

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) Publication number:

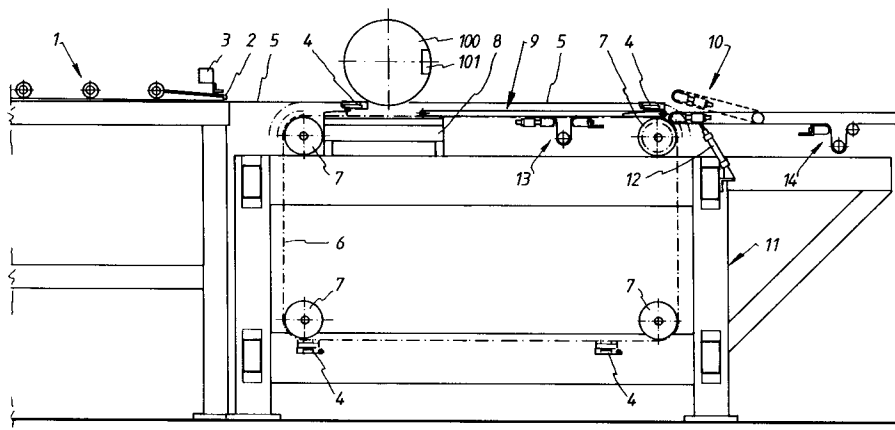
0 561 474 A1

(12)

EUROPEAN PATENT APPLICATION(21) Application number: **93200783.4**(51) Int. Cl.⁵: **B41F 15/16, B41F 15/28**(22) Date of filing: **17.03.93**(30) Priority: **17.03.92 NL 9200494**(43) Date of publication of application:
22.09.93 Bulletin 93/38(84) Designated Contracting States:
AT CH DE DK FR GB IT LI NL SE(71) Applicant: **STORK X-CEL B.V.**
Wim de Körverstraat 43a
NL-5831 AN Boxmeer(NL)(72) Inventor: **Derks, Marius Joseph**
4, Kerkstraat
NL-5445 AD Landhorst(NL)(74) Representative: **Barendregt, Frank, Drs. et al**
EXTERPATENT B.V. P.O. Box 3241
NL-2280 GE Rijswijk (NL)(54) **Device for transportation substratum through a printing device and screen printing machine.**

(57) Device for conveying articles (5) for printing through a printing device with at least one rotatably driven printing forme, comprising at least one holding means (4) situated in an initial position, for receiving one flexible or inflexible article (5) for printing in each case, which holding means (4) is supported by guide means and can be moved by a drive means (6) of a first type from the initial position to an end position, along an essentially straight path leading along the printing forme (100), and resetting means are fitted for returning the one or more hold-

ing means (4) along the same or a different path from the end position to the initial position following discharge of the printed article (5), **characterised in that** provision is also made for a drive means (8) of a second type which at least temporarily takes over the movement of each holding means (4) on at least part of the path where the articles (5) can be printed, in order to achieve accurate positioning thereof in place and time along said part of the path. A screen printing machine comprising a conveyor device according to the invention is also described.

**Fig. 1****EP 0 561 474 A1**

The present invention relates to a device of the type described in the preamble of claim 1.

Such a device is known from US patent specification 3853315, which relates to a device for the throughfeed and bilateral printing of articles, the articles being held by holding means spaced apart and fixed on endless belts. This device is also provided with means for guiding the holding means during the printing operation. In addition, use is made of printing rollers provided with a recess in the periphery for allowing through said holding means.

It is common in printing technology, in particular in the case of rotary screen printing and offset printing, for flexible articles for printing to be conveyed through a printing machine, along a path running along a printing roller, by means of a drive means consisting of, for example, a conveyor belt or supporting roller. Despite the fact that the articles to be printed are held during the printing operation, uncontrolled shifts relative to the belt can occur during the feed and conveyance when accelerations occur. As a result of this, it is difficult to obtain accurate positioning of the articles relative to the printing roller and to retain it during printing, with the result that the printed image cannot be placed accurately at a predetermined position, and may even be deformed.

These uncontrolled shifts occur in particular in the case of inflexible articles, which can vary considerably in thickness and weight.

The object of the present invention is to provide a device of the type mentioned above which permits accurate positioning in place and time along at least the part of the path where the articles can be printed. In this case it must be possible for the articles to be all discrete sheet-type materials which are common in the industrial and printing markets, with a great diversity in thickness, surface area and weight, for example printed circuit boards.

This object is achieved by the device according to the invention as described in the characterising part of claim 1.

The above device can interact with feed means for placing articles for printing in position, which means consist of conveyors, for example a conveyor belt, for conveying each article for printing against a positioning cam, and of transfer means for transferring articles lying against the positioning cam, one at a time, over the same distance to a holding means, the holding means being disposed at the same position on the path in each case.

Articles can be fed in either continuously or intermittently. The latter applies in particular for cases where the articles are fed in manually, as a result of which relatively long waiting times occur. The printing rollers are sometimes stopped during these long waiting times.

The feed means for placing the articles for printing in position can also consist of conveyor means for conveying said articles to a waiting position, and of transfer means for transferring one article at a time from the waiting position to a holding means. In order to obtain accurate transfer of the article for printing from the transfer means to the holding means, the transfer means, like the holding means, can be provided with stop cams which, after acceleration of the transfer means, run against stop cams of the holding means, with the result that both means are positioned accurately relative to each other, and following which both means are also running at the same speed.

