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(54) Combing machine electronically managed with improved system for detecting the impulses from the encoders for operating the respective electric motors

(57) A combing machine comprising a plurality of combing groups including at least one combing roll (6) and at least one couple of tearing rollers (411-411'; 412-412') that can move in a clockwise and anti-clockwise rotation to accompany the slivers in advancement (11,12,13,...), associated to combing system with comb (52) and nippers (51-54) with reciprocating movement that joins and combs the torn tufts of said sliver on said tearing rollers (412-412') to obtain again a continuity of the sliver, and this by using:

- at least one electric motor (67/42') that operates said combing rolls and
- an electric motor that operates said tearing rollers (411;412);

where both said motors are associated to encoders (420,690) that determine and measure the turning parameters of at least said combing rolls (6-690) and said tearing rollers (4-420), characterized in that said combing machine is further provided with hardware for managing the respective electric motors, and in said hardware at least one impulse multiplier (931,932) of said encoders for the respective count is further provided, so that the count calculations for the motors drive and synchronization can occur on a value of multiple impulses if compared to the number of the impulses emitted by the respective encoder.

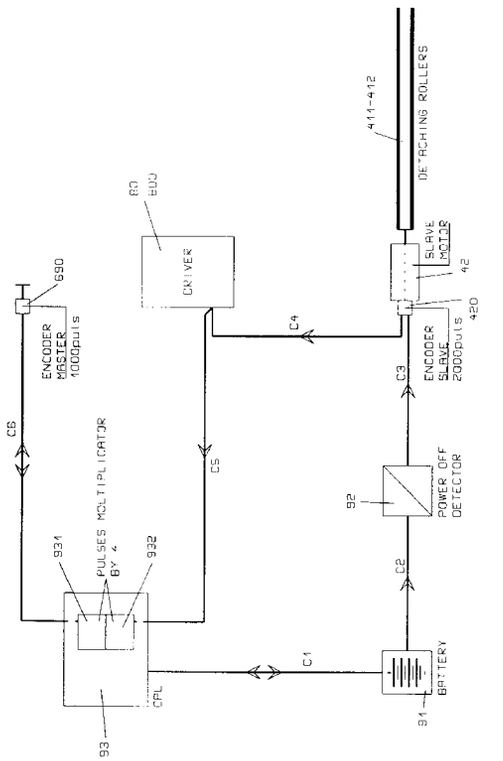

FIG. 10

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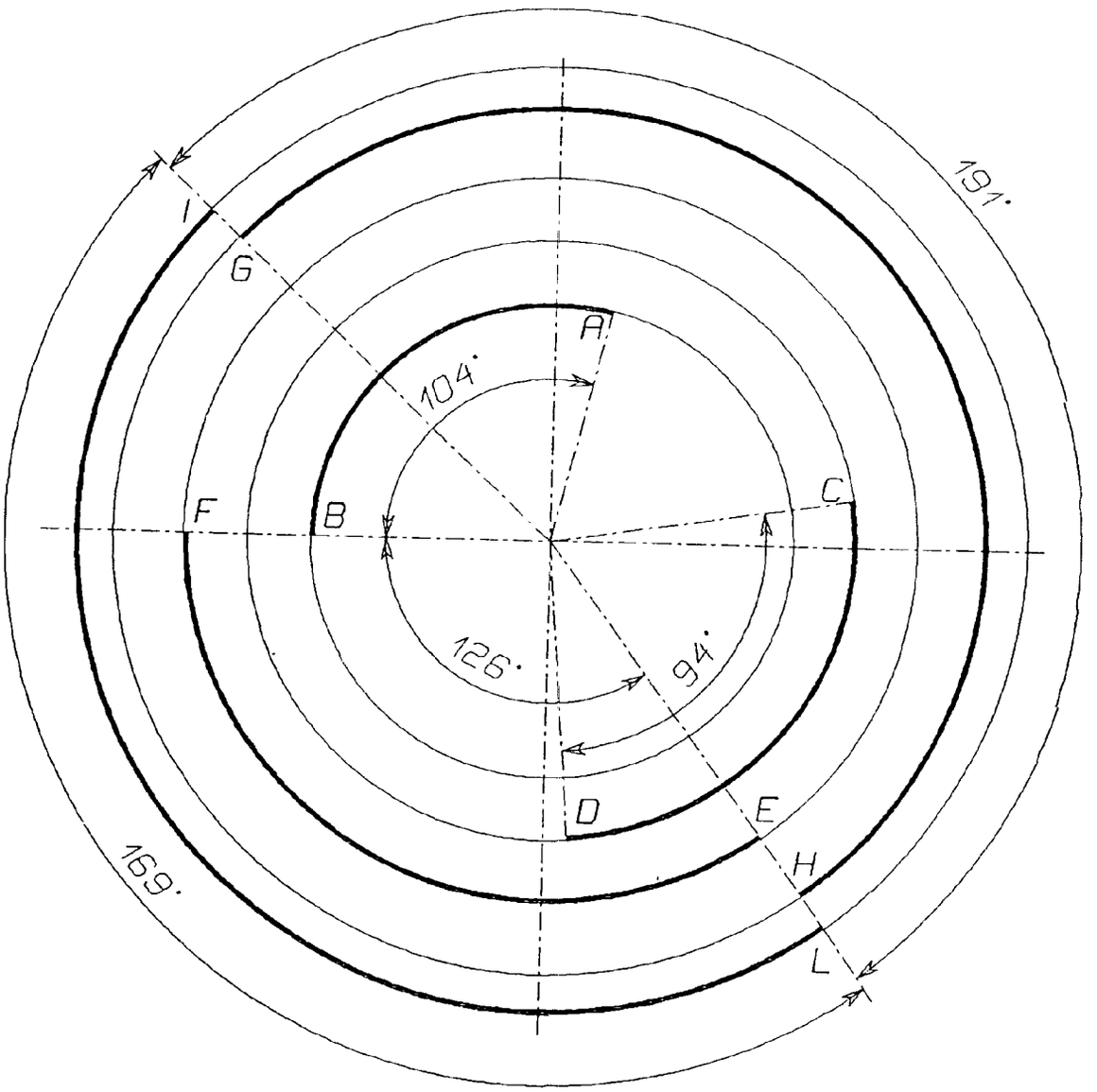

FIG. 10A

Description

This invention has an electronically managed combing machine comprising a plurality of combing groups including a combing sector roll (comb cylinder) and at least one couple of tearing rolls that can move in a clockwise and/or anti-clockwise rotation to accompany advancing slivers to be combed and torn, in counter rotation, associated to linear comb with reciprocal movement and to nippers reapproaching the tufts torn of said slivers on said tearing rolls to obtain again a continuity of sliver by reinversion of the rotation of said tearing rolls in the advancement direction to accompany the sliver thus joined and comb it while it advances.

At the present state of technology these types of machines are known, and said tearing rolls are generally in couples and move substantially with a movement that is defined as "pilgrim pitch" that is forwards and backwards.

This forward and backward movement of said tearing rolls, associates more particularly to a combing roll also known as comb cylinder, that rotates continuously in the advancement direction of the sliver and comprises a comb cylinder sector that rotates for a certain rotation angle, combs in a downwards direction the tuft of the sliver end left torn at the top.

Before the tuft combing there is the clamping, by means of grooved upper and lower supporting jaw nippers, that move above the comb cylinder, coming and going, that is in a reciprocal sense in respect to the advancing direction and co-ordinated with the rotation and reversal movement of said tearing rolls.

After the combing, the nippers open and move by sliding the combed tuft towards the mouth of the tearing rolls.

This in order to allow the tuft of sliver which is at the top to overlap the one at the bottom, to then again rotate said tearing rollers by advancing them in the direction of rotation, drawing together the two overlapped tufts and combing them with the help of an overhanging adjacent linear comb with reciprocating movement and placed immediately at the beginning, and so on until the whole sliver is finished and conveyed advancing orthogonally to form a wider sliver by means of more slivers, that are combed by groups of this type.

This system for moving the different deflecting rollers and rolls, including the combing roll and said tearing rollers, was made by means of mechanical drive.

Machines made by Vouk Gorizia, with electric motors that operate both the combing roll and the tearing rollers, substantially in conformity with IT-83324A/90 and WO-91/11548 are already available and therefore disclosed on the market .

Also in a solution proposed in EP-A-0374723 the use of an electric drive motor is suggested for said combing roll and one or two electric motors for said tearing rollers. These electric motors depend closely one on the other, and are managed by respective encoders mounted on the axes of the combing roll and on an axis of a tearing roller.

The system with more electric motors therefore works substantially as the drive gears system, replacing them, but with no possibility of modifying their parameters, all being managed and determined by said encoders and rigid processing means of the data supplied by these encoders.

In these recent techniques, the first motor, that is the one operating the combing roll, also operates the drawing system of all the rollers and the movement of the combs (linear and circular) and of said nippers, by means of complex oil bath mechanical drive. By using only two motors, only one part of the complex mechanical drive is obviated, while a great part of an oil bath gear drive remains.

