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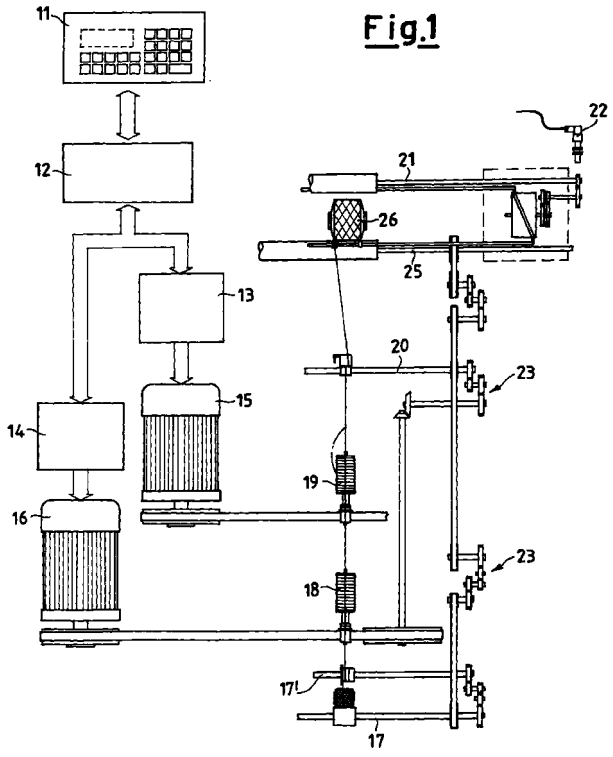
(54) Method for the continuous modulation of the speed of textile covering and twisting machines, and arrangement thereof

(57) A method for the continuous modulation of the speed of textile covering and twisting machines, including at least one actuating motor (16, 15, 36-39) controlling at least one line of spindles (18, 19) feeding the collecting of the yarn, where provision is made for a variable-speed control system (14, 13, 35) of at least one motor (16, 15, 36-39) of the machine, capable of being regulated by a panel (11) actuated by an operator, where the panel (11) in the control system (14, 13, 35) can be set up to achieve a continuous speed variation of the machine during the entire processing cycle, depending on pre-selected parameters.

Fig.1



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Description

[0001] This invention refers to a method for the continuous modulation of the speed of textile covering and twisting machines and arrangement thereof, in particular for the continuous regulation of their speed during the entire processing cycle.

[0002] The yarn covering machines are known to use spindles whose weight varies with the type of processing as well as in time, as a result of the unreeling of the yarn.

[0003] Based on the reel employed, a different spindle can be combined with it, and the type of spindle employed will in turn determine the maximum attainable speed.

[0004] This leads to different operating speeds of the textile machines, depending on their setups based on their particular reel and final packaging.

[0005] The machines must therefore be set-up from the very beginning of their processing cycle, and regardless of whether the reel is of a small or larger size, its initial speed remains constant over the entire winding cycle.

[0006] This means that in a few cases the labor costs are correlated to the time of doffing and intermediate loading of the machine, which could be avoided by using reels of a larger size. The productivity is consequently low, because the speed is at a constant level both with a full and an empty reel, and less than ideal windings could occur due to some stresses along the yarn, especially in the final spindle emptying phase.

[0007] One of the scopes of this invention is to provide a method and an arrangement capable of overcoming the technical and economic problems associated with the spindle's constant speed during the entire covering and twisting operation, thus overcoming the limitations outlined above.

[0008] This scope is achieved by a method according to this invention, which can in its most general sense better be defined by the characteristics listed in claim 1. The relative arrangement is the object of subordinate claims.

[0009] In a preferred embodiment in a covering machine equipped with perforated spindles, this consists in providing a control system for at least one variable-speed main motor of the machine, and a panel actuated by an operator, capable of setting up a diagram for varying the speed of the machine based on a particular chosen parameter. The parameter may be the processing time or alternatively the meters of yarn wound-up during the collecting phase, or a particular variation of speed according to a preset rule determined by selected parameters that generate a particular function.

[0010] It is therefore possible, by using a variable speed control system of the motor (or motors) according to this invention, to achieve a condition whereby a high speed spindle can also be utilized to produce packages of one kg and more.

