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Device for conveying sheets

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SUMMARY

A sheet conveying device for use in a converting press for paper or cardboard sheets which comprises at least one feeding station, a converting station, a waste stripping station and a delivery station for converted sheets. The conveying device comprises two endless gripper bar chains arranged to convey the sheets from the feeding station to the delivery station, a transverse driving shaft (2) provided with driving wheels (3, 3') for the endless gripper bar chains (5, 6) and at least one device for sheet capture secured to the endless gripper bar chains (5, 6). The transverse driving shaft (2) is driven separately from the device of the other press stations by at least one independent motor/reduction unit (1). The independent motor/reduction unit (1) is able to function by driving cycles including at least one motion phase and one deceleration and/or breaking phase controlled by a control device (CDE), each independent motor driving cycle duration being equivalent to a converting cycle duration of said converting station.

(fig. 2)

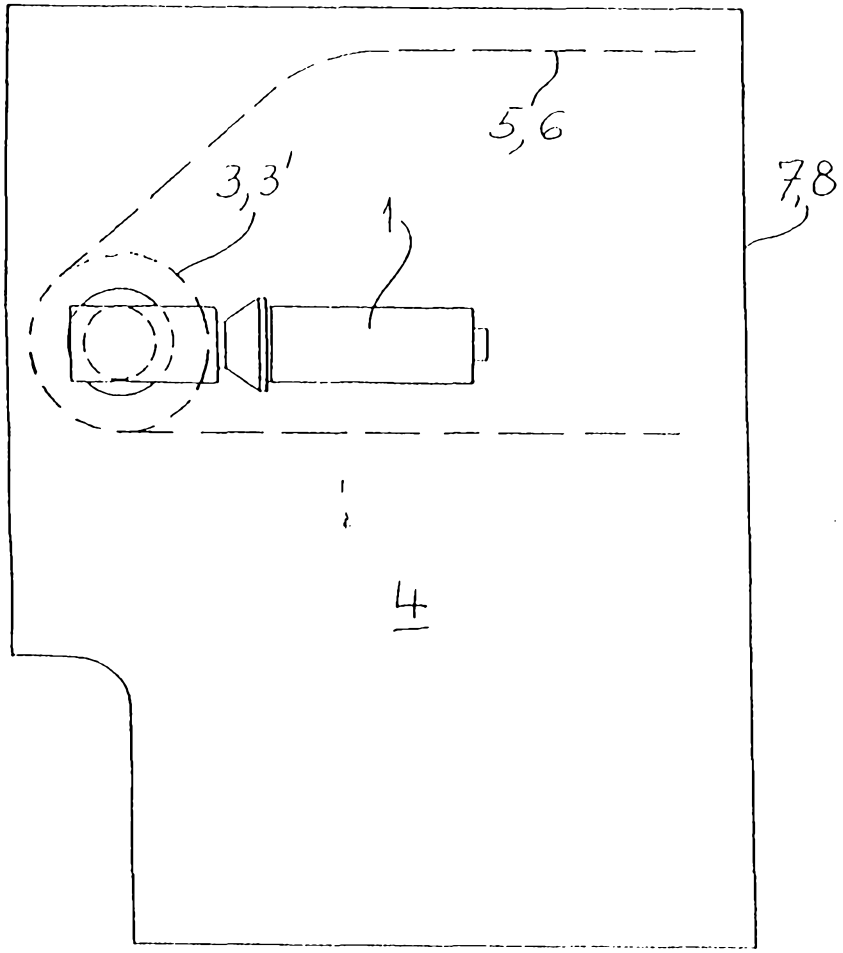

Fig. 1a

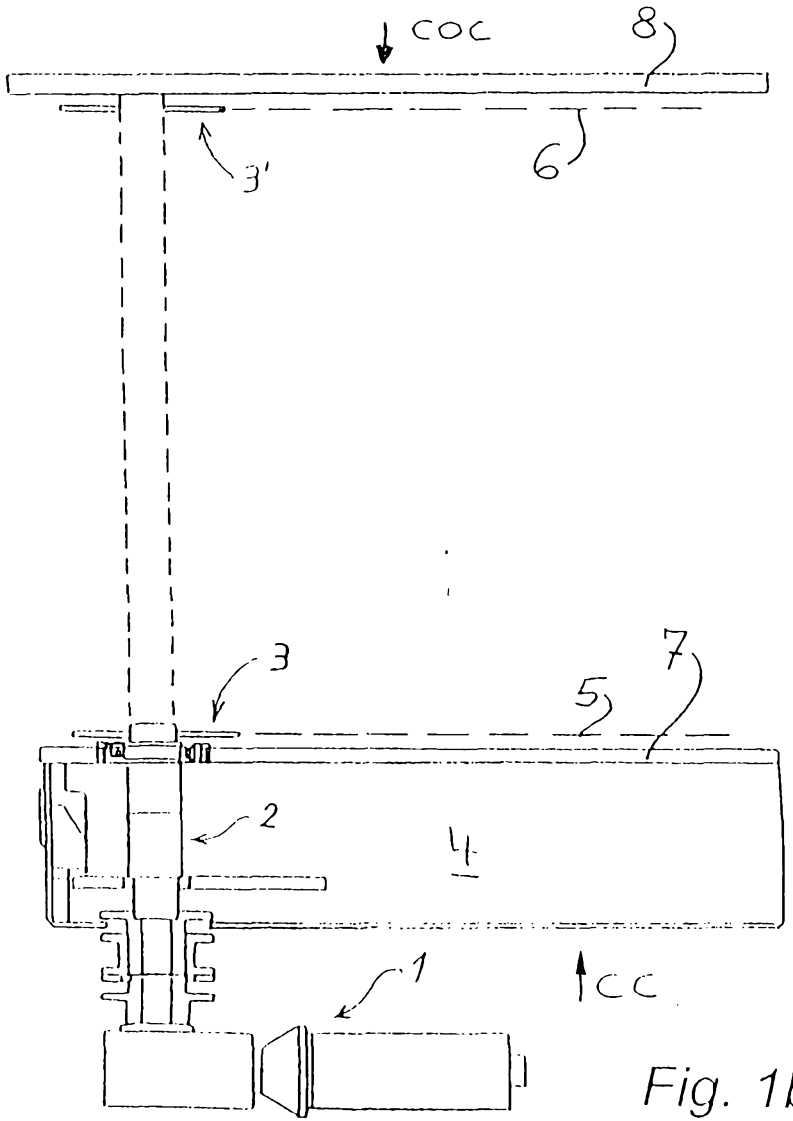

Fig. 1b

AUSTRALIA

Patents Act 1990

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COMPLETE SPECIFICATION
STANDARD PATENT

Invention Title:

Device for conveying sheets

The following statement is a full description of this invention including the best method of performing it known to us:-

DEVICE FOR CONVEYING SHEETS

The present invention relates to a device for conveying sheets, into a converting press for paper or cardboard sheets. Such a press usually includes at least one feeding station, a converting station, a waste stripping station and a delivery station for converted sheets, said conveying device includes two endless gripper bar chains arranged to convey the sheets from the feeding station to the delivery station, a transverse driving shaft provided with driving wheels for the endless gripper bar chains and at least one device for sheet capture secured to the endless gripper bar chains.

The wording "transverse" means here a horizontal direction, generally perpendicular to the machine axis.

In known converting presses, only one electric motor usually drives the whole machine. This motor directly actuates an inertia flywheel, a clutch brake device being located between this flywheel and the other machine bodies. This system drives all elements which function in synchronism, in particular the movable beam of the platen press, the waste stripping and blank delivering stations, as well as the chains bearing the gripper bars ensuring sheet capture and conveyance from one station to the next.

A sheets conveying and converting cycle includes a sheet stop phase during which it is proceeded to a converting operation, such as blanking or

waste stripping, and at least one moving phase during which the sheet is conveyed from one station to the next one. This moving phase necessarily includes an acceleration and a deceleration phase and, usually, between both, a phase during which the sheet slightly moves at a constant speed.

