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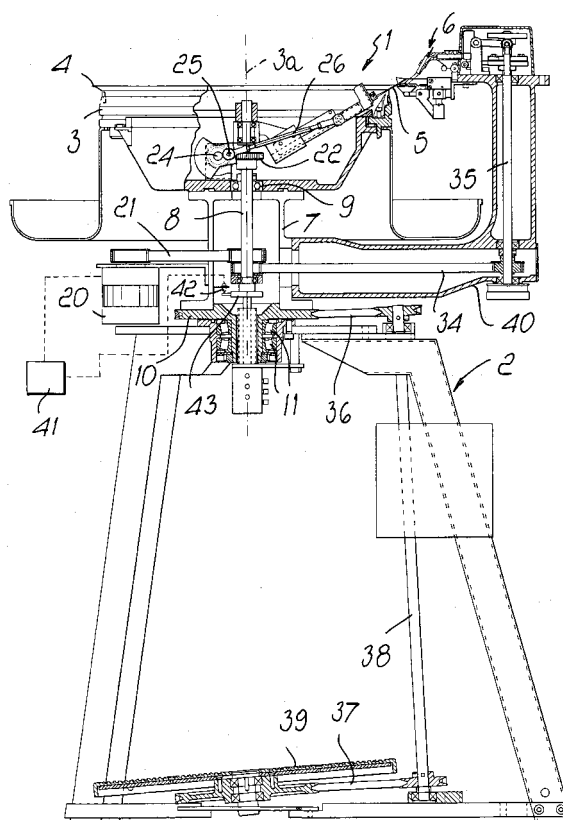
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(54) **Linking machine capable of locking the linking chain-stitch so as to prevent unraveling**

(57) A linking machine (1) capable of locking a linking chain-stitch so as to prevent unraveling, comprising a frame (2) that supports, so that it can rotate about its own axis (3a), a point dial (3) that is provided peripherally with multiple points that are orientated radially and are distributed uniformly around the axis of the point dial. The frame (2) supports, proximate to a peripheral region of the point dial, a needle (5) that can move on command along its own axis with an alternating motion that has a radial component with respect to the point dial (3) in order to enter one of the points (4) in each instance. The machine also comprises auxiliary means (6), which cooperate with the needle (5) in the forming of chain-stitches, and means for actuating the point dial with a rotary motion about its own axis, for actuating the needle with an alternating translational motion along its own axis, and for actuating the auxiliary means (6) with a motion that is correlated to the motion of the needle in order to form a chain-stitch at each forward and return motion of the needle along its own axis. The machine also comprises unraveling prevention means, which are adapted to return or retain a same point (4) along the path of the needle (5) during the execution of at least two consecutive forward and return motions of the needle (5) along its own axis.



*Fig. 1*

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## Description

**[0001]** The present invention relates to a linking machine capable of locking the linking chain-stitch so as to prevent unraveling.

**[0002]** As is known, knitted portions are joined in the manufacture of items of clothing by sewing, which joins two flaps of knitted material regardless of the arrangement of the loops or stitches, or, if one seeks a qualitatively better result, by linking, which gradually joins one loop of one flap to a loop of the other flap of knitted material.

**[0003]** Linking is performed by using machines known indeed as linking machines.

**[0004]** The currently most widely used linking machines are circular linking machines, which are substantially composed of a frame that supports a point dial that has a vertical axis and is provided peripherally with a plurality of points that are orientated radially, with their tip directed outward, and are distributed uniformly around the axis of the point dial.

**[0005]** Each point is designed to support two loops or stitches respectively of one flap of knitted material and of the other flap of knitted material to be joined together.

**[0006]** The linking machine is provided with a needle, which by being inserted in the points in succession joins the pairs of loops fitted over the points.

**[0007]** The loops are joined by means of a sort of chain-stitched seam, formed by making the needle cooperate with auxiliary means, which can be constituted by a looper or a thread loading element, depending on the type of needle used, face the tip of the needle, and are arranged opposite thereto with respect to the point dial.

**[0008]** In some kinds of linking machine the needle is arranged inside the point dial and the auxiliary means are arranged externally, while in other kinds of machine the needle is arranged externally and the auxiliary means are arranged inside the point dial.

**[0009]** Some linking machines use a needle with an eye that carries the thread used to form the linking chain-stitch. In these machines, the auxiliary means are constituted by a looper that is designed to engage the eye of thread formed by the needle and retain it so that it is crossed by the needle while forming a subsequent stitch, indeed so as to form the chain-stitch.

