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(54) **Control unit for "pilgrim step" operation of the detaching cylinders in a combing machine**

Steuereinheit für die "Pilgerschrittbewegung" der Abreisswalzen einer Kämmmaschine

Unité de contrôle pour l'opération "pas de pèlerin" des cylindres arracheurs d'une machine de peignage

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Description

[0001] The present invention relates to a control unit for "pilgrim step" operation of the detaching cylinders of a combing machine.

[0002] As is known, combing machines are used to comb natural textile fibres; this operation consists in positioning the fibres in a parallel direction, to make them suitable for subsequent spinning treatments.

[0003] To perform this combing operation of the textile fibres, known combing machines are provided with a plurality of components that act on the textile fibres and operate in synchronism.

[0004] In particular, combing is performed by means of a circular comb with a toothed sector to penetrate between the fibre cloth tufts, so that the teeth of the toothed sector remove the short fibres.

[0005] Moreover, a group of detaching cylinders moves the combed fibre tuft forwards and backwards, according to a movement commonly known as "pilgrim step", in synchronism with the movement of the circular comb.

[0006] An example of such a combing machine is described in the patent. IT 1 222 820.

[0007] In the first known system, a cam, provided with uniform rotary motion, engages with contrast rollers that provide alternate movement to a connecting rod, the latter being joined to an end of a forked arm, mounted on a shaft entering a differential.

[0008] Splined on this shaft is a toothed wheel or planetary gear that engages another three input planet wheels, in turn connected to output planet wheels that engage an output planetary gear, flanged on which is a gear.

[0009] This gear meshes with a pair of spools, fitted at the ends of respective spindles, provided with a splined portion, and realising the detaching cylinders.

[0010] By means of this combination of components, alternate movement of the connecting rod is transmitted to the detaching cylinders to perform "pilgrim step" movement of these.

[0011] Nonetheless, in this system, there are components to transmit motion to the detaching cylinders, such as the connecting rod, provided with alternate movement, which must thus be started, stopped and made to start up again in the opposite direction, which is somewhat wasteful from the point of view of energy and also the source of undesired excessive stress on the machine.

[0012] A second known system is described in the patent No. EP 0 374 723.

[0013] According to this solution, "pilgrim step" movement of the detaching cylinders is obtained using an electric motor, in particular a brushless motor, to operate the detaching cylinders by means of suitable reduction components.

[0014] The electric motor is fed with electrical impulses synchronised with the rotary movement of the circular combs; moreover, the electric motor is reversible, so that the detaching cylinders can rotate both forwards and backwards.

[0015] Although devices of this second type are able to perform the function for which they have been designed, they have the shortcoming that the motors to operate the detaching cylinders must be stopped and started up again.

[0016] Therefore, the object of the present invention is to create a control unit for operation of detaching cylinders in a combing machine that allows the above problems to be solved, permitting efficient operation of the combing machine.

[0017] Another object of the present invention is to create a control unit for operation of the detaching cylinders that allows better operating characteristics and greater overall efficiency of the combing machine to be obtained, together with decreased wear through time, owing to reduced stress.

[0018] Yet another object of the present invention is to present a control unit for operation of detaching cylinders that can be set at work in a simple and inexpensive manner, without the need to use costly materials or complex technologies.

[0019] These and other objects are achieved with a control unit for "pilgrim step" operation of the detaching cylinders in a combing machine, according to claim 1, to be referred to for brevity.

[0020] Further characteristics of the present invention are defined, moreover, in the subsequent claims.

[0021] Further objects and advantages of the present invention will emerge more clearly from the description below and appended drawings, provided as a purely exemplary and non-limiting example, in which:

- figure 1 represents a side elevation of the main components inside the combing machine, which are used to comb the fibres;
- figure 2 represents an axonometric projection of the control unit for operation of the detaching cylinders in a combing machine, according to the present invention;
- figure 3 represents a diagram showing the operating curves of the control unit in figure 2; and
- figure 4 represents a diagram showing the operating curves of a control unit, according to another embodiment of the present invention.

[0022] With specific reference to the figures mentioned, all components used for the combing operation are indicated globally with the numeric reference 30, while the control unit for operation of the detaching cylinders, according to the present invention is indicated globally with the numeric reference 10.