Various embodiments carrying out this kind of cycle already exist, in which the wheels driving the chains are interdependent in rotation with a coupling unit which is, by axial displacement, alternatively caught or released from a driving unit, while standby means release or immobilize the wheels driving the chains, although the driving unit is alternatively driven in one or another rotative direction.

Such mechanical devices have been described for example in CH 219422 and CH 411555. For such devices, an oscillating toothed segment operating onto the transverse driving shaft of the gripper bar chains via a pinion is actuated by a rod connection to an eccentric secured on the top of a shaft driven by the general machine driving device, which carried out a complete rotation by a back and forth run of the oscillating toothed segment.

In relation with this kind of mechanical drive, one deals with a single motion law, determined by the parts geometry. This kind of driving device is very suitable for low or average rates of up to approximately 5'000-6'000 sheets/hour; beyond this, accelerations and decelerations at the beginning and at the end of the motion phase become very strong. However, after the sheet

blanking operation, the latter are still connected only by their nicks, which can break in the case of heavy acceleration, causing a machine jam.

Several mechanical devices have been proposed to overcome this defect. Patent CH 411555 suggests placing the driving of the toothed segment under the control of a double cam sending a rocking motion to a lever which, by means of a connecting rod drives the toothed segment, whereas among the two lever elements cooperating with the two cams, the one, which is sending the back free motion to the toothed segment, is elastically closed up against the cam. The cams system allows to amend the motion law by relieving the start-up, however, for a set of reference cams, this motion law cannot be amended any more, except when changing cams.

Devices are also known in which attempts have been made to remove the time delay needed for the blanking operation. In one of those devices, the manufacturer gave a linear motion to the two blanking station platen, so that the latter travel together with the blanked sheets, a solution which allowed removing the time delay while modulating the linear displacement motion of the endless gripper bar chains.

Any discussion of documents, acts, materials, devices, articles or the like which has been included in the present specification is solely for the purpose of providing a context for the present invention. It is not to be taken as an admission that any or all of these matters form part of the prior art base or were common general knowledge in the field relevant to the present invention as it existed in Australia before the priority date of each claim of this application.

One aim of the present invention is to provide a device for conveying sheets which allows high rates while ensuring an optimal sheet conveying cycle without too severe an acceleration which could break the nicks between the sheets blanks. Another aim of the invention is to allow a rate change of the

sheet conveying cycle, independently from the conveying cycle of the converting station. The rate change or modification of a sheet conveying cycle involves acting on the acceleration and deceleration curves and on the respective duration of cycle phases according to the kind of work to carry out, without requiring, between two operation, changes to the parts of the sheets conveying device.

According to the present invention there is provided a device for conveying sheets, into a converting press for paper or cardboard sheets which press comprises at least one feeding station, a converting station, a waste stripping station and a delivery station for converted sheets, said conveying device including two endless gripper bar chains arranged to convey the sheets from the feeding station to the delivery station, a transverse driving shaft provided with driving wheels for the endless gripper bar chains, and at least one device for sheet capture secured to the endless gripper bar chains characterized by the fact that said transverse driving shaft is arranged to be driven separately from the drive for the other press station, by means of at least one independent motor, said independent motor being capable of operating driving cycles including at least one motion phase and one breaking phase controlled by a control device, each driving cycle duration of the independent motor being equivalent to a converting cycle duration of said converting station.