[0011] The advantages thus obtained can be briefly outlined as follows:

- a savings in labor costs, because a package of twice the previous size can be achieved by recovering the time needed for the doffing and intermediate loading of the machine;
- an increase in productivity, because the speed can be gradually increased as the reel empties;
- a controlled quality, by setting up the speed so as to prevent any slippage of the dragging belt or peak stresses on the yarn, especially in the final reel emptying phase;
- a better production flexibility thanks to the possibility of programming the doffing time and a better usage of the spindles and reels.

[0012] The method of this invention can advantageously be applied to the covering machines for simple or double coverage as well as to other types of twisting machines.

[0013] A more sophisticated version of the method envisions the use of several variable speed motors capable of controlling the two lines of spindles, the predrawing, the drawing and the picking-up phase; these motors are kept synchronized with each other by a sophisticated system of electric shafts.

[0014] The latter implementation and realization of the method further supplements the mentioned advantages with the possibility of varying the speed ratios between the various shafts, without a need to change sprockets or other elements of the machine.

[0015] Whatever the embodiment assumed by the method of this invention, it provides in addition to the mentioned advantages also a better flexibility in organizing the production. The speed may in fact be varied to stop the processing when desired, that is at the time the personnel for the doffing and restarting of the machine is available, and perhaps also save on a certain amount of energy, by producing at lower speed.

[0016] Another collateral advantage is a better flexibility in using the various types of spindles and reels; the usage range of the latter is in fact increased with the resulting benefit that should many different processing tasks be required, the relative production problems could be solved with a smaller variety of equipment.

[0017] Further advantages and characteristics of a control method for a continuous speed variation of textile covering and twisting machines according to this invention may become clearer from the following description, offered for exemplifying but non-limiting purposes, with reference to the attached drawings in which:

Figure 1 shows a schematic view of a double coverage covering unit, using the speed varying method of this invention,

Figure 2 shows a schematic view of a single coverage covering unit, also using the method of this invention, and

Figure 3 shows a schematic view of a second double coverage covering unit, in which the method of this invention is implemented by a multiple number of motors directly associated with each device of the machine, all running at a variable speed regulated during the processing cycle.

[0018] In a first reference, Figure 1 shows the way the method of this invention is performed for regulating the speed of textile covering and twisting machines, in particular for the continuous regulation of the speed during the entire processing cycle.

[0019] In particular, it can be seen that in a double covering machine the method consists in providing a control system for at least one variable speed main motor of the machine, and a panel actuated by an operator, where a diagram may be set up so as to vary the speed of the machine based on a particular pre-selected parameter.

[0020] As mentioned above, according to the invention the parameter may be the time of processing or alternatively the meters of yarn wound up during the collecting step, or a particular variation of the speed based on a pre-selected rule, determined by selected parameters generating a particular function.

[0021] Figure 1 shows the main components of the system associated with the control arrangement of the invention. They comprise an operator interface, simplified in 11 and constituted by a panel which allows introducing a diagram of speed as a function of time, of the meters of yarn collected or of some other pre-selected function.

[0022] It is alternatively possible to set up some optimizing criteria and achieve an automatic computation of the optimum diagram; this is done only for the most sophisticated applications.

[0023] The data introduced by the operator by using the panel 11 are passed to a computing and optimizing system showed in a simplified manner in 12, which will, in addition to the machine's other general regulating functions, also perform the additional function of optimizing the speed as an object of this patent.

[0024] The computing system 12 sends the relative data, after finding the optimum speed of each motor based on its associated equipment and the continuous regulating functions of the pre-selected speeds, to some variable speed controllers shown in a simplified manner in the present embodiment with numerals 13 and 14. The embodiment provides in fact for a main (master) motor 16 and another secondary (slave) motor 15. The data are also sent out while taking into account the speed ratio between the mentioned main motor 16 and the secondary motor 15.

[0025] In this embodiment the speeds of the remaining drawing and pre-drawing shafts 17 and 17', of the overfeeder shaft 20 and collector shaft 21 are derived from the motion of the main motor 16 by a series of kinematic mechanisms, indicated in the overall by the number 23, capable of ensuring a mechanical synchronization.