[0023] As the structure of the combing machine is well-known in the art it is not further described in detail herein; therefore, only the operating components useful for the interpretation and embodiment of the invention are mentioned.

[0024] Figure 1 shows the components 30 used for combing operations, in a combing machine.

[0025] In this a feed cylinder 33 guides a fibre cloth 32 in the combing zone, formed essentially of a nipper unit 31, collaborating with a circular comb 18, made to rotate by a main motor and equipped with a toothed sector 19, in turn collaborating with a unit of detaching cylinders 22, 23, 22' and 23'.

[0026] In particular, combing of the textile fibres is performed by the action of the toothed sector 19 which penetrates between the tufts of the fibre cloth 32, by means of its uniform rotation, while the detaching cylinders 22, 23, 22' and 23' move the fibre cloth 32 forwards and backwards, according to the movement known as "pilgrim step".

[0027] This description makes it easier to understand the structure and operation of the control unit 10 for operating the detaching cylinders 22 and 23 of the combing machine, according to the present invention.

[0028] With reference to figure 2, the control unit 10 has an electric motor 11 that rotates a shaft 12.

[0029] Mounted idle on the shaft 12 is a planetary gear 13, equipped with a planet wheel 14, mounted idle on an input disk 20.

[0030] The planetary gear 13 also has a toothed wheel 15 that is engaged by a corresponding toothed wheel 16, operated by the main electric motor of the combing machine (not shown for simplicity).

[0031] A shaft 17 is also splined to the toothed wheel 16; this rotates the circular comb 18 of the combing machine, equipped with its toothed sector 19.

[0032] The planet wheel 14, mounted on the planetary gear 13 on the input disk 20, is idle and is rotated by rotation of the shaft 12, by engaging with the pinion 12', and is connected, by means of an output disk 20' to another planet wheel 14' that transmits its motion to a transmission component 21, which is idle and connected by its toothed wheel to the detaching cylinders 22 and 23.

[0033] The planet wheel 14' transmits its motion to the transmission component 21, by means of the toothed pinion 12''.

[0034] The shaft 17 is rotated uniformly by the main electric motor, in order to make the circular comb 18 of the combing machine rotate uniformly.

[0035] Besides this function, the shaft 17 transmits, by means of the toothed wheel 16, its rotary motion to the toothed wheel 15, connected to the planetary gear 13.

[0036] This motion rotates the planetary gear 13 and in particular the input disk 20 and corresponding planet wheel 14.

[0037] Simultaneously, the secondary or modulating electric motor 11 rotates the shaft 12, according to a specific law of motion better illustrated below.

[0038] Therefore, the planet wheel 14, mounted idle and already rotating in one direction due to the motion imparted by the input disk 20, receives rotary motion in the opposite direction from its mesh with the pinion 12', to function like a differential device.

[0039] This complex movement is transmitted, through the output disk 20', to the planet wheel 14, which in turn transmits it to the transmission component 21, from where it is transmitted to the detaching cylinders 22 and 23.

[0040] When the fibre cloth 32 moves forwards and backwards, the detaching cylinders 22' and 23', which are idle, move with it.

[0041] Going into greater detail in the description of movement, it can be seen that the motor that rotates the shaft 17 of the circular comb 18 is operated with uniform rotary motion, where this motion is indicated in the graph in figure 3 with a straight line inclined upwards (straight line A).

[0042] Incidentally, in the graphs in figures 3-4 it can be seen that the phase index has been indicated on the abscissa; according to a commonly used convention in the technical sector of the invention, this has been divided into 40 parts corresponding to a round angle.

[0043] The ordinate indicates the millimetres of forward or backward movement of the various components involved in the control unit of the invention.

[0044] The secondary motor 11, is instead operated with a law of motion represented in the lower half of the same graph with the modulated curve B, where in the course of one turn there is slight acceleration followed by slight deceleration in relation to a mean value.

[0045] The resulting motion on the detaching cylinders 22 and 23 is given, due to interaction of the components of the control unit 10 described previously, by the algebraic sum of the values of the curves A and B, represented in the curve C.

[0046] This motion has the characteristics typical to "pilgrim step" motion, in which a phase of slight backward movement is followed by a forward phase.