It is advantageous to make the articles for printing run at the same speed as that of the moving holding means, because more articles can then be fed in per unit time, for in that case the holding means no longer have to accelerate after receiving an article. It is advantageous here if the transfer means are driven by a mechanical drive which follows a specific curve recorded in a specific drive program by means of which the transfer means can be positioned accurately. This increases the reliability and accuracy even at high speeds. In this case the transfer means can be provided with clamping means consisting of a top and bottom arm, or with suction means, for example suction nozzles, by which the articles can be picked up, held and released by means of vacuum, without being damaged.

The guide means, the drive means of the first type and the resetting means together can consist of one driven endless chain or toothed belt, which is supported at two positions at least, and along which the holding means are fixed at regular intervals. This greatly benefits the simplicity of the construction.

In addition, the drive means of the first type can move the holding means by means of compressed air. The holding means can then be moved independently of each other, which is not possible if a chain or toothed belt is used as the first drive means.

The drive means of the first type can also move the holding means by means of magnetic force, with the result that the holding means can be moved independently of each other, and regulation of this movement is possible without mechanical valves, which are liable to wear.

The advantage of using a device according to the invention, i.e. a drive means of a second type which at least temporarily takes over the movement of each holding means along at least part of the path where the articles can be printed, is accurate positioning thereof in place and time along said part of the path. For, high accuracy can be ensured in this way on the part of the path where that is

necessary, and for the rest a less accurate first drive means will suffice.

An advantageous embodiment of the device according to the invention is formed if the drive means of the second type consists of a lead screw placed parallel to the path, while each holding means is fitted with at least one cam which can engage with the lead screw. In this case the cam can be mounted on bearings on the holding means, so that the cam can roll along the lead screw, and a reduction in wear is possible. If the cam is conical in this case, the drive means of the second type can acquire a very high positioning accuracy.

Another advantageous embodiment is formed if the drive means of the second type consists of an at least externally toothed endless belt which runs parallel to the path and is supported at two points at least, and at least one tooth per holding means which can engage with the toothed belt.

Yet another advantageous embodiment is formed if the drive means of the second type consists of a ground endless chain which is provided with pointed teeth on the outside, and which runs parallel to the path and is supported at least at two points, and if at least one pointed tooth per holding means can engage with the ground chain.

It is particularly advantageous in this case if the holding means are provided with guide means which essentially prevent movement in the plane in which the articles are being printed, other than in the direction of the path. These guide means can be formed by a profile which is fitted parallel to the path, and by each holding means having three or four rollers thereon, the axes of which are perpendicular to the plane in which the articles are being printed, and which rest against the profile in pairs on either side during the passage of the holding means.

In particular if the guide means, the drive means of the first type and the resetting means together are formed by a driven endless chain or toothed belt, the discharge means for removing articles for printing from the holding means situated in an end position can comprise a conveyor which is disposed essentially in line with the path at a short distance from the end thereof, at which end the chain or toothed belt with holding means fixed thereon is deflected by a roller. The distance from the conveyor to the chain or toothed belt is in each case temporarily increased, in order to allow each holding means to pass unimpeded. A second conveyor can also be provided here before the end of and essentially parallel to the path, which conveyor takes over the carrying of the articles from the holding means and guides said articles to the conveyor lying essentially in line with the path. The purpose of both conveyors is to discharge articles coming from the holding means.

A recess is advantageously provided in the printing forme, so that the holding means can pass through.

The invention also relates to a screen printing machine such as described in claim 15, in which the machine contains a device according to the invention as described above.

The supporting roller of the screen printing machine is provided with a recess which serves to allow the holding means to pass through between the printing roller and the supporting roller. The material of the screen can be made of a metal such as, for example, nickel, produced by electroforming. It is preferable to use high-mesh material for this, on account of the low deformation of this material. The screen can be provided with strips, extending along the edges in the peripheral direction of the printing roller. In that case the screen can be stretched in the axial direction by two cylindrical rings gripping behind the strips.

The squeegee can advantageously be removed from the inside of the printing roller while the bridge is passing, thereby preventing excessive wear of the squeegee. For this purpose, a cam which imposes this movement on the squeegee can be provided on the inside of the printing roller.

It is also advantageous if the printing roller can be adjusted in longitudinal register by two meshing gear wheels provided with oblique teeth. The adjustment is carried out by shifting one of these two gear wheels along an axis of rotation. Finally, it is advantageous to provide a facility for adjusting the distance between the printing roller and the supporting roller, whereby the axis of the printing roller can be adjusted by an eccentric cam of a rotary pulley.

The invention will now be explained in greater detail with reference to the drawing, in which:

Fig. 1 shows a side view of a rotary printing device;

Figs. 2a to 2d show partial views of the device according to the invention, having therein the holder or holding means, the drive means of the second type and additional guide means;

Fig. 2e is a diagrammatic illustration of the top view of the part of the screen printing machine where a transfer means rests against a holding means;

Fig. 3 shows a side view of a screen printing machine having therein a device such as shown in Fig. 1;

Fig. 4 is a perspective diagrammatic illustration of the printing head of the screen printing machine according to Fig. 3;

Fig. 5 shows a view of a part of the printing head of the screen printing machine according to Fig. 3, having therein a cross-section of a part of the longitudinal register adjustment; and

Fig. 6 shows the principle of the thickness adjustment of the printing roller relative to the supporting roller.