[0026] Figure 1 shows two perforated spindles 18 and 19 of two lines of spindles, mounting a flanged reel. Moreover, a proximity sensor 22 allows reading the rotary speed of a collecting shaft 21, or of a neighboring shaft 25 on which a yarn collecting reel 26 rotates and winds, and calculating therefrom the number of meters wound up during the collecting phase. In this case the rotary speed of the two motors 16 and 15 of the two lines of spindles can be continuously optimized precisely based on the reading of the meters of the wound-up yarn.

[0027] Figure 2 shows the same application of the method used in the arrangement previously illustrated in Figure 1, but in this case for a simple covering machine.

[0028] In the case of a simple covering there is a clear separation between the two lines of spindles, each of which is independently programmed.

[0029] Figure 2 shows for simplicity only one line of spindles, because the second is identical to the former, and in this second embodiment equal elements are marked by equal reference numbers.

[0030] The operator panel 11 allows introducing the speed diagram as a function of time or of the meters collected. As for the previous embodiment, it should be noted that it is alternatively possible to set up some optimizing criteria and have an automatic computation of the optimum diagram, a case reserved only for the most sophisticated applications.

[0031] The data inserted from the operator panel 11 are passed to the computing and optimizing system 12, which will, along with the machine's other regulating functions, also perform the additional function of optimizing the speed as an object of this patent.

[0032] After finding the optimum speed of the motor 16 of the first line of spindles 18, the computing system 12 relays the relative data to the variable speed controller 14, and the same process also occurs for the second line of spindles, shown in the figure for the motor 15 and the perforated spindle 19.

[0033] The speed of the other drawing 17 and predrawing shafts 17', the overfeeding shaft 20 and the collecting shaft 21 are all derived from the motor 16 of the spindles 18 through kinematic mechanisms 23, capable of ensuring a mechanical synchronization.

[0034] Even in this case provision is made for a proximity sensor 22 which allows reading the rotary speed of the collecting shaft 21 and to calculate therefrom the number of meters wound up during collecting, upon which the speed is optimized.

[0035] A similar process occurs for the second line of spindles, which are only partially shown.

[0036] Figure 3 shows a schematic view of a double-coverage covering unit, where a continuous speed var-

ying system has been installed according to this invention.

[0037] Even in this figure, which shows the main components of the system, equal elements are indicated by equal reference numbers.

[0038] As before, the operator panel 11 allows introducing the speed diagram as a function of time or of the meters collected, and it is alternatively always possible to set up some optimizing criteria and achieve an automatic computation of the optimum diagram.

[0039] The data introduced by the operating panel 11 are passed to the computing and optimizing system 12 which, along with the machine's other regulating functions, also performs the additional function of optimizing the speed which has been seen to be the object of this invention.

[0040] In this case the computing system 12 deals with a series of mechanisms 30, 31, 32, 33 and 34, arranged in a tunnel of electrical actuating mechanisms indicated as an overall group by the number 35, which are in turn coupled to a corresponding series of motors 16, 15, 36, 37, 38 and 39, all at a variable speed and correlated to the various devices of the double covering machine.

[0041] After finding the optimum speed of each motor and the speed ratios between them, the relative data are sent to the tunnel of the electrical actuating mechanisms 35 operating at variable speed. This tunnel 35 will in turn govern the motors of the spindles 16 and 15 and the motor 36 of the drawing shaft 17 and pre-drawing shaft 17', the motor 37 of the feeding shaft 20, and the motor 38 of the collecting shaft 21.

[0042] All these motors are managed in an electric axis with functions as a network gap, governed by a network gap control 40 and an intelligent feed 41 in case of micro-interruptions, which are also part of the tunnel of the actuating mechanisms 35.

[0043] The shafts governed by the motors 36, 37 and 38 include the drawing shaft 17, the pre-drawing shaft 17', the feeding shaft 20 and the collecting shaft 21, respectively.

[0044] The computing and optimizing system 12 also controls an electronic traversing system constituted by a traversing system controller 42 which generates the tapering, differentiating and ruffling functions.

[0045] The controller traversing system 42 acts on a positioning controller 43, it is in practice a shaft controlling system which generates the commands needed to control the traversing element in place.

[0046] A brushless driver 44 is also provided, which is a low-level actuator designed to control the speed and positioning commands by governing the signals sent to the traversing brushless motor 39.

