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(54) **A method for setting a position of printing bodies in machines for flexographic printing**

(57) In a method for setting a contact position of a printing roller with a central drum and an anilox roller with the printing roller in machines for flexographic printing, in which the printing roller and the anilox roller are activated in translation by at least an electric motor along a nearing/distanceing direction between a no-contact position and a contact position and a contact position with the drum, respectively with the roller associated thereto, supply of an electric current to the electric motor (30,40) is commanded in accordance with a reference value, corresponding to a value of the current which value is just sufficient to cause translation of the roller along said nearing/distanceing direction (D), to which a determined angular velocity of the electric motor corresponds. An encoder is then used to detect a lag between said angular velocity and the actual angular velocity, which sharply decreases at a moment of contact between the rollers. The electric motor is then halted and the encoder is used to measure an exact linear distance travelled by the roller up to the halting of the electric motor.

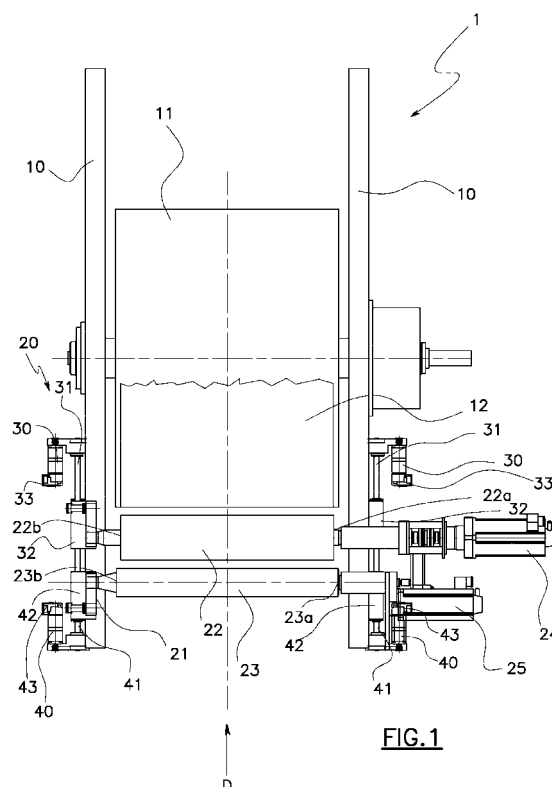


FIG. 1

Description

[0001] The present invention generally relates to machines for flexographic printing, comprising a central printing drum which supports the sheet which is to be printed on, with which one or more printing groups are placed in contact. The printing groups comprise a printing roller which bears a printing plate and an inking roller of the plate, known as an anilox roller.

[0002] In machines of the above-described type a first pair of electric motors moves the printing roller of each printing group towards/away from the central drum, and a second pair of electric motors moves the anilox roller of each printing group towards/away from the respective printing roller.

[0003] Each printing roller and each anilox roller exhibits ends that are slidable on a guide, and a motor is associated to each end which causes linear translations thereof.

[0004] Each motor is generally associated to a transducer device of the angular position of the drive shaft to which a linear position of the printing roller and/or of the inking roller or anilox rollers corresponds.

[0005] A recognised problem in these known-type flexographic printing machines is in determining the printing position of the printing rollers in relation to the drum, with the aim of guaranteeing sufficient printing pressure, though not excessive, as excess of printing pressure would damage the printing plates used, with repercussions on the printing quality.

[0006] The same problem is encountered in determining the reciprocal position between the anilox rollers and the respective printing roller.

[0007] To solve this problem visual setting systems are known for the position of the printing rollers and the inking rollers, based on an operator's visual evaluation, or on automated optical-type systems.

[0008] A known setting method of the printing and respective anilox rollers, described in detail in European patent application EP 2 085 223, consists in moving a printing roller towards the central drum and visually determining that a contact position has been reached between the printing roller (from which surface the printing plates project) and the central drum.