The substantial difference of the VOUK IT-83324A/90 and WO-91/11548 solution in respect to EP-A-0374723 regards the fact that the electric motors by VOUK have an interdependent movement programmable and modifiable by means of computerised hardware system that, by software, determines on the basis of the angular rotation impulses supplied by the encoders of the drive system of the combing roll and by the drive system of the tearing rollers, the movement of the tearing rollers motor in respect to the first one.

In this solution it is also provided that the tearing rollers are operated directly by only one intermediate motor pinion (isosceles triangle drive) keyed and coaxial with the axis of the respective motor, to vary the rotation of the tearing rollers as wished with a minimum of errors.

This system makes it possible to make the machine work as desired and according to the type of sliver and fiber treated, by adjusting and operating both on the difference of acceleration and/or speed of the tearing rollers and on their opposite reverse running moment and/or o at their moment of gear re-inversion to come into unison with the advancement of the sliver for its advancement re-starting, this, therefore, occurring substantially with a step-by-step advancement - stop - advancement .... movement

Being-able therefore if wished to make the machine work even without the tearing movement, for example as re-comber, depending only on the software which manages said hardware.

These known systems with electric motors which detect the parameters of the impulse rotations by means of encoder, to determine the operation of the electric motors, have, in any case, the drawback that the errors notoriously occurring between the impulses of encoders mounted on the respective axes of the rollers and combing roll (particularly for the tearing rollers, that must continuously reverse their running), are difficult to correct to give a perfectly co-ordinate and continuous movement, and therefore the accumulation of the calculation errors result in phase displacements that do not allow a continuous correct tearing and rejoining work, phase dis-

placement that is caused by frequent stops of the machine and re-setting (setting-up).

Furthermore , if the machine stops for some reason, for example for lack of current, this advances for a certain angular value because of the inertia, and also in this case, the re-setting is very difficult, for the restarting of the work and the cycle, as set by the software of the hardware system.

Considering the causes thereof, it was found that the main cause of the accumulation of errors lies in the mechanical drive parts between the axes of the rollers or rolls and the axes of the motors, generally because complex and non rational drive systems are provided.

On the other hand the encoders need to be placed on the axes of the rollers or rolls, for a correct functioning, wherefore the solving of the problem from a planning point of view is difficult and out of the reach of the common designer.

After different attempts and experiments there was finally the bright and up to now unthought-of idea, as claimed , of:
making a combing machine comprising a plurality of combing groups including a combing roll and at least one couple of tearing rollers that can move in a clockwise and anti-clockwise rotation to accompany the advancing slivers to be combed and/or torn in one direction and bringing back of the torn tuft for an adequate portion, clamped between them, associated to linear comb and nippers that move for clamping the tuft of the end of the sliver left at the top and bringing it forwards overlapping the tuft at the bottom for rejoining the sliver and making it advance combing it by reversion of the rotation of the tearing rolls, and by using:

- at least one electric motor that operates said tearing rollers independently from:
- an electric motor that operates said combing rolls,
- both of them associated to encoders that determine and measure the rotation parameters of at least said combing rolls and said tearing rollers, characterized in that at least one main encoder is substantially provided mounted directly on the axis of combing rolls and at least one encoder mounted directly on the axis of said motor of tearing roller.

In this way it is possible to obviate the drawbacks deriving from the necessity of knowing continuously and exactly the position of the motor of the tearing rollers and the necessity of knowing always and continuously the exact position of the mechanical parts directly coordinated, and in particular the exact angular position of the combing roll and of the motor of the tearing rollers.

In fact, in the known solution, the encoders are placed only on the axes of the devices: the combing roll and tearing roll, wherefore it is not possible to know the exact position of the motor because of the transmission clearance and the consequent rotation reversal causes the feared phase displacements.

The solution of using:

- an encoder on the combing roll that determines the exact position of the system of the mechanisms that work and make the sliver advance, and consequently the position of the torn sliver, and
- the other encoder on the motor of the tearing rollers that determines the exact position of the motor that operates these rollers, allows the computer to intervene at the exact moment of their rotation reversal in accordance with the respective needs.

In fact, it must be considered that the sliver at the top advances at a step-by-step movement, that is forwards, stop, forwards, ..., while the sliver at the bottom advances at pilgrim pitch, that is forwards, backwards, forwards, ..., coinciding substantially between the two, only one portion of the forward movement, that is only the one in which the two sliver tufts have been overlapped and therefore rejoined for advancing the assembly, therefore the solution of putting one encoder on the drive and one on the motor of the tearing rollers is really the safest and most reliable if compared to other solutions.

To reduce the clearance errors, besides putting the pinion of the motor of the tearing rollers, directly keying with the tearing rollers (as in solution VOUK IT-83324A/90 and WO-91/11548), it was thought not to use a reduction ratio, but a direct drive ratio, (with equal teeth), in this way the tearing rollers will rotate at the same speed as the motor greatly simplifying its control by means of computer.

Additionally it was noticed that the encoders generally supply some angular impulse values too wide to control in a rational manner the motor of the tearing rollers in its starting up and stopping.

This problem is obviated by means of an impulse multiplier coming from said encoders for the respective count, so that the count calculations for the control and synchronization of the motors can be done on a value of multiple impulses in respect to the number of the impulses emitted from the respective encoders.

In this way the commands can be given in a more exact way, and the closest possible, to the optimal working parameters to obtain the highest quality of the combed product, and avoid undesired tearings and malfunctions.

The problem of the accumulation of the errors given by the encoders to the computerised managed system is solved in an unexpected and concrete way.

A further problem in the combing machines consists in that when there is a lack of current, there is the great need of restarting the work in a correct way, and with the cycle perfectly synchronized, otherwise there would be a continuous breaking of slivers or joints without adequate section for the overlapping of the tufts.

This problem is solved as claimed by using a storage system which maintains the current tension, prefer-

ably with battery, that stores in any way the angular rotation position of said encoders, to determine with this a correct restart of the cycle.

In this way the position of the machine parts is perfectly stored and the computer/software system will be able to re-set all automatically when the cycle starts again.

Another important problem to be solved on these kinds of machines comes from the fact that notwithstanding the use of two electric motors, one that operates the whole drive including the combing roll and one that operates the tearing rollers, involves always problems of adapting the cycle and therefore of choosing the exact moment of reversal of the running of the tearing rollers.

Further therefore, as claimed, to obviate this complexity, and in particular to properly solve the problem of an exact and rational combination and synchronization of the pilgrim pitch movement on the detaching rollers, it was thought of a substantially simpler and innovative solution that obviates the trouble of using a rotation reversal motor, by means of a combing machine using at least two independent electric motors, one for the advancement and one for the drive of said tearing rollers, characterized in that:

- the first motor also operates a part of the movement of said tearing rollers, that is their clockwise step-by-step rotation and,
- the second motor operates said tearing rollers only for the second part, that is in an opposite direction in respect to the advancement system operated by the first one.

One therefore has :

- the use of at least one electric motor that operating all the advancement mechanisms and therefore also said combing roll, also rotates said tearing rollers in one direction only, in a reciprocal way according to the needs and in the same advancement rotation direction and,
- the use of at least one second electric motor that rotates said tearing rollers in a direction opposite to the advancement, at the proper moment in a step-by-step way .

In this way the electric motor that operates the tearing rollers will not move at a pilgrim's pitch, as the previous ones, but will possibly be a simpler and less powerful electric motor, and therefore less expensive, having to perform only rotation and stop movements in one direction and not rotation reversal like the previous ones.

Substantially, all the hysteresis and inertia problems are avoided, caused by the backing-up reversal of the electric motors and in particular also the accumulation of errors to and from the encoders and that cause problems to the synchronization during the rotation reversal in the drive of a single motor that works in both directions.

Furthermore (as said), the present techniques substantially provides the use of only one electric motor for the whole drive system of the sliver and therefore this moves not only said combing roll, but all the other members in complex mechanical drive, therefore even said comb, said nippers, and the other deflecting rollers, drive ones etc.

To obviate this problem we use separate electric motors and all equipped with encoder controlled by a computer, for each system member, eliminating therefore substantially all the complex oil bath mechanical drive and being-able to reduce to a minimum the drives and use simple deflecting pulleys for minor parts.

Advantageously, said system with linear comb and nippers is driven by a separate electric motor.

In this way the transmission mechanisms are even more simplified.

Just as advantageously the system with nippers is operated by a separate motor that, together with an encoder, rotates in both directions.

In this way we obtain the advantage of being able to independently adjust by computer even the movement of the nippers.

In the better solution six independent electric motors are used but all substantially co-ordinated one to the other and controlled by encoder and control computer of same.

In this way practically all the complex and expensive mechanical oil bath drive systems are eliminated, it being-possible to use some simple belt drives and deflecting pulleys.

Just as advantageously, all said five electric motors function by rotating unidirectionally, only one of them rotates in direction opposite to the advancement rotation direction and is keyed to said detaching rollers.

In this way we obtain the highest construction simplicity and functionality.

The electric motors presently used managed by encoders have the drawback of being cumbersome and expensive, with little precision and with low torque values if compared to the current or number of revolutions.

For such reason it was thought to use electric motors without brushes supplied by sinusoidal alternating current, both in the synchronous version with permanent magnets and in the asynchronous induction version, supplied by three-phase current, of the type with field or vectorial orientation.

