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(54) **Weaving loom drive, with no flywheel and friction clutch**

Antriebsvorrichtung für Webmaschinen ohne Schwungrad und Reibungskupplung

Commande de métier à tisser sans volant ni embrayage à friction

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(56) References cited:
EP-A- 0 116 292

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Description

[0001] The present invention concerns a drive unit for weaving looms, and particularly a new type of drive unit, with no flywheel and friction clutch, to operate the main and auxiliary devices of a loom.

[0002] As known, the mechanical operation of a loom is normally obtained by means of a main motor, connected to the main shaft of the loom through a drive, for instance a belt drive, which also comprises a brake and a friction clutch system. In this technical field, by the term "main shaft" is meant the shaft which operates the essential weaving devices of the loom, namely the sley with the reed, the weave machine and, in gripper looms, the mechanisms to control the grippers, as well as any auxiliary devices, such as the yarn tensioning devices, the selvage forming devices, and so on.

[0003] The known type looms are moreover provided with a secondary motor, connected to the weave machine by a respective clutch, which is used to carry out the shed search as well as to operate the whole loom in slow running conditions.

[0004] In the first case the weave machine is disconnected from the main shaft of the loom and the secondary motor can operate the weave machine in forward gear or in reverse gear, to carry out the search of the shed containing a faulty weft to be eliminated, or to perform other special weaving operations. During such operations, the angular position of the weave machine can thus be modified in respect of the angular position of the main shaft, namely in respect of the weft beating up and picking devices, the correct phase timing between said devices and the weave machine being easily obtained, for example thanks to clutches having only one possible angular coupling position.

[0005] In the second case the weave machine remains connected to the main shaft of the loom, while the friction clutch of the main motor is disconnected so that the secondary motor can operate the whole loom at a low rotation speed, the so-called "slow running", frequently adopted to carry out checks on the working of the loom, searches for failures, weaving tests, and the like.

[0006] A different prior art approach for the solution of the problem described above is illustrated in patent EP-0 116 292. In this case, both the main weaving devices and the weave machine are in constant mesh with the main motor through synchronous gearings, an insertion clutch further being optionally provided to disengage the weave machine only from the drive. The auxiliary motor transmission further consists of a satellite gearing and said transmission overlaps the main motor transmission, to control - in backward motion - only the warp beam and the cloth beam without interfering with the loom main motion. The weave machine works only in forward motion, and when it is necessary to search for a previous shed where a weaving fault occurred, the weaving programme of the weave machine is selected

backwards through the electronic control device of said machine. This document does hence not disclose that the main motor driving the loom can separately control the weave machine and the weaving devices.

[0007] Within the field of known technique described heretofore, the object of the present invention is to simplify the driving systems of a weaving loom by using a single driving motor, while allowing the normal and correct performance of the different loom operations above described.

[0008] According to the present invention, said object is reached by means of a drive unit for a weaving loom, comprising a main shaft which operates the essential weaving devices of the loom, a driven shaft which operates a weave machine, and an electric motor for loom operation, characterized in that, said motor is connected to the main shaft through a first synchronous gearing comprising a disengageable clutch, and to the driven shaft through a second synchronous gearing in constant mesh.

[0009] Further characteristics and advantages of the present invention will anyhow be more evident from the following detailed description of some preferred embodiments thereof, illustrated by way of example on the accompanying drawings, in which:

Fig. 1 is a diagrammatic view of a first embodiment of the drive unit according to the present invention; Fig. 1A shows, on an enlarged scale, the detail enclosed in the circle of fig. 1;

Fig. 2 is a diagrammatic view of a second embodiment of the drive unit according to the present invention;

Fig. 2A is a diagrammatic view of a variant of the embodiment of fig. 2, comprising a synchronous gearing; and

Fig. 3 is a diagrammatic view of a third embodiment of the drive unit according to the present invention.

[0010] The drive unit for looms of the present invention, illustrated in fig. 1, comprises a main motor 20 which operates the main shaft 21 of the loom through a train of gears comprising a pinion 22, coaxial to the motor 20, and a gearwheel 23. The main shaft 21 merely operates the weaving devices - diagrammatically illustrated by the block 27 - namely the sley and, in the case of gripper looms, the mechanisms to control the grippers as well as any auxiliary weaving devices, for instance the selvage forming devices.

[0011] The gearwheel 23 is connected to the main shaft 21 by means of an electro-mechanical front clutch 28, remote controlled by a driving unit 30 which is in turn controlled by a control unit 31. When the electromechanical clutch 28 is disengaged, the gearwheel 23 acts as an idle wheel.

[0012] The pinion 22 also operates a gearwheel 24 constantly meshing therewith, said gearwheel 24 being coaxial to and integral with a driven shaft 25. The driven

shaft 25 is connected to the weave machine - diagrammatically illustrated by the block 26 - and to any other auxiliary devices thereof.