The driving of the sheet conveying device by an independent motor instead of driving it by the same motor as the other converting press stations was wrong prejudiced by fears of a synchronization defect between the sequential sheets run and the blanking platen operation of the downstream stations. The present inventors have recognised on the contrary that a control, particularly an electronic control, which receives a representative signal of the blanking station platen location and a representative signal of the gripper bar chains location allows control of the independent motor driving the gripper bar chains run with optimal synchronism related to the platen cycle. During a conveying cycle, a control device driving the independent motor by delivering a suitable electrical current is able to adjust with much more flexibility than a mechanical device could do, the characteristics of the acceleration phase, of the deceleration phase and of the breaking phase of the conveying device. Operation of the conveying device by means of the independent motor allows in particular better adjustment of the relative duration of the moving and breaking phases of the gripper bar chains with the moving and breaking phases of the diecutting platen and, consequently, a decrease in the duration of the platen breaking phase, which results in an increase in the whole machine production rate.

Other characteristics and advantages will be apparent to one skilled in the art from the following description of an embodiment of the invention, with

reference to the drawings, in which:

- Figs. 1a and 1b are respectively side and top views showing the establishment of a driving motor of a conveying device into a converting press;

-Fig. 2 is a diagrammatic view of the control device of the motor;

-Fig. 3 shows the recording of a cycle characteristics.

Figs. 1a and 1b show an independent motor/reduction unit 1 directly assembled with a lengthening of the transverse driving shaft 2 which comprises driving wheels 3, 3' of endless gripper bar chains 5, 6 of a converting press. As can be seen in Fig. 1a, the motor is located at the unit 4 level, which in a prior art converting press, comprises the driving mechanism parts of the gripper bar chains 5, 6 and the coupling parts to the motor actuating the various press stations, these parts not being shown in detail. This independent motor/reduction unit 1 can thus be assembled without modifying the embodiment of an existing machine. For one skilled in the art it will be apparent that the motor can also be secured in a position so called "in mirror", i.e. on the opposite end of the transverse driving shaft of the gripper bar chains, therefore as well in a position so called "operator's side" OS than in a position so called "opposite operator's side" OOS. The independent motor/reduction 1 can also be mounted in a position between frames 7, 8 and be arranged to actuate the transverse shaft 2 by known means such as pinions, belts, chains, which allow removal of the driving side units 4 and reduction of

the width dimension of the device.

The independent motor/reduction unit actuating the endless gripper bar chains 5, 6 is preferably an electric motor of high dynamic regulation. This independent motor/reduction unit 1 can be selected from commercially available synchronous motors, asynchronous, with d.c. motor, with or without brakes. For example, at the time of the depositor's tests, a brushless synchronous driving device comprising a motor type HXA60VH distributed by ABB Normelec S.A. (Switzerland) allowed the driving of the endless gripper bar chains 5, 6 of a converting press at significant rates, while permitting removal of the original mechanical driving means. Several manufacturers offer electric motors with standard embodiments able to reach couples of up to 200-500 Nm, allowing gripper bar chains accelerations up to 25 to 70m/s^2 to be achieved. The cost of such standard motors is lower than the one of all mechanical elements of known devices.

Fig. 2 is a schematic diagram of the electronic control device of the independent motor/reduction unit 1. The CDE control device receives from an absolute and incremental coder 9 as a signal indicative of the exact location of the blanking platen 10, this signal being used as a master reference within the whole system. The CDE control device also receives from an absolute and incremental coder 11 the absolute location of the gripper bar chains 5, 6; the CDE control device also receives the angular location of the independent

motor/reductor 1 scanned by the absolute and incremental coder 12. The comparison between these signals allows the electronic CDE control device to exactly define the blocking and releasing times of the independent motor/reduction unit 1, i.e. to define the beginning and the end of the breaking phase and to issue the current/tension feeding instructions defining, at any time, accelerations and speed rates of the independent motor/reduction unit 1.

Fig. 3 shows five curves 13 to 17 on a same diagram, showing in arbitrary units, for the curve 13, the tension, for the curve 14, the intensity of the current feeding the independent motor/reduction unit 1, for the curve 15, the acceleration, for the curve 16, the attained speed, and for the curve 17, the angular motion of the independent motor/reduction unit 1. On this Fig. the X-coordinate axis represents the angular rotation of the independent motor/reduction unit 1 during one rotation, that is to say 360° which corresponds to a sheet travelling from one station to the immediately next one.

