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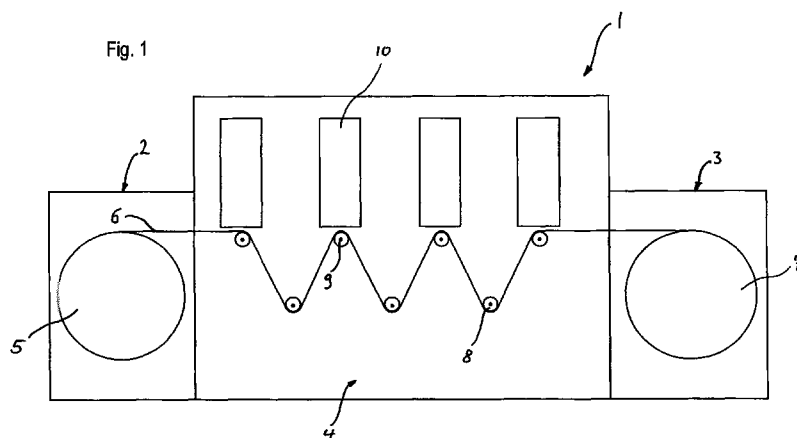
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(54) Title: A METHOD AND AN APPARATUS FOR TURNING AND/OR Laterally SHIFTING A WEB IN A PRINTING MACHINE



(57) Abstract: An apparatus for turning and/or laterally shifting a web in a printing machine is provided. The apparatus has a first roller for guiding the web, a second roller for guiding the web, a third roller for guiding the web. The first to fourth rollers are arranged to allow guiding the web around said rollers in the above order, wherein said first and second rollers are spaced a distance which allows the web to perform a 90° twist in the strand extending between these rollers, said third and fourth rollers are spaced a distance which allows the web to perform a 90° twist in the strand extending between these rollers. The first and fourth axis of rotation are in substance parallel to each other, said second and third axis of rotation are in substance parallel to each other, and said first and fourth axis of rotation are in substance at right angles to said second and third axis of rotation. Such an apparatus for turning and/or laterally shifting a web may be provided in a printing machine for printing on a web.

A METHOD AND AN APPARATUS FOR TURNING AND/OR LATERALLY SHIFTING A WEB IN A PRINTING MACHINE

TECHNICAL FIELD

5 The present invention relates to a method and an apparatus for turning and/or laterally shifting a web in a printing machine.

BACKGROUND ART

10 In the printing industry, it is known to print on a continuous web while it is transported through a one directional print engine. Such a one directional or print engine for example provides a print medium, such as ink or toner, on one side of the continuous web, typically the top side, while it is transported along said print engine. Such a print engine may comprise a single print head for a single color print or a plurality of print heads for multicolor
15 prints. For multicolor prints typically at least four print heads are provided using the colors cyan, magenta, yellow and carbon (black).

 If double sided printing on the continuous web is desired by such a one directional print engine, it is necessary to turn or flip the web by 180° to allow a second pass of the web through the one directional print
20 engine, in such a state that the previously none printed side of the web faces the respective print head(s) of the print engine.

 To perform this turning function, it has been known to utilize a so-called "turn bar arrangement", which is typically made up of several stationary turn bars, which are angled with respect to a paper transport path to
25 provide a turning function. Inasmuch as the turn bars are typically stationary, contact between the web and the turn bar should preferably be reduced to a minimum, in order to avoid vibration of the turn bar and/or the web. Therefore, such turn bars are typically provided with through holes, to allow air to be blown through the turn bar, in order to generate an air cushion
30 between the turn bar and a web while it is traveling around the turn bar.

 Despite the fact that such an arrangement allows both a turning and a lateral shifting of the web, such system is rather expensive and causes a

lot of noise due to the blowing of air through the turn bar. Furthermore, the air cushion between the turn bar and the web is not always stable, thus, causing problems in appropriately guiding the web through the print engine.

An alternative turning device for a continuous web is for example known from IBM Technical Disclosure Bulletin, Vol. 22, No. 6, November 19, 1979 page 2465. In this turning device a continuous web is guided after having been printed on a first side around a first roller, a second roller oriented at 90° with respect to the first roller and a third roller arranged at an angle of 90° to the second roller, i.e. parallel to the first roller. The web is guided around these rollers in such a manner that between the first and second roller and the second and third roller the web performs a 90° twist. The second roller is arranged approximately at a midpoint between the first and second rollers, such that turning and laterally shifting of the web is achieved. This arrangement, however, causes problems with properly guiding the web, inasmuch as the second roller will cause a tendency of the web to move towards the diverting line between the second and third rollers.

SUMMARY OF THE INVENTION

In view of the above, it is an object of the present invention to provide an alternative method and apparatus for turning and/or laterally shifting a web in a printing machine, which may overcome one or more of the problems set forth above.

The object is achieved in accordance with the present invention by an apparatus and a method for turning and/or laterally shifting a web in a printing machine, as set forth in claims 1 and 18, respectively. Further embodiments of the invention are claimed in the dependent claims.

In particular, the apparatus comprises a first roller for guiding the web, said first roller having a first axis of rotation, a second roller for guiding the web, said second roller having a second axis of rotation, a third roller for guiding the web, said third roller having a third axis of rotation and a fourth roller for guiding the web, said fourth roller having a fourth axis of rotation. The first to fourth rollers are arranged to allow guiding of the web

around said rollers in the above order, wherein said first and second rollers are spaced a distance, which allows the web to perform a 90° twist in a strand extending between these rollers. The third and fourth rollers are also spaced a distance, which allows the web to perform a 90° twist in the strand extending
5 between these rollers. The first and fourth axis of rotation are in substance parallel to each other, the second and third axis of rotation are in substance parallel to each other, and the first and fourth axis of rotation are in substance at right angles to said second and third axis of rotation. This arrangement allows a web to be twisted by 90° between the first and second rollers, to be
10 laterally shifted between the second and third rollers and to be again twisted by another 90° between the third and fourth rollers. Thus, the lateral shifting is decoupled from the turning of the web, thereby improving guidance of the web through the apparatus.

In accordance with one embodiment of the invention, the first
15 and second rollers are arranged such that a plane which extends at right angles to the axis of rotation of one roller and bisects a respective web guide surface of said roller extends through the other roller. Thus, the rollers are approximately centered with respect to each other, thus allowing the web to be guided in a stable manner on each of the rollers. Preferably, the above
20 defined plane extends through the axis of rotation of the other rollers, thus providing an exact centering of the rollers with respect to each other. A similar relationship may be provided between the third and fourth rollers.