[0013] According to a second embodiment of the drive unit for looms of the present invention, illustrated in fig. 2, said unit comprises - likewise as indicated with reference to the first embodiment thereof - the main motor 20 which operates the main shaft 21 of the loom through the train of gears comprising the pinion 22, coaxial to the motor 20, and the gearwheel 23. Also in this second embodiment, the main shaft 21 merely operates the aforementioned weaving devices 27, to which it is directly connected.

[0014] In this case, however, the gearwheel 23 is connected to a gearwheel 23b coaxial thereto, which is in turn connected to a gearwheel 24 by way of a synchronous gearing, for example a toothed belt, the gearwheel 24 being coaxial to and integral with the driven shaft 25 which operates the weave machine (block 26) as described heretofore.

[0015] A variant of this second embodiment is illustrated in fig. 2A. In said variant, the gearwheel 23 meshes directly with the gearwheel 24 connected to the driven shaft 25; when the clutch 28 is disengaged, the gearwheel 23 acts as an idle wheel in the kinematic mechanism transmitting the motion from the motor 20 to the weave machine 26.

[0016] According to a third embodiment of the drive unit for looms of the present invention, illustrated in fig. 3, said unit comprises two pinions 22a and 22b, the first one mounted on the output shaft of the motor 20 and the second one on an intermediate shaft 34, coaxial and aligned thereto, which is operated by the shaft of the motor 20 by way of an electromechanical front clutch 28a, fully similar to the clutch 28 of the previous embodiments. The pinions 22a and 22b are respectively meshing with the gearwheels 24 and 23 connected, respectively, to the driven shaft 25 and to main shaft 21, so that - as it happens in the previous embodiments - the driven shaft 25 is always connected to the movement of the motor 20, while the main shaft 21 can be disconnected therefrom by disengagement of the clutch 28.

[0017] In the first two embodiments described heretofore, the angular positions of rotation of the gearwheel 23 and of the shaft 21 are respectively and instantly detected by means of position sensors 29a and 29b - for instance of the encoder type - which provide to send corresponding signals to the control unit 31; it is hence possible to connect the gearwheel 23 to the main shaft 21 in different angular positions, variable at choice, according to a program controlled by the control unit 31 according to the loom weaving conditions. In a fully similar way, in the third embodiment described heretofore the sensor 29a is positioned upstream of the clutch 28 and the sensor 29b is positioned on the shaft 21 which, in this case, is connected to the gearwheel 23. The angular shifting value will thus be reckoned directly between the output shaft of the motor 20 and the main shaft 21. A third sen-

sor 29c is finally provided close to the weave machine 26, to detect the momentary angular position of the driven shaft 25. This arrangement hence allows to obtain a programmed automatic phase timing variation, possibly also during the weaving operation, between the loom weaving devices 27 and the weave machine 26 which determines the opening and closing movements of the shed. Preferably, the electromechanical clutch 28 allows a plurality of coupling positions, separated by a constant angular pitch; said angular pitch thus determines the minimum possible angular phase shifting value between the gearwheel 23 and the main shaft 21.

[0018] The drive unit for looms of the present invention does not comprise at all the flywheel and brake/friction clutch devices which are normally provided in the known type drive units for the purpose of making the loom rotation speed as constant as possible, independently from the cyclically variable stresses imparted by the weaving devices on the drive unit, and of allowing a fast stopping of the loom.

[0019] To reach said objects, in the drive unit according to the invention the main motor 20 is current controlled so as to continuously vary its driving torque and/or its direction of rotation. Said type of control is obtained by means of a driving unit 30, which operates the motor 20 and the electromechanical clutch 28 according to the control signals received from a control unit 31, so as to obtain different working conditions of said motor and thus of the loom.

[0020] In normal working conditions, the clutch 28 is in an engaged position and the motor 20 operates both the weaving devices 27 and the weave machine 26 at the wanted speed - thus, possibly, also at a slow speed - by suitably adjusting the torque of the motor 20 to keep the speed at the desired constant level. By inverting the torque direction, it is instead possible to obtain the required gradual or prompt braking effect.

[0021] With the motor 20 at a stop, the clutch 28 can be disengaged; then, by starting again the motor 20, it is possible to obtain the desired movements of the weave machine only, in forward and reverse gear, to carry out the search of the shed containing a faulty weft to be eliminated. Said operation should of course take place in a preselected angular range of the loom weaving devices 27, such that the grippers are external to the shed. Once the fault has been eliminated, before engaging again the clutch 28, the gearwheel 23 is caused to rotate at low speed up to reaching the desired phase timing with the main shaft 21 of the loom, which timing is detected, as said above, by means of the sensors 29. It is important to determine the value of the relative rotation angle between the gearwheel 23 (or output shaft of the motor 20) and the main shaft 21 in order to be able to engage the clutch 28 at the same phase timing which it had before stopping of the loom, or else in a position varied at will and meant to provide a different phase timing between the loom weaving devices and the weave machine.