[0047] Figure 3 also shows the two perforated spindles 18 and 19 mounting the flanged reel. The system always provides for a proximity sensor 22, which allows reading the rotary speed of the collecting shaft 21 and computing therefrom the number of meters wound up during the collecting phase, upon which the speed is continuously optimized.

[0048] The action of varying the speed is generally produced by the computing and optimizing system 12 which may envision a micro-processor or PLC, capable for instance of measuring the meters of yarn wound-up during the collecting phase while using a proximity sensor, and based on the latter, of setting up the optimum spindle speed during the entire working process.

[0049] The desired speed value is sent to the actuating mechanism of the variable speed motor, through a serial communication line.

[0050] The setting up of the speed varying diagram is done on a display 50 in the visualizing system of the operator panel 11, for example by four lines of 20 characters each and a small operating keyboard. It also provides for a version with a graphical setting of the speed profile.

[0051] A more advanced alternative of the continuous speed control according to this invention is the definition of an automatic algorithm for setting up the speed, which utilizes one or more limiting criteria, such as:

- The power absorbed by the motor (constant power operation while the element carrying the yarn is emptied),
- The maximum tension of the yarn after the balloon-breaking terry, measured by an appropriate in-line sensor (constant tension operation),
- The optimization of power consumption (by setting up the curve capable of guaranteeing the maximum energy savings during the machine's entire working process),
- The doffing time (the speed is set up so as to initiate the doffing at the expected motion),
- Any combination of the foregoing limiting criteria.

[0052] The program allows setting up one or more of the above criteria and therefore calculates the optimum speed profile based on the pre-selected objectives.

[0053] The skilled in the art may apply any addition or improvement to the embodiment described above and illustrated in the exemplifying arrangements, capable of achieving the speed control according to this invention.

[0054] In particular, this may include some methods for setting up data differing from those described and illustrated above, as well as different controlling and governing systems to achieve a variable speed control. This will make it possible to achieve the maximum potential speed during processing, compatible with the yarn's technical and mechanical limitations.

Claims

1. A method for the continuous modulation of the speed of textile covering and twisting machines, including at least one actuating motor (16, 15, 36-39) controlling at least one line of spindles (18, 19)

feeding a reel (26) to collect the yarn on a spool, characterized in that it provides for a variable-speed control system (14, 13, 35) of at least one motor (16, 15, 36-39) of the machine, adjustable by a panel (11) actuated by an operator, where said panel (11) in said control system (14, 13, 35) can be set up to achieve a continuous speed variation of the machine during the entire processing cycle, based on pre-selected parameters.

2. A method for the continuous modulation of the speed of textile machines according to claim 1, characterized in that it provides as a control system a variable speed controller (13, 14, 30-34, 42) coupled to a corresponding variable speed motor (16, 15, 36-39).

3. A method for the continuous modulation of the speed of textile machines according to claim 1, characterized in that it utilizes the processing time as a parameter capable of producing the speed variation of the machine.

4. A method for the continuous modulation of the speed of textile machines according to claim 1, characterized in that it utilizes the meters of yarn collected on a collecting spool (26) as a parameter capable of producing the speed variation of the machine.

5. A method for the continuous modulation of the speed of textile machines according to claim 1, characterized in that it utilizes a speed variation according to a pre-set rule defined by selected parameters generating a particular function as a parameter capable of producing the speed variation of the machine.

6. An arrangement for regulating the speed of textile covering and twisting machines, utilizing the method according to any of the foregoing claims, characterized in that it provides for a variable speed control system (14, 13, 35) of said at least one variable speed motor (16, 15, 36-39) of the machine, by using an operator-actuated panel (11).

7. An arrangement according to claim 6, characterized in that it provides for a sensor (22) coupled to a collecting shaft (21) of a yarn on a reel (26) shaping a spool, capable of reading the rotary speed of said collecting shaft (21).

8. An arrangement according to claim 6, characterized in that it provides for a main motor (16) and another secondary motor (15), correlated with the respective variable speed controllers (13, 14) and to a computing and optimizing system (12) capable of processing and transmitting data, where said main motor (16) governs, by a series of kinematic mechanisms (23), the controlled speed rotation of drawing and pre-drawing shafts (17, 17'), overfeeding shafts (20) and collecting shafts (21) in a mechanical synchronism, according to a parameter set-up in advance by an operator interface (11) constituted by a panel and a display (50).