The second and third rollers may be arranged such that a plane which extends at right angles to the axis of rotation of one roller and which
25 bisects a respective web guide surface of said roller is substantially coplanar to a respective plane of the other roller. Thus, the second and third rollers are also centered with respect to each other to improve guidance of the web there around. The second and third rollers may be spaced in a lateral shift direction only, i.e. while extending between the second and third rollers, the web is
30 moved in substance only in a lateral shift direction. Alternatively, the second and third rollers may be spaced both in a lateral shift direction and a second direction.

In accordance with one embodiment, the first and fourth rollers are arranged substantially horizontal and said second and third rollers are arranged substantially vertical, which allows the web to be guided in a horizontal manner prior and after turning and/or laterally shifting thereof, as is typically advantageous for printing purposes. Preferably, the second and third rollers are crown rollers, i.e. rollers having a curved form in a direction transverse to a running direction, in particular a circular curved form having a center located on a plane bisecting the web guide surface direction. Such crown rollers provide a self-centering function with respect to the web, which is especially advantageous when the rollers are vertically arranged, as they might otherwise have a tendency to run f

The apparatus may comprise a web position sensor for detecting the position of the web on the first or fourth roller. A device for moving at least one of the second and third rollers in the direction of the axis of rotation of the first or fourth rollers responsive to an output of the web position sensor may be provided. Such a device may be used as an integrated web guide within the apparatus.

In accordance with another aspect a printing machine for printing on a web may be provided. The printing machine may comprise a plurality of rollers for guiding the web through the printing machine, said plurality of rollers being arranged to define a simplex path and a duplex path for said web, said duplex path being arranged adjacent and laterally shifted with respect to said simplex path. At least one print arrangement may be positioned for printing an image on said web while being moved along said simplex path and said duplex path. The printing machine also comprises an apparatus for turning and/or laterally shifting the web as set forth above, said apparatus being arranged to transfer the web from the simplex path to the duplex path.

Such a printing machine allows printing on both sides of a continuous web, if the web is both turned and laterally shifted between the simplex and duplex paths, or twice printing on the same side of the web, if the

web is only laterally shifted between the simplex and duplex paths but not turned.

The at least one print arrangement may comprise at least one inkjet print head, which may print on the web both in the simplex as well as the duplex path. The at least one print arrangement may also comprise
5 separate inkjet print heads for printing on said web in said simplex path and said duplex path. To provide multi color printing, preferably at least four print arrangements are provided.

In accordance with another aspect of the invention, a method
10 for turning and/or laterally shifting a web in a printing machine is provided. The method comprising the steps of guiding the web around a first roller, guiding the web around a second roller, said second roller being rotated with respect to said first roller by about 90° , such that a strand of the web extending between the first and second rollers performs a first twist by about
15 90° , guiding the web around a third roller arranged about parallel to the first roller such that the strand of the web extending between the second and third rollers is straight, and guiding the web around a fourth roller, said fourth roller being rotated with respect to said third roller by about 90° such that the strand of the web extending between the third and fourth rollers performs a
20 second twist by about 90° .

Such a method may provide both turning and laterally shifting of a web in a printing machine, while allowing good guidance of said web. Preferably, the first twist is arranged such that the side of the web contacting the first roller also contacts the second roller, thereby an image on the first
25 side of the web may be kept out of contact with the rollers for an extended period of time. The first twist and the second twist may be oriented in the same way, such that the web performs a 180° twist while being guided around the rollers, i.e. the web is turned or flipped over. Alternatively, the first and second twists may be oriented in opposite ways such that the web does not
30 perform a twist, i.e. it keeps its original orientation. This may for example be advantageous, if the same side of the web is to be printed on twice. In this case, the method only provides for a lateral shifting of the web.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of the embodiments of the invention, as illustrated in the accompanying drawings. The elements of the drawings are not necessarily to scale relative to each other.

BRIEF DESCRIPTION OF THE DRAWINGS

- Fig. 1 is a schematic side view of a web printing apparatus along line I-I in Fig. 3;
- Fig. 2 is a schematic side view along line II-II in Fig. 3;
- Fig. 3 is a schematic top view onto a turning and/or laterally shifting device for a web in a printing machine, along line III-III in Fig. 1;
- Fig. 4 is a schematic top view similar to Fig. 3 onto an apparatus for turning and/or laterally shifting a web in a printing machine according to an alternative embodiment;
- Fig. 5 is a top view onto a printing apparatus of Fig. 3;
- Fig. 6 is a schematic top view similar to Fig. 3 onto an alternative apparatus for turning and/or laterally shifting a web in a printing machine;
- Fig. 7 is a schematic side view of a roller to be used in the apparatus for turning and/or laterally shifting a web in a printing machine.

DETAILED DESCRIPTION OF THE INVENTION

In the following description relative terms such as left, right, above and below and others may be used. These terms are used for illustrative purposes only and relate to the embodiments shown in the drawings. The relative terms are not to be construed to limit the application.

Figs. 1 to 3 and 5 show a first embodiment of a printing machine 1. The printing machine 1 has a web feeding section 3, a web receiving section 4 and a printing section 5 arranged between the web feeding section 3 and the web receiving section 4.

The web feeding section has a frame 7, in which a roller 8 for a web 9 is received. The roller 8 is rotatively supported within the frame 7, such that the web 9 may be unwound from the roller 8 in a known manner.

5 The web receiving section, which is best shown in Fig. 2, has a frame 11 rotatively supporting a roller 12 for receiving the web 9 after it has been guided through the printing section 5. The web feeding section 3 and the web receiving section 4 have been shown in a very simplified manner, and a plurality of rollers may be provided in each section for providing web guidance and/or web tensioning mechanisms, as is known in the art.

10 The printing section 5 comprises a frame 14, supporting a plurality of print engines 16, a plurality of dryers 18, a plurality of rollers 20 for guiding the web 9 along the print engines 16 and a roller arrangement 22 for turning and/or laterally shifting the web 9 in the printing machine 1.

As can be seen in Fig. 5, two tiers of print engines 16 are provided adjacent each other. The first tier of print engines 16 consist of print engines 16a to d and the second tier of print engines 16 consist of print engines 16e to 16h. The print engines 16a to 16d are arranged to cover a first path of the web 9 through the printing machine 1. The path of the web extending below print engines 16a to 16d will be called a simplex path in the following. Print engines 16e to 16h are arranged to cover a second path of the web 9 through the printing machine 1. This second path will be called a duplex path in the following.