[0047] It is important to point out that, according to the invention, this motion is obtained by combining the action of two electric motors, each of which operates without having to stop and without having to change the direction of rotation, as both motors mesh at all times.

[0048] A second alternative embodiment of the invention envisages that the shaft 17 is always operated with uniform rotary motion, but with different values.

[0049] In the case in figure 3, rotation A of the shaft 17 connected to the first motor is represented with positive value, while modulated rotation B is represented with a negative value, that is in opposite rotation.

[0050] The absolute value of A is prevails over the value of B and therefore their sum C is positive.

[0051] In the case in Figure 4, rotation A' of the shaft 17 connected to the first motor is represented with a negative value, while modulated rotation B' in the opposite direction, that is first accelerated and then decelerated, is represented with a positive value.

[0052] In fact, in the graph in figure 4, a straight line inclined downwards (straight line A') indicates the uniform rotary motion that operates the shaft 17, the curve B' indicates the law of motion of the motor 11 and the

curve C' indicates the law of motion resulting from the algebraic sum of the values of the curves A' and B', which is analogous to the law of motion of the curve C and which represents the motion resulting on the detaching cylinders 22 and 23.

[0053] The description gives a clear explanation of the characteristics of the control unit for operation of the detaching cylinders in a combing machine, which is the object of the present invention, and of the advantages.

[0054] To better identify these advantages the following considerations are expounded below.

[0055] With the device of the present invention it is possible to obtain specific "pilgrim step" motion on the detaching cylinders, with only two electric motors, and without requiring to stop the motors and/or change their direction of rotation.

[0056] Moreover, the two motors mesh at all times.

[0057] Lastly, it is clear that numerous variation may be made to the control unit for operation of the detaching cylinders in a combing machine, which is the object of the present invention, without departing from the principles of intrinsic novelty of the invention as defined by the claims.

[0058] In the practical embodiment of the invention, the materials, shapes and dimensions of the details illustrated may vary according to requirements and these may be replaced with others that are technically equivalent.

Claims

1. Control unit (10) for "pilgrim step" operation of the detaching cylinders (22, 23) in a combing machine, comprising a first electric motor, which rotates with uniform motion all the main components of the aforesaid combing machine deriving motion from a shaft (17) of its own and a second electric motor (11), which rotates a shaft (12), said shaft (12) housing the components to transmit motion to said detaching cylinders (22, 23), **characterised in that** said first electric motor also acts on some of the components of the control unit (10) to transmit motion to the detaching cylinders (22, 23), and said second motor (11) is provided with means of operation with a unidirectional law of motion comprising acceleration and deceleration phases, where both said first and second motor mesh at all times and always rotate continuously in the same direction and their rotary motions are combined by means of a differential device to obtain resulting motion of the "pilgrim step" type on said detaching cylinders (22, 23).

2. Control unit (10), as claimed in claim 1, **characterised in that** said differential device comprises a planetary gear (13), provided with at least one planet wheel (14) fitted idle on an input disk (20), where said planetary gear (13) is fitted idle on said shaft (12) connected to said second motor (11).

3. Control unit (10), as claimed in claim 2, **characterised in that** said planetary gear (13) has a toothed wheel (15) engaged by a corresponding toothed wheel (16), rotated by said first motor controlling operation of the circular comb (18) of said combing machine.

4. Control unit (10), as claimed in claim 3, **characterised in that** said planet wheel (14), fitted on the planetary gear (13) on said input disk (20), is idle and rotated by the rotation of said shaft (12), by means of engagement with a pinion (12'), and it is connected, by means of an output disk (20') to another planet wheel (14') to transmit its motion to said detaching cylinders (22, 23).

5. Control unit (10), as claimed in claim 4, **characterised in that** said planet wheel (14') transmits its motion, by means of a toothed pinion (12''), to a transmission component (21), which is idle and is connected by means of its toothed wheel to said detaching cylinders (22, 23).