In this way the operative efficiency is improved, the work is done properly and with precision, the encumbrances are reduced, with lower costs and a better torque/n. revolutions ratio

These and other advantages will appear from the following description of illustrative preferential realization solutions related to the enclosed drawings.

Figure 1 represents the machine with 5 independent motors;
Figure 1A shows a solution in which the motor that operates the combing roll also operates in the same direction, the tearing rollers, while another motor is provided for operating the tearing rollers in the opposite direction;
Figure 1B represents a variation in which the motor that operates the combing roll also operates, in the same direction, the tearing rollers, while another motor is provided for operating the tearing rollers in the opposite direction;
Figure 2 represents a top view of the single electric motor that operates the couple of tearing rollers.
Figure 3 represents a cross sectional view of the gears system driving the motion of the motor axis to the two axes of the tearing rollers.
Figure 4 represents the top and sectional view of one of the electric motors that include the respective encoder.
Figures 5 and 6 represent the plan-view of an entire combing machine, respectively with continuous working sliver and with torn sliver.
Figure 7 represents the schematic side view of the synchronized position of the tearing rollers, of the comb and of the feeding roll in exact synchronized position and with correct overlap of the tufts to rejoin the sliver during the combing.
Figure 8 represents the same view of the previous Figure, but with a wrong placement of the tufts, caused by the problems of the clearances and of phase displacement due to the reversal of the rotation in the previous technique.
Figure 9 represents a side view of the entire mechanism, rollers, rolls and unwinding bobbin for each single group.
Figure 10 represents a block scheme of the hardware system which controls the machine according to the invention with the least number of encoders (in this specific case for only two motors).
Figure 10A represents the control angular diagram of the different motors, done by the hardware-software system

With reference to the Figures it is noticed that with 1 the general sliver in advancement is indicated while with 11,12,13,14,15,16,17,18 the sliver portions, that is slivers that are treated for each single group of the combing machine, starting from the feeding bobbins of the slivers 11',12',13',14',15',16',17',18'.

The work-stations comprise towards the top, a couple of leading rollers 2, a group 3 with couple of leading rollers 31,32, a tearing group 4 that comprises the couple of tearing rollers 411,412, associated to idle counterrolls 411',412', the first being operated by the gear box 41 with motor axis pinion (420) in direct mesh with 1 to 1 ratio, directly from the axis of the electric motor 42 that comprises in axis also the encoder 420.

5 indicates the linear comb group 52, and nipper 51,54 and sliver feeding roll 53.

6 indicates the combing roll, its combing circular sector is indicated with 61, and

6' indicates an underlying rotating cylindrical brush, that cleans continuously the circular comb sector 61.

The nipper group 51,54 moves by coming and going:

- from a position adjacent to the torque at the top of the tearing rollers (412,412'), above the underlying combing roll 6,
- to a position further back at the top,

to allow the combing action of the circular sector comb 61 under the feeding roller 53.

7 indicates a second roll for deflecting and sliver tensing .

81 and 82 (see also Fig. 9), indicates the couple of sliver unwinding rollers, that is support and rotation rollers of the sliver bobbin to be combed 8 in step-by-step unwinding.

We have therefore the flux of different slivers coming from a bobbin for each group 11',12',13',14',15',16', 17',18', to flow all together after detaching-rejoining and combing downwards 11,12,13,14, 15,16,17,18 to form by degrees the final sliver 1.

In Figure 1 operating electric motors are thus distributed upwards:

- first sliver extraction control electric motor 23, that operates by means of reducer and couple of gears 24 the two extraction rollers (accompanying) 2 in advancement rotation from the bobbin 11', 12', 13', 14', 15', 16', 17', 18' towards the sliver 1 by means of 11, 12, 13,14,15,16,17,18;
- second electric motor 4 with encoder 420 incorporated that operates the two couples of tearing rollers (411-411'; 412-412').

In an advantageous solution said motor can rotate only in the opposite direction by clutch disengagement and/or freewheel (F), while the rotation in advancement direction is obtained by the main drive 6,6' (see Fig. 1A and 1B).

- third electric motor 67 with encoder 670, that operates by means of rotation drive only in a clockwise direction and by means of pulleys and trapezoidal belt drive 68,68',69, the axes of the combing roll 6 controlled by the respective encoder 690, and of the deflecting and tensing roll 7, by means of the deflecting axis 68,
- the electric motor 50 that operates the brush 6', by means of pulleys and belt, always in clockwise advancement direction (alternatively can control only in one direction by freewheel even the step-by-step advancement rotation of the tearing rollers

(411-412) as indicated in the alternative Figure 1B.

The motor for moving nippers and linear comb 80 that rotates in both directions, with respective encoder 800, by means of the axis 8 that operates the mechanical drive (not shown) of the nipper system 51-53 and linear comb 52 of the nipper group 5.

The bobbin for unwinding the sliver is mounted on support rollers 81,82 for unwinding the sliver by means of motor-gear system 830-83-84 where the operating electric motor 83 involves a respective control encoder 830.

The different motors are operated by the hardware system as indicated in Figure 10, where, for the sake of simplicity, only the motor group of the of the tearing rollers system 42 are indicated with respective encoder 420, and the encoder of the combing roll 690, while "D indicates the hardware card of power control to operate one of the feeding motors.

All other feeding motors will have analogous connections and in particular even motor 42 besides the motor 67 that operates the combing roll.

In this scheme the following is additionally presented :

- a lack of tension detector 92 that also provides the maintenance of the motor feeding 42 by connection c3 to the encoder 420 of the same motor;
- a connection C2 to a battery 91 to obtain a continuity of the impulses from the encoder 420 even if there is a lack of current;
- a connection C1 of the battery 91 to a CPU 93 that comprises an impulse multiplier system respectively:

    - multiplier 932 from the encoder 420 that is connected to the motor power card D, with the connections C4 and from this to the multiplier C5;
    - multiplier 931, from the main encoder 690 of the combing roll 6, by means of the connection C6 (all other encoders of other motors will be connected in a similar way, even if in the present case, not shown, for simplicity).

Multipliers 931 and 932, multiply the impulses received from the encoders for a value not lower than 4, and send the received data to the CPU (93) for respective calculation and management by means of management software.

This multiplication system is very important because it reduces the errors due to a count done on encoder impulse values too wide because of a mechanical derivation, thus substantially improving the setting up system in perfect synchrony the system for restarting the cycle.

In particular, it can also be noticed that in the nipper group and comb 5, for re-joining and combing the torn tuft, is placed immediately at the top end of the tearing rollers 4, the respective linear comb 52 that can adhere in a coming and going manner to the upper roll of the first couple of tearing rollers 412', while the nippers, (51-511; 54-511') open, accompany the tuft portion at the top towards and against the mouth (s) of the first couple of tearing rollers 412-412', to make it adhere to the tuft portion at the bottom (s) that hangs and adheres for an adequate portion, on the lower roll (412) of said first couple of tearing rollers 412-412', so that when rotation in advancement direction restarts, an overlap of the tufts can be obtained (the one at the top and the one at the bottom) and a drive of the whole, clamped by the tearing rollers, as shown in Fig. 7.

The overlap must be carried out in a precise way and for a sufficiently wide space in order to obtain a sufficient and correct tightness overlap to form a continuous sliver, for this reason the software together with the computer management 93 is prefixed, that will manage and vary according to the needs all the parameters relative to the moments of starting and stopping of the motors movement and therefore of the respective step-by-step cycles of the parts that produce the sliver.

In particular the tearing-combing and rejoining operative cycle occurs as follows:

- the nippers close while moving back with the torn tuft, hanging downwards;
- under the tuft rotates the circular comb in direction opposite to the nippers movement (advancement direction), and the circular sector of the comb engages the hanging tuft combing it;
- when the combing is over, that corresponds about to the most backward position of the nippers,
- the nippers start to advance again and after a while open, simultaneously the tearing rollers rotate backwards, in order to bring an adequate tuft portion to allow the overlap of the tuft that advances on the nippers;
- as soon as the overlap is done, with open nippers, the tearing rollers reverse the rotation, dragging the whole sliver forwards ,
- the sliver clamped at the top end between feeding roll 53 and lower nippers 54, tears;
- simultaneously the linear comb penetrates into the fibers of the sliver that advances performing the final combing;
- in the meantime, the nippers that are open, return backwards clamping themselves on the tuft at the top and a new cycle starts again.

As said in the solution according to Figure 10 of the block scheme, the only the two essential encoders and only the electric motor of the tearing rollers 42 are illustrated for simplicity, while the whole management of all other motors is not shown (sole advancement motors or anyhow co-ordinated for rotating in the sole advancement direction and managed by corresponding power cards "D" and corresponding encoders.)

From the experiments carried out it was found that for a rational, correct and sufficient management of the motors a multiplication of said multipliers (931,932) not lower than 4 is necessary.

In Figure 1A and in Figure 1B, the physical separation of the two forward and backward movements of the tearing rollers, with the aid of drive: is shown

- direct for backward movement (4,42,420, ...) and
- indirect for forward movement, 4',42',420',41':

  - in a first solution, deriving from the motor 42' that operates directly the combing roll;
  - in a second solution, deriving from the motor 50 that operates the brush 6'.