[0022] In order to avoid any possible errors in the drive unit working, the actual condition of engagement/disengagement of the electromechanical front clutch 28 is detected by means of a proximity switch 32 connected to the control unit 31. After said unit 31 has sent a control signal to the driving unit 30 to change the position of the clutch 28, it makes sure - before sending a further control signal to the unit 30 to operate any movements of the motor 20 - that the clutch 28 is actually in the wanted position, by reading the signal issued by the switch 32. As an alternative to the proximity switch 32, the position of the clutch 28 can be reckoned by sending a torque pulse to the motor 20 and simultaneously reading the position sensors 29.

[0023] Although the motor 20 is normally used, by inverting its torque direction, also as a brake for the loom, a safety brake 33 is also provided to keep the loom and the weave machine in a blocked position during the operations to eliminate faulty wefts and in case of failure of the electric current supply, so as to prevent any undesired movement of the loom under the action of elastic forces imparted by the weave machine or by the warp yarns. Due to the presence of small torques or potential loads, particularly on account of the tensions imparted by the weave machine, a clutch brake or a blocking brake 35 acts moreover during the operations of shed search, said brake acting on the main shaft 21 of the loom in order to oppose the residual potential energy of the weaving devices 27.

[0024] From the above description it appears evident how the drive unit according to the present invention has fully reached the intended object, seen that it allows to perform with a single motor - without making use of any complicated structure - any possible desired operations of the loom components, thanks to the fact that said motor is always connected to the weave machine, while it can be connected at will to the loom weaving devices by automatically setting the required phase timing.

[0025] The drive unit according to the present invention has been described with reference to some particular and preferred embodiments thereof, but it is understood that its protection field extends to any possible variants within reach of a technician skilled in the art, falling within the scope of the following claims.

Claims

1. Drive unit for a weaving loom, comprising a main shaft (21) which operates the essential weaving devices (27) of the loom, a driven shaft (25) which operates a weave machine (26), and an electric motor (20) for loom operation, **characterized in that**, said motor (20) is connected to the main shaft (21) through a first synchronous gearing comprising a disengageable clutch (28), and to the driven shaft (25) through a second synchronous gearing in constant mesh.

2. Drive unit as in claim 1), wherein said first synchronous gearing comprises a pinion (22) coaxial to and integral with the output shaft of said motor (20), a first gearwheel (23) meshing with said pinion (22) and coaxial to said main shaft (21) of the loom, and an electromechanical front clutch (28) apt to rotatively connect said first gearwheel (23) and said main shaft (21).

3. Drive unit as in claim 2), wherein said second synchronous gearing comprises a second gearwheel (24) meshing with said pinion (22), coaxial to and integral with said driven shaft (25) of the loom.

4. Drive unit as in claim 2), wherein said second synchronous gearing comprises a second gearwheel (23b) coaxial to and integral with said first gearwheel (23), and kinematically connected to a third gearwheel (24) coaxial to and integral with said driven shaft (25) of the loom.

5. Drive unit as in claim 4), wherein the kinematic connection between said second and third gearwheels (23b, 24) is obtained through a toothed belt engaging with said gearwheels.

6. Drive unit as in claim 1), wherein said first synchronous gearing comprises a first pinion (22a) coaxial to and integral with the output shaft of said motor (20), a second pinion (22b) coaxial to the first pinion (22a), an electromechanical front clutch (28a) apt to rotatively connect said pinions, and a first gearwheel (23) meshing with said second pinion (22b), coaxial to and integral with said main shaft (21) of the loom.

7. Drive unit as in claim 6), wherein said second synchronous gearing comprises a second gearwheel (24) meshing with said first pinion (22a), coaxial to and integral with said driven shaft (25) of the loom.

8. Drive unit as in claim 2) or 6), wherein said electromechanical front clutch (28, 28a) comprises a plurality of engagement positions, mutually shifted by a constant angular pitch.

9. Drive unit as in any one of the previous claims, further comprising control unit (31) apt to control a driving unit (30) in order to modify the driving torque and/or the direction of rotation of said motor (20), so as to obtain the working of the loom at normal speed or at reduced speed (slow running), as well as the braking and stopping of the loom.

10. Drive unit as in claim 9), wherein said control unit (31) is apt to control said driving unit (30) in order to engage or disengage said electromechanical front clutch (28).

11. Drive unit as in claim 10), further comprising devices (29a, 29b, 29c) to detect the angular position of said main and, respectively, driven shafts, said devices being connected to said control unit (31) to allow engaging the clutch (28) according to a preset phase timing value between said main shaft (21) and said driven shaft (25). 5
12. Drive unit as in claim 11), further comprising a proximity switch (32) for said electromechanical front clutch (28), connected to said control unit (31) in order to detect the actual position of said clutch (28). 10
13. Drive unit as in any one of the previous claims, comprising moreover a safety brake (33) for said motor, and a clutch brake or a blocking brake (35) to oppose the residual potential energy of the weaving system (27). 15