[0009] After repeated trials the best position of the printing roller is established, such as to guarantee good printing quality while not damaging the printing plates. This method therefore comprises a visual and experimental evaluation of the correct contact position between the printing roller and the drum.

[0010] The same activities are carried out in determining the contact between the printing roller and the respective inking roller.

Visual or experimental determination is not free of errors and does not guarantee that the printing plate is free of risk of damage, during the setting operations, by a possible excessive pressure which might obtain during the reciprocal nearing between the printing roller and the

central drum and likewise between the inking roller and the printing roller.

[0011] The aim of the present invention is to establish a setting method for positioning between a first and a second roller of a machine, for example for determining the reciprocal position between a printing roller and the drum and between the inking roller and the relative printing roller, which is free of the drawbacks existing in the prior art.

[0012] In particular, the aim of the present method is to determine automatically and repeatably the contact position between the printing roller and/or the printing plate supported thereby with the central drum, as well as the contact position between the inking roller with the printing roller and/or the printing plate supported thereby, independently of a visual analysis.

[0013] Following determination of the contact positions the present method calculates the effective distance between the detected contact positions and the desired non-contact positions defined for the printing roller and the inking roller, respectively.

[0014] The calculated distances will enable, in the use conditions of the machine, the correct automatic positioning of the printing rollers and the respective inking rollers in the respective contact positions with the central drum and the printing roller destined for carrying out the printing.

[0015] The aims are attained by a method having the characteristics recited in independent claim 1; the dependent claims delineate preferred and/or particularly advantageous aspects of the invention.

[0016] In particular, the invention provides a method for setting a reciprocal positioning of the two rollers, the central drum and the printing roller, or the printing roller and the inking roller.

[0017] One of the rollers is activated in translation by at least an electric motor along a reciprocal nearing-distancing direction, between a reciprocal non-contact position and a reciprocal contact position.

[0018] In the invention, the contact position to which corresponds the correct pressure between the printing roller and the central drum is the position which obtains when the printing roller halts against the drum when the motor commanding the translation of the printing roller is activated with the value of the minimum current sufficient to cause the translation of the printing roller, which will be called the reference value.

[0019] The same obviously applies in relation to the contact pressure between the anilox roller and the printing roller.

[0020] A transducer device of the angular position of the rotor of the electric motor is comprised, which indicates the linear trajectory of the roller associated to the motor.

[0021] The method of the invention also comprises the activity of commanding electric current supply to the electric motor using the reference value, in order to bring about translation of the roller moved by the motor along

the nearing direction to the roller associated thereto.

[0022] A determined velocity of the electric motor corresponds to

the reference value of the current, and it is thus possible to detect, by means of an encoder, a lag between the velocity and the instant advancement velocity, which obviously sharply declines at the moment of contact between the rollers.

[0023] This difference, or lag, determines the correct contact position between the rollers.

[0024] The optimal pressure between the rollers is thus determined by the angular difference between the theoretical position of the rotor and the stator of the electric motor, and the reciprocal position thereof following reciprocal contact between the first roller and the second roller.

[0025] As has been mentioned, the first roller can be taken to be the central drum and in this case the second roller is the printing roller; alternatively the first roller can be taken to be the printing roller and therefore the second roller is the relative inking roller.

[0026] In this way the detection of the optimal printing pressure is a function of the contact position between the printing roller and the drum (and between the inking roller and respectively the printing roller), without its being necessary, for determining the optimal pressure, to take careful and expensive measurements of the distance between the rollers.

[0027] In a preferred aspect, the method of the invention comprises steps of determining a zero position, in which the second roller is in a non-contact position with the first roller, and a step of memorising the distance moved by the second roller between the zero position and the position in which the difference (lag) has been detected.

[0028] To determine the reference value of the current, i.e. the minimum sufficient value for causing translation of the printing roller towards the drum, and between the anilox roller and the printing roller, or the reference current, the invention includes the following steps:

- a) setting a test value of the supply current to the motor which is broadly known to be insufficient to set the rotor in rotation;
- b) commanding the setting of the electric current to the electric motor according to the test value;
- c) progressively increasing the test value up to when the rotor begins to rotate;
- d) memorising the value at which the rotor begins rotating.