In these two cases obviously the motor 67 transmits the motion to the only sliver advancement (0) and to the tensing roll 7.

In both these solutions, a free wheel RL is provided to satisfy the necessity to continue the rotation in advancement direction of the respective parts in direct mesh (brush or combing roll), eventually with flywheel.

However, nothing excludes the use of servo-controlled clutch disengagement from the computerised system.

The scheme according to Figure 10A shows in angular values the rotational behaviour of the different parts:

- motor 50 of the brush 6';
- motor 67 (with encoder 670) of the combing roll 6;
- motor 80 with encoder 800 of the nippers 51-54 and linear comb 52;

  - motor 42, with respective encoder 420 of the tearing rollers 411-411',412-412'.

Even more particularly, from the angular diagram 10A, it appears that:

- the arch A-B of 104°, regards the cleaning of the combing roll (6) with brush (6'):
- the arch C-D of 94° regards the combing angle with the circular comb 6;
- the arch E-F of 126°, regards the forward and backward movement of the nippers 51-54 and linear comb 52;
- the angle H-G of 191° regards the forward rotation of the tearing rollers 11-411',412-412', rotation that is carried out by the system 4', with the motor 42', managed by encoder 420', that operates the combing roll 6 (Fig.1A) or its brush (Fig.1B);
- the angle I-L of the value of 169°, regards always the rotation of the tearing rolls 11-411',412-412', but this time in opposite direction, rotation that is carried out by a separate motor directly keyed to the tearing rollers axes 42 and managed by respective encoder 420, as shown above.

Claims

1. A combing machine comprising a plurality of combing groups including at least one combing roll (6) and at least one couple of tearing rollers (411-411'; 412-412') that can move in a clockwise and anticlockwise rotation to accompany the slivers in advancement (11,12,13,...), associated to combing system with comb (52) and nippers (51-54) with reciprocating movement that joins and combs the torn tufts of said sliver on said tearing rollers (412-412') to obtain again a continuity of the sliver, and this by using:

   - at least one electric motor (67/42') that operates said combing rolls and
   - an electric motor that operates said tearing rollers (411;412);

   where both said motors are associated to encoders (420,690) that determine and measure the turning parameters of at least said combing rolls (6-690) and said tearing rollers (4-420), characterized in that said combing machine is further provided with hardware for managing the respective electric motors, and in said hardware at least one impulse multiplier (931,932) of said encoders for the respective count is further provided, so that the count calculations for the motors drive and synchronization can occur on a value of multiple impulses if compared to the number of the impulses emitted by the respective encoder.

2. A combing machine according to claim 1., characterized in that it comprises:

   - at least one first encoder (690) mounted directly on the combing rolls axis (6) and
   - at least one second encoder mounted directly on the axis of said motor (42) of said tearing rollers (411,412).

3. A combing machine according to the previous claim, characterized in that said machine has tension maintaining means (91) that store, in any case, the angular rotation position of the combing roll and of the tearing rollers motor, and with the position of the nipping comb system, by means of said encoders (420,690) thus always maintained in tension storage and/or emission of impulses.

4. A combing machine according to claim 2, characterized in that said tension maintaining means (91) work by battery.

5. A combing machine that uses at least two independent electric motors, one for the advancement and one for operating said tearing rollers, according to the previous claims, characterized in that:

   - the first electric motor/s system/s being substantially a drive one/s and intended for operating also a part of the movement of said tearing rollers, when these must rotate in the same direction and,
   - the second electric motor carries out only the second operating part of said tearing rollers, that is in the direction opposite to the advancement system carried out by the first one.

6. A combing machine according to previous claims of the type in which the tearing rollers system is operated by a separate electric motor, characterized in that said electric motor has a drive ratio directed to said tearing rollers with a 1 to 1 value.

7. A combing machine according to previous claims, characterized in that the drive system of the slivers (1) is operated by separate electric motor (23,24,2).

8. A combing machine according to previous claims, characterized in that said nippers (51,54) are operated independently from electric motor controlled by encoder and rotating in both directions, corresponding to the coming and going reciprocal movement of said nippers.

9. A combing machine according to previous claims, characterized in that it has more independent electric motors (42,67,50,80,23,83,42') substantially all co-ordinated one to the other and managed by encoders that, connected to computerized system and management software, control in a co-ordinate way the stop and the start of the:

   - tearing rollers (420-42);
   - general drive system (230-23);
   - the combing roll movement system (670-67).

10. A combing machine according to previous claims, characterized in that it has at least one hardware system managed by computer with CPU 93, that includes respective multipliers (931,932) of impulses from encoders (420,690, ...), and electrical drive motors power cards "D", that manages:

    - on one side the respective drive motors in the advancement direction of the sliver (76, 23, 80, 50,42'..) and
    - on the other the motor for operating said tearing rollers (42), at least in opposite direction rotation.

11. A combing machine according to previous claims, characterized in that the respective electric motors are electric motors without brushes, working on three phase sinusoidal alternate current, with field or vectorial orientation.

12. A combing machine according to previous claims, characterized in that the respective electric motors are electric motors without brushes, working on three phase sinusoidal alternate current, of the synchronous type with permanent magnets.

13. A combing machine according to previous claims, characterized in that the respective electric motors are electric motors without brushes, working on three phase sinusoidal alternate current, of the induction asynchronous type .

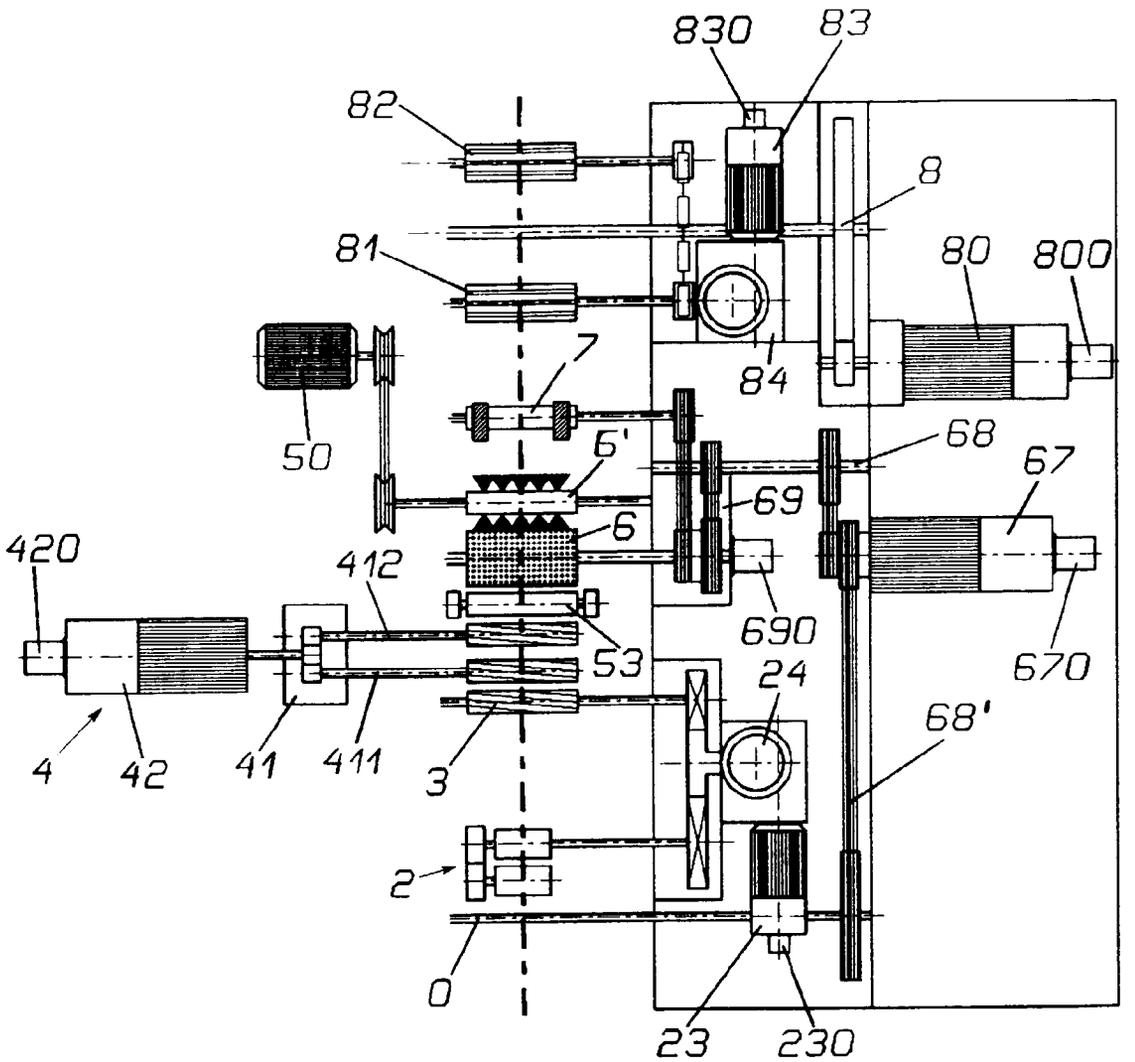
830
83
82
8
81
80
800
84
7
50
6'
68
67
69
6
420
412
690
53
670
24
68'
4
42
41
411
3
2
0
23
230