9. An arrangement according to claim 6, characterized in that it provides for an actuating tunnel (35) comprising a series of variable speed controllers (13, 14, 30-34, 42) coupled to respective variable speed motors (16, 15, 36-39) connected to the various parts of the textile machine, equipped with a computing and optimizing system (12) capable of processing and sending out data according to a parameter set-up in advance by an operator, interface (11) constituted by a panel and a display (50) for said actuating tunnel (35).

10. An arrangement according to claim 9, characterized in that it also includes a traversing controller (42) that acts in turn on a positioning control system (43) which generates the necessary inputs to control a traversing element in place, by the interposition of a driver (44) for a system brushless motor (39).

Fig.1

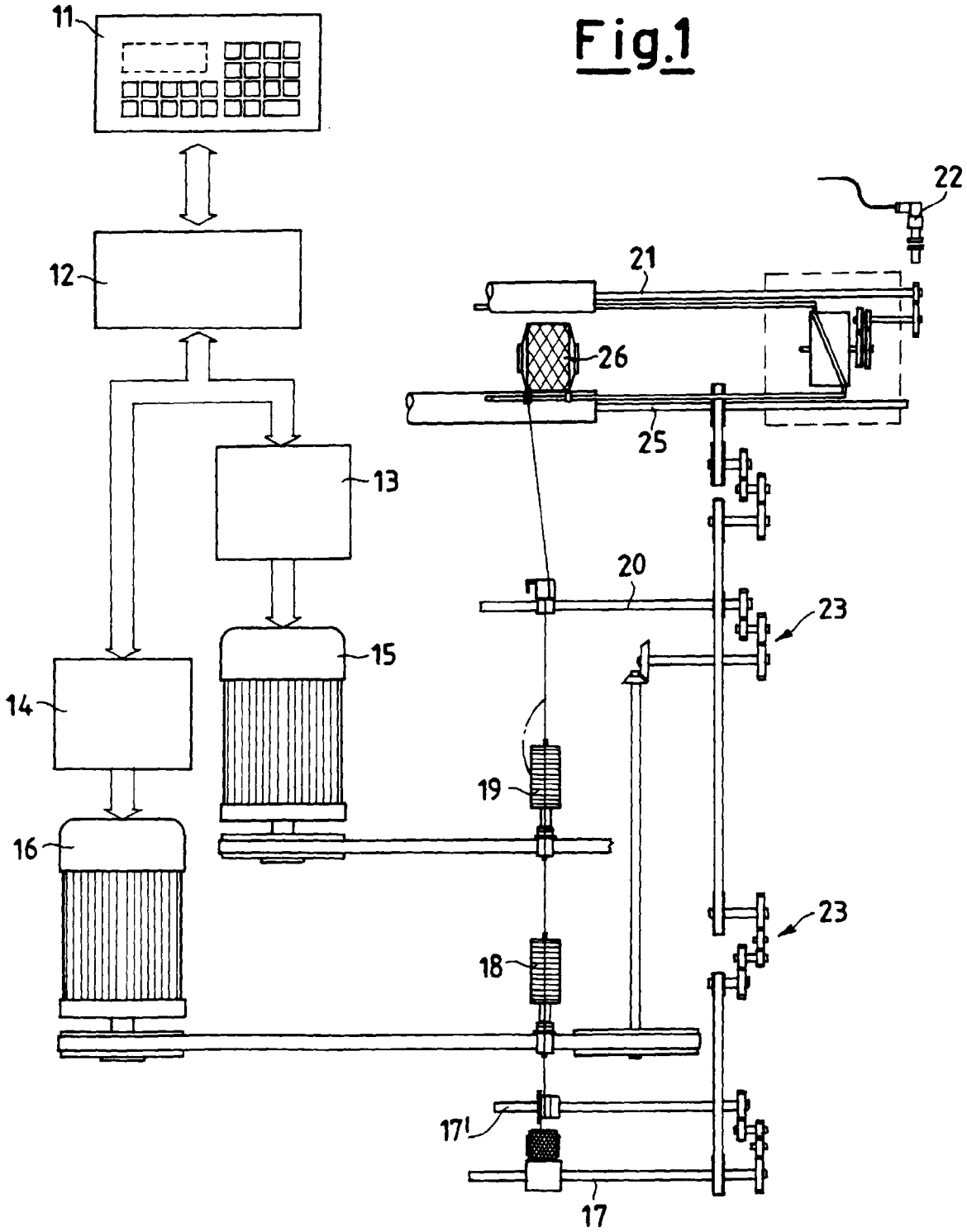


Fig.2

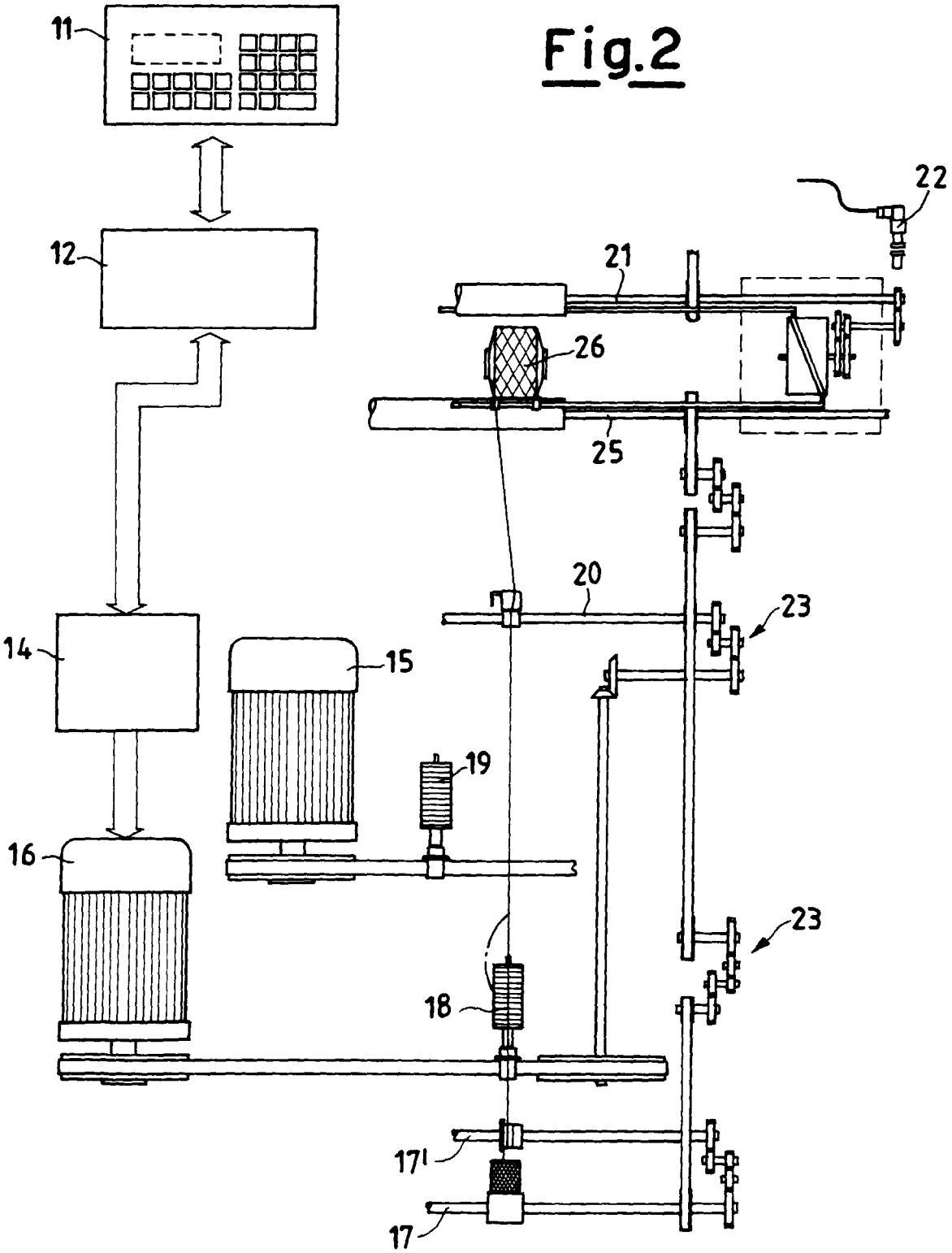
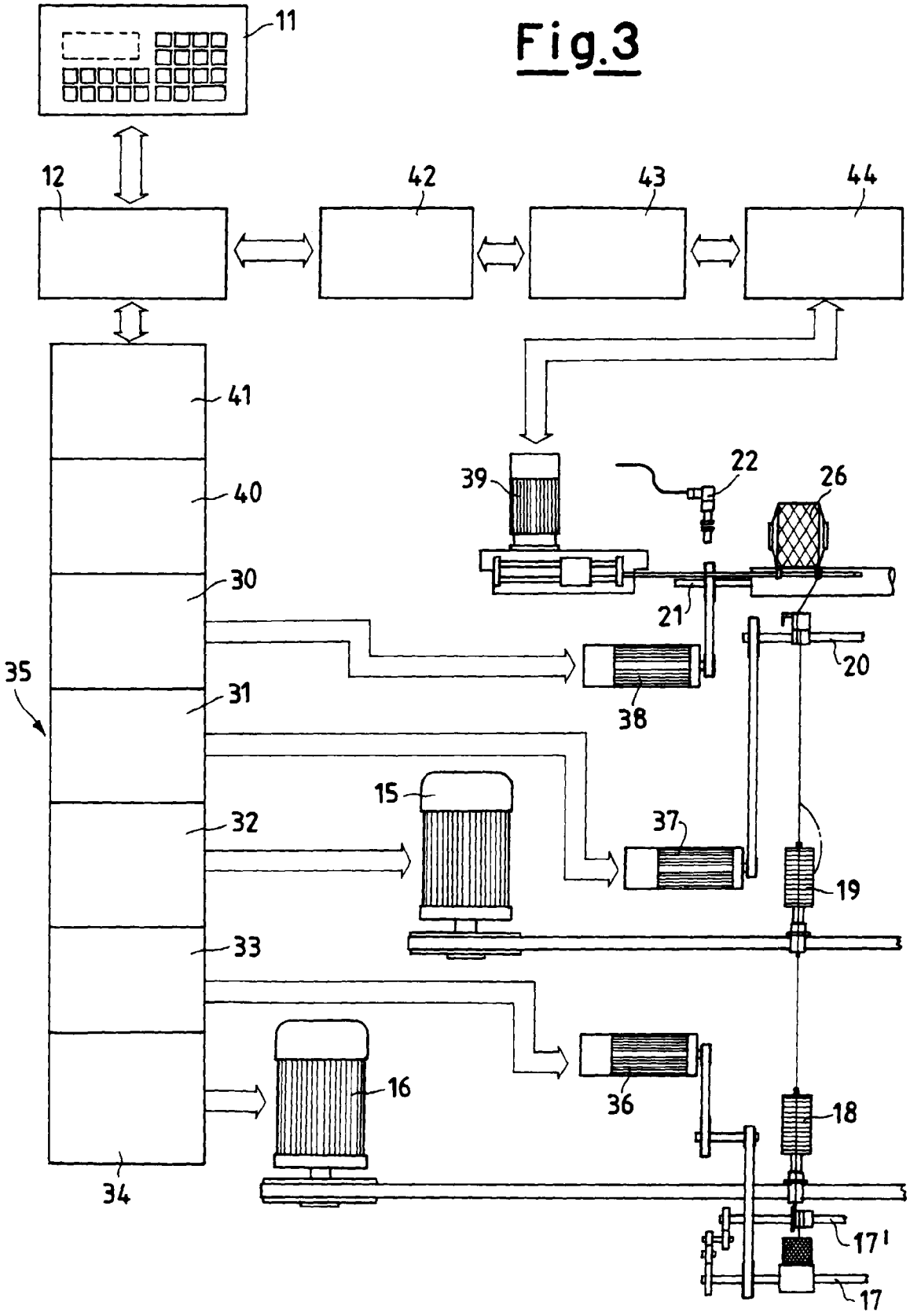


Fig.3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EUROPEAN SEARCH REPORT

Application Number
EP 99 20 1635

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

D01H
D02G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18 November 1999	Henningsen, O

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