arranged part (12) of the unit (11), so that it is possible to change positions of the shafts, and to have an automatically performed changing process of coils (10) of the foil (3). Furthermore, in order to allow for a temporary standstill of the foil (3) in a path near the coil supporting unit (11) when a coil changing process takes place and still ensuring a supply of foil (3) to the printing press (1), buffer means (19) for storing a length of the foil (3) are provided, which are arranged at a position downstream of the coil supporting unit (11).

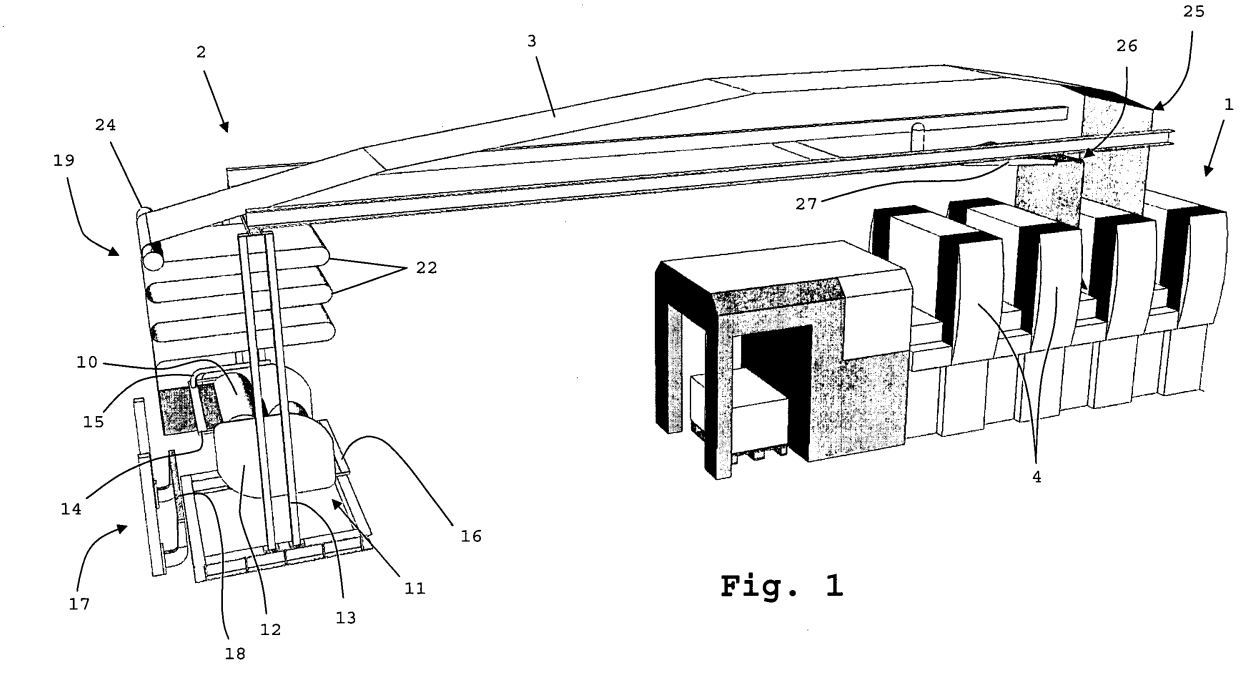

Fig. 1

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Description

[0001] The present invention relates to a device for supplying foil to be used in a printing process to a printing press, comprising: a unit for supporting at least one coil of the foil; and a number of rollers for supporting and guiding the foil, and imposing a displacement on the foil. Furthermore, the present invention relates to a combination of a printing press and a device for supplying foil to be used in a printing process to a substrate on a cylinder of the printing press, wherein this device comprises: a unit for supporting at least one coil of the foil; and a number of rollers for supporting and guiding the foil, and imposing a displacement on the foil.

[0002] In general, the present invention is applicable in the field of applying a thin layer of a metal such as aluminium to a substrate such as paper or carton during a printing process, as in this field, there is a need for useful methods for supplying a foil comprising the thin metal layer and a carrier layer to a printing press. In this respect, techniques for transferring the metal layer from the carrier layer of the foil to the printing substrate have been developed which do not require any heating process for letting the desired transfer take place. The foil which is used in carrying out these techniques usually comprises a carrier layer made of polyethene, wherein a layer of aluminium is deposited on this carrier layer.

[0003] By using the foil as described in the foregoing, it is possible to realize printed matter having shiny, silver-like or gold-like portions, wherein the exact colour of the portions is dependent on the colour of the metal layer of the foil which has been used during the printing process. In particular, the shiny portions are obtained by performing the following steps: applying a specific type of glue to predetermined areas on the printing substrate; and pressing the printing substrate and the foil against each other, with the metal layer of the foil being positioned at the side of the printing substrate. During the latter step, a transfer of the metal layer from the carrier layer of the foil to the printing substrate takes place at the areas where the glue is present, so that the metal is arranged on the printing substrate according to the pattern of the glue.

[0004] In practice, the foil is supplied on a coil, wherein a coil may have a length of 10,000 metres, for example. In a printing process, the coil is unwound, and when the end of the coil has been reached, the printing process needs to be stopped until a new coil has been put in place. In the context of current printing presses, when the length of the coils is 10,000 metres, indeed, this means that it is only possible to have a continuous process for a period of about one hour. Terminating a printing process, changing the coil of foil, and starting the process again takes a lot of time, and involves a lot of useless printed matter. It is an object of the present invention to provide a solution to this problem, according to which changing of a coil of foil does not require a temporary stop of the printing process, and wherein a loss of printed matter is minimal.

[0005] The object of the present invention is achieved by a device for supplying foil to be used in a printing process to a printing press, comprising: a unit for supporting at least one coil of the foil; a number of rollers for supporting and guiding the foil, and imposing a displacement on the foil; and buffer means for storing a length of the foil, which are arranged at a position downstream of the coil supporting unit; wherein the buffer means comprise at least two units having a space for accommodating a loop of the foil, and being adapted to create a pressure which is lower than the atmospheric pressure in the loop accommodating space.

[0006] For sake of clarity, it is noted that the terms "downstream" and "upstream" are to be understood as being related to a direction in which the foil and/or a printing substrate are moving during operation of the foil supplying unit and/or the printing press.

[0007] According to the present invention, a foil supplying device comprises buffer means for storing a length of the foil. In the buffer means, it is possible to temporarily have a difference between an input rate of the foil and an output rate of the foil,
wherein one of these rates may even be zero. When a coil of foil is changed, the input rate is zero as long as there is no coil in place. Nevertheless, it is possible to maintain a desired output rate, namely by decreasing the length of the foil in the buffer means. Hence, by choosing an appropriate foil storing capacity of the buffer means, it is possible to create enough time for allowing for a change of coils of foil.

[0008] In particular, the buffer means comprise at least two units having a space for accommodating a loop of the foil, and being adapted to create a pressure which is lower than the atmospheric pressure in the loop accommodating space. By using at least two buffer units as mentioned, it is possible to actually have an appropriate buffer length of the foil, i.e. a length which allows for a changing process of coils of foil, while guaranteeing a proper functioning of the units.