Patentansprüche

1. Antriebseinheit für einen Webstuhl, mit einer Hauptwelle (21), die die wesentlichen Webeinrichtungen (27) des Webstuhls betreibt, eine Antriebswelle (25), die eine Webmaschine (26) betreibt und einen Elektromotor (20) für den Webbetrieb, **dadurch gekennzeichnet, dass** der Motor (20) mit der Hauptwelle über ein erstes Synchrongetriebe mit einer lösbaren Kupplung (28) und mit der angetriebenen Welle (25) über ein zweites Synchrongetriebe in ständigem Eingriff verbunden ist. 20
2. Antriebseinheit nach Anspruch 1, wobei das erste Synchrongetriebe ein Ritzel (22) aufweist, das koaxial zu und integral mit der Ausgangswelle des Motors (20) ist, ein erstes Zahnrad (23) mit dem Ritzel (22) kämmt und mit der Hauptwelle (21) des Webstuhls koaxial ist und eine elektromechanische Frontkupplung (28), die zur Drehverbindung des ersten Zahnrads (23) und der Hauptwelle (21) geeignet ist, vorgesehen ist. 25
3. Antriebseinheit nach Anspruch 2, wobei das zweite Synchrongetriebe ein zweites Zahnrad (24) aufweist, das mit dem Ritzel (22) kämmt und koaxial zu und einstückig mit der Antriebswelle (25) des Webstuhls ist. 30
4. Antriebseinheit nach Anspruch 2, wobei das zweite Synchrongetriebe ein zweites Zahnrad (23b) aufweist, das koaxial zu und einstückig mit dem ersten Zahnrad (23) ist und kinematisch mit einem dritten Zahnrad (24) verbunden ist, das koaxial zu und einstückig mit der Antriebswelle (25) des Webstuhls ist. 35
5. Antriebseinheit nach Anspruch 4, wobei die kinematische Verbindung zwischen dem zweiten und dem dritten Zahnrad (23b, 24) durch einen Zahnriemen bewirkt wird, der mit den Zahnradern in Eingriff ist. 40
6. Antriebseinheit nach Anspruch 1, wobei das erste Synchrongetriebe ein erstes Ritzel (22a) aufweist, das koaxial zu und einstückig mit der Ausgangswelle des Motors (20) ist, ein zweites Ritzel (12b), das mit dem ersten Ritzel (22a) koaxial ist, eine elektromechanische Frontkupplung (28a), die dazu geeignet ist, die Ritzel drehbar zu verbinden und ein erstes Zahnrad (23), das mit dem zweiten Ritzel (22b) kämmt und koaxial zu und einstückig mit der Hauptwelle (21) des Webstuhls ist, vorgesehen ist. 45
7. Antriebseinheit nach Anspruch 6, wobei das zweite Synchrongetriebe ein zweites Zahnrad (24) aufweist, das mit dem ersten Ritzel (22a) kämmt und koaxial zu und einstückig mit der angetriebenen Welle (25) des Webstuhls ist. 50
8. Antriebseinheit nach Anspruch 2 oder 6, wobei die elektromechanische Frontkupplung (28, 28a) eine Mehrzahl von Eingriffspositionen hat, die gegeneinander um einen gleichbleibenden Winkel verschoben sind. 55
9. Antriebseinheit nach einem der vorangehenden Ansprüche, weiter mit einer Steuereinheit (31), die zum Steuern einer Antriebseinheit (30) geeignet ist, um das Antriebsmoment und/oder die Drehrichtung des Motors (20) zu modifizieren, um so das Arbeiten des Webstuhls mit einer normalen Geschwindigkeit und einer reduzierten Geschwindigkeit (Langsamlauf) zu bewirken, als auch das Bremsen oder Stoppen des Webstuhls.
10. Antriebseinheit nach Anspruch 9, wobei die Steuereinheit (31) eingerichtet ist zum Steuern der Antriebseinheiten (30), um die mechanische Frontkupplung (28) zu verriegeln oder zu lösen.
11. Antriebseinheit nach Anspruch 10, weiter mit Einrichtungen (29a, 29b, 29c) zum Erkennen der Winkelposition der Hauptwelle bzw. der Antriebswellen und Einrichtungen, die mit der Steuereinheit (31) verbunden sind, um den Eingriff der Kupplung (28) entsprechend eines vorgegebenen Phasenzeitpunktes zwischen der Hauptwelle (21) und der angetriebenen Welle (25) zu erlauben.
12. Antriebseinheit nach Anspruch 11, weiter mit einem Näherungsschalter (32) für die elektromechanische Frontkupplung (28), der mit der Steuerungseinheit (31) verbunden ist, um die tatsächliche Position der Kupplung (28) zu erkennen.