Patentansprüche

1. Steuereinheit (10) für den "Pilgerschritt"-Betrieb der Abreißwalzen (22, 23) einer Kämmmaschine, umfassend
einen ersten Elektromotor, der alle Hauptbestandteile der vorgenannten Kämmmaschine mit gleichförmiger Bewegung dreht, deren Bewegungen von einer eigenen Welle (17) abgeleitet sind, sowie einen zweiten Elektromotor (11), der eine Welle (12) dreht, wobei die genannte Welle (12) die Komponenten zur Übertragung der Bewegung zu den genannten Abreißwalzen (22, 23) trägt,
dadurch gekennzeichnet, dass der genannte erste Elektromotor auch auf einige der Komponenten der Steuereinheit (10) einwirkt, um Bewegung zu den Abreißwalzen (22, 23) zu übertragen, und der genannte zweite Motor (11) mit Betriebsmitteln ausgestattet ist, die einem unidirektionalen Bewegungsgesetz mit Beschleunigungs- und Verlangsamungsphasen unterliegen, wobei sowohl der erste als auch der zweite Motor zu jeder Zeit im Eingriff sind und sich kontinuierlich in die gleiche Richtung drehen und ihre Drehbewegungen mittels einer Differentialvorrichtung kombiniert werden, um eine resultierende Bewegung vom "Pilgerschritt"-Typ an den Abreißwalzen (22, 23) zu erzielen.

2. Steuereinheit (10) nach Anspruch 1,
dadurch gekennzeichnet, dass die genannte Differentialvorrichtung ein Planetengetriebe (13) umfasst, das zumindest mit einem Planetenrad (14) ver-

sehen ist, das frei an einer Antriebsscheibe (20) angebracht ist, wobei das genannte Planetengetriebe (13) frei auf der genannten Welle (12) angebracht ist, die mit dem genannten zweiten Motor (11) verbunden ist.

3. Steuereinheit (10) nach Anspruch 2, **dadurch gekennzeichnet, dass** das genannte Planetengetriebe (13) ein Zahnrad (15) aufweist, das mit einem entsprechenden Zahnrad (16) kämmt und von dem genannten ersten Motor gedreht wird, der den Betrieb des Rundkamms (18) der genannten Kämmmaschine steuert.

4. Steuereinheit (10) nach Anspruch 3, **dadurch gekennzeichnet, dass** das genannte Planetenrad (14), das in dem Planetengetriebe (13) an der genannten Antriebsscheibe (20) angebracht ist, frei ist und über das Zusammenwirken mit einem Ritzel (12') durch die Rotation der genannten Welle (12) gedreht wird, und dass es über eine Abtriebsscheibe (20') mit einem weiteren Planetenrad (14') verbunden ist, um seine Bewegung auf die genannten Abreißwalzen (22, 23) zu übertragen.

5. Steuereinheit (10) nach Anspruch 4, **dadurch gekennzeichnet, dass** das genannte Planetenrad (14') seine Bewegung über ein Ritzel (12") zu einem Übertragungselement (21) überträgt, das frei und über sein Zahnrad mit den genannten Abreißwalzen (22, 23) verbunden ist.

Revendications

1. Unité de contrôle (10) pour l'opération « pas de pèlerin » des cylindres arracheurs (22, 23) dans une machine de peignage, comprenant un premier moteur électrique, qui fait tourner avec un mouvement uniforme tous les composants principaux de la machine de peignage précitée en dérivant le mouvement à partir d'un arbre (17) qui lui est propre et un deuxième moteur électrique (11), qui fait tourner un arbre (12), ledit arbre (12) logeant les composants pour transmettre le mouvement auxdits cylindres arracheurs (22, 23), **caractérisée en ce que** ledit premier moteur électrique agit également sur certains des composants de l'unité de commande (10) pour transmettre le mouvement aux cylindres arracheurs (22, 23), et ledit deuxième moteur (11) est muni de moyens de fonctionnement avec une loi unidirectionnelle de mouvement comprenant des phases d'accélération et de décélération, où à la fois lesdits premier et deuxième moteurs engrènent tout le temps et tournent toujours continuellement dans la même direction et leurs mouvements de rotation sont combinés au moyen d'un dispositif différentiel pour obtenir un mouvement résultant du type « pas de pèlerin » sur lesdits cylindres arracheurs (22, 23).

2. Unité de contrôle (10) selon la revendication 1, **caractérisée en ce que** ledit dispositif différentiel comprend un engrenage planétaire (13), muni d'au moins une roue planétaire (14) montée libre sur un disque d'entrée (20), où ledit engrenage planétaire (13) est monté libre sur ledit arbre (12) relié au dit deuxième moteur (11).