Fig. 1 shows a device according to the invention in which the articles for printing are conveyed by a conveyor 1 against a positioning cam 2, thereafter are transferred one by one over the same distance in each case to a holding means 4 by means 3 which are provided with clamping means, comprising a bottom and a top arm, for holding the articles, the holding means 4 being disposed at the time on an essentially straight path in the same initial position. The holding means bears the article 5 for printing and is itself supported by an endless chain 6 which is stretched over pulleys 7 and at the same time serves as drive means of a first type, while the holding means 4 fixed thereto with play in the direction of the path moves out of the initial position of the path and passes along a printing forme 100 with recess 101 for allowing through the holding means 4 towards an end position (left and right respectively in the figure, as shown). The device according to the invention, being a drive means of a second type 8, then temporarily takes over the movement of the holder 4 and ensures accurate positioning in place and time along the part of the path over which it is operating.

Discharge means are formed by a conveyor 9, which is fitted before the end of the path, runs parallel thereto and takes over the articles from the holding means 4 and conveys them to another conveyor 10 lying in line with the path. Whenever a holding means 4 has to pass, the distance between the latter conveyor 10 and the chain 6 is temporarily increased for the purpose, by means of a compressed air cylinder 12 which is hingedly fixed to the machine frame 11. The chain is also used to return the holding means 4 to the initial position. The conveyors 9 and 10 are kept under tension by tensioning devices 13 and 14 respectively, which are known per se.

Figures 2a to 2d show in detail the holding means 4, which is driven by the device according to the invention indicated by reference number 8 in Fig. 1, which is a drive means of the second type, which in Figures 2a and 2b is formed by a lead screw 15 which is placed parallel to the path and engages with a cam 17 mounted on bearings on the holding means 4. A guide 23, along which the holding means 4 can move by means of guide rollers 24, is also disposed parallel to the path. The holding means 4 is fixed to a link 20 of the supporting chain 6 by means of a pin 21 which engages with play in a hole 22. This play ensures that the movement of the chain 6 does not have to correspond exactly to the movement imposed on the holding means by the lead screw 15 and guide

23.

Figure 2c shows a different embodiment of the invention, in which the drive means 8 of the second type is formed by an endless toothed belt 51 provided with teeth on the outside and on the inside and running parallel to the path, which belt runs over a toothed belt wheel 53, and by at least one holding means 4 which is provided with teeth which mesh with the toothed belt.

In Figure 2d, in a preferred embodiment, the drive means 8 of the second type is formed by a ground endless chain 52 provided on the outside with pointed teeth and running parallel to the path, which chain runs over a chain wheel 54, and by a holding means 4 which is provided with pointed teeth which mesh with the ground chain.

Fig. 2e shows diagrammatically a possible position of the transfer means relative to a holding means, in which a sheet to be printed can be transferred very accurately to the holding means. The transfer means 57 in this case falls partially into the openings of the holding means 4. Both the transfer means and the holding means are provided on either side with stop cams 55 and stop cams 56 respectively, which lie against each other in this position.

The device shown in Fig. 1 is extended to a screen printing machine in Fig. 3, by adding a printing roller 25 and supporting roller 26 and the drive means necessary for the purpose. A screen 35 is stretched along the periphery on the printing roller 25. The squeegee 27 is removed from the inside of the printing roller whenever the bridge 28 is passing. A recess 29 is provided in the supporting roller, in order to allow the holding means 4 to pass freely.

Fig. 4 is a diagrammatic representation of a printing roller containing a squeegee 31, which printing roller is made up of two end rings 33 with a bridge 34 between them, which stretches along the periphery between the dashed lines, and a screen 35 which is stretched with the aid of register pins 36 and dividing tensioning rings 30, 37 which grip behind polyurethane strips glued on the screen, and which printing roller is rotatably driven in oblique teeth 38. The squeegee can rotate about a shaft 32 which runs at a distance from and parallel to the axis of rotation of the printing roller and is raised by cam 39, which imposes a movement on the squeegee by means of a rod mechanism, so that the squeegee does not touch the passing bridge 34. The printing roller can rotate in its entirety in bearings (not shown) which are provided around the ends of the roller. In order to prevent twisting of the printing roller, it can, of course, be provided with teeth at both ends and be driven.

The principle whereby longitudinal register adjustment is applied to permit adjustments while in operation is shown diagrammatically in Fig. 5. The oblique teeth 38 of the printing roller mesh with a gear wheel 40, which can be shifted with the bearing shaft 41, on which the gear wheel is immovably fixed by means of a key 42 and bush 43, along the axis of rotation in the direction indicated by arrow A. A shifting of gear wheel 40 causes a relative rotation of shaft 41 with respect to the printing roller, as indicated by arrow B, as a result of which the longitudinal register changes. This adjustment can also be made when the machine is in operation.

Finally, Fig. 6 shows the principle applied in order to increase the distance between the printing roller 25 and the supporting roller 26, so that they lie clear of each other. This ensures that, for example, if no articles for printing are being passed through, printing ink is prevented from being applied to the supporting roller 26 by the printing roller 25. The printing roller 25 is accommodated by means of a bearing 62 in a disc 60 which is situated eccentrically relative to the printing roller, and which is accommodated by means of a bearing 63 in the frame of the screen printing machine. Before the printing roller 25 is moved upwards, the squeegee is placed in an off position by a rod mechanism. Due to the fact that the printing roller lies eccentrically in the disc 60, as a result of the retraction of the driving rod into the pneumatic cylinder 61, the disc 60 can be rotated through an angle in the frame, with the result that the printing roller 25 is moved upwards.

A screen printing device of the type described above is built, for example, for articles with dimensions of maximum 1400 mm by 1000 mm and can achieve a printing speed of 4000 articles per hour, during which a printed image with an accuracy of 0,1 mm can be obtained.

The printing forme to be used expediently comprises a screen material of nickel, formed by electroforming, which can be a fineness of 20-500 mesh and higher (the mesh number is the number of screen openings per linear inch) and a thickness of between 50 and 300 micrometres. Of course, finenesses and thicknesses deviating from the above can also be used.