13. Antriebseinheit nach einem der vorangehenden Ansprüche, weiter mit einer Sicherheitsbremse (33) für den Motor und eine Kupplungsbremse für eine Blockierbremse (35) zum Wirken gegen die restliche potentielle Energie des Websystems (27)

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Revendications

1. Unité d'entraînement de métier à tisser, comprenant un arbre principal (21) qui met en oeuvre les dispositifs principaux (27) de tissage du métier, un arbre entraîné (25) qui met en oeuvre une machine (26) de tissage, et un moteur électrique (20) de mise en oeuvre de métier, **caractérisé en ce que** ledit moteur (20) est en prise avec l'arbre principal (21) par l'intermédiaire d'un premier engrenage synchrone comprenant un embrayage débrayable (28), et en prise constante avec l'arbre entraîné (25) par l'intermédiaire d'un second engrenage synchrone.
2. Unité d'entraînement selon la revendication 1, dans laquelle ledit premier engrenage synchrone comprend un pignon (22) coaxial à l'arbre de sortie dudit moteur (20) et d'un seul tenant avec celui-ci, une première roue d'engrenage (23) engrenant avec ledit pignon (22) et coaxiale audit arbre principal (21) du métier, et un embrayage électromécanique avant (28) apte à mettre en prise en rotation ladite première roue d'engrenage (23) et ledit arbre principal (21).
3. Unité d'entraînement selon la revendication 2, dans laquelle ledit second engrenage synchrone comprend une deuxième roue d'engrenage (24) engrenant avec ledit pignon (22), coaxiale audit arbre mené (25) du métier et d'un seul tenant avec celui-ci.
4. Unité d'entraînement selon la revendication 2, dans laquelle ledit second engrenage synchrone comprend une deuxième roue d'engrenage (23b) coaxiale à ladite première roue d'engrenage (23) et d'un seul tenant avec celle-ci, et en prise cinématique avec une troisième roue d'engrenage (24) coaxiale audit arbre mené (25) du métier et d'un seul tenant avec celle-ci.
5. Unité d'entraînement selon la revendication 4, dans laquelle ladite prise cinématique entre lesdites deuxième et troisième roues d'engrenage (23b, 24) s'obtient par une courroie crantée engageant lesdites roues d'engrenage.
6. Unité d'entraînement selon la revendication 1, dans laquelle ledit premier engrenage synchrone comprend un premier pignon (22a) coaxial à l'arbre de sortie dudit moteur (20), et d'un seul tenant avec celui-ci, un second pignon (22b) coaxial au premier

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pignon (22a), et un embrayage électromécanique avant (28a) apte à mettre en prise en rotation lesdits pignons, et une première roue d'engrenage (23) engrenant avec ledit second pignon (22b), coaxiale audit arbre principal (21) du métier et d'un seul tenant avec celui-ci.

7. Unité d'entraînement selon la revendication 6, dans laquelle ledit second engrenage synchrone comprend une deuxième roue (24) d'engrenage en prise avec ledit premier pignon (22a), coaxiale audit arbre mené (25) du métier et d'un seul tenant avec celui-ci.
8. Unité d'entraînement selon les revendications 2 ou 6, dans laquelle ledit embrayage électromécanique avant (28, 28a) comprend une pluralité de positions d'engagement, décalées mutuellement d'un pas angulaire constant.
9. Unité d'entraînement selon l'une quelconque des revendications précédentes, comprenant en outre une unité (31) de commande apte à commander une unité (30) d'entraînement dans le but de modifier le couple de transmission et/ou le sens de rotation dudit moteur (20), de façon à obtenir le travail du métier à vitesse normale ou à vitesse réduite (marche lente), de même que le freinage et l'arrêt du métier.
10. Unité d'entraînement selon la revendication 9, dans laquelle ladite unité (31) d'entraînement est apte à commander ladite unité (30) d'entraînement dans le but d'embrayer ou de débrayer ledit embrayage électromécanique avant (28).
11. Unité d'entraînement selon la revendication 10, comprenant en outre des dispositifs (29a, 29b, 29c) servant à détecter la position angulaire desdits arbres, respectivement, principal et entraîné, lesdits dispositifs étant connectés avec ledit module (31) de commande pour permettre d'embrayer l'embrayage (28) en fonction d'une valeur de cadencement de phases prédéterminée entre ledit arbre principal (21) et ledit arbre mené (25).
12. Unité d'entraînement selon la revendication 11, comprenant en outre un commutateur (32) de proximité destiné audit embrayage électromécanique avant (28), connecté à ladite unité (31) d'entraînement dans le but de détecter la position réelle dudit embrayage (28).
13. Unité d'entraînement selon l'une quelconque des revendications précédentes, comprenant de plus un frein (33) de sécurité destiné audit moteur, et un frein d'embrayage ou un frein (35) de blocage servant à s'opposer à l'énergie potentielle résiduelle du

système (27) de tissage.