It can be seen from these curves the relationship between control tension and speed as well as the lack of excessive acceleration. By modifying the preset tension curve, one can easily remove the constant speed motion phase, lengthen or shorten the motion phase duration inside a cycle.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A device for conveying sheets into a converting press for paper or cardboard sheets which press comprises at least one feeding station, a converting station, a waste stripping station and a delivery station for converted sheets, said conveying device including two endless gripper bar chains arranged to convey the sheets from the feeding station to the delivery station, a transverse driving shaft, a transverse driving shaft provided with driving wheels for the endless gripper bar chains, and at least one device for sheet capture secured to the endless gripper bar chains characterized by the fact that said transverse driving shaft is arranged to be driven separately from the drive for the other press station, by means of at least one independent motor, said independent motor being capable of operating driving cycles including at least one motion phase and one breaking phase controlled by a control device, each driving cycle duration of the independent motor being equivalent to a converting cycle duration of said converting station.

2. A conveying device according to claim 1, characterized by the fact that said independent motor is an electric motor/reduction unit of high dynamic regulation.

3. A conveying device according to claim 2, characterized by the fact that said independent motor/reduction unit is selected from the group of

synchronous motors, asynchronous, with D.c. current, with brake or without brake.

4. A conveying device according to claim 3, characterized by the fact that said independent motor/reduction unit is assembled on an extension of said transverse driving shaft operator's side.

5. A conveying device according to claim 3, characterized by the fact that said independent motor/reduction unit is secured on an extension of said transverse driving shaft, opposite the operator's side.

6. A conveying device according to claim 3, characterized by the fact that said independent motor/reduction unit is secured between frames.

7. A conveying device according to any of the preceding claims, characterized by the fact that it comprises an electronic control device for the independent motor/reduction unit which can adjust, for each driving cycle, at least the duration and amplitude of an acceleration phase, of a deceleration phase and of a breaking phase.

8. A conveying device according to claim 7, characterized by including a coder for the converting station location, a coder for the endless gripper bar chains location and an angular position coder for the independent motor/reduction unit, all connected to said electronic control device.

9. A conveying device substantially as hereinbefore described with reference to and/or as shown in the accompanying drawings.

DATED this thirtieth day of January 2001

Bobst SA
Patent Attorneys for the Applicant:

F.B. RICE & CO.