The print engines 16 are for example of the inkjet type. The print engines 16a to 16d, covering the simplex path, may use different colors, such as cyan, magenta, yellow and carbon (black) for multicolor prints. Similarly, print engines 16e to 16h, covering the duplex path, may use the same colors as print engines 16a to 16d, if multicolored printing on both sides of the web 9 is desired. Alternatively, print engines 16e to 16h may use different colors, if for example additional colors are to be printed on the same or reverse side of the web, as will be explained in more detail herein below.

Even though, adjacent print engines 16a and 16e in the simplex and the duplex path are shown as separate print engines, they may be formed

by a single print engine, which covers both the simplex path and the duplex path.

Between the print engines 16a to 16d in the simplex path and 16e to 16h in the duplex path, dryers 18 are provided, which cover both the simplex and the duplex path. The dryers 18 may be formed by any suitable type of dryer for drying ink on said web 9. Even though, the dryers 18 are shown as intra-station dryers, i.e. being arranged between print engines 16, a single dryer at the end of the simplex path and at the end of the duplex path may also be provided.

If the print engines 16 are for example of the electro-photographic type, the dryers 18 could be replaced by respective fuser arrangements, which would typically be provided at the end of the simplex path and at the end of the duplex path.

As mentioned above, rollers 20 are provided for guiding the web 9 in the vicinity of the print engines 16.

Further to these rollers 20, a roller arrangement 22 for turning and/or laterally shifting the web 9 is provided. The roller arrangement 22 is arranged to guide the web 9 from the simplex path to the duplex path, thereby providing a lateral shift of the web 9.

The roller arrangement 22 has of a first roller 26, a second roller 27, a third roller 28 and a fourth roller 29. Additionally a roller 31 is arranged at the end of the duplex path, to allow the web 9 to be guided towards first roller 26 (see Fig. 1). Similarly, a roller 32 is provided at the beginning of the duplex path, to allow the web 9 to be guided from the fourth roller 29 towards the duplex path.

The first and second rollers 26, 27 are arranged below the duplex path and the third and fourth rollers 28, 29 are arranged below the duplex path.

The first roller 26 has an axis of rotation, which is in substance parallel to the axis of rotation of each of the rollers 20, 31, 32 and the fourth roller 29.

The second and third rollers 27, 28 each have an axis of rotation which is in substance at right angles to the axis of rotation of the other rollers, in particular the first and fourth rollers 6, 29. The first and second rollers 26, 27 are arranged such that a plane (indicated at 35 in Figs. 1 and 3) which extends at right angles to the axis of rotation of one of the rollers 26, 27 and bisects a respective web guide surface thereof extends through the other roller 27, 26, and in particular through the axis of rotation of the other roller 27, 26. Thus, the respective rollers are centered with respect to each other but rotated by 90° to each other. The third and fourth rollers 28, 29 are similarly arranged, as indicated at 36 in Figs. 3 and 2. Thus, also the third and fourth rollers 28, 29 are centered with respect to each other but rotated by 90° to each other.

The first and second rollers are spaced a distance, which allows the web to perform a 90° twist in the strand extending between these rollers. Similarly, the third and fourth rollers 28, 29 are also spaced a distance which allows the web to perform a 90° twist in the strand extending between these rollers. The 90° twist being provided due to the fact that the rollers are rotated 90° with respect to each other. Due to the fact that the rollers are centered with respect to each other, as explained above, no side forces act on the web, while being guided by rollers 26 and 27. If the rollers are not centered, side forces may act on the web, which may cause damage of the web or which may lead to the fact that the web moves sideways off the respective rollers 26, 27. The same is true for the third and fourth rollers 28, 29. The second and third rollers 27, 28 are spaced in a lateral direction, to provide a lateral shift of the web 9, in order to transfer the web 9 from the simplex path to the duplex path. Due to the fact that the axis of rotation of each of the second and third rollers 27, 28 is in substance parallel, the web 9 extends straight between these two rollers 27, 28.

The 90° twist in the web 9 between the first and second rollers 26, 27 may be in the same direction as the 90° twist between the third and fourth rollers 28, 29. In this case, the web is not only laterally shifted, but

also turned upside down or flipped. This enables double-sided printing on the web.

The first 90° twist between the first and second rollers 26, 27, however, may also be in a different direction to the second 90° twist between the third and fourth rollers 28, 29. In this case, the web will not be turned upside down, but only laterally shifted. This would enable additional printing on the same side the web, while it is in the duplex path. In this case, additional colors may be provided in the print engines 16e to 16h. Such additional colors may for example be gold, silver or other special colors which may not be achieved by the colors used in print engines 16a to 16d.

Fig. 6 shows an alternative embodiment of the roller arrangement 22, in which the same reference signs will be used as in the previous description. The roller arrangement 22 again consists of a first roller 26, a second roller 27, a third roller 28 and a fourth roller 29. The rollers are arranged in the same manner as previously discussed.

The second roller, however, is mounted on one end of the bracket 40, which is pivotably mounted at its other end. A guide motor 42 is provided, which allows the bracket to be moved around its pivotable end, as indicated by the double headed arrow. In so doing, the second roller 27 is moved sideways with respect to the first roller 26. The skilled person will realize that this movement also has a component directed towards and away from the first roller, but this component is of lesser importance. The sideways movement of the second roller 27 may be used as a web guide to properly guide the web 9 on the first roller 26. To achieve this purpose, a position sensor 44, such as an edge sensor, may be provided in the vicinity of the first roller 26. An edge sensor can sense the edge of the web 9 and thereby the position of the web 9 on the first roller 26. The guide motor 42 may be moved in response to an output signal of the edge sensor, in order to appropriately position the web 9 on the first roller 26.

A similar arrangement may be provided for the third roller 28 and an edge sensor may be provided in a vicinity of the fourth roller 29. Fig.

4 shows an alternative roller arrangement 22 for turning and/or laterally shifting the web 9.