3. Unité de contrôle (10) selon la revendication 2, **caractérisée en ce que** ledit engrenage planétaire (13) a une roue dentée (15) engagée par une roue dentée correspondante (16), mise en rotation par ledit premier moteur commandant le fonctionnement du peigne circulaire (18) de ladite machine de peignage.

4. Unité de contrôle (10) selon la revendication 3, **caractérisée en ce que** ladite roue planétaire (14), montée sur l'engrenage planétaire (13) sur ledit disque d'entrée (20), est libre et mises en rotation par la rotation de l'arbre (12), au moyen de l'engagement avec un pignon (12'), et elle est reliée, au moyen d'un disque de sortie (20'), à une autre roue planétaire (14') pour transmettre son mouvement auxdits cylindres arracheurs (22, 23).

5. Unité de contrôle (10) selon la revendication 4, **caractérisée en ce que** ladite roue planétaire (14') transmet son mouvement, au moyen d'un pignon denté (12"), à un composant de transmission (21), qui est libre et est relié au moyen de sa roue dentée auxdits cylindres arracheurs (22, 23).

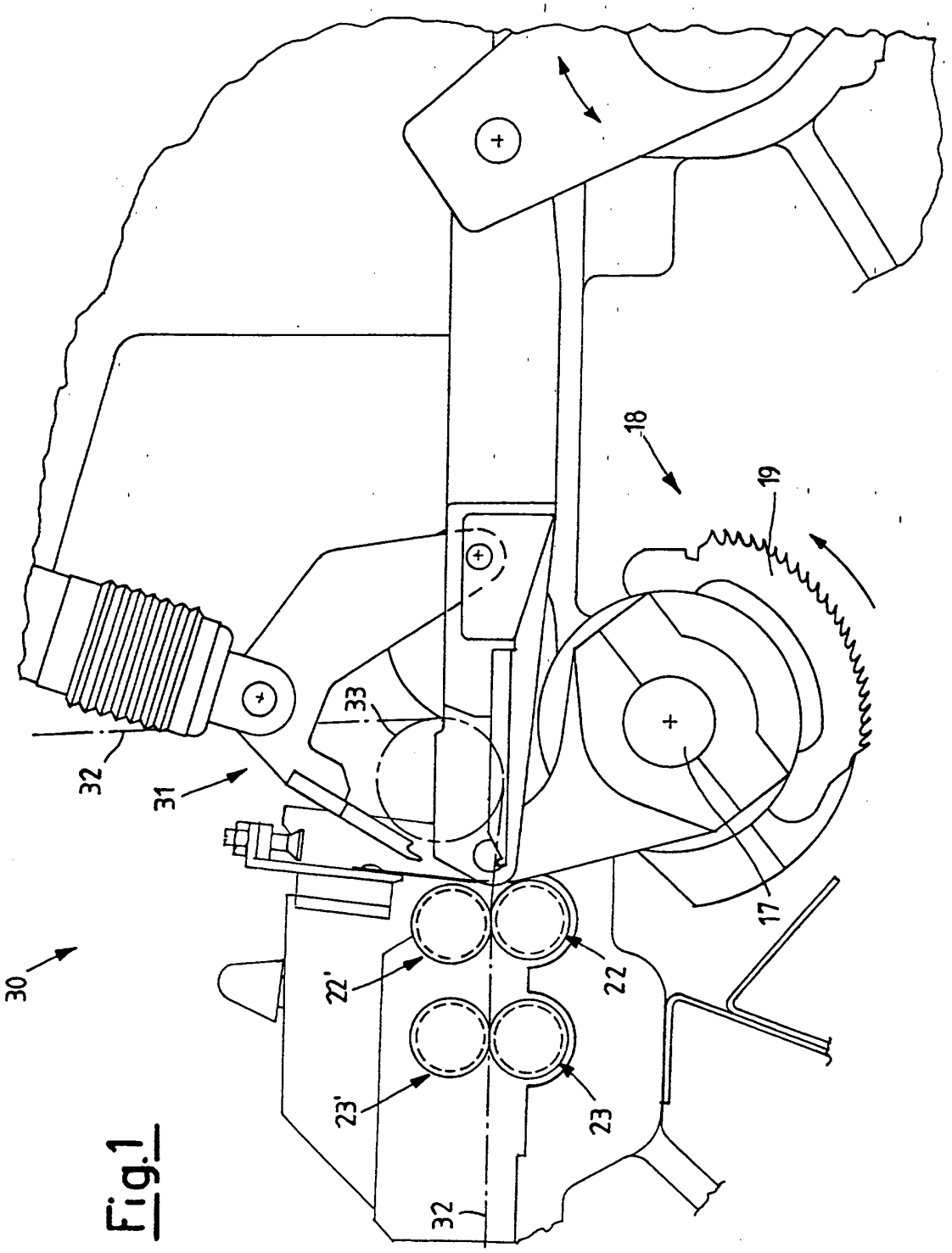