[0009] In view of the fact that during a printing process, the metal layer needs to be separated from the carrier layer by glue, adhesion forces between the two layers of the foil are minimal. Furthermore, the metal layer is highly susceptible to damage, wherein damage clearly shows in the printed matter. Hence, it is important that the foil is handled with great care in the buffer means. According to the present invention, this is achieved by creating loops in the foil under the influence of an underpressure, wherein one side of the foil may remain free from contact. Hence, by having buffer means comprising units which are adapted to create an underpressure in the loop accommodating space, it is possible to avoid a situation in which the metal layer of the foil is touched by one or more components of the buffer means.

[0010] Preferably, the buffer units are arranged in parallel with respect to each other, so that a compact design of the buffer means is obtained, in which the loops of the

foil are positioned next to each other, as it were. For example, the buffer units may be oriented such that all loops are extending in a substantially horizontal direction, but it is also possible that the buffer units are oriented such that all loops are extending in a substantially vertical direction.

[0011] In a practical embodiment, rollers for supporting and guiding the foil, and imposing a displacement of the foil are arranged at entrances of the loop accommodation spaces of the buffer units, wherein no further rollers are needed in the buffer units, as a desired shape of a loop in the foil is controlled under the influence of an underpressure. Advantageously, means are provided for electronically controlling a rotational speed of each of the rollers arranged at the entrances of the loop accommodation spaces of the buffer units, so that it is possible to accurately set a speed at which the foil is supplied to the loop accommodation spaces, and a speed at which the foil is taken from the loop accommodation spaces. In this way, it is possible to accurately control the buffer length of the foil, and to guarantee a suitable speed of the foil at an output side of the buffer means under all circumstances.

[0012] In particular, it is preferred if the controlling means are adapted to vary the rotational speed of all of the rollers simultaneously when a size of a stored length of the foil needs to be varied during functional operation of the device, as it is preferred to maintain a loop of the foil in each of the loop accommodation spaces, in order to avoid the need for new processes of filling one or more of these spaces during the printing process.

[0013] The present invention further relates to a device for supplying foil to be used in a printing process to a printing press, comprising a unit having two shafts for supporting two coils of the foil, wherein the unit further comprises a frame having a stationary arranged part and a movably arranged part, wherein the movably arranged frame part is rotatable with respect to the stationary arranged frame part, about an axis extending parallel to longitudinal axes of the coil supporting shafts, and wherein the shafts are mounted on the movably arranged frame part.

[0014] Since the device as defined in the foregoing paragraph is adapted to support two coils of the foil, and the coil supporting shafts are arranged on a movably arranged part of the device, it is possible to have an automatically performed changing process of coils of the foil. In particular, provided that the movably arranged part is capable of rotating at least a half turn, it is possible to put one coil to the initial position of another coil, and to put this other coil to the initial position of the one coil.

[0015] In an advantageous embodiment of the foil supplying device, the movably arranged frame part comprises a first strip-like member extending parallel to the longitudinal axes of the shafts, and a second strip-like member which is movably arranged with respect to the first strip-like member, wherein the second strip-like member is adapted to move between a position for covering a substantial portion of the first strip-like member and a position for leaving the first strip-like member free. In this embodiment, the first strip-like member can be used for supporting a length of adhesive tape for interconnecting a first part of foil of a fresh coil of foil and a last part of foil which has just been separated from an exhausted coil of foil. Furthermore, the second strip-like member can be used for temporarily covering a portion of the tape, so that a defined portion can be used for connection to the first part of foil of the fresh coil of foil in a first instance, and another portion can be used for connection to the last part of foil which has just been separated from the exhausted coil of foil in a second instance.

[0016] The second strip-like member may be hingably connected to the first strip-like member, but other practical arrangements of the second strip-like member with respect to the first strip-like member are feasible as well, such as a slidable arrangement. In order to guarantee a sufficient grip of the first strip-like member on the length of adhesive tape, it is preferred if the foil supplying device further comprises means for generating an attractive force such as a vacuum force at a surface of this member.

[0017] It is preferred if a waste of materials during a changing process of coils of foil is kept to a minimum. In view of this, it is preferred to realize an abutting configuration of the first part of the foil of the fresh coil of foil and the last part of the foil of the exhausted coil of foil on the adhesive tape. A correct positioning of an edge of the first part of the foil of the fresh coil of the foil is obtained by performing a cutting action after this part has been pressed against the tape. In order to facilitate such action, it is advantageous if the second strip-like member comprises a groove, which may be used as a guiding slot for a cutting member.

[0018] For the purpose of separating the last part of the foil of the exhausted coil of foil from this coil, another cutting action may be performed. To this end, the foil supplying device may further comprise a unit having a movably arranged third strip-like member and a movably arranged cutting member. Preferably, the device also comprises means for generating an attractive force such as a vacuum force at a surface of the third strip-like member, so that the foil may be kept in place on this surface. The arrangement of the unit having the third strip-like member in the device is chosen such as to be movable, so that this unit may be used for taking a retained foil portion to the unit having the first strip-like member and the second strip-like member, in order to put the foil portion in contact with adhesive tape retained by the first strip-like member, wherein it is also possible for the unit having the third strip-like member to be out of the way when there is no need for the action as described.

[0019] A foil supplying device having all advantageous features as described in the preceding paragraphs, i.e. a foil supplying device comprising a unit having two coil supporting shafts, wherein these coils are mounted on a movably arranged frame part of this unit, and wherein this frame part has two strip-like members, and a unit

having a movably arranged third strip-like member and a movably arranged cutting member is very well suitable to be used for the purpose of changing coils of foil and connecting parts of foil of the two coils to each other by means of adhesive tape, in an abutting configuration. A more detailed description and explanation of such device will be given with reference to the attached figures. For sake of completeness, it is noted that it is advantageous if the device further comprises buffer means, so it is possible for a printing process to be continued when a change of coils takes place.

[0020] The present invention further relates to a combination of a printing press and a device for supplying foil to be used in a printing process to a substrate on a cylinder of the printing press, wherein this device comprises: a unit for supporting at least one coil of the foil; a number of rollers for supporting and guiding the foil, and imposing a displacement on the foil; detection means for detecting an actual rotational speed of the cylinder of the printing press; and controlling means which are in communication with the detection means, and which are suitable to be used for adapting both the rotational speed of a first foil supporting and guiding roller positioned upstream of the cylinder of the printing press and the rotational speed of a first foil supporting and guiding roller positioned downstream of the cylinder of the printing press to the rotational speed of the cylinder of the printing press, in order to let the foil between the rollers move at a speed that corresponds to a moving speed of the substrate.

[0021] In order to avoid slip between the foil and the printing substrate, and the inaccuracies involved therein, it is most advantageous to ensure that the substrate and the foil are moving at equal speeds. According to the present invention, the speed at which the substrate is moving is measured, and the speed at which the foil is moving is adapted to this speed by controlling rotational speeds of foil supporting and guiding rollers positioned closest to the printing press, both upstream and downstream.

[0022] Preferably, the combination of the printing press and the foil supplying device further comprises a unit which is arranged downstream of the first foil supporting and guiding roller of the foil supplying device positioned downstream of the cylinder of the printing press, and which is suitable for performing a shredding action. By shredding the portion of the foil which remains after having passed the printing press, and which is waste that is no longer useful, further handling and discharge of this portion is facilitated. In any case, shredding this portion is preferred over winding this portion on a coil, as it is easier to process shreds than a compact coil.