Claims

1. Device for conveying articles (5) for printing through a printing device having at least one printing forme which may be rotatably driven, comprising at least one holding means (4) situated in an initial position, for receiving one flexible or inflexible article (5) at the time for printing, which holding means (4) is supported

by guide means and can be moved by a drive means (6) of a first type from the initial position to an end position, along an essentially straight path leading along the printing forme (100), and resetting means are fitted for returning the one or more holding means (4) along the same or a different path from the end position to the initial position following discharge of the printed article (5), **characterised in that** provision is also made for a drive means (8) of a second type which at least temporarily takes over the movement of each holding means (4) on at least part of the path where the articles (5) can be printed, in order to achieve accurate positioning thereof in place and time along said part of the path.

2. Device according to claim 1, **characterised in that** the drive means (8) of the second type is formed by a lead screw (15) placed parallel to the path, and at least one cam (17) per holding means (4) which can engage with the lead screw.

3. Device according to claim 2, **characterised in that** the cam (17) is fixed on bearings on the holding means (4), so that said cam can roll along the lead screw (15).

4. Device according to claim 3, **characterised in that** the cam (17) is conical.

5. Device according to claim 1, **characterised in that** the drive means of the second type is formed by an endless toothed belt (51) which runs parallel to the path and is supported at two points at least, and at least one tooth per holding means (4) can engage with the toothed belt (51).

6. Device according to claim 1, **characterised in that** the drive means of the second type is formed by a ground endless chain (52) which is provided with pointed teeth on the outside and runs parallel to the path and is supported at least at two points, and at least one pointed tooth per holding means (4) which can engage with the ground chain (52).

7. Device according to one of claims 1 - 6, **characterised in that** each holding means (4) is provided with additional guide means (23, 24) which essentially prevent shifts in the plane in which the articles (5) are being printed, other than in the direction of the path.

8. Device according to claim 7, **characterised in that** the additional guide means are formed by

a profile (23) which is fitted parallel to the path, and in that each holding means (4) has rollers (24) fitted thereon, the axes of which are perpendicular to the plane in which the articles (5) are being printed, and which rest against the profile (23) in pairs on either side during the passage of the holding means (4).

9. Device according to claim 7, **characterised in that** the additional guide means are formed by a profile (23) which is fitted parallel to the path, and in that each holding means (4) has rollers (24) fitted thereon, the axes of which are perpendicular to the plane in which the articles (5) are being printed, and which are placed in such a way that they rest against the profile during the passage of the holding means (4), the central roller, viewed in the direction of the path, being situated at a different side of the profile from the other two rollers (24).

10. Device according to one of claims 1 - 9, **characterised in that** drive means (8) of the second type are fitted along several parts of the path, in each case where a printing roller is fitted, which drive means can take over the movement of each holding means (4) and can ensure accurate positioning thereof in place and time along these parts of the path.

11. Device according to claim 1, **characterised in that** the holding means (4) and the transfer means (57) are both provided with one or more stop cams (55, 56), by means of which both means can lie very accurately positioned against each other.

12. Device according to claim 11, **characterised in that** when the transfer means (57) is resting with the stop cam (55) against the stop cam (56) of the holding means (4) the transfer means (57) is running at the same speed as the holding means (4).

13. Device according to one or more of claims 1 - 12, **characterised in that** the device can interact with discharge means for removing articles (5) for printing from the holding means (4), which are situated in an end position and comprise a conveyor (10) which is disposed in line with the path at a slight distance from the end thereof, at which end the chain or toothed belt (6) with holding means (4) fixed thereon is deflected by a pulley (7), from which conveyor (10) the distance to the chain or toothed belt (6) is in each case temporarily increased, in order to allow each holding means to pass unimpeded, and which conveyor (10) serves to

discharge articles (5) coming from the holding means (4).

14. Device according to claim 13, **characterised in that** the discharge means also comprise a second conveyor (9), which is fitted before the end of and essentially parallel to the path, which conveyor takes over the carrying of the articles (5) from the holding means (4) and guides said articles to the conveyor (10) situated essentially in line with the path.

15. Screen printing machine, comprising a printing roller (25) and supporting roller (26) interacting therewith, between which rollers the articles (5) for printing can be moved and printed, and in which the printing roller consists of two rigid annular ends (33) which are interconnected by a rigid bridge (34), and on which printing roller a screen (35) is stretched over a part of the periphery, which screen is fixed in the peripheral direction by register pins (36) fitted on the bridge between the annular ends (33), and which screen (35) is pretensioned in the axial direction, and in the inside of which printing roller (25) a squeegee (31) which does not move with it is fitted, for pressing printing medium out through the screen (35), the machine comprising a device according to one or more of the preceding claims 1 - 14.

16. Screen printing machine according to claim 15, **characterised in that** a recess (29) is provided in the supporting roller (26), for allowing the holding means (4) through between the printing roller (25) and the supporting roller.

17. Screen printing machine according to claim 15 or 16, **characterised in that** the screen (35) is provided with strips along the edges, extending in the peripheral direction of the printing roller (25).

18. Screen printing machine according to claim 17, **characterised in that** the screen (35) can be tensioned in the axial direction by two cylindrical rings (30, 37) gripping behind the strips.

19. Screen printing machine according to one of claims 15 - 18, **characterised in that** the squeegee (31) can be removed from the inside of the printing roller (25) while the bridge (34) is passing.

20. Screen printing machine according to claim 19, **characterised in that** a cam (38) which imposes the movement of the squeegee (31) is fitted on the inside of the printing roller (25).