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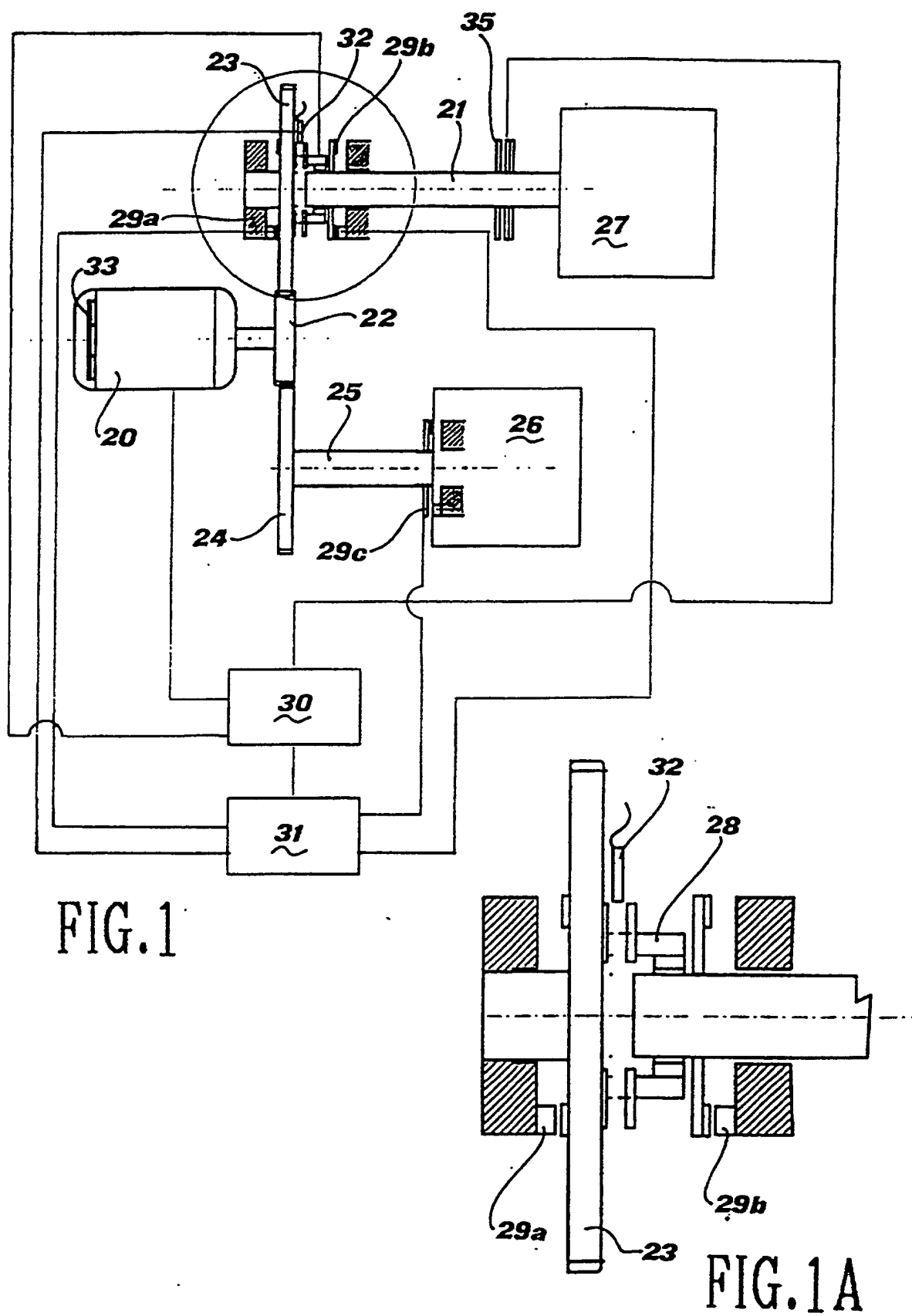
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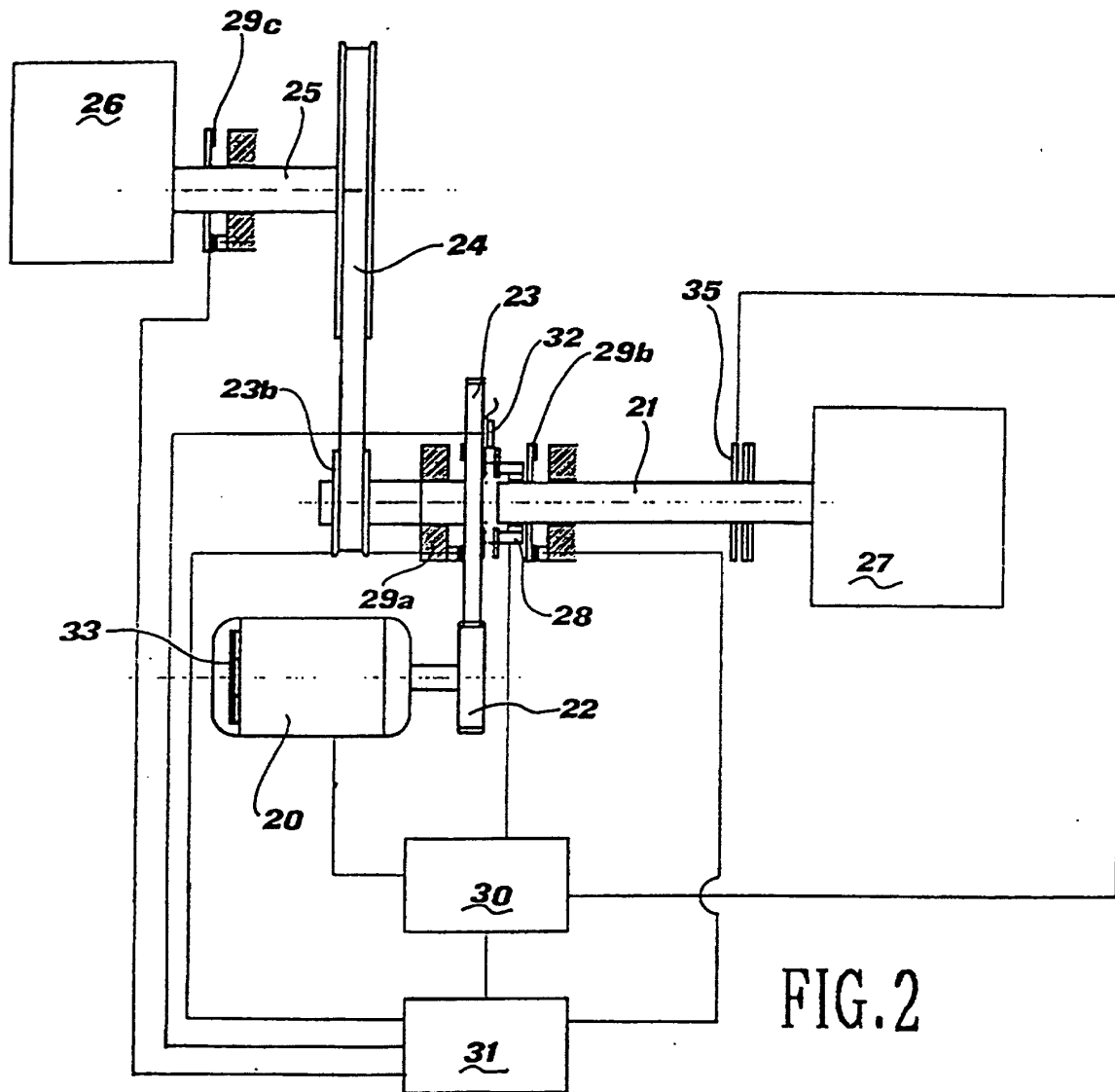