**[0010]** Other linking machines use a hooked needle. In these machines, the auxiliary means are constituted by a thread loading element that feeds the thread to the needle, which draws it through two loops to be joined, forming an eye, and returns it toward the thread loading element after passing through two successive loops, so as to engage a new eye of thread, which is concatenated with the previous eye, which is released.

**[0011]** In any case, the chain-stitch used for linking, owing to its very structure, if subjected to tension at its trailing end, i.e., the end formed last, unravels very easily.

**[0012]** In order to prevent such an occurrence in a knitted article following accidental tensioning or normal use, it becomes necessary to perform manual sewing in order to lock the trailing end of the chain-stitch. This operation constitutes an additional cost, and very often requires the transfer of the knitted article from the manufacturer to workshops specialized in this work.

**[0013]** The aim of the present invention is to solve the problem described above, providing a linking machine that is capable of performing, at the end of the linking process, a locking of the chain-stitch that effectively prevents its unraveling.

**[0014]** Within this aim, an object of the invention is to provide a linking machine in which the possibility to lock the chain-stitch does not penalize at all production potential, versatility and practicality of use.

**[0015]** Another object of the invention is to provide a method for locking the chain-stitch for linking knitted articles on linking machines so as to prevent unraveling.

**[0016]** This aim and these and other objects that will become better apparent hereinafter are achieved by a linking machine, comprising a frame that supports, so that it can rotate about its own axis, a point dial that is provided peripherally with multiple points that are orientated radially and are distributed uniformly around the axis of said point dial; said frame supporting, proximate to a peripheral region of said point dial, a needle that can move on command along its own axis with an alternating motion that has a radial component with respect to said point dial in order to enter one of said points in each instance; auxiliary means being provided which cooperate with said needle in the forming of chain-stitches; means being further provided for actuating said point dial with a rotary motion about its own axis, for actuating said needle with an alternating translational motion along its own axis and for actuating said auxiliary means with a motion that is correlated to the motion of the needle in order to form a chain-stitch at each forward and return motion of the needle along its own axis; characterized in that it comprises unraveling prevention means that are adapted to return or retain a same point along the path of said needle during the execution of at least two consecutive forward and return motions of said needle along its own axis.

**[0017]** Further characteristics and advantages of the invention will become better apparent from the description of a preferred but not exclusive embodiment of the linking machine according to the invention, illustrated by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a schematic partially sectional side elevation view of the machine according to the invention;

Figure 2 is an enlarged-scale view of a detail of Figure 1;

Figure 3 is a schematic top plan view of the machine according to the invention;

Figure 4 is an enlarged-scale schematic sectional view of Figure 3, taken along the line IV-IV;

Figure 5 is an enlarged-scale schematic sectional view of Figure 3, taken along the line V-V.

**[0018]** With reference to the cited figures, the linking machine according to the invention, generally designated by the reference numeral 1, comprises a frame 2 and a point dial 3, which is provided peripherally with a plurality of points 4, which are orientated radially and are uniformly distributed around the vertical axis 3a of the point dial 3.

**[0019]** The point dial 3 is supported, so that it can rotate about its own axis 3a, by the frame 2. Proximate to a peripheral region of the point dial 3, the frame 2 supports a needle 5, which can move on command along its own axis with an alternating motion that has a radial component, with respect to the point dial 3, so as to enter in each instance one of the points 4 that is aligned with the path of the needle 5.

**[0020]** Furthermore, the linking machine is provided with auxiliary means 6, which cooperate with the needle 5 in forming the chain stitches, and with actuation means, which actuate the point dial 3 with a rotary motion about its own axis 3a, actuate the needle 5 with an alternating translational motion along its own axis, and actuate the auxiliary means 6 with a motion that is correlated to the motion of the needle 5 in order to form a chain-stitch at each forward and return motion of the needle 5 along its own axis.

**[0021]** According to the invention, the linking machine comprises unraveling prevention means that are suitable to return or retain a same point 4 at the path of the needle 5 during the execution of at least two consecutive forward and return motions of the needle 5 along its own axis.

**[0022]** More particularly, the point dial 3 is mounted on a rotatable structure 7, which is arranged around a main shaft 8, whose axis coincides with the axis 3a of the point dial 3. Bearings 9 are interposed between the main shaft 8 and the rotatable structure 7 in order to allow the main shaft 8 to rotate, about its own axis, with respect to the rotatable structure 7 or vice versa.

**[0023]** The rotatable structure 7 is fixed to a pulley 10, whose axis coincides with the axis 3a; the pulley is supported, so that it can rotate about the same axis, by the frame 2 by way of the interposition of bearings 11.