[0029] In this way an optimal current to supply the motor with is established, i.e. the minimum current which causes a displacement of the rotor (reference current).

[0030] This current enables advancing the roller at a known velocity, small, controlled and constant, and therefore enables a precise determination to be made of the contact position between the rollers, guaranteeing at the

same time safeguarding of the printing plate mounted on the printing roller.

[0031] The invention further comprises the step of manually setting a maximum travel of the roller associated to the motor along the nearing/distancing direction of the other roller, at the end of which an error is signalled and the electric motor is commanded to return the respective roller into the zero position.

[0032] Obviously the maximum travel will be just above the travel corresponding to the contact position between the rollers determined in the above-indicated way.

[0033] In this way the printing plate is protected, even in a case of malfunctioning of the transducer of the angular position.

[0034] In a case in which the printing machine comprises a pair of electric motors for each of the rollers, the optimal printing pressure between the rollers is determined, as described above, independently for each of the electric motors.

[0035] This solution enables a determination to be made, for each motor involved in the movement of a roller, of the exact run which enables obtaining the optimal pressure exerted by the roller.

[0036] Further characteristics and advantages of the invention will emerge from a reading of the following description, provided by way of non-limiting example, with the aid of the figures illustrated in the accompanying tables of drawings.

Figure 1 is a schematic plan view of a machine of flexographic printing, according to the invention.

Figure 2 is a lateral view of figure 1.

Figure 3 is a flow chart of the functioning of the setting method of the invention.

Figure 4 is a flow chart of the step of determining the minimum supply current for each motor.

[0037] With reference to the figures of the drawings, 1 denotes in its entirety a machine for flexographic printing.

[0038] The machine 1 comprises a frame 10, on which a motorised central drum 11 is mounted, which central drum 11 bears a sheet 12 to be printed, which sheet 12 can be at least partially wound on the central drum 11.

[0039] The machine 1 comprises at least a printing group 20, which is formed by a gantry associated to the frame 10 and rotatably supporting at least a printing roller 22 and a respective inking roller 23.

[0040] The printing roller 22, also known as a bearing plate, is destined to support one or more printing plates, not illustrated in the figures as of known type. The printing plates can be of different shape and thickness and vary according to the graphic element to be printed.

[0041] The printing roller 22 and the inking roller 23 are activated in rotation by respective motors 24 and 25.

[0042] The rotation axes of the printing roller 22, the inking roller 23 and the central drum 11 are substantially parallel.

[0043] The printing roller 22 is activated in translation

along special guides which are part of the gantry, in a direction D of nearing/distancing to or from the central drum 11 by two electric motors 30, independent of one another and supported by the scaffold and arranged laterally with respect to the printing roller 22.

[0044] Each of the electric motors 30 is destined to set in translation, along direction D, the respective distal ends 22a, 22b of the printing roller 22.

[0045] The printing roller 22 is mobile between a zero position, in which it is not in contact with the central drum 11, and a printing position, in which it is in contact with the central drum.

[0046] An endless screw 31 is associated to each electric motor 30, which screw 31 is arranged with a screw axis parallel to the direction D.

[0047] The distal ends 22a and 22b of the printing roller 22 are rotatably supported by two respective threaded bushings 32 that enmesh the endless screws 31 in order to activate the printing roller 22 in translation along direction D.

[0048] An encoder 33 is keyed on each motor 30, which encoder 33 is destined to determine both the angular position of the endless screw 31 of the rotor of the motor 30 and also the linear position of the bushing 32 when the motor 30 is supplied by the reference value of the current, and the eventual angular difference between the theoretical position of the rotor and the consequent contacting position between the rollers.

[0049] In this way the encoder 33 can calculate the linear distance run by the respective bushing 32 along the direction D up to the moment of contact. The inking roller 23 is activated in translation along direction D by two further electric motors 40, independent of one another, supported to the scaffold 21 and arranged laterally with respect to the inking roller 23.