In Fig. 4 again the same reference signs will be used as in the previous description. The roller arrangement 22 again has a first roller 26, a second roller 27, a third roller 28 and a fourth roller 29. The axis of rotation of the first and fourth rollers 26, 29 are in substance parallel to each other. Similarly, the axis of rotation of the second and third rollers 27, 28 are in substance parallel to each other and are rotated by 90° with respect to the axis of rotation of the first and fourth rollers 26, 29. The first and second rollers 26, 27 are again centered with respect of each other and sufficiently spaced to allow the web 9 to perform a 90° twist in the strand extending therebetween.

Also the third and fourth rollers 28, 29 are again centered with respect to each other as explained above and are spaced sufficiently to allow the web to perform a 90° twist in the strand extending between.

The arrangement of Fig. 4 differs from the previous arrangement inasmuch as the second and third rollers 27, 28 are adjacent each other in the lateral shift direction. Similarly, the first and fourth rollers 26, 29 are adjacent to each other in the lateral shift direction. When this arrangement is used, the simplex and duplex path of the printing machine may run in opposite directions, such that the web feeding section and the web receiving section may be arranged on the same side of the printing machine 1.

Fig. 7 shows a side view of a specific embodiment of the second and fourth roller 27 and 28. As indicated, in the above embodiment the second and third rollers 27, 28 are arranged vertically and therefore the web may have a tendency to move down by gravity. The rollers 27, 28 are, however, in this embodiment formed as crown rollers, i.e. rollers having a curved form in a direction transverse to a running direction. In particular, a circular curved form having a center located on a plane bisecting the web guide surface in transverse direction is provided. Such crown rollers provide a self centering function of the web while the web is moved there around either during printing or webbing operation.

Next a method of printing on a web will be described under reference of the drawings.

First, the web has to be introduced into the printing machine and it is typically manually guided to extend along the print engines covering the simplex path. Then it is guided around roller 31 to extend to roller 26. 5 Next it is guided around roller 26 and to roller 27. The web 9 is guided in such a manner that it performs a 90° twist in the strand extending between the first and second rollers 26, 27. The web 9 may be guided in such a manner, that the top side thereof, i.e. the side which is on top in the simplex path, will not contact the second roller 27. The web 9 is then guided towards and around 10 the third roller 28. From the third roller 28 the web 9 is guided to the fourth roller 29, and again a 90° twist is introduced into the web 9. This 90° twist may be in the same or in an opposite direction to the first twist, as indicated above. From roller 29 the web 9 is guided towards roller 32 and through the duplex path towards the web receiving section. Once the web is guided in this 15 manner through the printing machine 1 and it extends between the web feeding and the web receiving section, printing on the web may start in a known manner.

The invention has been described with respect to specific 20 embodiments thereof without being limited to these specific embodiments.

Claims

1. An apparatus for turning and/or laterally shifting a web in a printing machine, said apparatus comprising:

- a first roller for guiding the web, said first roller having a first axis of rotation;
- a second roller for guiding the web, said second roller having a second axis of rotation;
- a third roller for guiding the web, said third roller having a third axis of rotation; and
- a fourth roller for guiding the web, said fourth roller having a fourth axis of rotation;

said first to fourth rollers being arranged to allow guiding the web around said rollers in the above order, wherein said first and second rollers are spaced a distance which allows the web to perform a 90° twist in the strand extending between these rollers, said third and fourth rollers are spaced a distance which allows the web to perform a 90° twist in the strand extending between these rollers, said first and fourth axis of rotation are in substance parallel to each other, said second and third axis of rotation are in substance parallel to each other, and said first and fourth axis of rotation are in substance at right angles to said second and third axis of rotation.

2. The apparatus of any one of the preceding claims, wherein the first and second rollers are arranged such that a plane which extends at right angles to the axis of rotation of one roller and bisects a respective web guide surface of said roller extends through the other roller.

3. The apparatus of claim 2, wherein the first and second rollers are arranged such that the plane which extends at right angles to

the axis of rotation of one roller and bisects the respective web guide surface of said roller extends through the axis of rotation of the other roller.

5 4.The apparatus of any one of the preceding claims, wherein the third and fourth rollers are arranged such that a plane which extends at right angles to the axis of rotation of one roller and bisects a respective web guide surface of said roller extends through the other roller.

10

5.The apparatus of claim 4, wherein the third and fourth rollers are arranged such that a plane which extends at right angles to the axis of rotation of one roller and bisects the respective web guide surface of said roller extends through the axis of rotation of the other roller.

15

6.The apparatus of any one of the preceding claims, wherein the second and third rollers are arranged such that a plane which extends at right angles to the axis of rotation of one roller and bisects a respective web guide surface of said roller is substantially coplanar to a
20 respective plane of the other roller.

7.The apparatus of any one of the preceding claims, wherein the second and third rollers are spaced in a lateral shift direction.

25 8.The apparatus of any one of the preceding claims, wherein the second and third rollers are spaced in a lateral shift direction and a second direction.

30 9.The apparatus as set forth in any one of the preceding claims, wherein said first and fourth rollers are arranged substantially horizontal and said second and third rollers are arranged substantially vertical.

10. The apparatus as set forth in any one of the preceding claims, wherein said second and third rollers are crown rollers.

5 11. The apparatus of any one of the preceding claims, further comprising a web position sensor for detecting the position of the web on the first or fourth roller.

10 12. The apparatus of claim 11, further comprising a device for moving at least one of the second and third rollers in the direction of the axis of rotation of the first or fourth roller responsive to an output of the web position sensor.

15 13. A printing machine for printing on a web, comprising:
a plurality of rollers for guiding said web through said printing machine, said plurality of rollers being arranged to define a simplex path and a duplex path for said web, said duplex path being arranged adjacent and laterally shifted with respect to said simplex path;
20 at least one print arrangement positioned for printing an image on said web while being moved along said simplex path and said duplex path;
and
an apparatus for turning and/or laterally shifting said web as set forth in any one of the preceding claims, said apparatus being arranged to transfer
25 the web from the simplex path to the duplex path.

14. The printing machine of claim 13, wherein said at least one print arrangement comprises at least one ink jet print head.

30 15. The printing machine of claim 14, wherein said at least one print arrangement comprises separate ink jet print heads for printing on said web in said simplex path and said duplex path.

16. The printing machine of any one of claims 13 to 15, wherein at least four print arrangements are provided.

5 17. The printing machine of any one of claims 13 to 16, wherein the apparatus for turning and/or laterally shifting said web is arranged below said print arrangements.