FIG.2

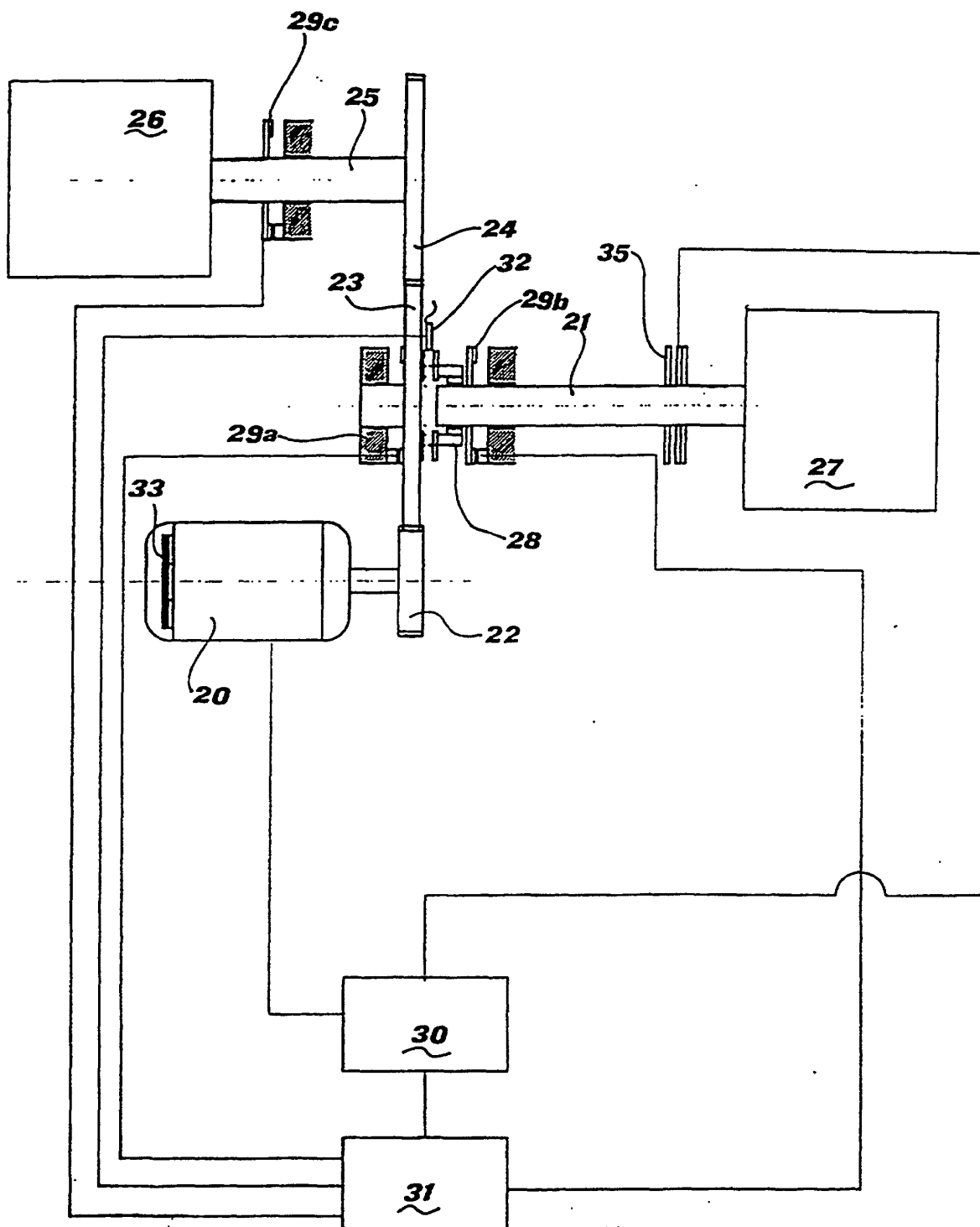