[0023] The present invention will further be explained on the basis of the following description, wherein reference will be made to the drawing, in which equal reference signs indicate equal or similar components, and in which:

figure 1 diagrammatically shows a combination of a printing process and a foil supplying device according to the present invention; figure 2 illustrates a path of the foil from a coil to a position downstream of the printing press;

figure 3 shows a number of components of the foil supplying device according to the present invention; and

figure 4 diagrammatically shows a perspective view of a slitter unit and an angle bar arrangement, which may be part of the foil supplying device according to the present invention.

[0024] Figure 1 diagrammatically shows a combination of a printing press 1 and a device 2 according to the present invention, which serves for supplying foil 3 to be used in a printing process to the printing press 1. In particular, the foil 3 comprises two layers, namely a metal layer and a carrier layer. It is intended to have a transfer of portions of the metal layer from the carrier layer to a printing substrate (not shown) such as a sheet of paper or a web of paper in the printing press 1, so that shiny portions are obtained on this substrate. The transfer may be realized in a way known per se, for example, by applying glue to the printing substrate and pressing the foil 3 against the substrate, in such a way that the metal layer of the foil 3 contacts the substrate and is removed from the carrier layer at the areas where the glue is present.

[0025] With respect to the printing press 1, it is noted that this may be any type of printing press 1 which is capable of processing the foil 3 and making shiny portions on printed matter by using the foil 3. In the example as shown in figures 1 and 2, the printing press 1 is a so-called offset press, and comprises a number of printing units 4 for adding various colours to the printing substrate. Figure 2 shows a sectional view of the printing press 1, and a number of cylinders of this printing press 1 may be seen in this figure.

[0026] In each unit 4 of the printing press 1, a plate cylinder 5 is arranged, which is a carrier of a printing plate. During a printing process, oil-based printing ink is supplied to the printing plate, and to this end, ink rollers 6 are arranged in the unit 4 as well. Furthermore, water rollers 7 are arranged in the unit 4. Areas of the printing plate which are not having an image to be transferred to the printing substrate are kept in a humid state, as a result of which the ink can not settle in these areas. According to the principles of offset printing technology, the image is not transferred directly from the printing plate to the printing substrate. Instead, an intermediate step is performed, in which a blanket is used for receiving the image from the printing plate and transferring the image to the printing substrate. In the printing unit 4, the blanket is mounted on a blanket cylinder 8 which is arranged at a position between the plate cylinder 5 and a cylinder 9 for supporting the printing substrate. This substrate supporting cylinder 9 could be an impression cylinder in case of a sheet fed press or a blanket cylinder in case of a web press.

[0027] As the offset printing process is known per se, this process will not be further explained here. In the context of the present invention, it is important to note that the foil 3 is intended to be supplied to a printing area of the printing press 1, i.e. an area between the blanket cylinder 8 and the substrate supporting cylinder 9.

[0028] The foil 3 is normally provided on a coil 10, and the foil supplying device 2 according to the present invention is adapted to realize a continuous supply of foil 3 to the printing press 1, even when a coil 10 of the foil 3 is exhausted and needs to be replaced by a fresh coil 10 of the foil 3. In particular, the foil supplying device 2 is adapted to interconnecting portions of foil 3 of the two coils 10 by means of a length of adhesive tape (not shown). Furthermore, the foil supplying device 2 is adapted to guarantee that the metal layer of the foil 3 is not touched and damaged when the foil 3 is on its way to the printing press 1. All advantageous aspects and features of the foil supplying device 2 according to the present invention will be further explained in the following.

[0029] The foil supplying device 2 according to the present invention comprises a unit 11 which is adapted to support two coils 10 of foil 3. This coil supporting unit 11 is shown in figures 1 and 3. In particular, the coil supporting unit 11 comprises two shafts for supporting the coils 10 of foil 3. These shafts are mounted in a frame part 12 which is movable with respect to a stationary arranged frame part 13.

[0030] When two coils 10 of foil 3 are arranged in the coil supporting unit 11, one of these coils 10 is at a position at which the foil 3 may be wound off the coil 10 in order to be supplied to the printing press 1, and another of these coils 10 is at a standby position. The movably arranged frame part 12 is rotatable with respect to the stationary arranged frame part 13 about an axis which is extending parallel to longitudinal axes of the shafts of the coil supporting unit 11, in such a way that the positions of the coils 10 may be changed when the movably arranged frame part 12 is rotated a half turn, i.e. a turn of 180°. In a practical embodiment, the movably arranged frame part 12 is arranged such as to be rotated a half turn in alternating directions. This means that when the movably arranged frame part 12 has been rotated clockwise for the purpose of changing positions of the coils 10 which are mounted in this frame part 12, the next rotation of the frame part 12 for the same purpose will be counterclockwise, and vice versa.

[0031] For the purpose of driving the coil 10 of foil 3 which is at a position for supply to the printing press 1, a servo system is provided. This servo system is also used for accurately controlling an unwinding process of the coil 10, and may also perform a braking function instead of a driving function when this appears to be necessary. On the basis of the application of a servo system, it is possible to keep a tension in the foil 3 at a desired level.

[0032] In view of the fact that it is important for a change of the positions of the coils 10 of foil 3 to take place in an accurate manner, it is preferred if another servo motor is provided for controlling the half turn movement of the movably arranged frame part 12.

[0033] At two opposite sides of the movably arranged frame part 12, a strip 14 is arranged, which serves for supporting a length of adhesive tape (not shown). The tape supporting strip 14 is positioned such that it is freely accessible at a standby side of the coil supporting unit 11. Furthermore, a device 15 for creating a vacuum on a surface of the tape supporting strip 14 is provided, so that it is possible to retain the length of tape under the influence of vacuum. A strip 16 for covering a portion of the surface of the tape supporting strip 14 is hingably attached to this strip 14. In this way, it is achieved that the covering strip 16 may easily be moved between a position for covering the portion of the surface of the tape supporting strip 14 and a position for leaving this surface free.

[0034] At a position close to the coil supporting unit 11, at a side of the coil supporting unit 11 where a coil 10 of foil 3 is driven such as to unwind and to supply foil 3, a unit 17 having a strip 18 which is movable in a substantially vertical direction is arranged. This unit 17 also has a linearly driven knife (not shown), which is movable along an edge of the strip 18, in a substantially horizontal direction. In view of the fact that the strip 18 serves for supporting and retaining a cut-off end of foil 3, the strip 18, like the tape supporting strip 14 of the movably arranged frame part 12, is connected to a device for creating a vacuum, so that it is possible to retain the foil 3 under the influence of a vacuum.

[0035] Besides the coil supporting unit 11 and the unit 17 having the vertically movable strip 18, the foil supplying device 2 according to the present invention comprises buffer means 19 for storing a length of the foil 3. The buffer means 19 comprise at least two units 20 as diagrammatically shown in figure 2. Each of these units 20 comprises a space 21 for accommodating a loop 22 of the foil 3, and each of these units 20 is associated with means (not shown) for creating an underpressure in the space 21. The desired loop 22 of the foil 3 is obtained under the influence of this underpressure, wherein it is also possible to have means (not shown) for blowing on the foil 3 from an entrance side of the buffer unit 20.

[0036] The buffer units 20 are arranged in parallel, so that a configuration may be achieved in which the loops 22 are positioned next to each other, as it were. In the example as shown in the figures, an orientation of the buffer units 20 is horizontal, but that does not alter the fact that other orientations are also possible.