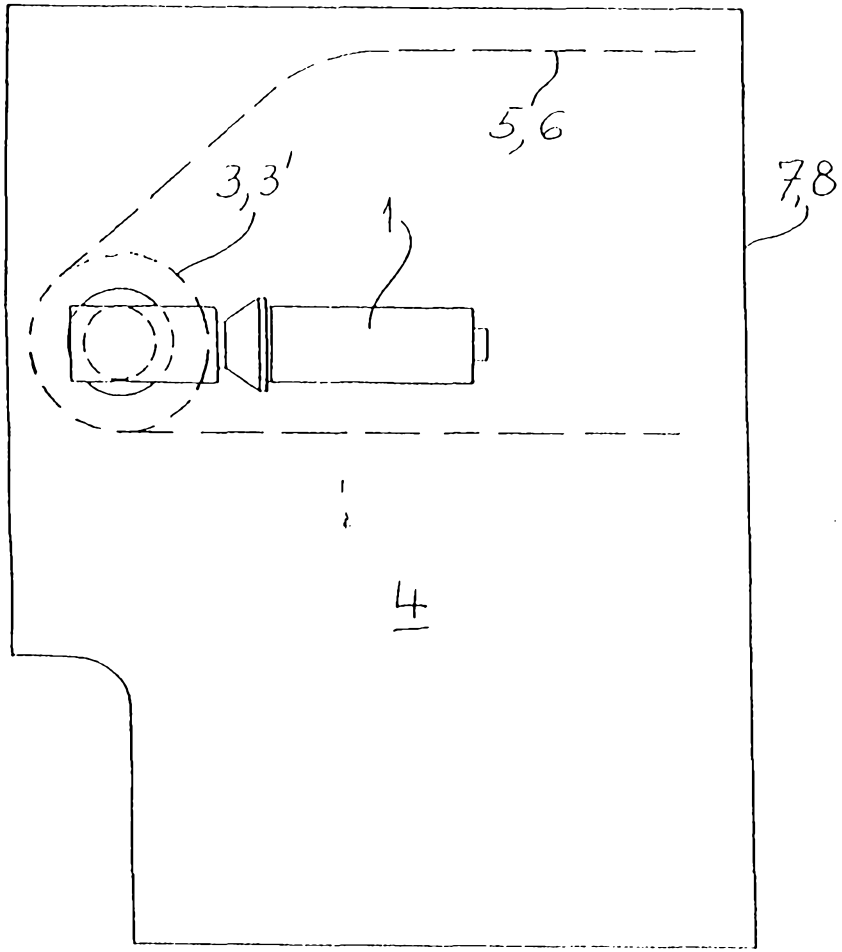

Fig. 1a

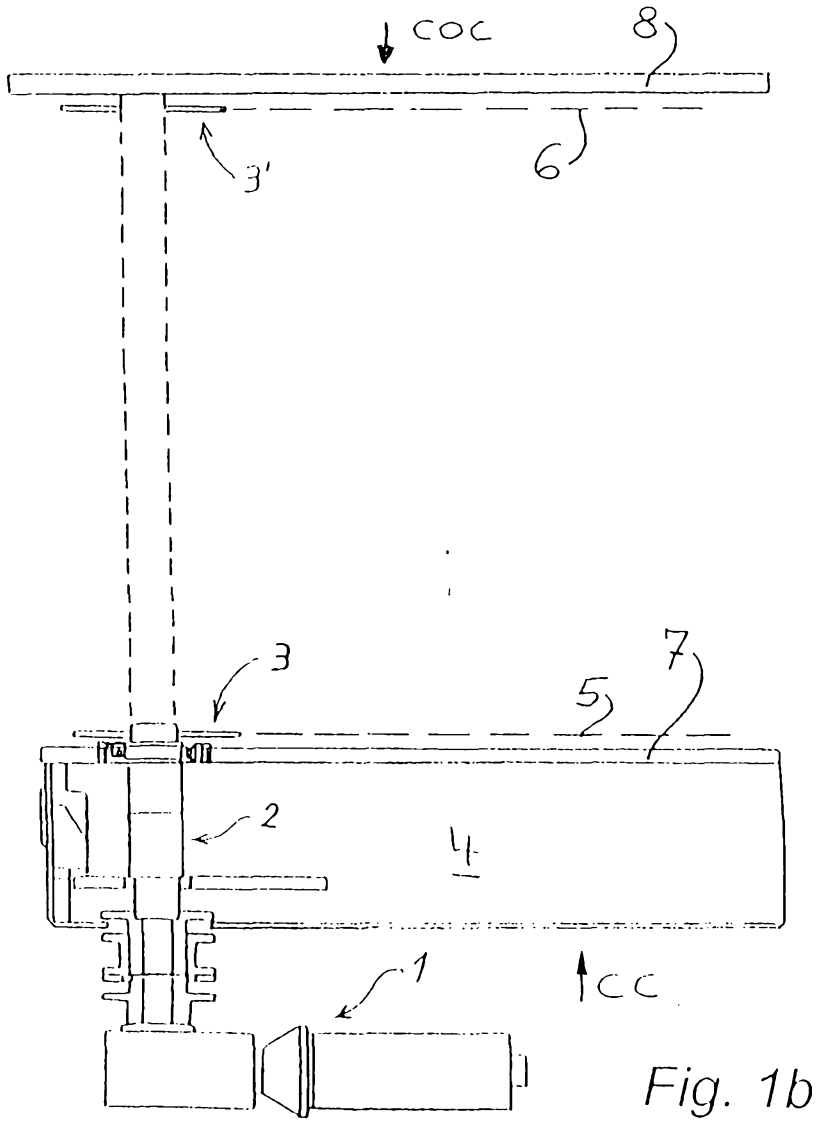