21. Screen printing machine according to one of claims 15 - 20, **characterised in that** the printing roller (25) can be adjusted in longitudinal register by two meshing gear wheels (38, 40) with oblique teeth, for which purpose one of these two gear wheels can be shifted along its axis of rotation. 5
22. Screen printing machine according to one of claims 15 - 21, **characterised in that** the printing roller (25) has an adjustment facility for adjusting the distance relative to the supporting roller (26) through the fact that the printing roller (25) is mounted on bearings in a disc (60) which is disposed eccentrically relative to the printing roller, is mounted on bearings in the screen printing machine, and can be rotated by a drive means. 10 15

20

25

30

35

40

45

50

55

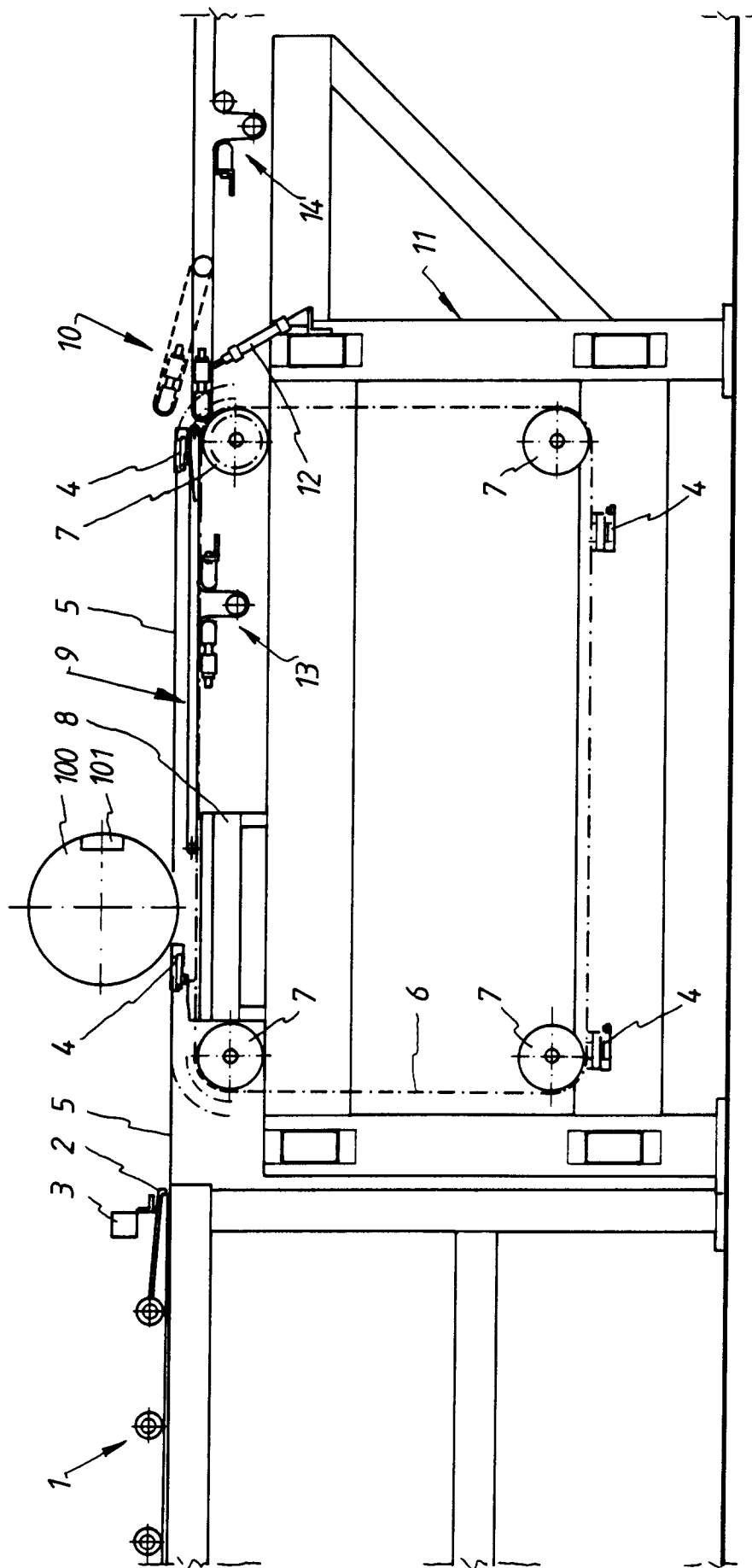


FIG. 1

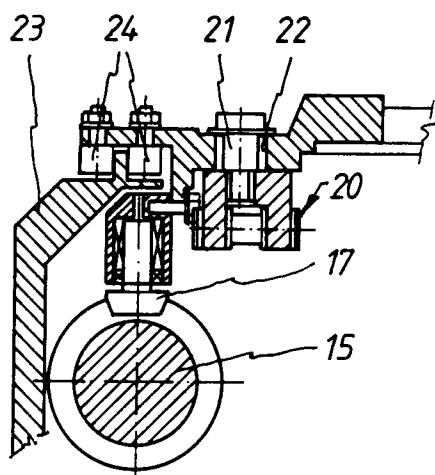


Fig. 2b

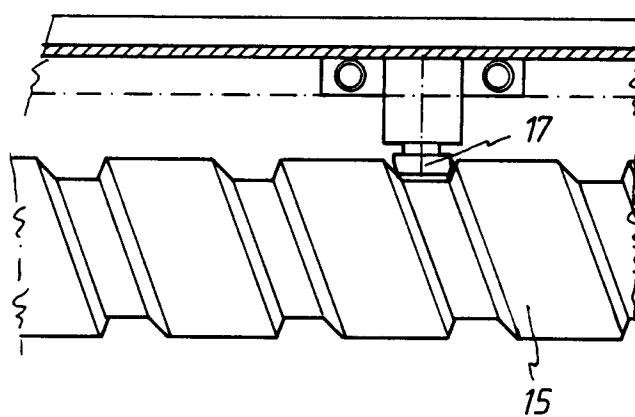


Fig. 2a

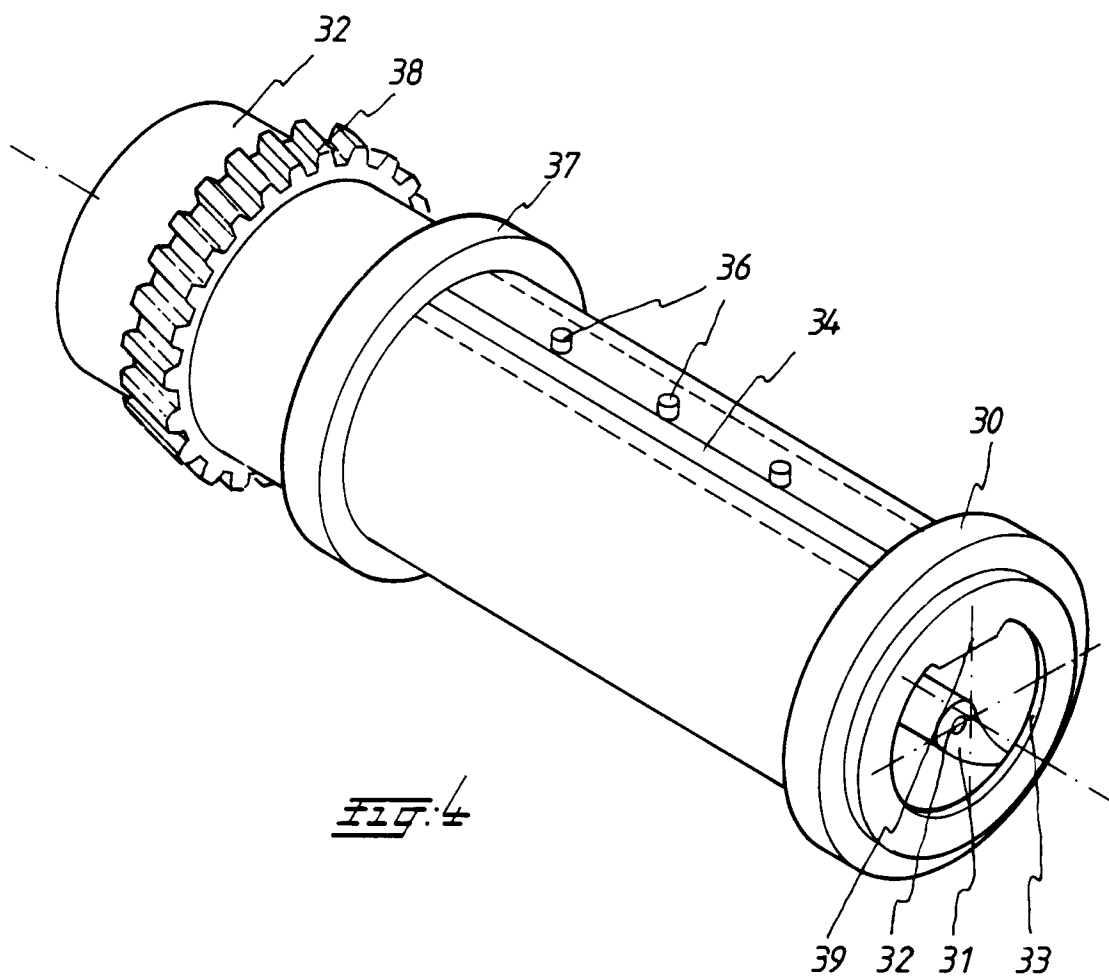
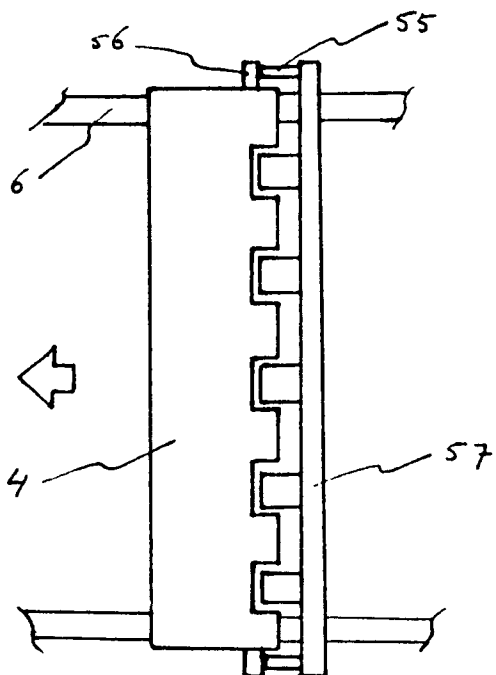
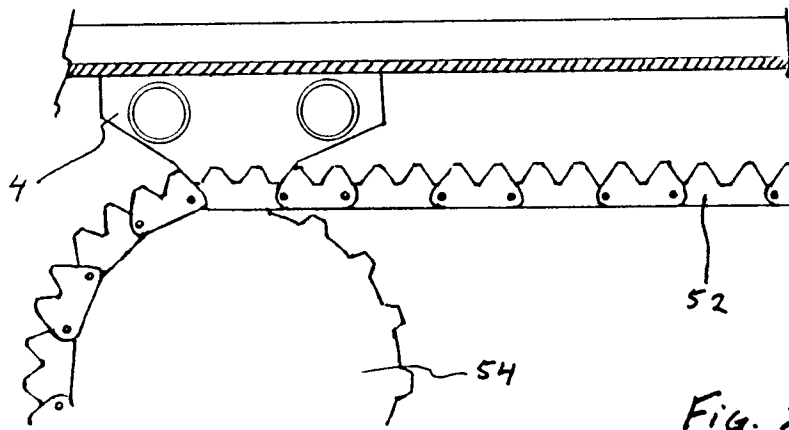
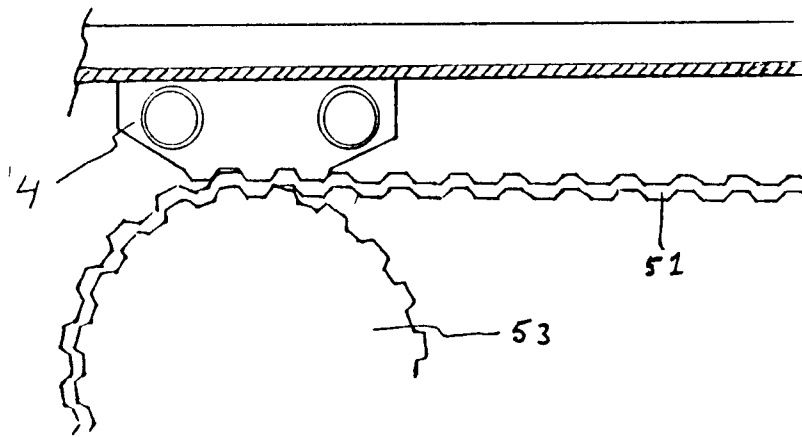
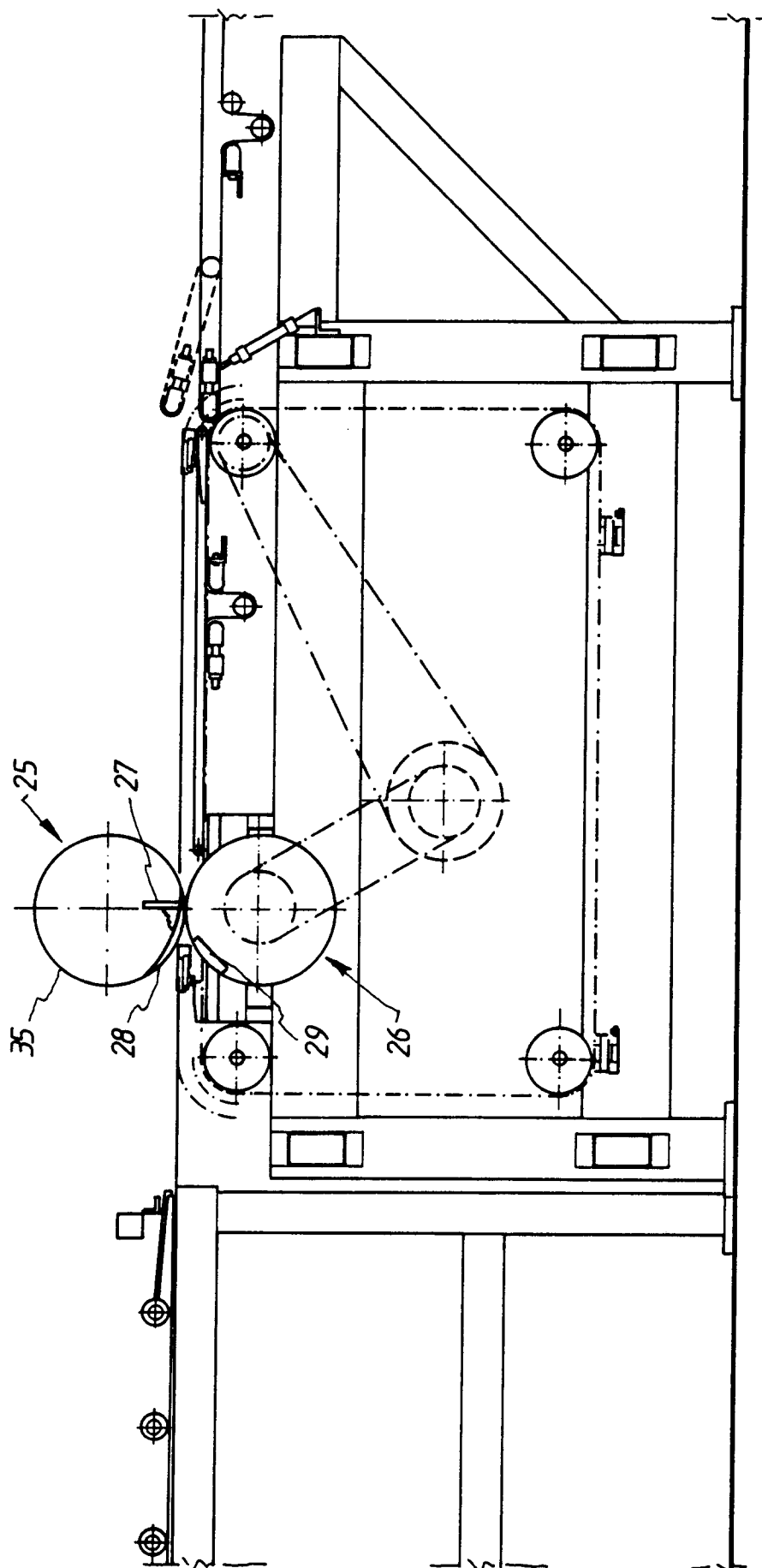