[0037] At the entrance side of the buffer units 20, rollers 23 for guiding the foil 3 in and out of the spaces 21 of the buffer units 20 are arranged. Advantageously, the buffer means 19 comprise suitable detectors (not shown) such as photocells for monitoring a position of the foil 3 in the spaces 21 of the buffer units 20, and a controller (not shown) for controlling a rotational speed of the rollers 23 in order to realize a required filling of the buffer units 20, in other words, in order to realize a required buffer length

of the foil 3. It is preferred if in situations in which the buffer length of the foil 3 needs to be varied, the rotational speeds of all rollers 23 are adjusted, so that a change of size of the loops 22 of the foil 3 takes place in all of the buffer units 20, and not in one buffer unit 20 at a time. In this way, a situation in which one or more buffer units 20 run out of foil 3 is avoided, so that it is not necessary to perform filling processes.

[0038] It is noted that a side of the foil 3 which is at an inside of the loops 22 is the side where the metal layer is present. In this way, damage of the metal layer is prevented, as this layer remains free from contact. Applying a pressure which is lower than the atmospheric pressure for creating loops 22 in the foil 3 is a feasible option on the basis of the fact that the foil 3 is relatively thin, wherein a thickness of the foil 3 is only a few micrometres.

[0039] Furthermore, it is noted that a path which is followed by the foil 3 through the buffer means 19 of the foil supplying device 2 according to the present invention and the printing press 1 is illustrated in figure 2. In this figure, a side of the foil 3 where the metal layer is present is indicated by triangles, and it may clearly be seen that this side is free from any contact until the foil 3 is fed between the blanket cylinder 8 and the substrate supporting cylinder 9 of the printing press 1, and that this side is directed towards the substrate supporting cylinder 9.

[0040] Due to the presence of the buffer means 19 in the foil supplying device 2 according to the present invention, it is possible to have a speed difference between the foil 3 in a path extending between the coil supporting unit 11 and the buffer means 19, and the foil 3 in a path extending between the buffer means 19 and the printing press 1. It is even possible to have a situation in which the speed of foil 3 in the path extending between the coil supporting unit 11 and the buffer means 19 is zero, while the speed of the foil 3 at the other side of the buffer means 19 is a normal speed or a reduced speed for supplying the foil 3 to the printing press 1. During the time that such situation exists, the speed difference is compensated for by a reduction of the buffer length of the foil 3, wherein the loops 22 of the foil 3 are getting smaller. The fact that such situation may exist when the foil supplying device 2 according to the present invention is applied is important, as this offers an opportunity for changing positions of coils 10 of foil 3 and making a connection between the coils 10 while guaranteeing a proper supply of foil 3 to the printing press 1, so that a printing process in which the foil 3 is used does not need to be interrupted.

[0041] At an output side of the buffer means 19, a rotatably arranged roller 24 for supporting and guiding the foil 3, and imposing a desired displacement on the foil 3 is positioned in the foil supplying device 2 according to the present invention. Advantageously, the roller 24 is a vacuum roller, so that the roller 24 is actually capable of exerting an attractive force on the foil 3, and slip of the foil 3 on the roller 24 is avoided. Furthermore, the foil supplying device 2 comprises more rollers for guiding and supporting the foil 3, and imposing a desired displacement on the foil 3, besides rollers for only guiding and supporting the foil 3. In the embodiment of the device 2 as shown in figure 1, both a roller 25 positioned near a side of the printing press 1 for receiving the foil 3 and a roller 26 positioned near a side of the printing press 1 for letting out a remaining portion of the foil 3 (the carrier layer and unused portions of the metal layer) are suitable for guiding, supporting and pulling the foil 3. As the latter roller 26 only serves for contacting a remaining portion of the foil 3, it is not necessary to take measures for avoiding damage. Therefore, this roller 26 may have a rough surface, and rubber press-on rollers (not shown) may be used. It is even preferred to create a firm grip on the remaining portion of the foil 3, as the controllability of a speed of the foil 3 through the printing press 1 is enhanced in this way.

[0042] In order to achieve excellent printing results, it is important that the speed of the foil 3 corresponds to the speed of the printing substrate in the printing press 1. In view of this, the foil supplying device 2 is equipped with means (not shown) for detecting the speed of the printing substrate, which may involve detecting a rotational speed of the substrate supporting cylinder 9 of the printing press 1 in practice. Furthermore, a servo system (not shown) is provided for controlling the rotational speed of the pulling rollers 24, 25, 26 arranged downstream of the buffer means 19. Preferably, the foil supplying device 2 comprises an apparatus (not shown) such as a touch screen for receiving input from a user of the device 2 regarding a desired tension in the foil 3, so that it is possible for the user to communicate with the servo system and to operate this system for adapting the rotational speed of the pulling rollers 24, 25, 26 in case the tension needs to be increased or decreased.

[0043] For the purpose of receiving and processing the remaining portion of the foil 3, a unit 27 which is suitable for performing a shredding action is provided. Furthermore, the unit 27 may be adapted to press the shreds in blocks which are suitable to be used for recycling purposes. In this way, automatic processing of the waste of the foil 3 is realized.

[0044] The way in which operation of the foil supplying device 2 according to the present invention may be initiated is described in the following.

[0045] A first coil 10 of foil 3 is put in place in the coil supporting unit 11, at the easily accessible standby side of this unit 11. Subsequently, the movably arranged frame part 12 is rotated a half turn. The coil 10 is unwound at a slow rate, so that a user of the foil supplying device 2 is allowed to put the foil 3 through the device 2 and the printing press 1 in a proper way. When the foil 3 has reached the last pulling roller 26, i.e. the roller 26 having the rough surface, the press-on rollers associated with this roller 26 are activated until the foil 3 has a fixed position on this roller 26. At that moment, a process of filling the buffer units 20 may be started, wherein lengths of the foil 3 are drawn into the spaces 21 of the buffer units 20

under the influence of forces related to underpressure, and wherein loops 22 are created in the foil 3, while the coil 10 is still slowly unwound. As soon as it is detected that the buffer units 20 are filled to a sufficient extent, the foil supplying device 2 is ready to be used.

[0046] During operation of the foil supplying device 2 according to the present invention and the printing press 1, pulling rollers 24, 25, 26 positioned downstream of the buffer means 19 are rotated with the same speed as the substrate supporting cylinder 9 of the printing press 1. The servo motor which is used for realizing the unwinding process of the coil 10 of foil 3 is controlled such as to keep the buffer units 20 filled with foil 3, wherein controlling signals are generated by a device which is adapted to check the presence of the loops 22 of the foil 3 in the spaces 21 of the buffer units 20. In the process, the touch screen or similar apparatus as mentioned earlier is used by a user of the foil supplying device 2 for checking the vital functions of the device 2 and for adjusting one or more of these functions if so desired.

[0047] During the time that the coil 10 of foil 3 is unwound, and the foil 3 is used in a printing process, the user has an opportunity for placing a new coil 10 of foil 3 in the coil supporting unit 11, at the standby side, and for preparing the foil 3 of this coil 10 for connection to the foil 3 of the other coil 10. To this end, the user makes sure that the surface of the tape supporting strip 14 which is at the standby side is uncovered, initiates the vacuum on this surface, and places a length of adhesive tape on the strip 14, with the adhesive side up. The tape may have a width of approximately 50 mm, for example, and may comprise two adhesive portions having a width of 20 mm, and a non-adhesive portion having a width of 10 mm, wherein the non-adhesive portion is a central portion which is extending between the adhesive portions. Advantageously, each of the two adhesive portions is covered by a layer of material which is easy to peel off.