**[0024]** The unraveling prevention means preferably comprise means for actuating the point dial 3 that are different from the actuation means of the needle 5 and of the auxiliary means 6.

**[0025]** More particularly, the actuation means of the linking machine comprise first actuation means for the rotary actuation of the point dial 3 about its own axis 3a, and second actuation means for the actuation of the needle 5 with an alternating translational motion along its own axis and for the actuation of the auxiliary means 6.

**[0026]** The first actuation means comprise a first electric motor 12, which is preferably constituted by a step motor and is connected, by means of its output shaft, to a first transmission shaft 13, for example by means of a toothed belt drive 14. The first transmission shaft 13 has a portion 13a that is shaped like a worm screw and mates with a helical gear 15 supported by a second transmission shaft 16. A gear 17 is keyed on the second transmission shaft 16 and meshes with a ring gear 18 that is fixed coaxially to the point dial 3.

**[0027]** The first electric motor 12 is connected kinematically, by means of its output shaft, to the point dial 3.

**[0028]** It should be noted that the helical gear 15 can be fitted so that it can rotate on the second transmission shaft 16, and that it is possible to fit in a per se known manner between these two elements a coupling, generally designated by the reference numeral 19, which allows to connect or disconnect manually the helical gear 15 with respect to the second transmission shaft 16 and therefore to connect or disconnect the point dial 3 with respect to the first electric motor 12.

**[0029]** The second actuation means comprise a second electric motor 20, preferably constituted by a step motor, which is connected by means of its output shaft to the main shaft 8, for example by means of a toothed belt drive 21. A gear 22 is keyed on the main shaft 8 and meshes with another gear 23 that is keyed on a third transmission shaft 24. The third transmission shaft 24 has, at one of its axial ends, a crank 25 which is connected to the needle 5 by means of a linkage 26.

**[0030]** The linking machine, in the illustrated embodiment, is constituted by a linking machine with a needle provided with an eye, which is supported inside the point dial 3, and the auxiliary means 6 are constituted by a looper 27, which is arranged outside the point dial 3.

**[0031]** The needle 5 is mounted on a needle supporting assembly 28, which can slide parallel to the axis of the needle 5 on a support 29, which is supported by the main shaft 8 so that it can rotate about the axis 3a.

**[0032]** The support 29, by utilizing its ability to oscillate about the axis 3a, is pulled by a spring 30 against a lever 31, which is supported, so that it can oscillate about an axis 31a that is parallel to the axis 3a, by the rotatable structure 7. The lever 31 has a cam follower 32, which engages the profile of a cam 33 (shown only schematically) that is keyed onto the third transmission shaft 24 at its opposite end with respect to the crank 25.

**[0033]** The profile of the cam 33, as a consequence of the rotation of the third transmission shaft 24, produces an oscillation of the lever 31 about the axis 31a, causing an oscillation of the support 29 about the axis 3a. By way of this oscillation, the needle 5, once inserted in a point 4, is actuated not only with an axial motion but also with a motion that has a tangential component with respect to the point dial 3, so as to follow the point dial 3 and arrange itself, once extracted from a point 4, at the next point 4, which it must enter immediately thereafter.

**[0034]** The looper 27 is supported externally with re-

spect to the point dial 3 by an arm 40, which is fixed to the rotatable structure 7 and is arranged opposite the needle 5 with respect to the point dial 3. The looper 27 is actuated by the second electric motor 20 by being connected kinematically to the main shaft 8 by way of a known type of kinematic chain that comprises a toothed belt 34 and a fourth transmission shaft 35 and other transmission elements, which are not described in detail for the sake of simplicity.

**[0035]** The pulley 10 is connected, by two belts 36 and 37 and an additional shaft 38, to a rotating platform 39 of a known type, which is arranged at the base of the frame 2 and can be actuated, for example with one foot by the operator, in order to turn the rotatable structure 7.

**[0036]** The first electric motor 12 and the second electric motor 20 are connected to a control and actuation element 41 of the electronic type, which supervises the operation of the machine. The control and actuation element 41 is programmable in order to synchronize the rotation rate of the output shaft of the first electric motor 12 with the rotation rate of the output shaft of the second electric motor 20 during normal linking and in order to allow a repeated actuation of the needle 5 at a same point 4, as will become better apparent hereinafter.