Fig.1

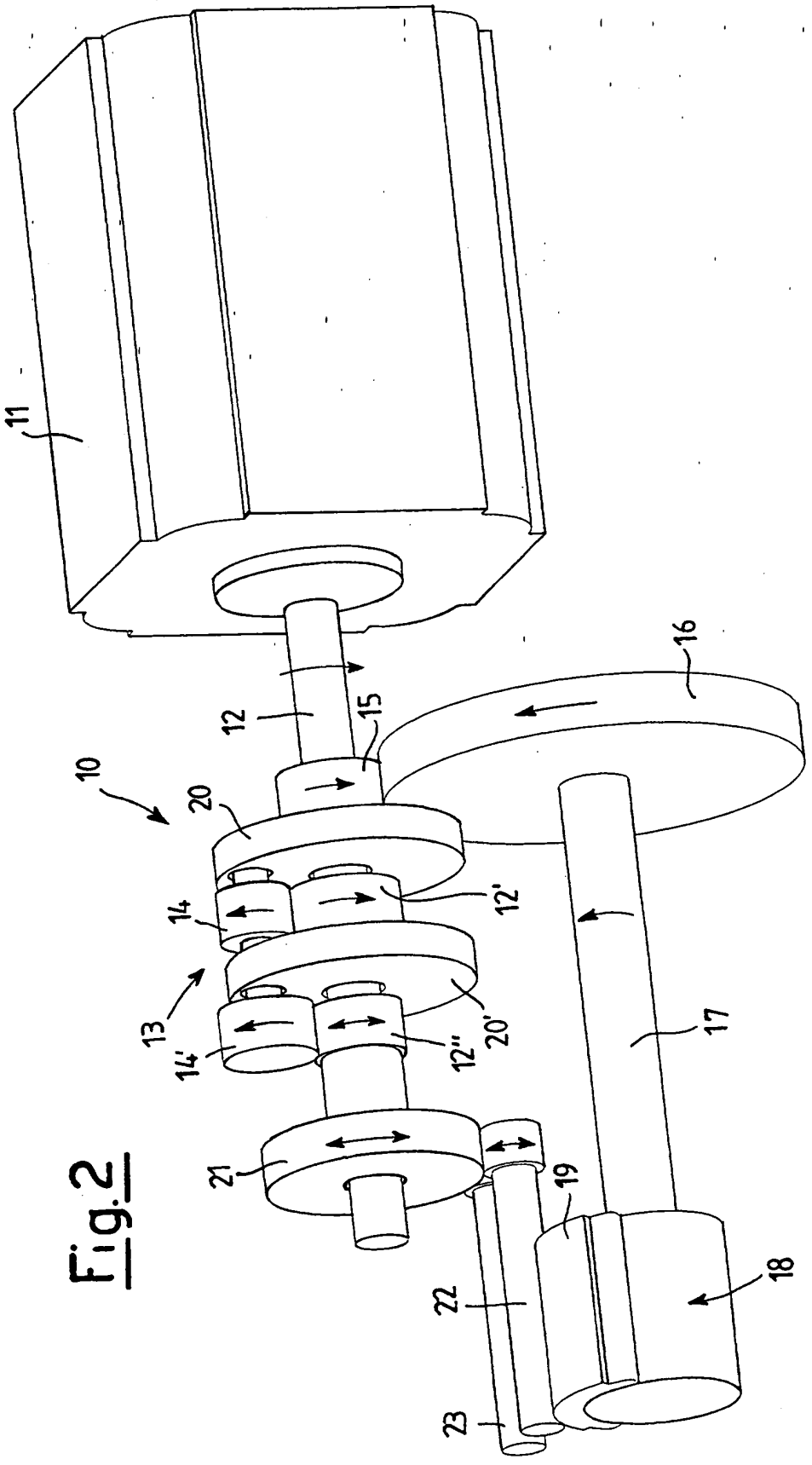

Fig.2

Fig.3

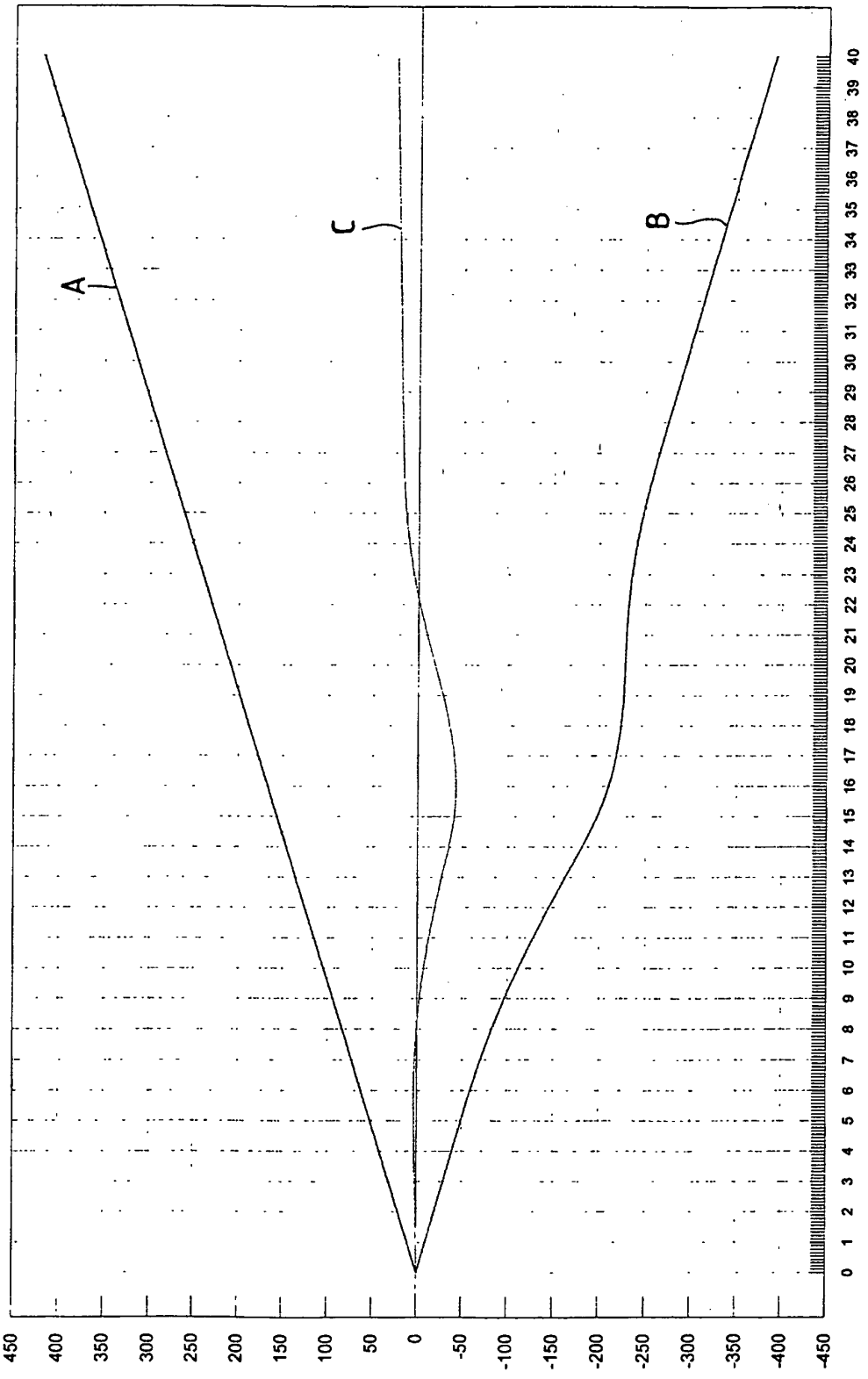
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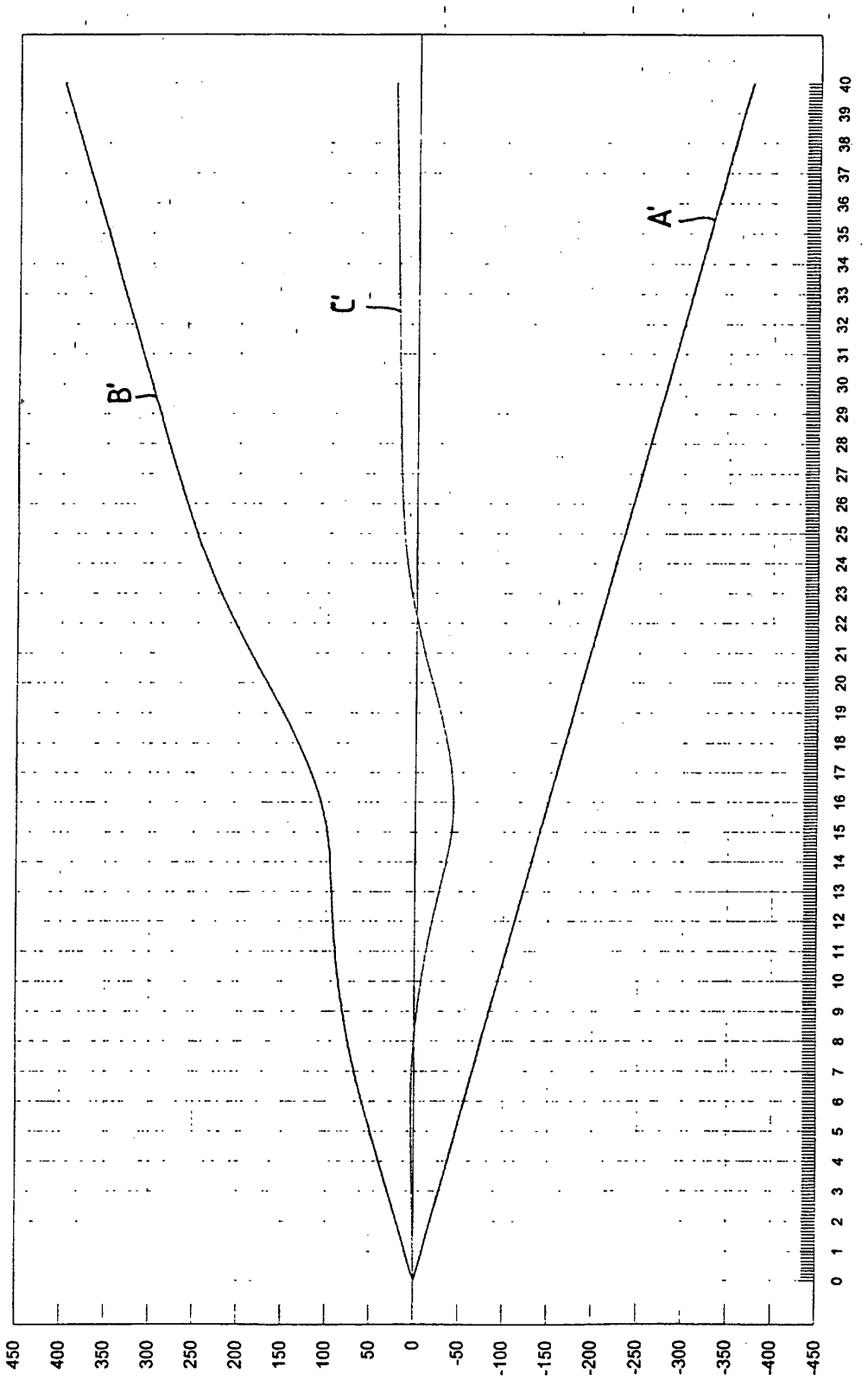
Fig.4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REFERENCES CITED IN THE DESCRIPTION

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