FIG. 1

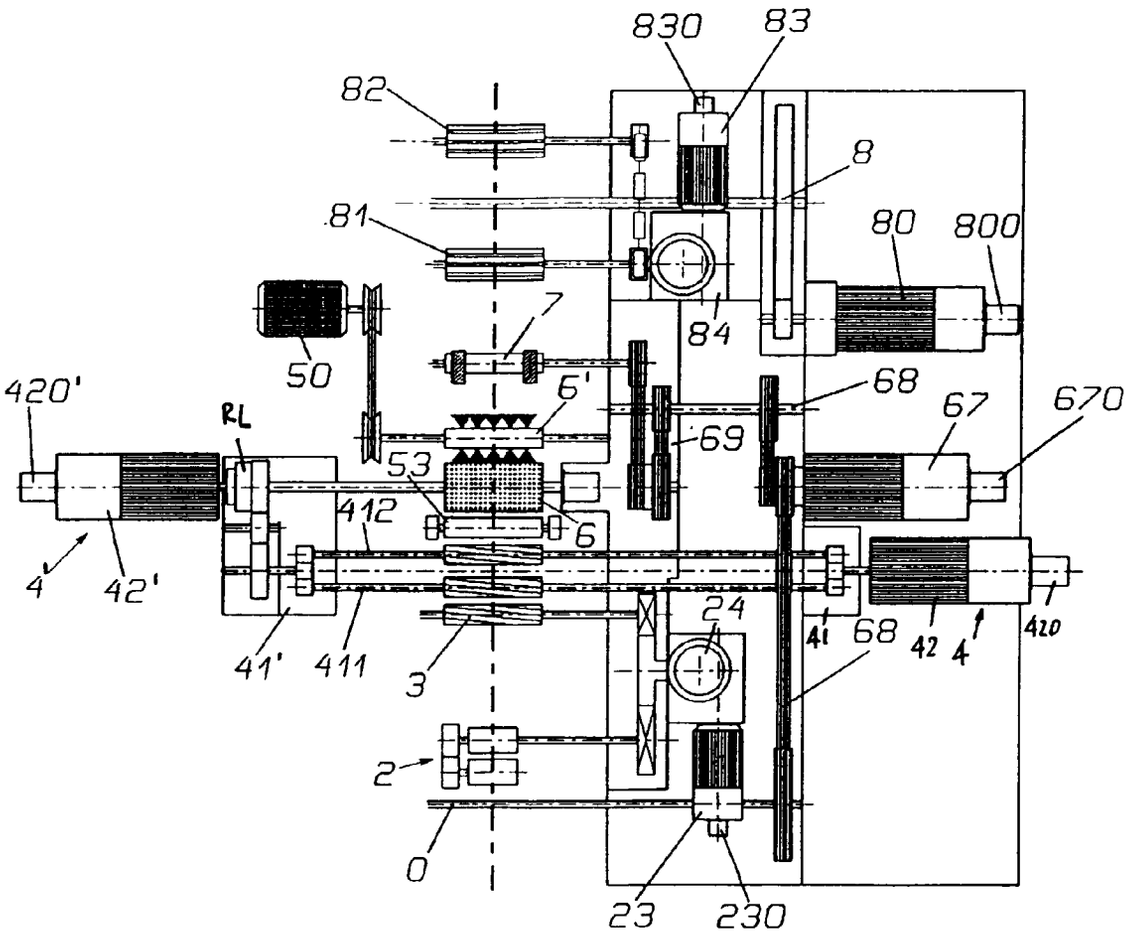
830
83
82
8
81
80
800
84
7
50
6'
68
67
670
420'
RL
69
53
412
6
4'
42'
24
41
68
42
4
420
41'
411
3
2
0
23
230

FIG. 1A

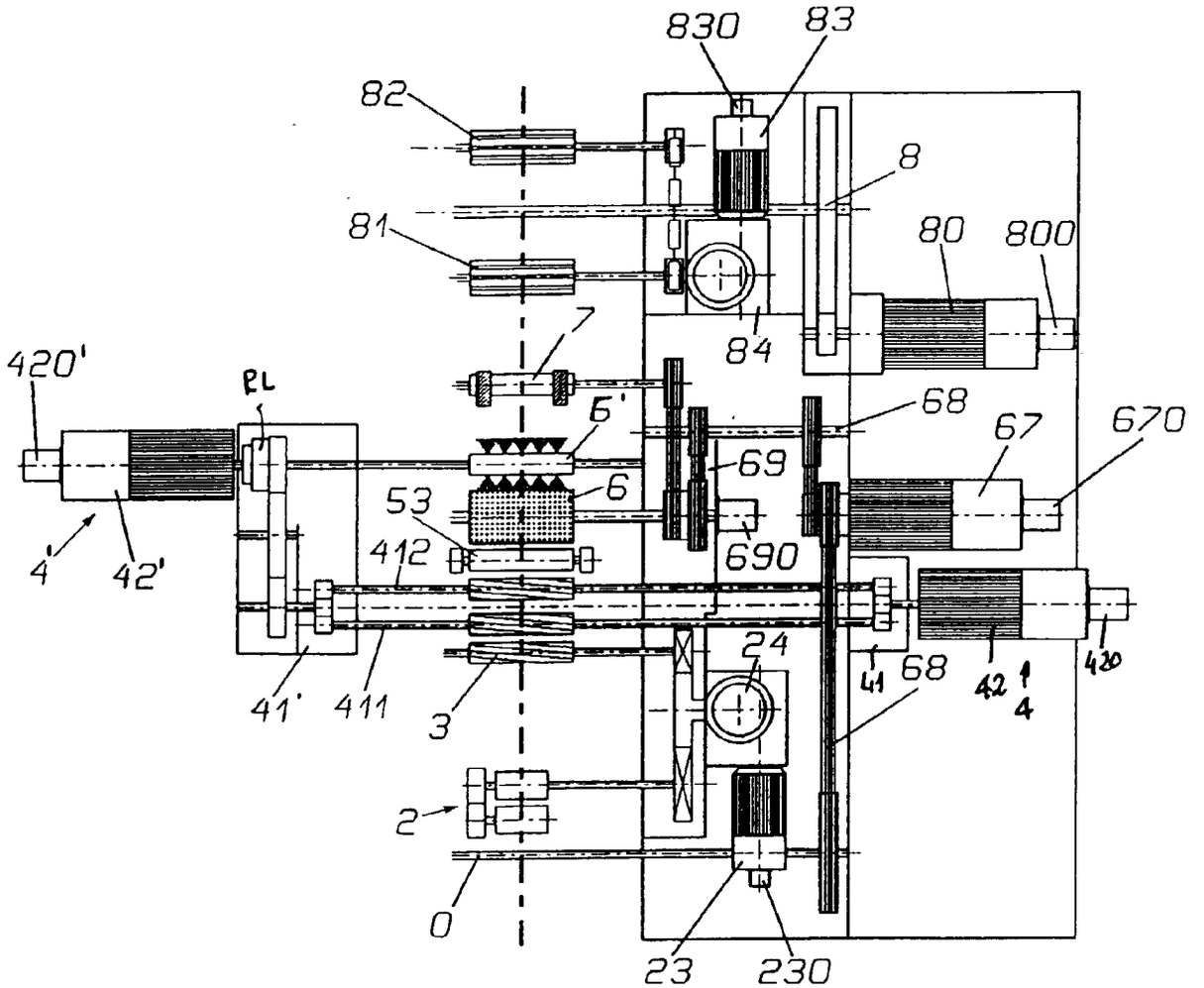
830
83
82
8
81
80
800
84
7
420'
PL
6'
68
67
670
69
6
53
690
4'
42'
412
24
68
41
42
4
420
41'
411
3
2
0
23
230