[0050] Each of the electric motors 40 is destined to set the respective distal ends 23a, 23b of the inking roller 23 in translation along direction D, in a nearing and distancing direction to and from the printing roller 22.

[0051] The inking roller 23 is in turn mobile between a zero position, in which it is not in contact with the printing roller 22, and an inking position, in which it is in contact with the printing roller 22.

[0052] A respective endless screw 41 is associated to the rotor of each electric motor 40, which endless screw 41 is arranged with the screw axis thereof parallel to direction D.

[0053] The distal ends 23a and 23b of the inking roller 23 are rotatably supported by two respective further bushings 42 that are threaded and enmesh the endless screws 41 for translating activation of the inking roller 23 along the direction D.

[0054] An encoder 43 is keyed on each motor 40, destined to determine both the angular position of the endless screw 41 and the rotor of the motor 40, and thus also the linear position of the bushing 42 when the motor 40 is supplied by the reference value of the current, and the eventual angular lag between the theoretical position

of the rotor and the position consequent to contact between the rollers.

[0055] In this way the encoder 43 can calculate the linear distance travelled by the respective bushing 42 along the direction D up to the moment of contact. The machine 1 comprises a plurality of printing groups 20 as described above and independent of one another, for example one for each printing colour.

[0056] The electric motors 30 and 40 are step-motors.

[0057] Before setting the machine it is necessary to position all the printing rollers 22, provided with respective printing plates and the respective inking rollers 23 in the respective non-contact positions, with the drum and the printing roller respectively defining the respective zero positions.

[0058] It is further worthwhile to perform a preliminary verification step, using suitable control instruments, to make sure the printing rollers 22 are arranged with the rotation axes thereof substantially parallel to the rotation axis of the central drum 11 and, in turn, to make sure the inking rollers 23 are arranged with rotation axes thereof substantially parallel to the rotation axis of the respective printing roller.

[0059] Further, during the preliminary verification step it is advisable to determine the maximum travel between the single printing rollers and the central drum, as well as between the various inking rollers and the respective printing rollers, such as to prevent, during the following operating steps, any drawbacks connected with an excessive run of the printing roller and/or the inking roller, as will more fully emerge herein below.

[0060] With particular reference to figures 3 and 4, the method for setting the positioning of the rollers associated to the electric motors 30 and 40 comprises following steps:

the zero position for each end 22a and 22b of the printing roller 22 is determined, as is the zero position for each end 23a and 23b of the inking roller 23;
the value of the reference current of the motors 30 and 40 is determined as described herein above;
the reference current supply to one of the electric motors 30, 40 is then started, such as to determine the translation of the printing and anilox rollers along the direction D, nearing the associated roller, respectively the central drum 11 or the printing roller 22;
the onset of the lag is then detected when the printing roller 22 contacts the central drum 11 and the inking roller 23 contacts the printing roller 22; this difference being caused by the contact between the two, and halting rotation of the endless screw 31 and/or 41, and therefore the rotor.

[0061] The method is operable for each electric motor 30 which activates the printing roller 22 in translation and for each printing roller 22 of the machine 1 and, likewise, for each motor 40.

[0062] The reference current intensity differs for each

motor and is defined by the different mechanical inertias acting on the ends of the rollers, due, for example, to the weight of the motors 24 and 25 which bears on one alone of the roller ends.

[0063] When the difference has been detected, in the above-described way, between the rotor and the stator of each electric motor 30, 40 using the encoder 33, 43, memorisation is performed of the distance travelled by the ends 22a and 22b of the printing roller 22, and 23a, 23b of the inking roller between the zero point and the point in which the difference was read.

[0064] The memorised distance is the distance defining the contact position at the optimal printing pressure between the rollers.

[0065] The advancement velocity of each roller is determined by the value of the reference current supplied to the motors 30 and 40. The advancement velocity of the flexographic machine is preferably comprised between 1 and 6 metres per minute, advantageously between 1 and 2 metres per minute. The maximum run of each roller is preferably 0.4 mm (settable value) beyond the pre-detected distance during the preliminary verification step.