Fig. 1b

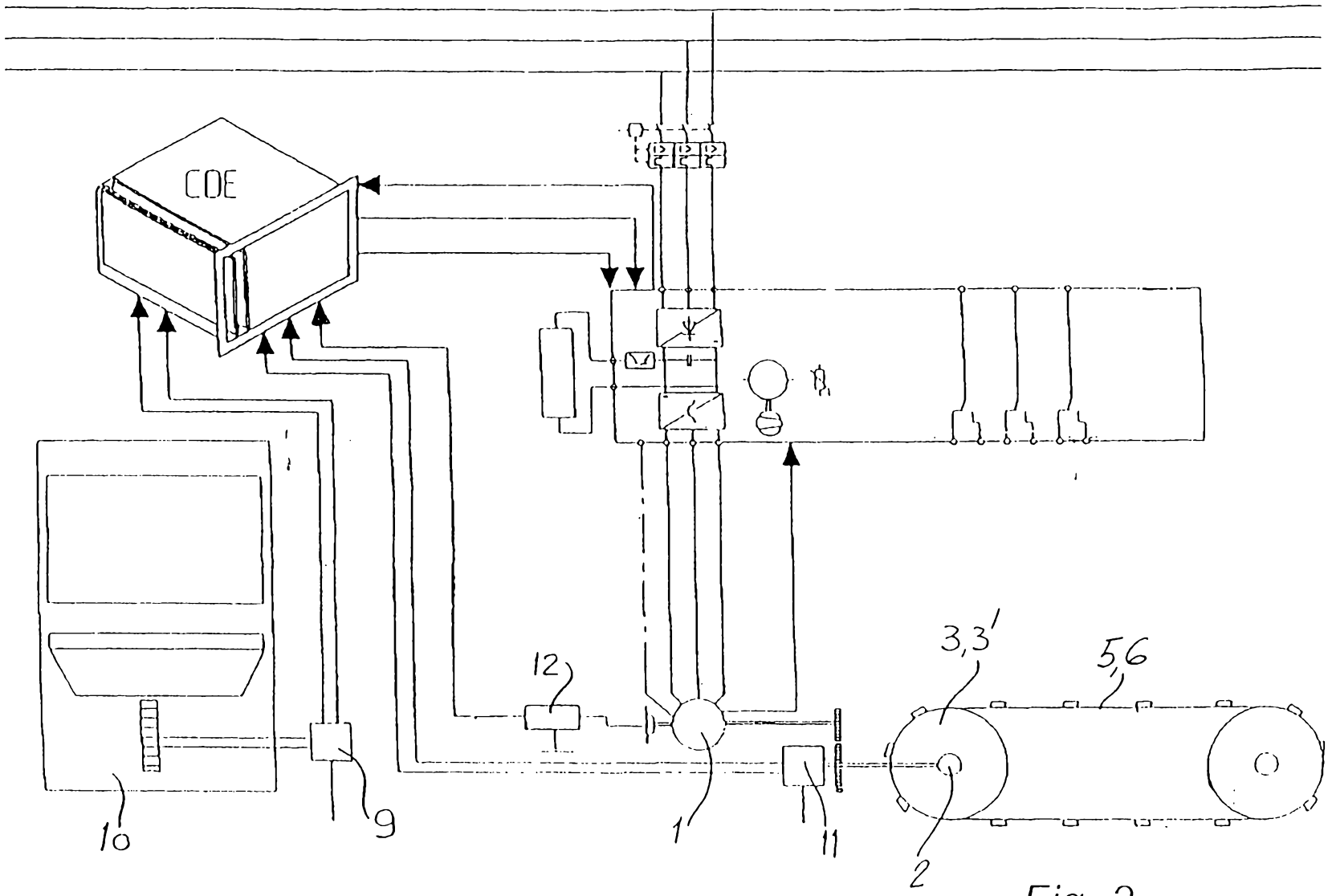

Fig. 2