FIG. 1B

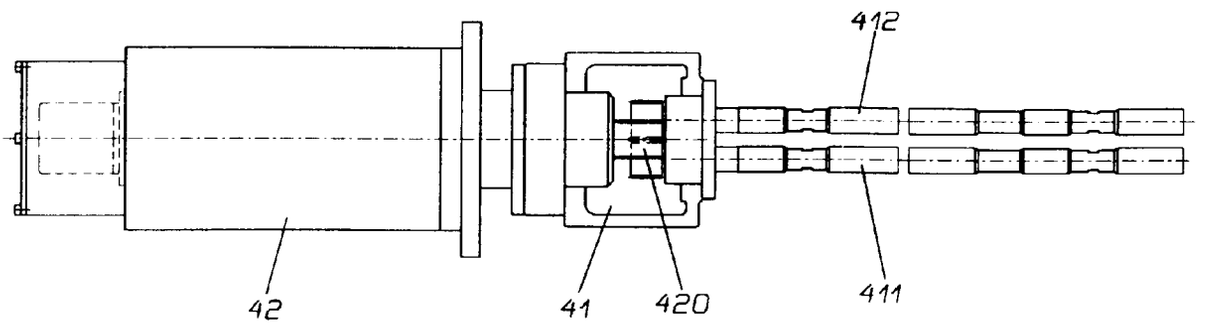

FIG. 2

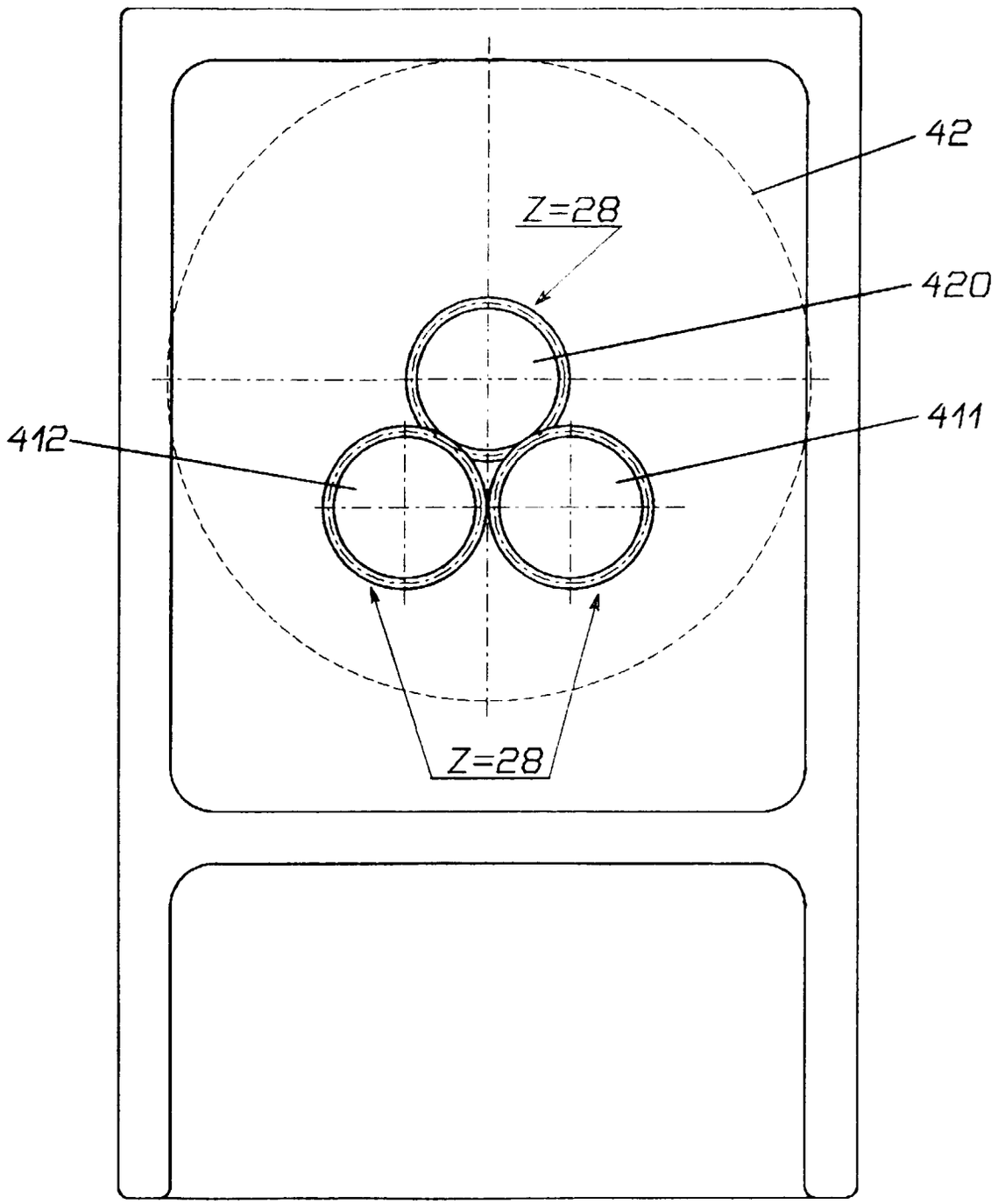

FIG. 3

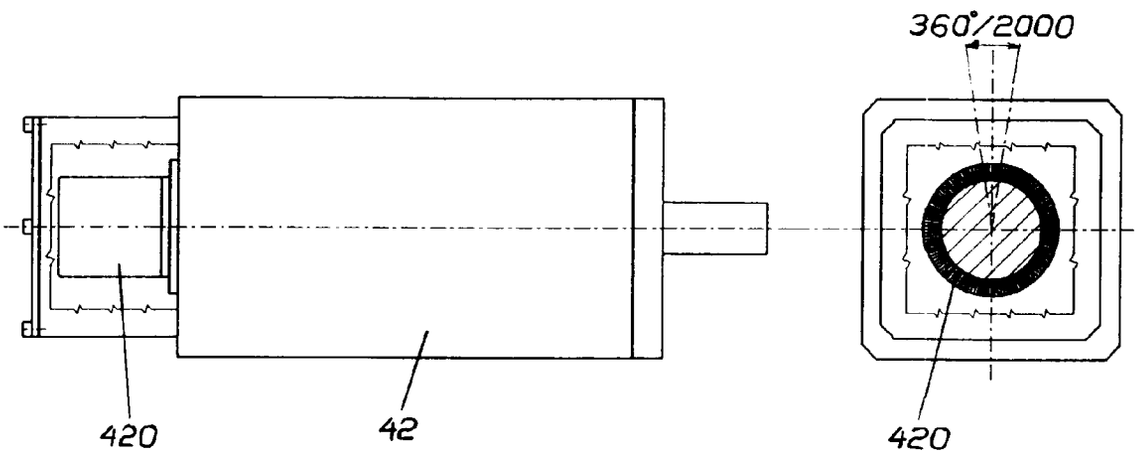

FIG. 4

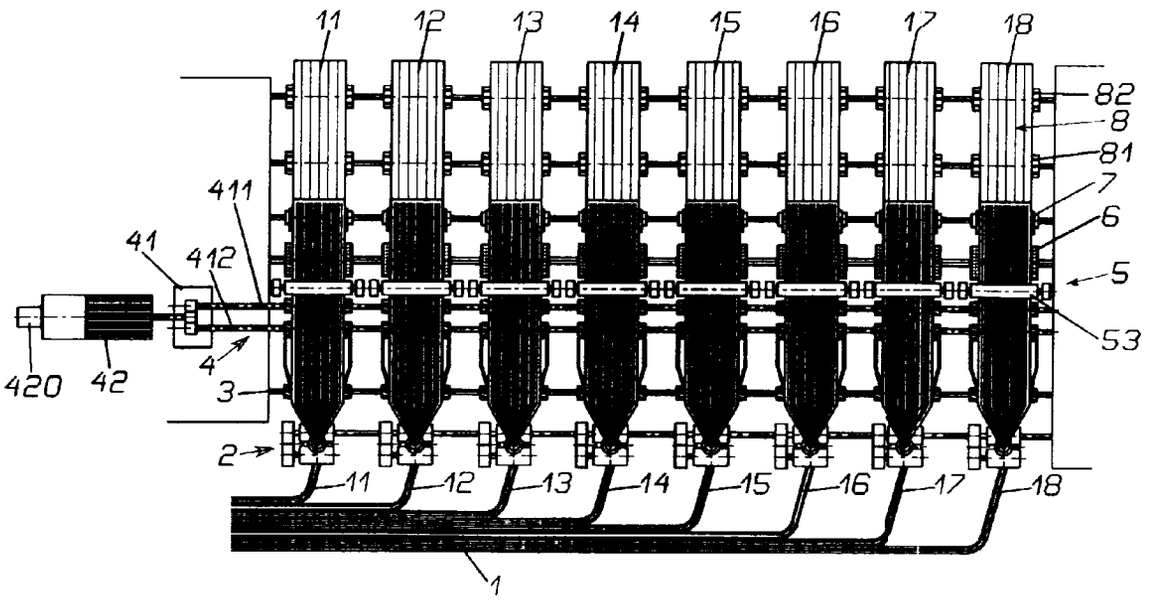

FIG. 5

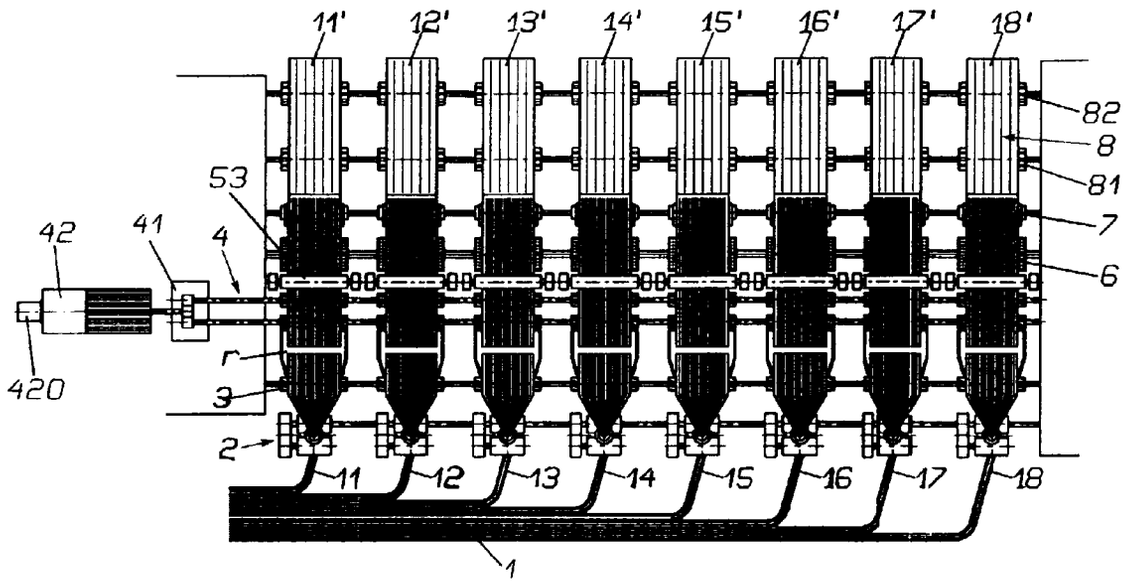
11'
12'
13'
14'
15'
16'
17'
18'
82
8
81
7
6
53
42
41
4
420
r
3
2
11
12
13
14
15
16
17
18
1