10 18. A method for turning and/or laterally shifting a web in a printing machine, said method comprising the steps of:

- guiding the web around a first roller;
- guiding the web around a second roller, said second roller being rotated with respect to said first roller by about 90° , such that a strand of the web extending between the first and second rollers performs a first
- 15 twist by about 90° ;
- guiding the web around a third roller arranged about parallel to the first roller, such that the strand of the web extending between the second and third rollers is straight; and
- guiding the web around a fourth roller, said fourth roller being rotated
- 20 with respect to said third roller by about 90° , such that a strand of the web extending between the third and fourth rollers performs a second twist by about 90° .

19. The method of claim 18, wherein said first twist is arranged such that the side of the web contacting the first roller also

25 contacts the second roller.

20. The method of claim 18 or 19, wherein said first twist and said second twist are oriented in the same way such that the

30 web has performed a 180° twist after the second twist.

21. The method of claim 18 or 19, wherein said first twist and said second twist are oriented in opposite ways such that the web is kept in its original orientation after the second twist.

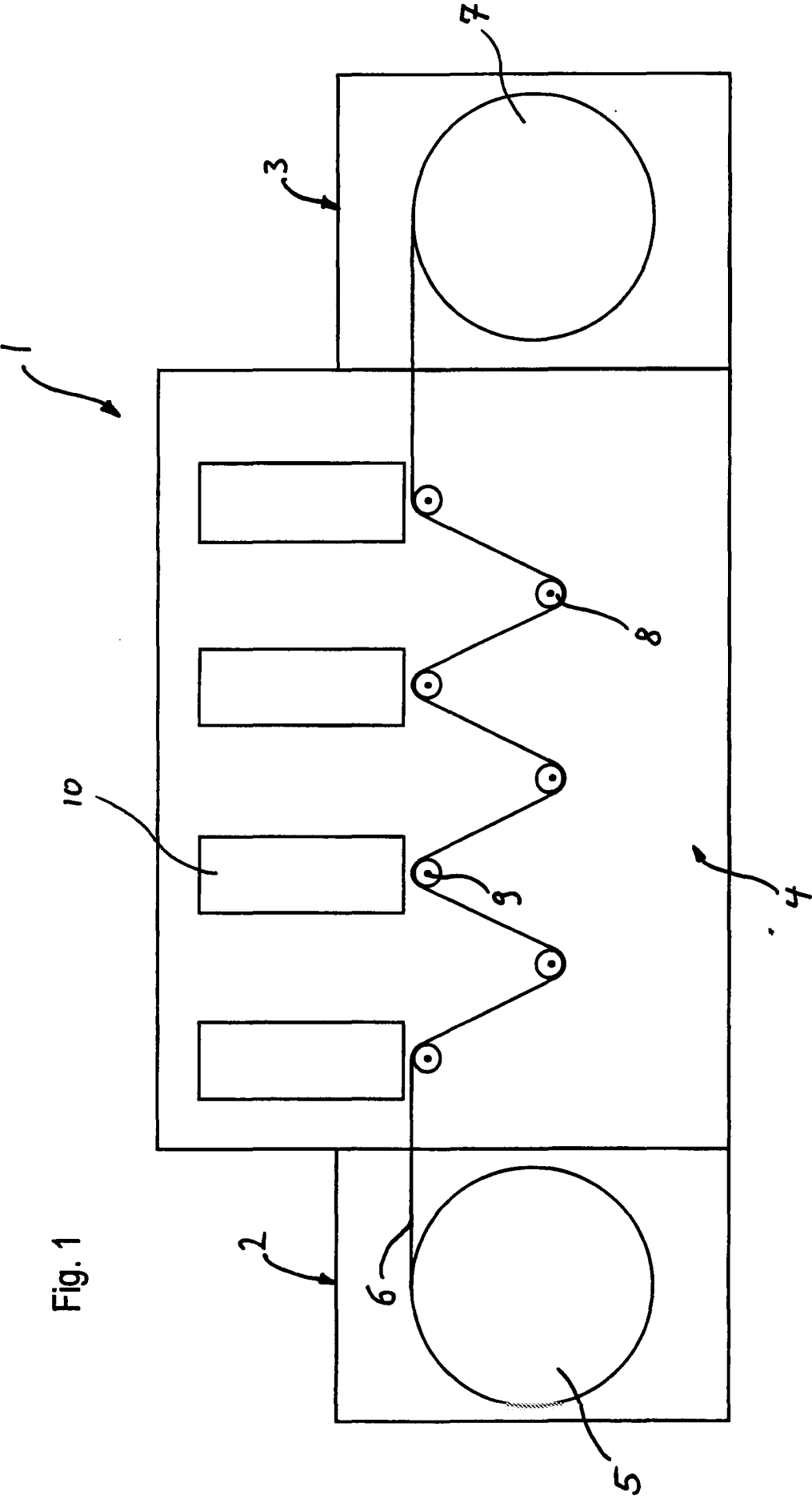


Fig. 1

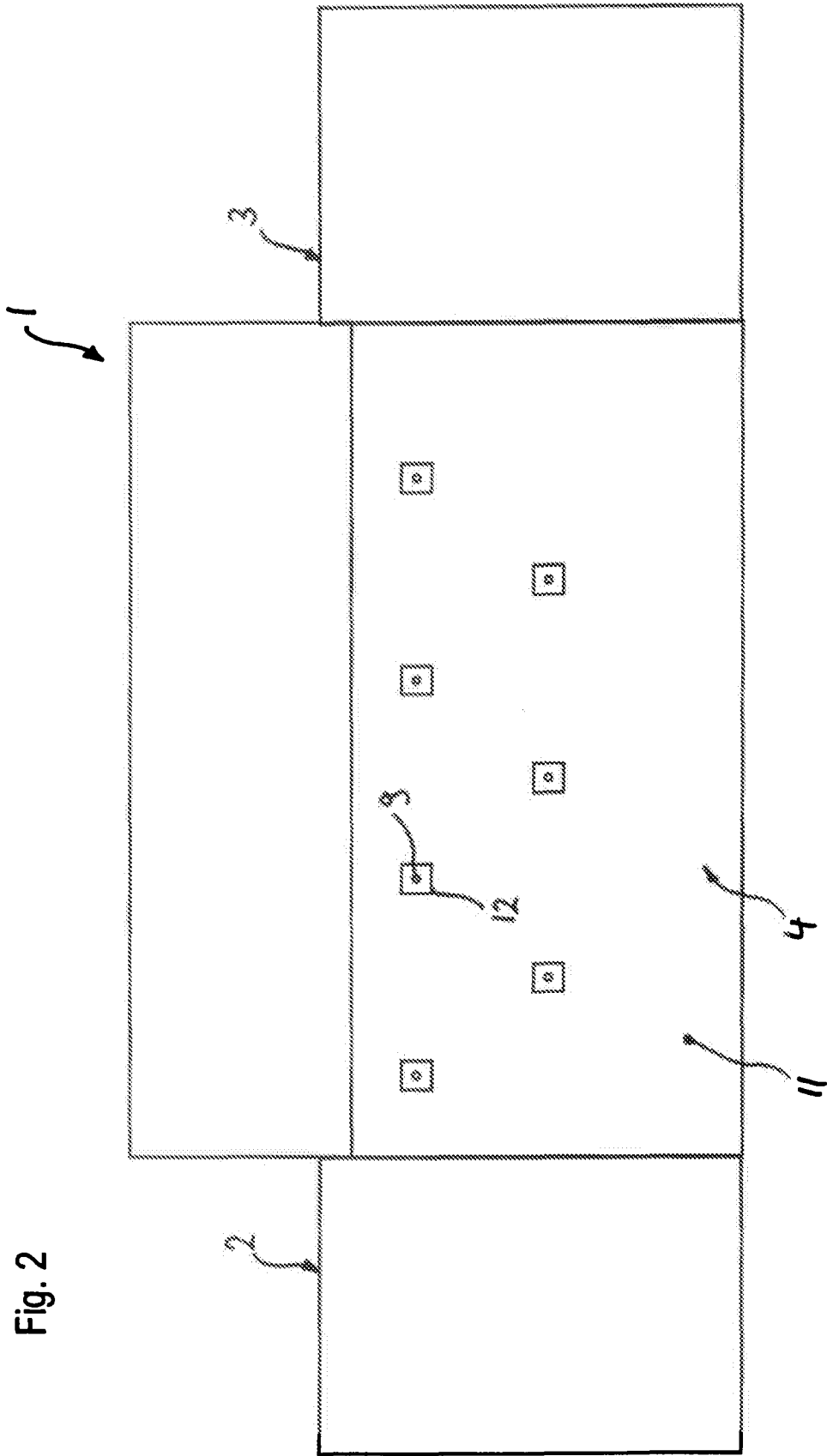


Fig. 3

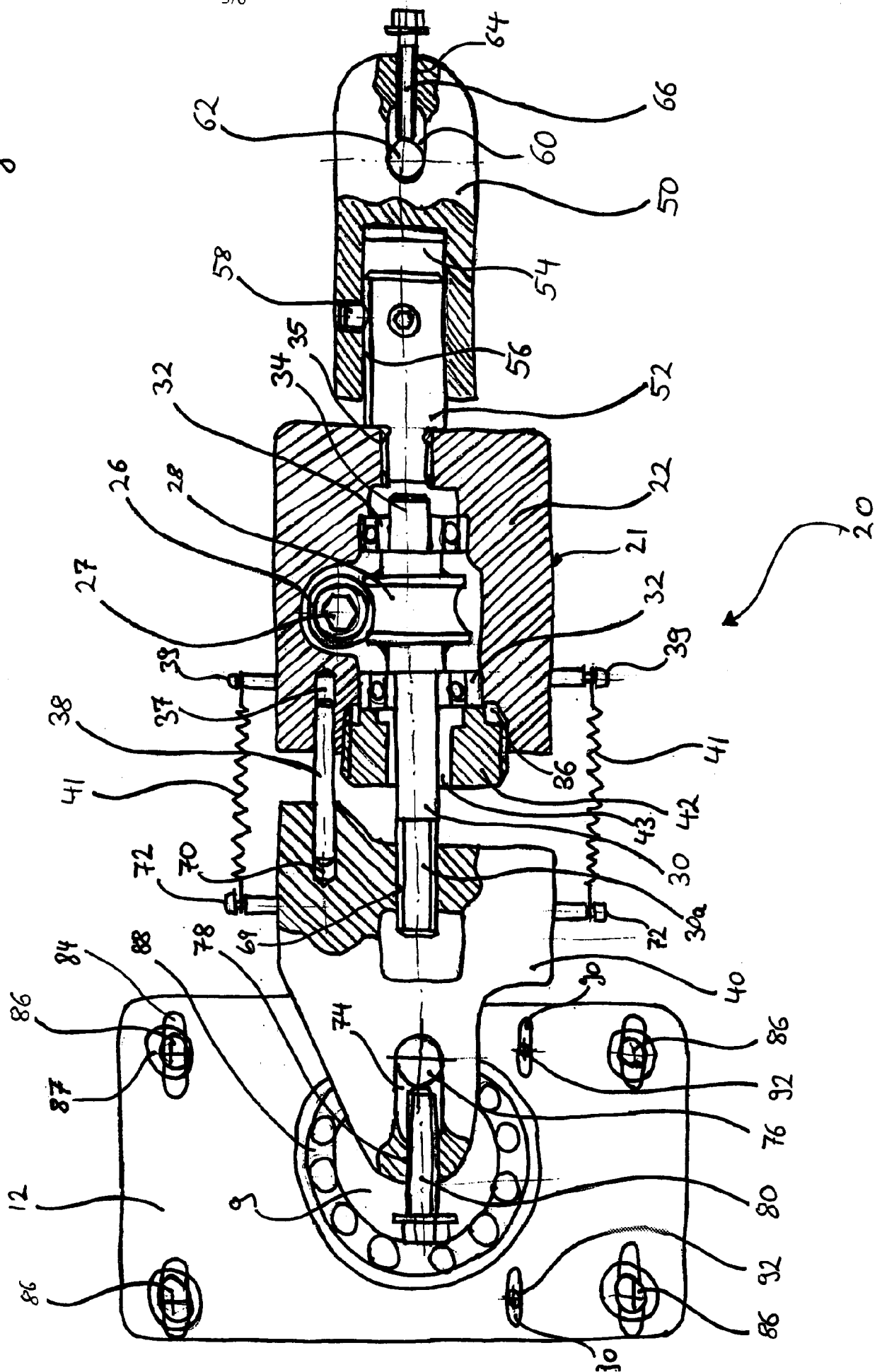
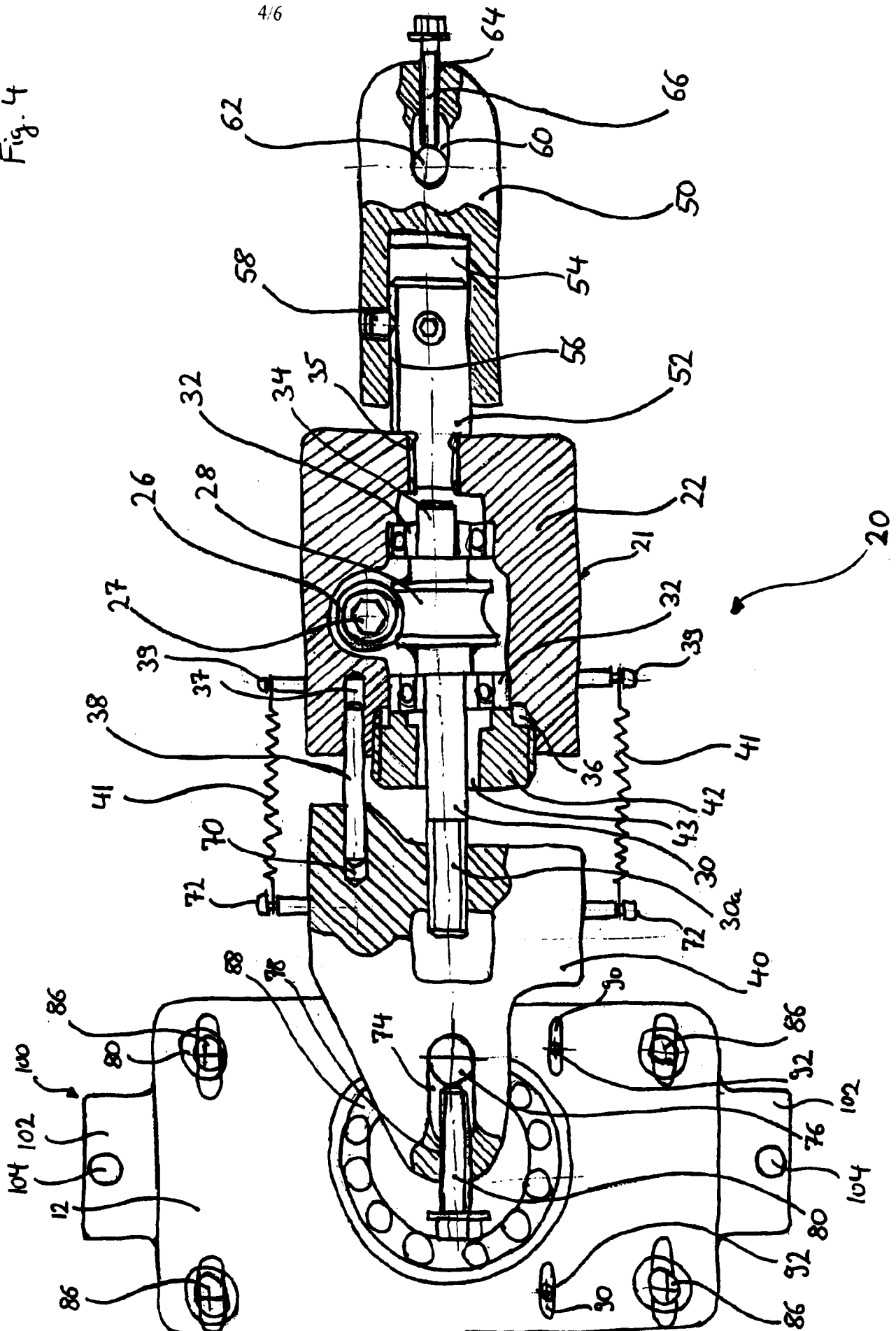
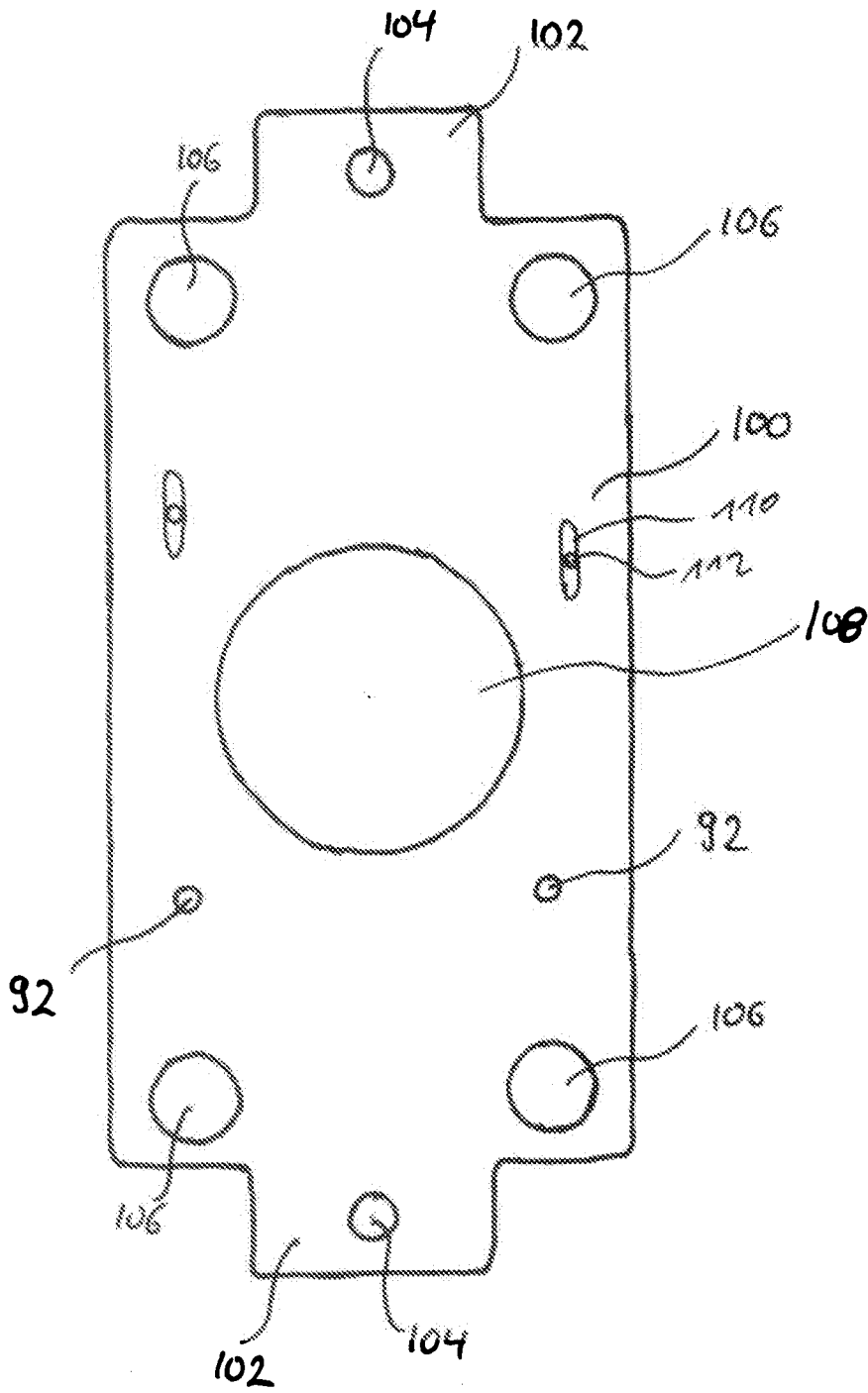
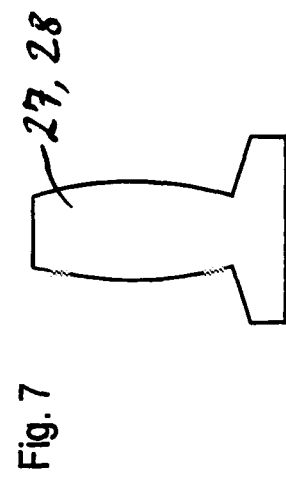
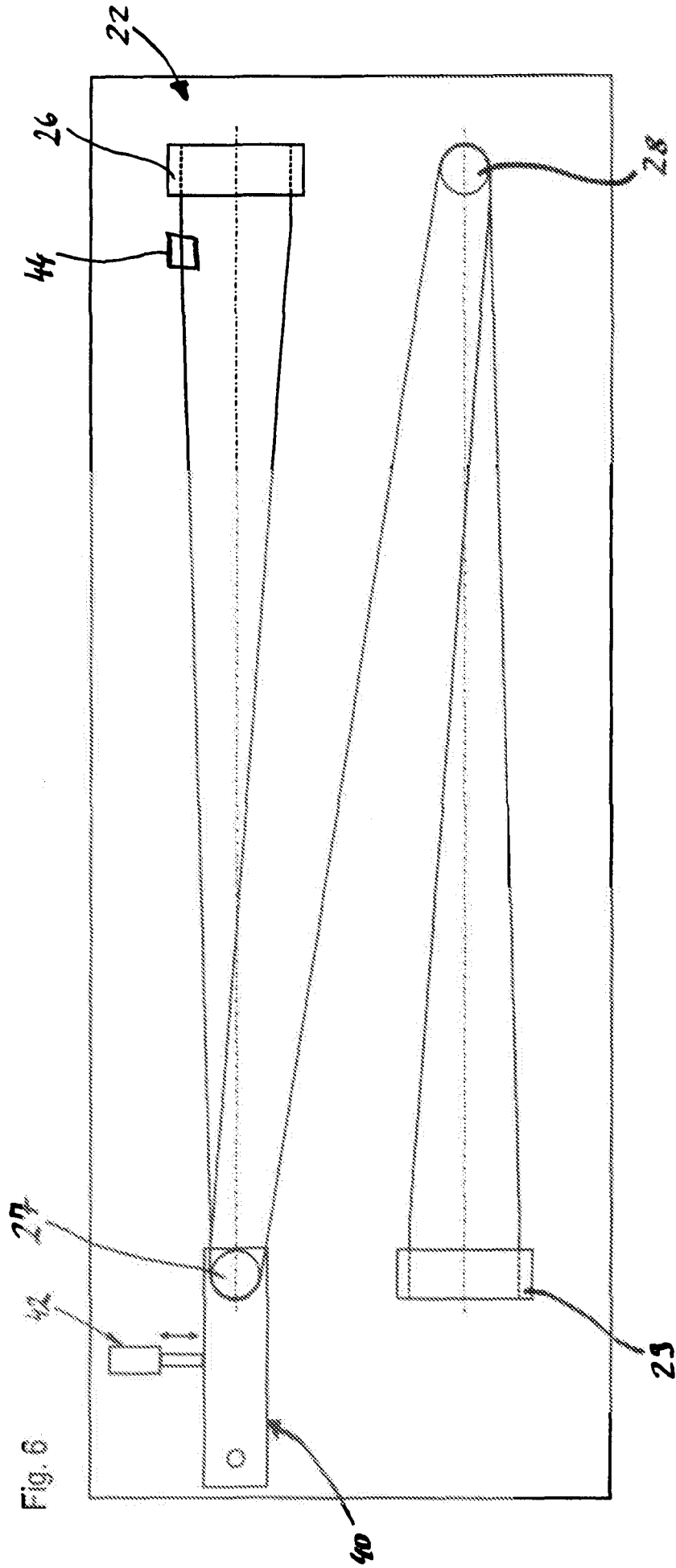