FIG.2A

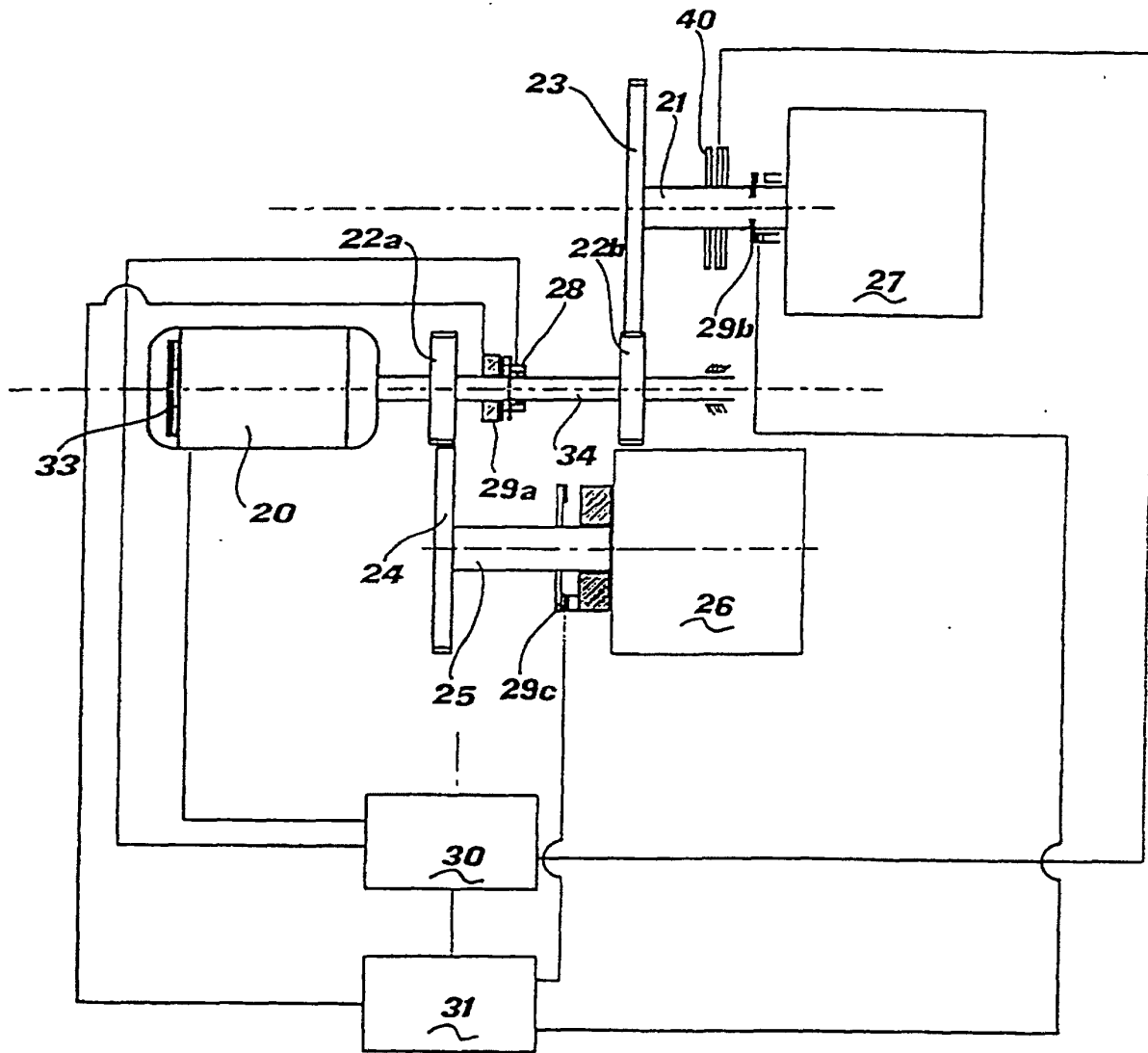


FIG.3