[0048] Under the influence of the vacuum, the adhesive tape is retained on the strip 14. As soon as the adhesive tape is in the right position, the covering strip 16 may be put in a position for covering one portion of the tape. Furthermore, the user may peel off the layer of material which is still uncovered, so that one of the adhesive portions of the tape is exposed. At that stage, the tape is ready for receiving foil 3 from the fresh coil 10 of foil 3.

[0049] For the purpose of attaching foil 3 of the fresh coil 10 to the tape, the coil 10 is unwound to a limited extent, and the user presses a portion of the foil 3 against the tape. Subsequently, the user makes a straight edge to the foil 3 by cutting the foil 3, wherein the user moves a knife through a groove which is arranged in the covering strip 16 for the exact purpose of guiding the knife. In this way, it is achieved that the edge of the foil 3 ends up in the central portion of the tape. After the cutting process, the covering strip 16 may be put to a position for leaving the surface of the tape free, so that the user may peel off the layer of material which is uncovered in the process, in order to expose the other adhesive portion of the tape. At that point, the foil 3 of the fresh coil 10 of foil 3 is fully prepared for connection to another portion of foil 3, through the tape.

[0050] When a diameter of the other coil 10 of foil 3 which is located in the foil supporting unit 11, i.e. the coil 10 of foil 3 which is unwound for the purpose of supplying foil 3 to the printing press 1, has reached a minimum, the unit 17 having the vertically movably strip 18 is activated, wherein the strip 18 is moved upwards, and the vacuum on the surface of the strip 18 is initiated. At the same time, the servo motor for unwinding the coil 10 of foil 3 stops the unwinding process, so that the foil 3 does not move in a path extending from the coil 10 to the buffer means 19. The vertically movable strip 18 is moved upwards until it is at a position at which the foil 3 is pulled against the surface of the strip 18 under the influence of the vacuum forces. Once the foil 3 is retained on the strip 18, the knife of the unit 17 of which the strip 18 is part is activated, so that the foil 3 is cut through. Subsequently, the strip 18 is moved downwards in order to make space for the movably arranged frame part 12 to perform a half turn, while the vacuum is maintained.

[0051] As soon as the movably arranged frame part 12 has been made to rotate, and the fresh coil 10 of foil 3 has taken the position of the exhausted coil 10 of foil 3, the strip 18 and the foil 3 retained thereon are moved upwards again, until the foil 3 touches the exposed adhesive portion of the tape. At that very moment, the connection between the portion of the foil 3 which is extending in the foil supplying device 2 and the portion of the foil 3 of the fresh coil 10 of foil 3 has been realized, wherein these portions of the foil 3 are configured in an abutting fashion. By stopping the vacuum, the area where the connection is made is released from the respective strips 14, 16.

[0052] During the process as described in the preceding paragraphs, the printing press 1 is operated at a speed which is lower than a usual speed, wherein the necessary supply of foil 3 to the printing press 1 is continued by decreasing the buffer length of the foil 3. When the connection is ready, the operational speed of the printing press 1 may be set at a normal value again. Any suitable means may be used for controlling the various steps of the process of cutting off foil 3 of an exhausted coil 10 of foil 3, changing coils 10 of foil 3 and connecting parts of foil 3 of various coils 10, and for adjusting the operational speed of the printing press 1 in a suitable manner.

[0053] In order to avoid that the adhesive tape ends up in the printed matter, a special photo cell (not shown) may be used, which is positioned directly downstream of the buffer means 19. On the basis of input provided by this photo cell, the supply of printing substrate to the printing press 1 may temporarily be stopped. Furthermore, another photo cell may be used for detecting cases in which the foil 3 is broken, so that the printing press 1 may be stopped when this appears to be necessary, and a warning signal may be given.

[0054] Throughout the printing process, the shredding unit 27 is kept in an activated state in order to process a portion of the foil 3 which remains after having passed the printing press 1. In order to avoid an unnecessary waste of foil 3, several measures may be taken.

[0055] In the first place, it is possible to stop the supply of foil 3 to the printing press 1 during times that there is no need for this supply in the printing process, or when the printing process is interrupted or stopped. For example, both the blanket cylinder 8 and the substrate supporting cylinder 9 could be provided with a gap, wherein the angular positions of the cylinders 8, 9 are adapted to each other in such a way that these gaps are positioned opposite to each other once every turn, and wherein mechanisms for retaining the blanket and the printing substrate are arranged in these gaps. During the times that the gaps as mentioned are positioned opposite to each other, the foil 3. is free from contact, and the supply of foil 3 can be stopped or at least decelarated. Due to the fact that the foil 3 is taken from buffer means 19, it is relatively easy to adapt the speed at which the foil 3 is moving through the printing press 1, wherein the size of the loop 22 of the foil 3 in a last buffer unit 20, i.e. a buffer unit 20 which is positioned closest to the printing press 1 may be varied, while there is practically no influence of inertia that needs to be accounted for. For the purpose of determining the exact position of the gaps in the cylinders 8, 9, an absolute encoder may be applied. As soon as the encoder indicates that the gaps are positioned nearly opposite to each other, the foil 3 is decelerated, and, if possible, brought to a stop, wherein the loop 22 of the foil 3 in the last buffer unit 20 increases, until the encoder indicates that the gaps have passed and the cylinders 8, 9 get into contact with each other again. At that time, the speed of the foil 3 is put back to a normal level.

[0056] In the second place, for the purpose of avoiding an unnecessary waste of foil 3 when it is not necessary to use the foil 3 along its entire width, it is advantageous to apply an angle bar arrangement 28 and a slitter unit 29 having a number of rotatably arranged slitters, as shown in figure 4. In this way, it is possible to make a number of smaller webs 30 of foil 3 out of one web 31 of foil 3 having the full width, i.e. the width of the foil 3 on the coil 10, and to only supply one or more smaller webs 30 of the foil 3 to the printing press 1, wherein the angle bar arrangement 28 is used for accurately positioning the webs 30 of the foil 3, so that it is possible to feed these webs 30 to the printing press 1 at appropriate positions. In particular, the angle bar arrangement 28 is adjustable such as to shift the webs 30 of the foil 3 which are supported by the various angle bars 32 thereof. In the shown example, a number of angle bats 32 are movably arranged in a frame 33 in such a way that a vertical position of each of these angle bars 32 in the frame 33 is adjustable. When the width of the smaller webs 30 is adapted to the width of portions of the printing substrate in which the foil 3 is to be applied, unnecessary waste of the foil 3 can really be avoided.

[0057] It will be clear to a person skilled in the art that the scope of the present invention is not limited to the examples discussed in the foregoing, but that several amendments and modifications thereof are possible without deviating from the scope of the invention as defined in the attached claims.

[0058] It is preferred if the user of the combination of the printing press 1 and the foil supplying device 2 is allowed to choose which unit 4 of the printing press 1 is used for receiving and processing the foil 3. Therefore, it is preferred if the positions of various rollers 25, 26 and the shredding unit 27 are adjustable.

[0059] The coil supporting unit 11 and the buffer means 19 of the foil supplying device 2 according to the present invention may be positioned at a side of the printing press 1, at the same level as the printing press 1, as shown in figure 1. However, it is also possible to have another positioning of the coil supporting units 11 and the buffer means 19.