Fig. 4







INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/052344

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65H23/32

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)
B65H 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 A	DE 40 11 405 A1 (ROEDERSTEIN KONDENSATOREN [DE]) 10 October 1991 (1991-10-10) the whole document	1-12, 18, 19, 21 13-17, 20
X A	US 3 309 037 A (EARL AMOS STEPHEN) 14 March 1967 (1967-03-14) the whole document	1-12, 18, 19, 21 7, 8, 13-17, 20
X A	JP 58 059148 A (HITACHI CONDENSER) 8 April 1983 (1983-04-08)	1-12, 18, 19, 21 7, 8, 13-17, 20
X A	JP 62 215455 A (KONISHIROKU PHOTO IND) 22 September 1987 (1987-09-22)	1-12, 18, 19, 21 13-17, 20
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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

1 December 2009

Date of mailing of the international search report

08/12/2009

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INTERNATIONAL SEARCH REPORT

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PCT/EP2009/052344

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 336 331 A (USINOR [FR]) 22 July 1977 (1977-07-22) -----	
A	US 6 615 717 B1 (PERDU PATRICK G L [CR] PERDU PATRICK [CR]) 9 September 2003 (2003-09-09) paragraph [0009] - paragraph [0012] paragraph [0068] - paragraph [0073] -----	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2009/052344

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