Fig. 4





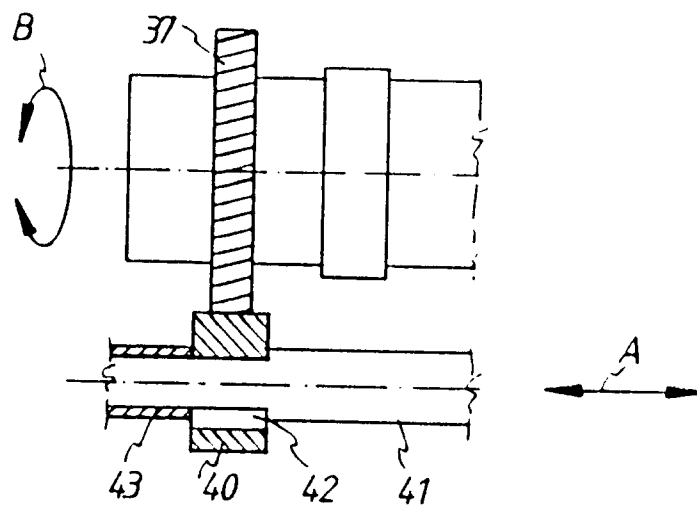


Fig. 5

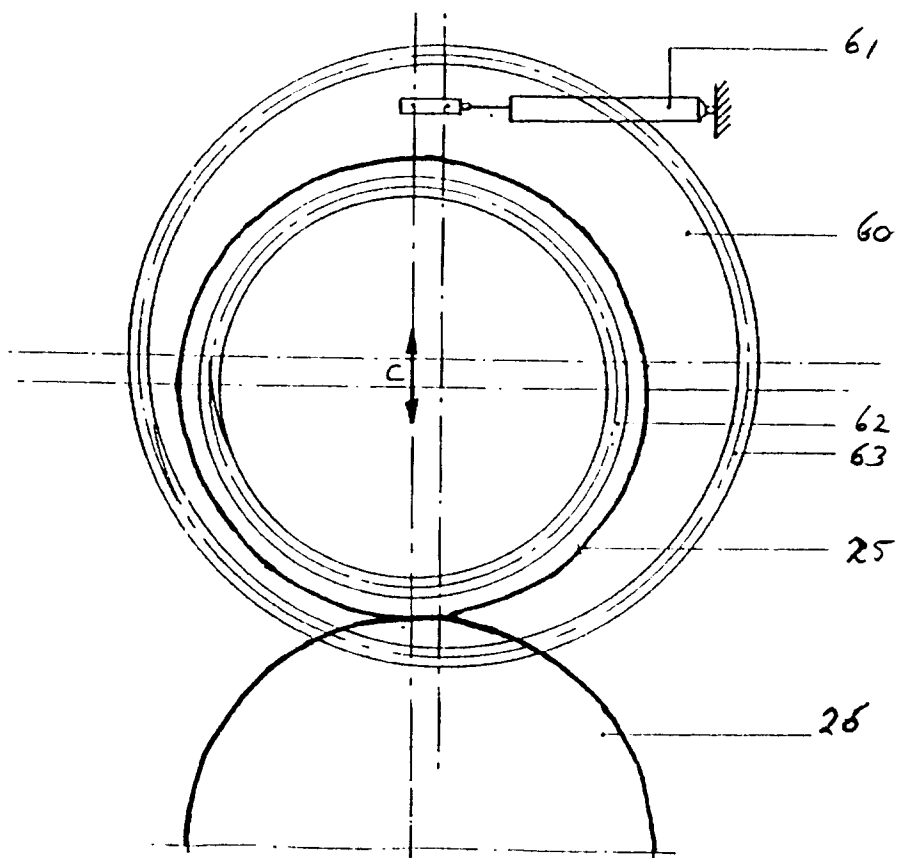


Fig. 6.



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 93 20 0783

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,A	US-A-3 853 315 (H. P. DAHLGREN) * the whole document *	1	B41F15/16 B41F15/28

A	US-A-2 363 137 (H. H. MELTCALF) ---	15	

A	US-A-3 155 034 (G. W. REINKE) * the whole document *	15-20	

A	DE-A-4 039 700 (RISO KAGAKU CORP.) * the whole document *	15	

A	US-A-2 660 115 (M. RAS) ---	21	

A	FR-A-338 658 (A. B. DICK COMPANY) ---	15	

A	US-A-4 081 723 (VETTER ET AL.) * the whole document *	1	

A	EP-A-0 218 860 (INTERNATIONAL BUSINESS MACHINES CORPORATION) * the whole document *	1	

A	US-A-2 364 277 (J. B. DEY ET AL) ---	1	

A	FR-A-2 272 838 (ALMEDAHL AKTIEBOLAGET) * the whole document *	15	B41F H05K B41L

A	US-A-2 703 526 (G. H. HANSSON) * the whole document *	1	

A	DE-A-3 629 003 (HALLER, HERBERT) ---	1	

A	PATENT ABSTRACTS OF JAPAN vol. 012, no. 294 (M-730)11 August 1988 & JP-A-63 071 349 (MATSUSHITA ELECTRIC IND CO) * abstract *	15	

The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 09 JUNE 1993	Examiner MEULEMANS J.P.
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 P : intermediate document T : theory or principle underlying the invention 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			