[0060] In the foregoing, a device 2 for supplying foil 3 to be used in a printing process to a printing press 1 has been disclosed. The foil supplying device 2 comprises a unit 11 for supporting at least one coil 10 of the foil 3, and a number of rollers 24, 25, 26 for supporting and guiding the foil 3, and imposing a displacement on the foil 3. The coil supporting unit 11 may comprise two shafts for supporting two coils 10 of the foil 3, wherein the shafts are mounted on a rotatably arranged part 12 of the unit 11, so that it is possible to change positions of the shafts. By applying such a coil supporting unit 11, it is possible to have an automatically performed changing process of coils 10 of the foil 3. Furthermore, in order to allow for a temporary standstill of the foil 3 in a path near the coil supporting unit 11 when a coil changing process takes place and still ensuring a supply of foil 3 to the printing press 1, buffer means 19 for storing a length of the foil 3 are provided, which are arranged at a position downstream of the coil supporting unit 11.

Claims

1. Device (2) for supplying foil (3) to be used in a printing process to a printing press (1), comprising:

- a unit (11) for supporting at least one coil (10) of the foil (3);
- a number of rollers (23, 24, 25, 26) for supporting and guiding the foil (3), and imposing a displacement on the foil (3); and
- buffer means (19) for storing a length of the foil (3), which are arranged at a position downstream of the coil supporting unit (11); wherein the buffer means (19) comprise at least two units (20) having a space (21) for accommodating a loop (22) of the foil (3), and being adapted to create an underpressure in the loop accommo-

dating space (21).

2. Device (2) according to claim 1, wherein the buffer units (20) are arranged in parallel with respect to each other.

3. Device (2) according to claim 1 or 2, wherein rollers (23) for supporting and guiding the foil (3), and imposing a displacement of the foil (3) are arranged at entrances of the loop accommodation spaces (21) of the buffer units (20), and wherein means are provided for electronically controlling a rotational speed of each of these rollers (23).

4. Device (2) according to claim 3, wherein the controlling means are adapted to vary the rotational speed of all of the rollers (23) simultaneously when a size of a stored length of the foil (3) needs to be varied during functional operation of the device (2).

5. Device (2) for supplying foil (3) to be used in a printing process to a printing press (1), comprising a unit (11) having two shafts for supporting two coils (10) of the foil (3), wherein the unit (11) further comprises a frame having a stationary arranged part (13) and a movably arranged part (12), wherein the movably arranged frame part (12) is rotatable with respect to the stationary arranged frame part (13), about an axis extending parallel to longitudinal axes of the coil supporting shafts, and wherein the shafts are mounted on the movably arranged frame part (12).

6. Device (2) according to claim 5, wherein the movably arranged frame part (12) comprises a first strip-like member (14) extending parallel to the longitudinal axes of the shafts, and a second strip-like member (16) which is movably arranged with respect to the first strip-like member (14), and wherein the second strip-like member (16) is adapted to move between a position for covering a substantial part of the first strip-like member (14) and a position to leaving the first strip-like member (14) free.

7. Device (2) according to claim 6, wherein the second strip-like member (16) is hingably connected to the first strip-like member (14).

8. Device (2) according to claim 6 or 7, further comprising means (15) for generating an attractive force such as a vacuum force at a surface of the first strip-like member (14).

9. Device (2) according to any of claim 6-8, wherein the second strip-like member (16) comprises a groove.

10. Device (2) according to any of claims 5-9, further comprising a unit (17) having a movably arranged third strip-like member (18) and a movably arranged cutting member.

11. Device (2) according to claim 10, further comprising means for generating an attractive force such as a vacuum force at a surface of the third strip-like member (18).

12. Device (2) according to any of claims 5-11, further comprising buffer means (19) for storing a length of the foil (3), which are arranged at a position downstream of the coil supporting unit (11).

13. Device (2) according to any of claims 5-12, further comprising means (29) which are adapted to make a number of smaller webs (30) of foil (3) out of one web (31) of foil (3) having a full width, i.e. a width of the foil (3) on the coil (10).

14. Device according to claim 13, further comprising means such as an adjustable angle bar arrangement (28) for accurately positioning the smaller webs (30) of the foil (3).

15. Combination of a printing press (1) and a device (2) for supplying foil (3) to be used in a printing process to a substrate on a cylinder (9) of the printing press (1), wherein this device (2) comprises:

- a unit (11) for supporting at least one coil (10) of the foil (3);
- a number of rollers (23, 24, 25, 26) for supporting and guiding the foil (3), and imposing a displacement on the foil (3);
- detection means for detecting an actual rotational speed of the cylinder (9) of the printing press (1); and
- controlling means which are in communication with the detection means, and which are suitable to be used for adapting both the rotational speed of a first foil supporting and guiding roller (25) positioned upstream of the cylinder (9) of the printing press (1) and the rotational speed of a first foil supporting and guiding roller (26) positioned downstream of the cylinder (9) of the printing press (1) to the rotational speed of the cylinder (9) of the printing press (1), in order to let the foil (3) between the rollers (25, 26) move at a speed that corresponds to a moving speed of the substrate.

16. Combination of a printing press (1) and a device (2) for supplying foil (3) to be used in a printing process to a substrate on a cylinder (9) of the printing press (1), wherein both the cylinder (9) as mentioned and a cylinder (8) for transferring an image to the substrate are provided with a gap, and wherein the foil supplying device (2) comprises:

- a unit (11) for supporting at least one coil (10) of the foil (3);
- a number of rollers (23, 24, 25, 26) for supporting and guiding the foil (3), and imposing a displacement on the foil (3);
- detection means such as an absolute encoder for detecting the positions of the gaps in the cylinders (8, 9) of the printing press (1); and
- controlling means which are in communication with the detection means, and which are suitable to be used for adapting both the rotational speed of a first foil supporting and guiding roller (25) positioned upstream of the cylinder (9) of the printing press (1) and the rotational speed of a first foil supporting and guiding roller (26) positioned downstream of the cylinder (9) of the printing press (1) to the rotational speed of the cylinder (9) of the printing press (1), in order to decrease a speed of the foil (3) between the rollers (25, 26) during times that the gaps in the cylinders (8, 9) are positioned opposite to each other.

17. Combination of a printing press (1) and a device (2) for supplying foil (3) to be used in a printing process to a substrate on a cylinder (9) of the printing press (1) according to claim 15 or 16, wherein this combination further comprises a unit (27) which is arranged downstream of the first foil supporting and guiding roller (26) of the foil supplying device (2) positioned downstream of the cylinder (9) of the printing press (1), and which is suitable for performing a shredding action.