FIG. 6

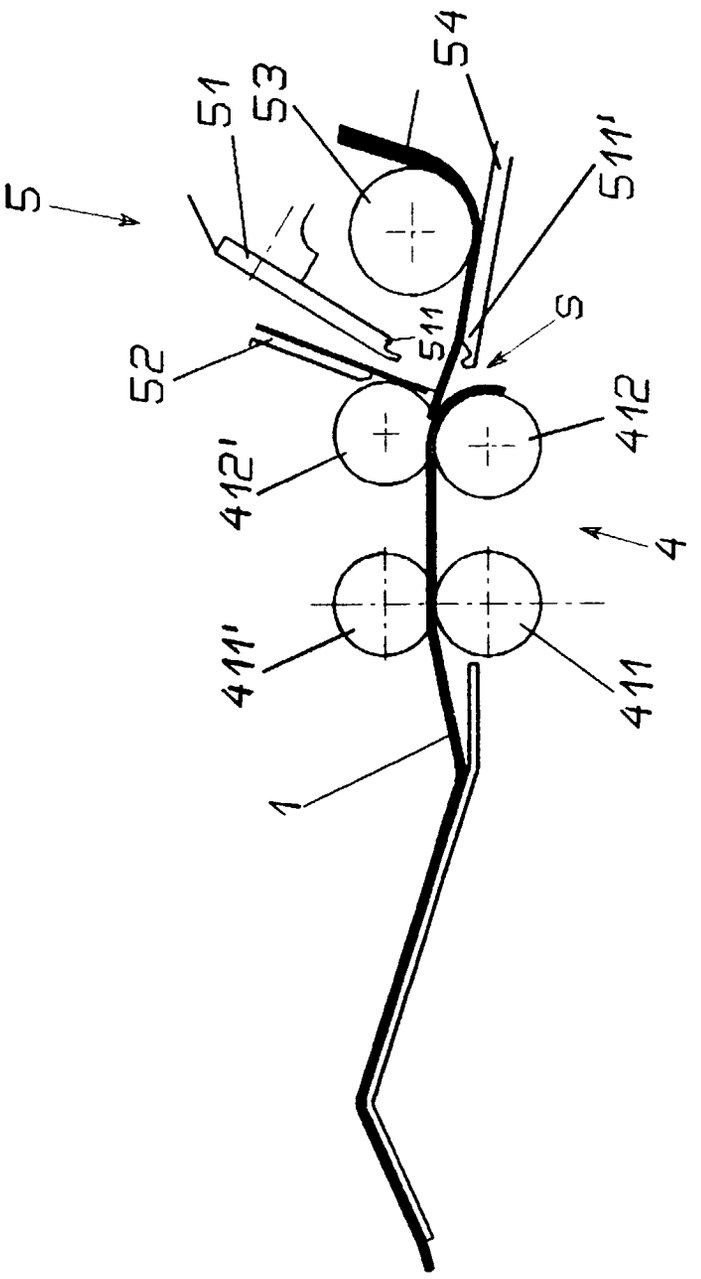

FIG. 7

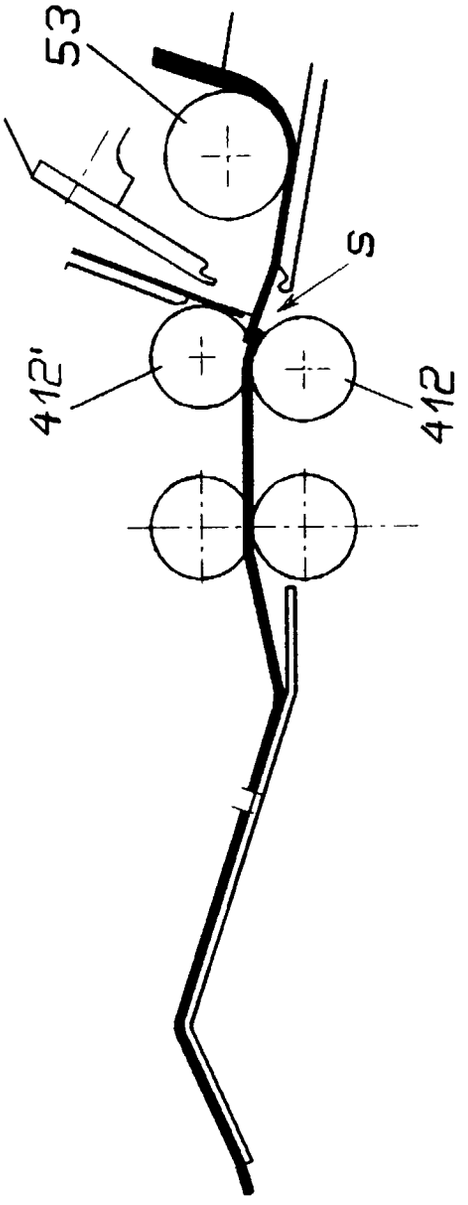

FIG. 8

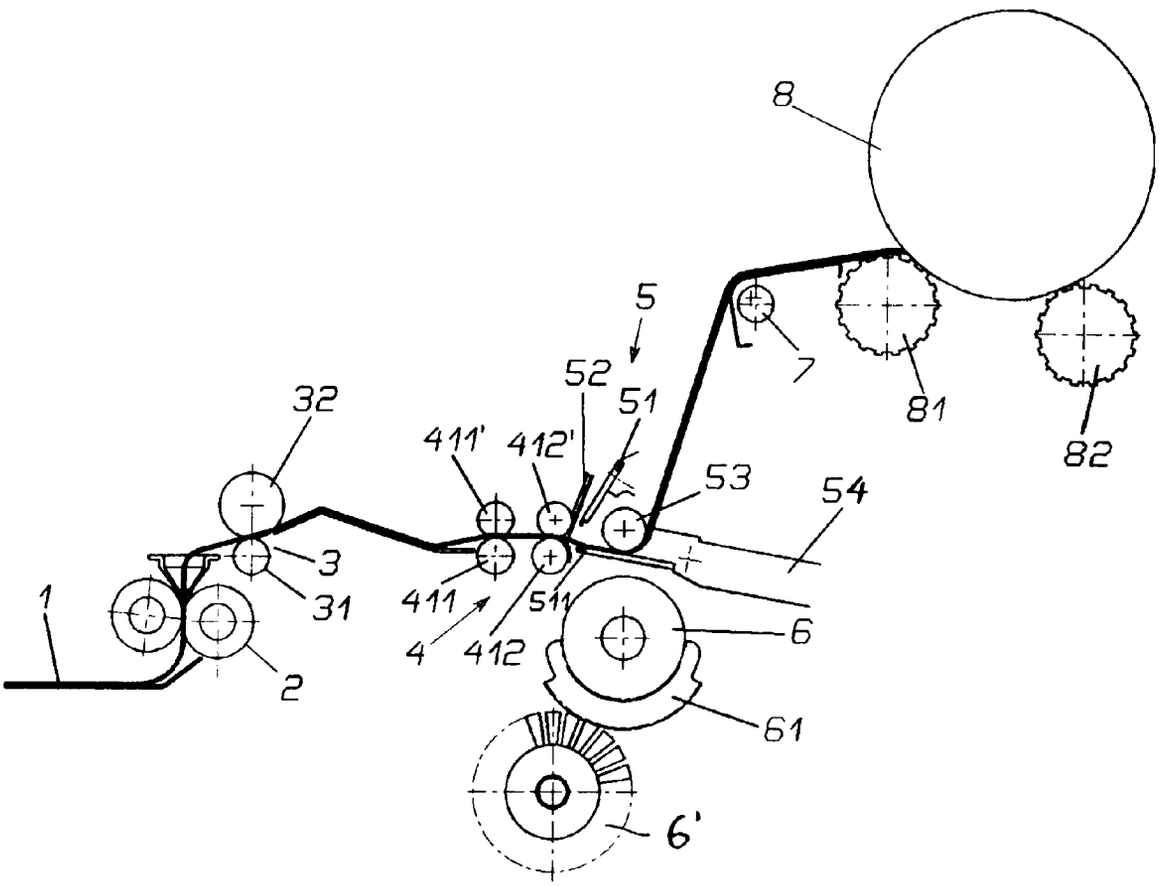

FIG. 9

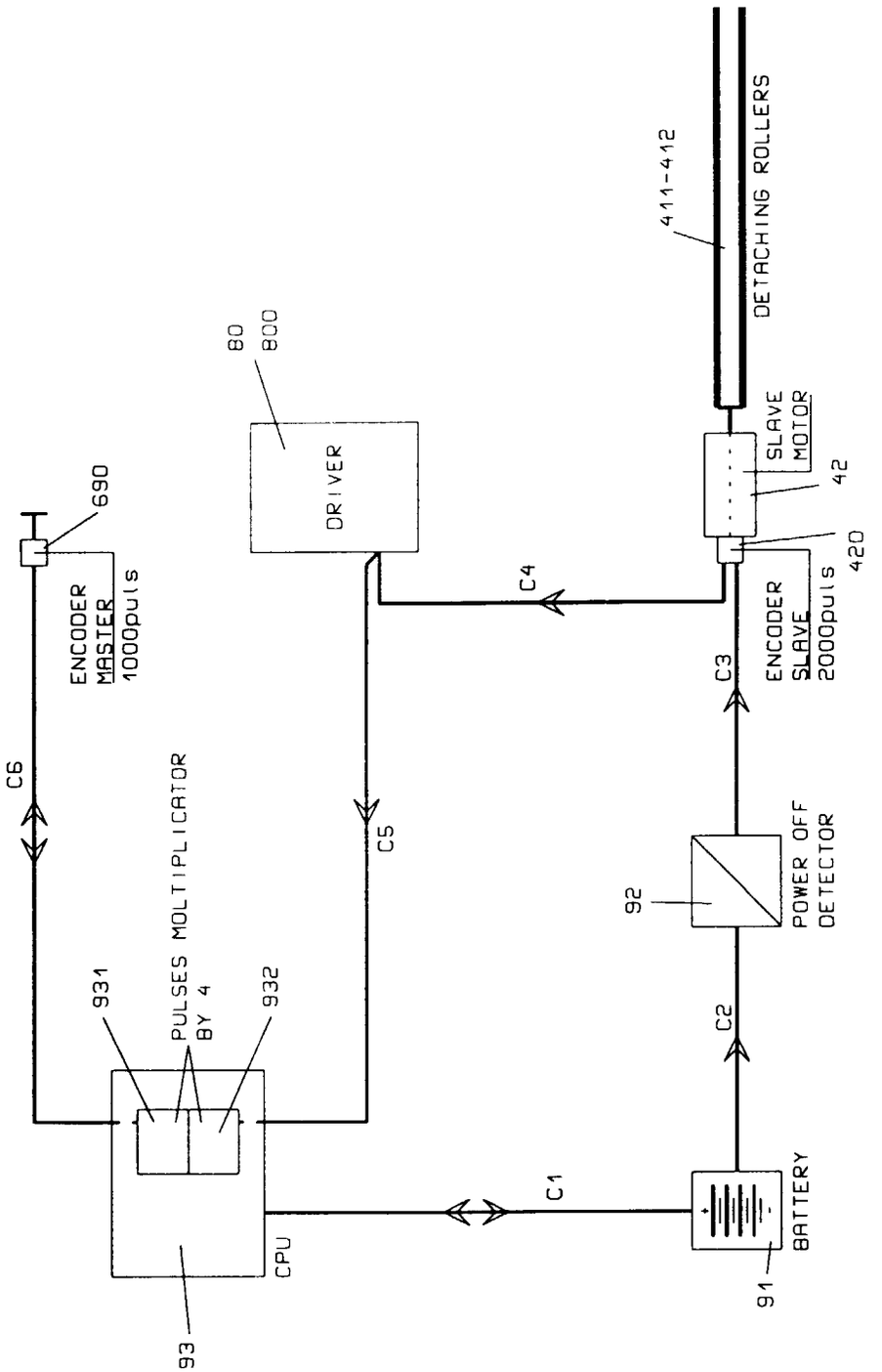
411-412
DETACHING ROLLERS
80
800
DRIVER
SLAVE MOTOR
42
690
420
ENCODER MASTER 1000puls
ENCODER SLAVE 2000puls
C4
C3
C6
C5
PULSES MOLTIPLICATOR BY 4
931
932
92
POWER OFF DETECTOR
C2
C1
BATTERY
CPU
91
93

FIG. 10

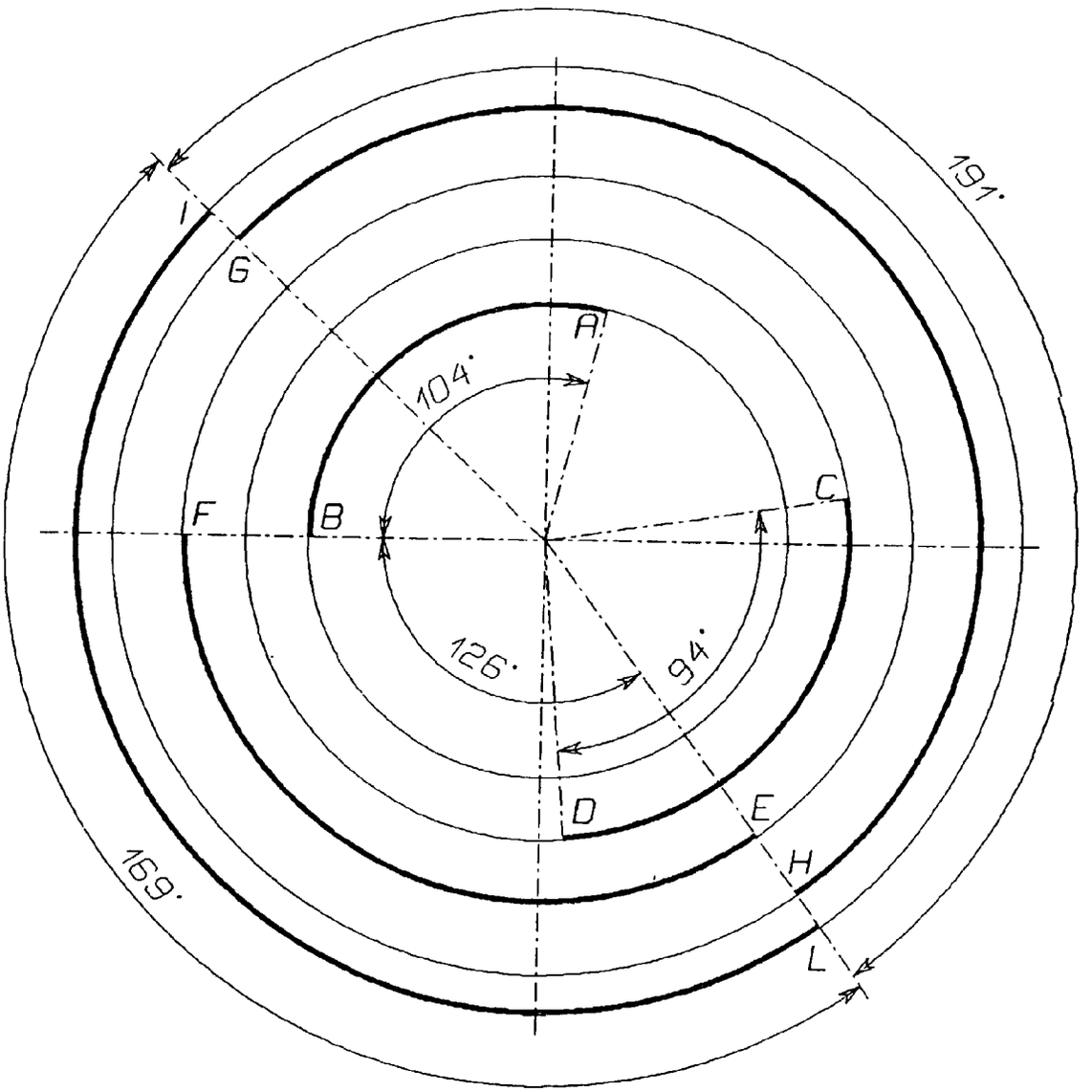

FIG. 10A

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 10 2843

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y,P	WO-A-95 27817 (SPINNEREIMASCHINENBAU LEISNIG GMBH) * page 8, paragraph 3 - page 15, paragraph 3; claims 1,3; figures 1,3 *	1,2	D01G19/26
A		7,9,11	

Y	PATENT ABSTRACTS OF JAPAN vol. 14, no. 446 (C-0763), 25 September 1990 & JP-A-02 175925 (OSAKA KIKO CO TLD), 9 July 1990, * abstract *	1,2	

A	EP-A-0 573 121 (INDUSTRIE MECCANOTESSILI MARZOLI S.R.L.) * the whole document *	1	

A,D	EP-A-0 374 723 (MASCHINENFABRIK RIETER A.G.) * the whole document *	1	
	-----		TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			D01G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	7 June 1996	Munzer, E

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