[0066] On reaching the maximum run, an error message is signalled, such that it is possible to repeat the above-described setting operations.

[0067] This maximum run enables, in the present example, the printing plate to be safeguarded in a case of encoder 33 malfunctioning.

[0068] The invention is susceptible to numerous modifications and variants, all falling within the ambit of the inventive concept, without forsaking the ambit of protection as set out in the following claims.

Claims

1. A method for determining the contact pressure between the printing roller (22) and the central drum (11) and between the inking roller (23) and the printing roller (22) in machines for flexographic printing, in which the printing roller (22) and the inking roller (23) are activated in translation by at least an electric motor (30, 40) along a nearing/distancing direction (D) between a no-contact position and a contact position respectively with the central drum and the printing roller associated thereto, **characterised in that:**

it commands the supply of an electric current to the electric motor (30, 40), in accordance with a reference value, corresponding to a value of the current which value is just sufficient to cause translation of the roller (22, 23) along the direction (D), to which a determined angular velocity of the electric motor (30, 40) corresponds; detecting, by means of an encoder (33, 43), a lag between said angular velocity of the electric motor (30, 40) and the actual angular velocity

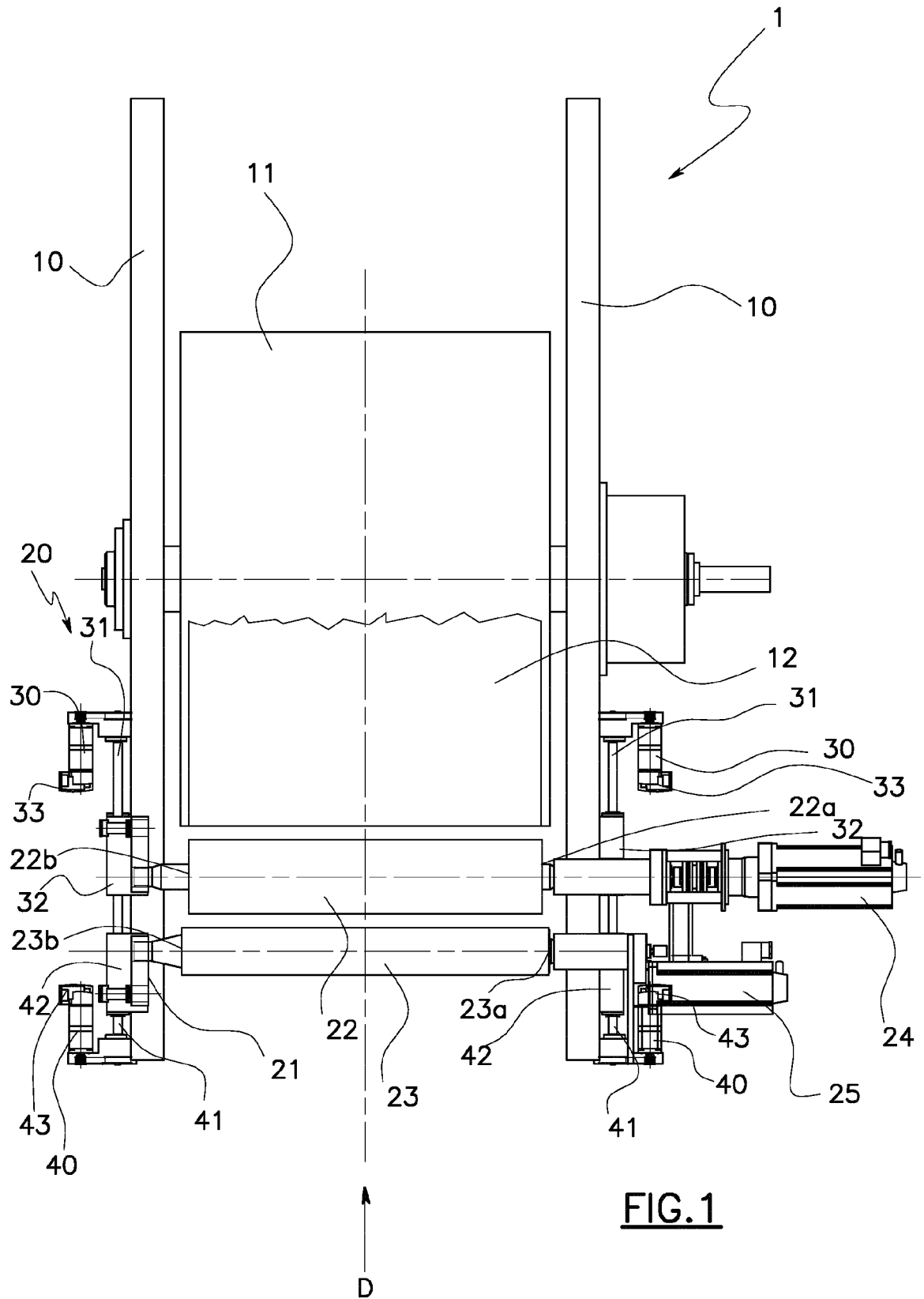
which sharply decreases at a moment of the first contact between the rollers; halting the functioning of the electric motor (30, 40), following said lag; and measuring, via the encoder (33, 43), an exact linear distance travelled by the roller (22, 23) from the non contact position, to the position at which the halting of the electric motor (30, 40) occurs, so as to determine the optimum pressure between the rollers depending from the detected lag.