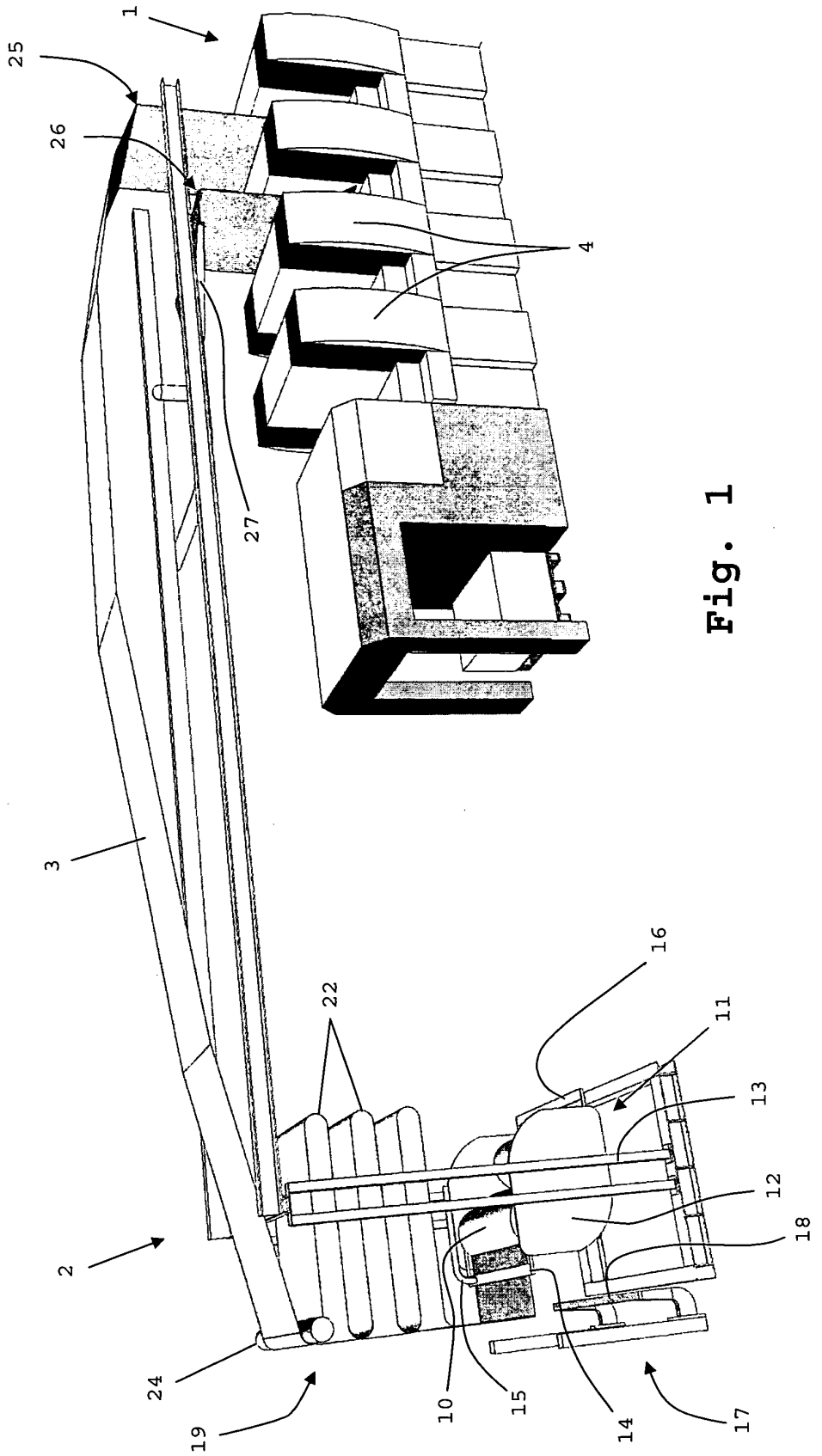

Fig. 1

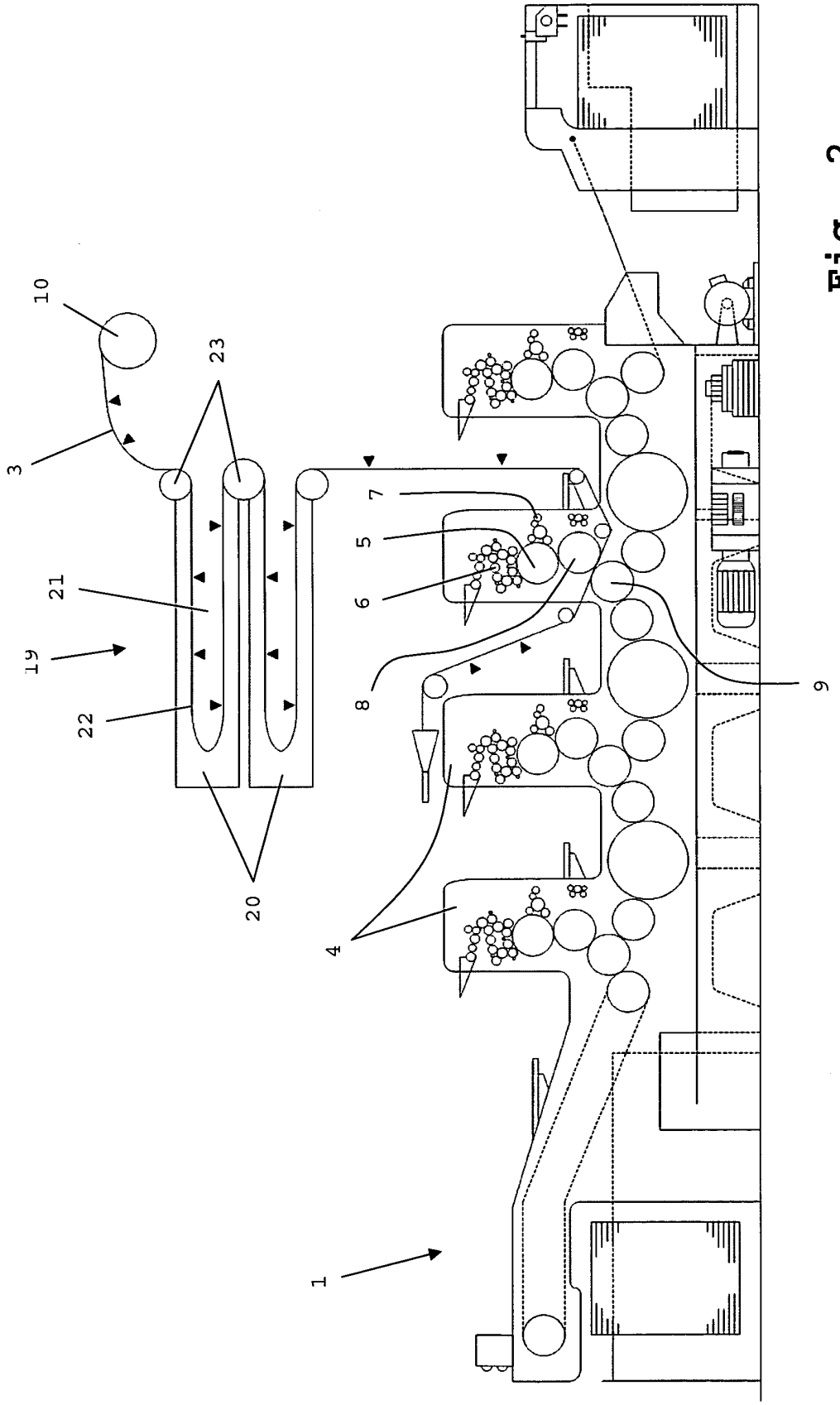

Fig. 2

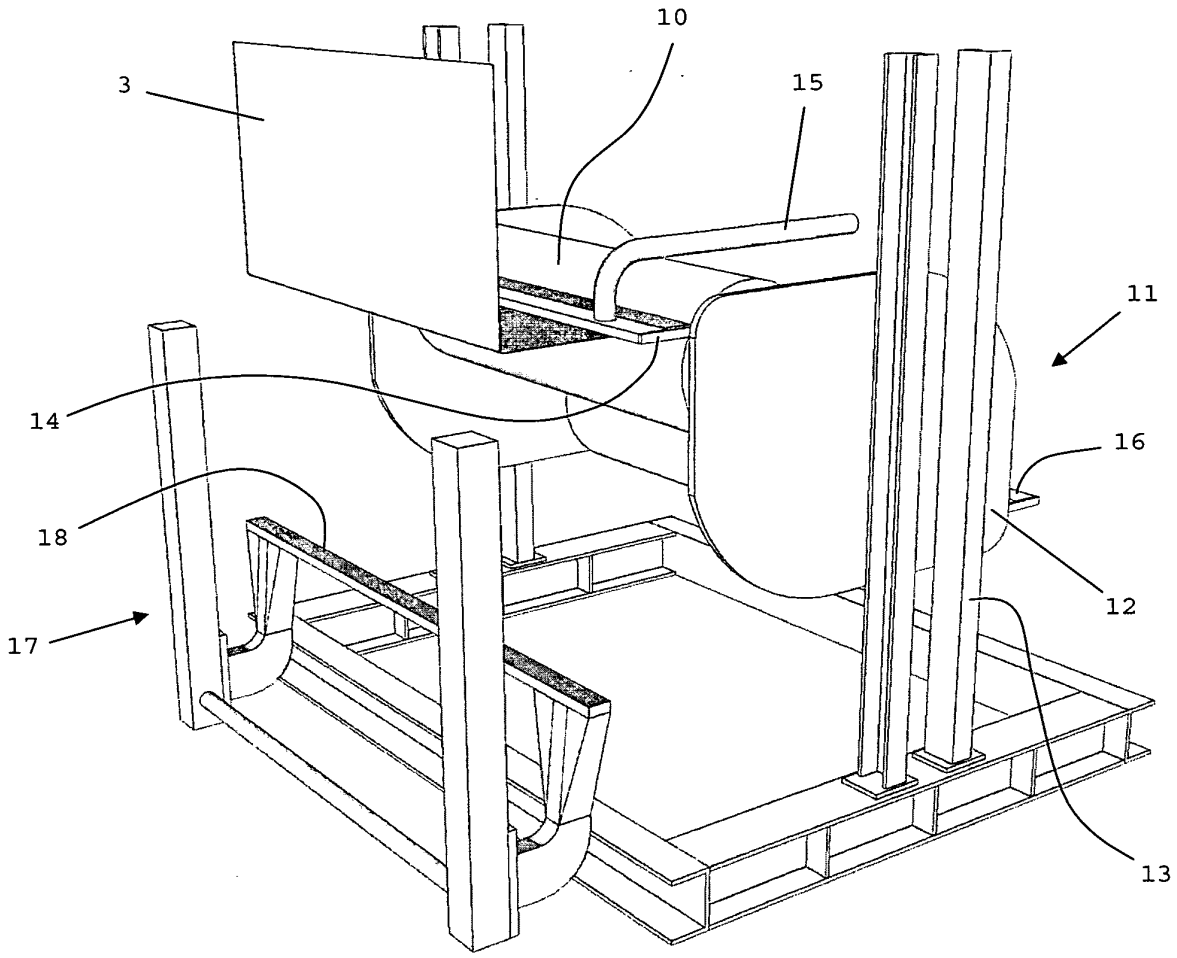

Fig. 3

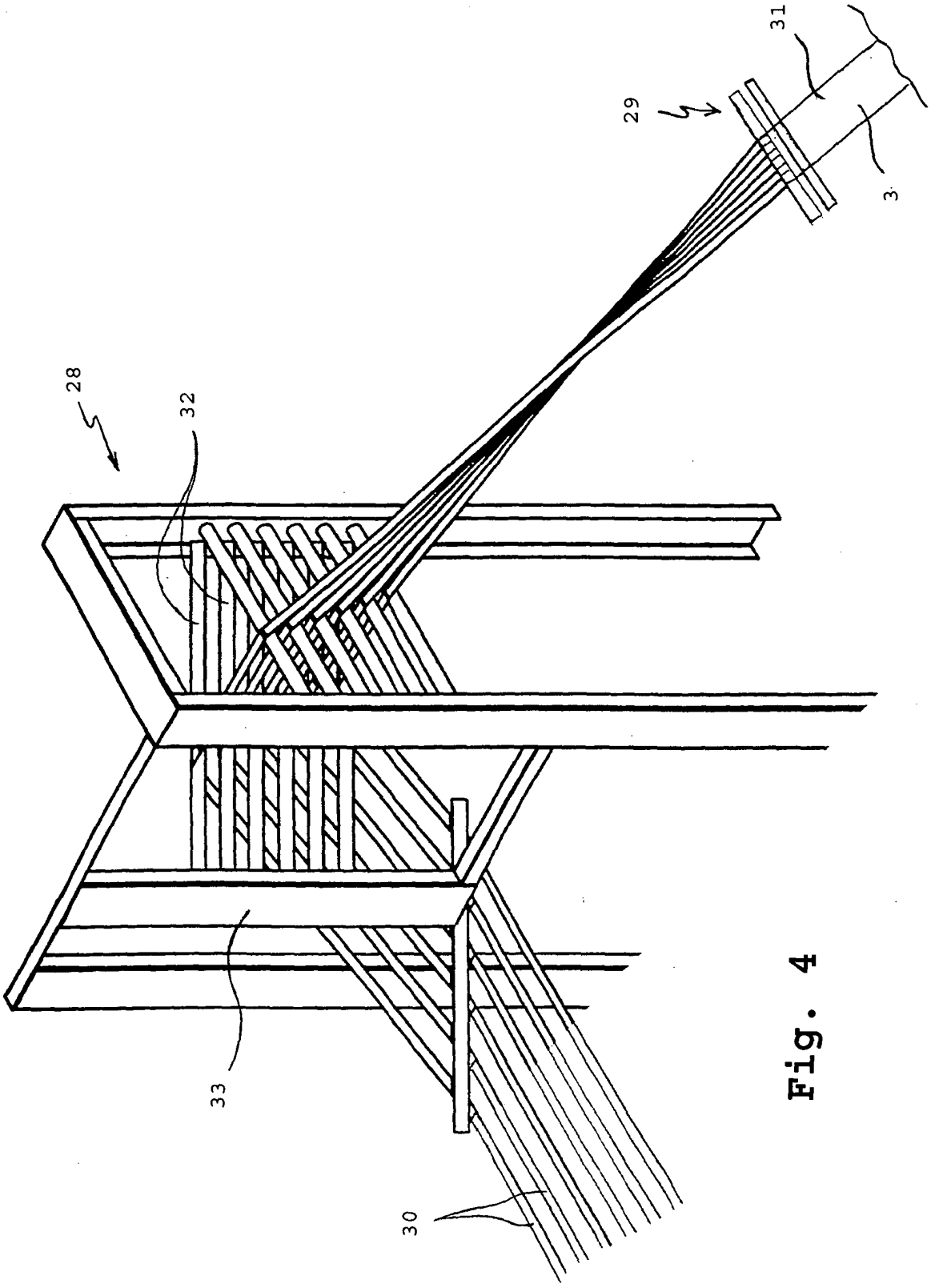

Fig. 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 08 00 1041

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Place of search	Date of completion of the search	Examiner
The Hague	27 August 2008	Diaz-Maroto, V

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

European Patent Office

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 08 00 1041

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-4

Foil supplying device with buffer means
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2. claims: 5-14

Foil supplying device with a coil supporting unit
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3. claims: 15-17

Printing press with a foil supplying device, and speed detection and controlling means .

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 00 1041

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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