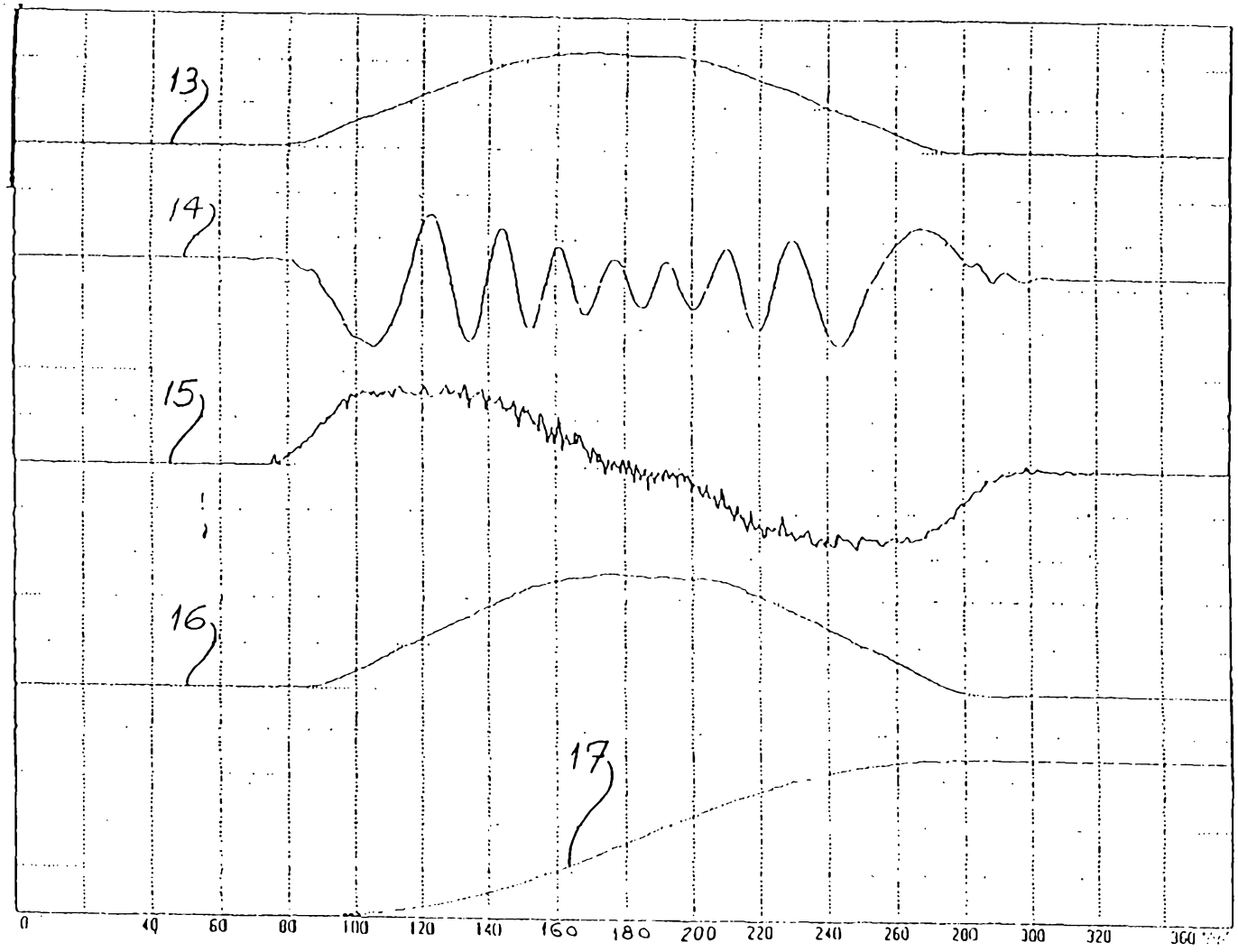
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Fig. 3