2. The method of claim 1, **characterised in that** it comprises steps of determining a zero position, in which the roller (22, 23) moved by the electric motor (30, 40) is in a no-contact position with the roller (11, 22) associated thereto, and memorising the distance travelled by the roller (22, 23) moved by the electric motor (30, 40) between the zero position and the position in which the lag was detected.

3. The method of claim 1, **characterised in that** the value of the reference current is determined as follows:

a test value of the supply current of the electric motor (30, 40) is set, which value is insufficient to set the rotor in rotation; supply of electric current to the electric motor (30, 40) is commanded in accordance with the test value; the test value is increased up until the rotor begins to rotate; the reference current is taken to be the current which corresponds to the start of the motion of the electric motor (30, 40).

4. The method of claim 1, **characterised in that** it comprises a step of setting a maximum travel for each roller (22, 23) moved by the electric motor (30, 40) along the respective direction (D), on reaching which maximum travel an error is signalled.
5. The method of one or more of claims from 1 to 4, wherein the printing machine comprises a pair of electric motors (30, 40) for each roller (22, 23) to be moved, **characterised in that** the optimal pressure between the rollers is determined according to the lag detected for each of the electric motors (30, 40) independently.



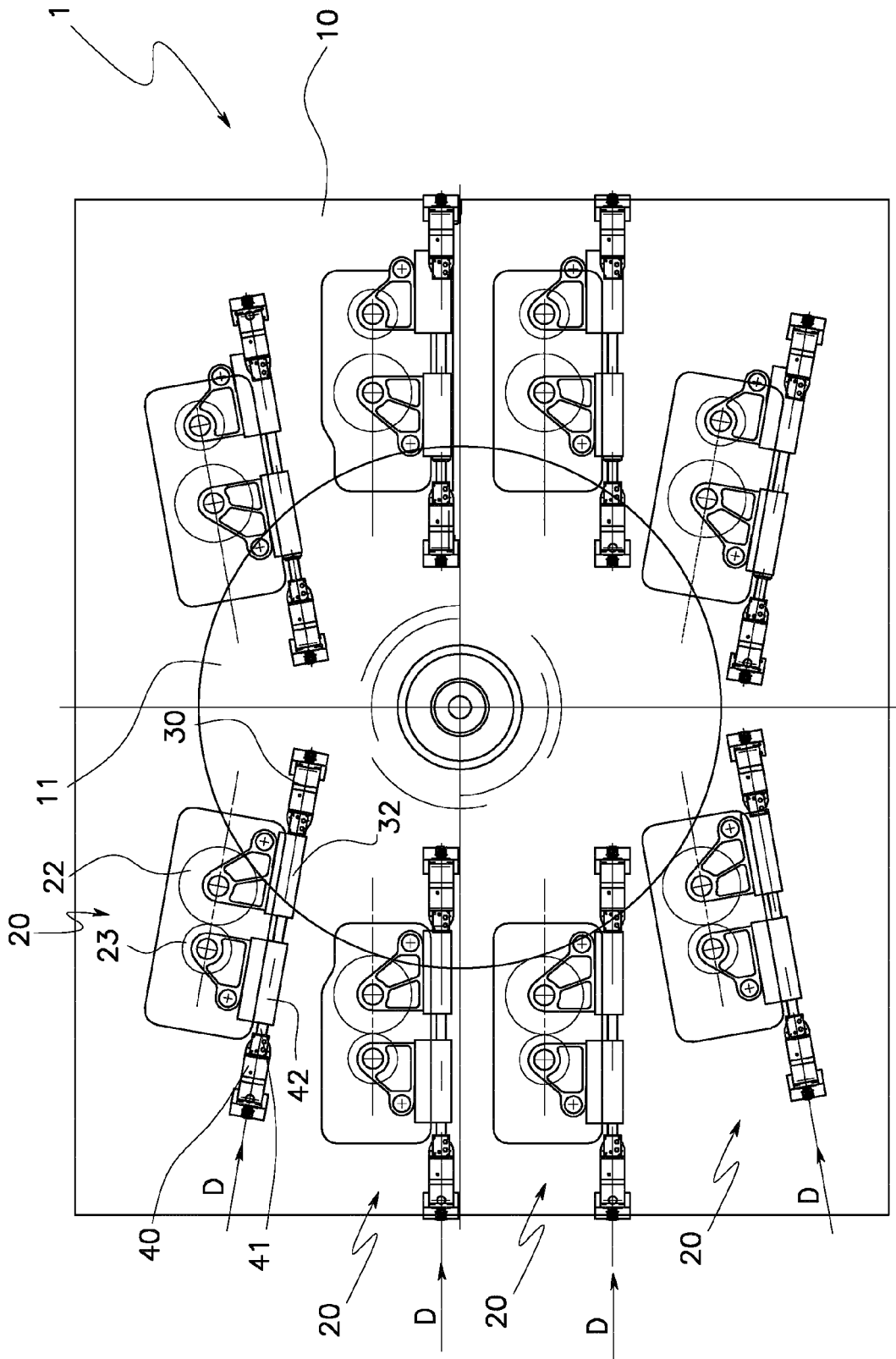


FIG. 2

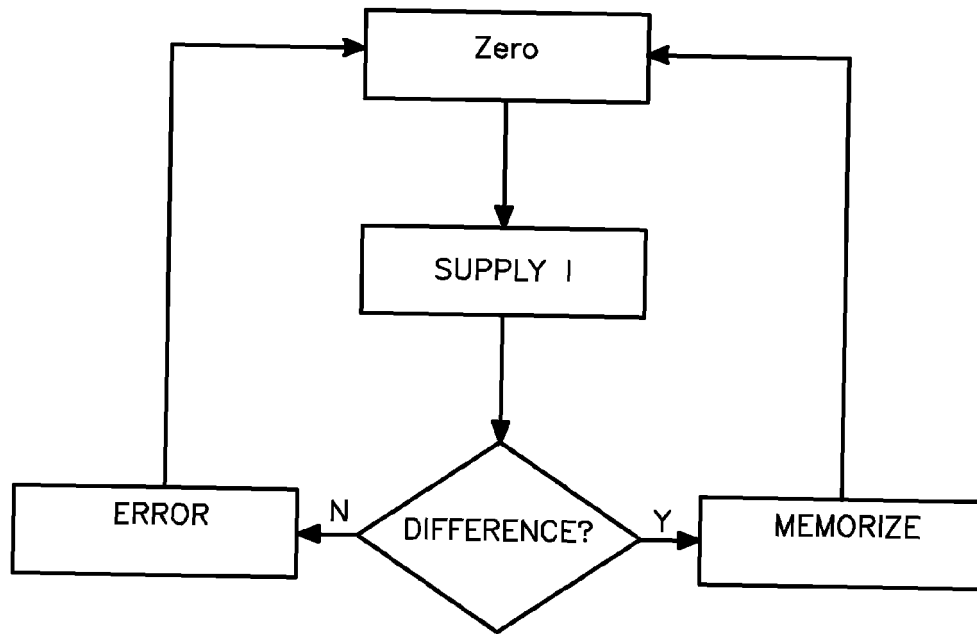


FIG.3

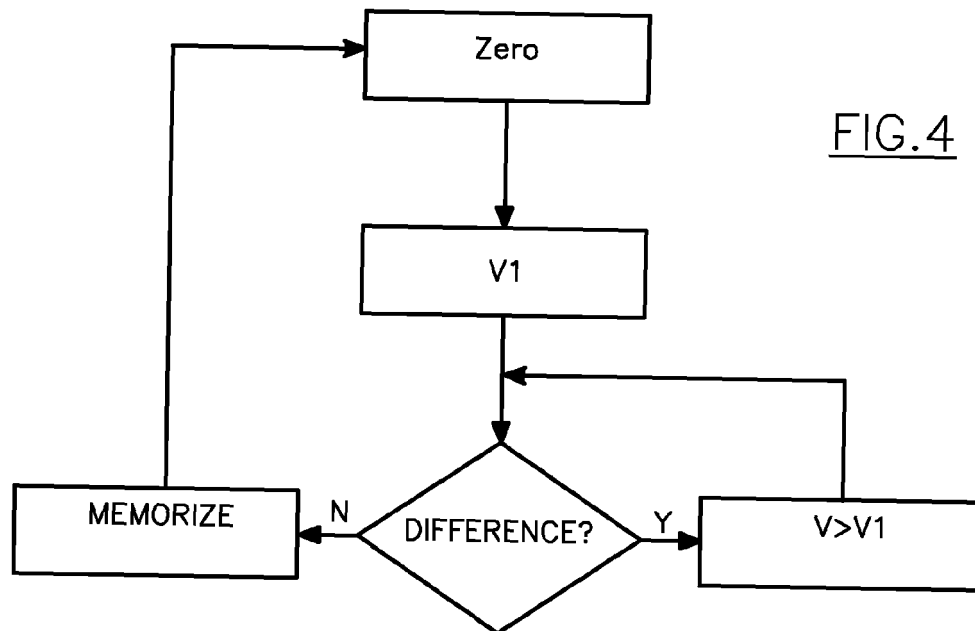


FIG.4



EUROPEAN SEARCH REPORT

Application Number
EP 11 18 6300

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	EP 2 085 223 A1 (COMEXI SA [ES]) 5 August 2009 (2009-08-05) * abstract * * paragraphs [0001] - [0005], [0009] - [0012], [0017] - [0031], [0038], [0040] - [0042], [0046] * * figures 1-4b *	1-5	INV. B41F5/24 B41F13/38 B41F31/32 B41F33/08 B41F33/10 B41F33/14
A	EP 1 018 426 A1 (FISCHER & KRECKE GMBH & CO [DE]) 12 July 2000 (2000-07-12) * abstract * * paragraphs [0006], [0011], [0015], [0018], [0021] * * figures 1-4 *	1-5	
A	EP 2 123 455 A1 (COMEXI SA [ES]) 25 November 2009 (2009-11-25) * abstract * * paragraphs [0002], [0004], [0009] - [0011], [0013], [0020], [0022] - [0023] * * figures 4-17 *	1-5	
			TECHNICAL FIELDS SEARCHED (IPC)
			B41F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 5 December 2011	Examiner Bellofiore, Vincenzo
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 11 18 6300

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05-12-2011

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