**[0037]** Advantageously, there are first means for sensing the position of the needle 5 in its alternating motion along its own axis. The first sensing means can be constituted by a sensor or photocell 42, which is supported by the rotatable structure 7 and faces a disk or cam 43, which is fixed to the main shaft 8. A locator is arranged on the disk or cam 43, can be detected by the sensor or photocell 42, and is located at said sensor or photocell 42 when the needle 5 is disengaged from the points 4 of the point dial 3.

**[0038]** The first sensing means are connected to the control and actuation element 41.

**[0039]** Conveniently, there are also second means for sensing the angular position of the point dial 3 around its own axis 3a. The second sensing means can be constituted by an encoder which monitors, for example, the rotation of the transmission shaft 16 or of the transmission shaft 13 or directly of the point dial 3.

**[0040]** The second sensing means also are connected to the control and actuation element 41.

**[0041]** Advantageously, there are means for sensing the knitted article loaded onto the points 4 which are capable of detecting the end of the flaps of article to be joined by linking. The article sensing means comprise a photocell 44, which is fitted externally with respect to the point dial 3, for example on the arm 40 or on another support that is rigidly coupled to the rotatable structure 7, and abuts against a reflector plate 45, which is arranged inside the point dial 3 and is supported by the rotatable structure 7 so that when the article fitted on the points 4 lies between the photocell 44 and the reflector plate 45 it interrupts the light beam emitted by the photocell 44.

**[0042]** The photocell 44 is arranged upstream of the

work area of the needle 5 along the direction of rotation, indicated by the arrow 46, of the point dial 3 about its own axis 3a with respect to the needle 5.

**[0043]** The photocell 44 also is connected to the control and actuation element 41.

**[0044]** The operation of the linking machine according to the invention is as follows.

**[0045]** The articles to be looped are fitted on the points 4 of the point dial 3 in the usual manner, leaving free some points 4 between the end of one article and the beginning of the next article.

**[0046]** The electric motors 12 and 20 are then actuated with mutually synchronized speeds, so that the needle 5, in its forward and return motion along its own axis, enters in succession the points 4 that pass progressively in front of its tip, joining by linking the two flaps of the articles fitted on the points 4.

**[0047]** The rotation of the point dial 3 about its own axis 3a gradually moves the end of the article being linked closer to the photocell 44. When the photocell 44 detects the end of the article, i.e., when the beam emitted by the photocell 44 freely reaches the plate 45, the control and actuation element 41, after a preset number of operating cycles of the needle 5, acts on the electric motors 12 and 20, halting the operation of the needle 5, of the auxiliary means 6 and of the point dial 3 after the needle 5 has produced the last linking stitch by entering and exiting the last point 4 occupied by the article.

**[0048]** The needle 5 is stopped, by way of the detection of its position by the sensor or photocell 42, when it is disengaged from the points 4. However, this causes the next point 4 to be arranged, in the meantime, at the path of the needle 5.

**[0049]** While the needle 5 is kept motionless, the first motor 12 is actuated in reverse to the direction used in the preceding linking step, so that the last point 4 occupied by the article is returned to the preceding position, i.e., in alignment with the needle 5.

**[0050]** Then the motors 12 and 20 are actuated again with the same direction of rotation used during the linking step, so that the needle 5 and the auxiliary means 6 produce a new linking stitch through said last point 4.

**[0051]** This step, which locks the linking chain-stitch so as to prevent unraveling, can be repeated several times, returning the same point 4 each time at the needle 5.

**[0052]** It should be noted that the chain-stitch locking stitches produced during this step are not true chain-stitches, since in order to form the chain-stitch it would be necessary to maintain the rotary motion of the point dial 3, but can be likened to knots that effectively prevent the unraveling of the linking chain-stitch.

**[0053]** It should be noted that if required, the machine according to the invention can also lock the chain-stitch externally with respect to the article being linked, i.e., on the leading and/or trailing portion of the chain-stitch. In this case, due to the fact that the needle 5 is not coupled to the corresponding point 4 by the loops of knitting of

the article, the point dial 3 can be simply kept motionless while the needle 5 forms the locking stitches, i.e., without the need to impart, at the end of the forming of each locking stitch, a retrograde motion to the point dial 3.

[0054] Once the step for locking the chain-stitch has ended, the operation of the machine resumes as in the linking step in order to link articles loaded onto subsequent points 4.

[0055] The linking machine according to the invention and its operation have been described with reference to the embodiment shown in the drawings, which relates to a linking machine with a needle provided with an eye and arranged internally with respect to the point dial and with auxiliary means 6 constituted by a looper arranged externally with respect to the point dial; however, the concept on which the invention is based can be used on linking machines with a hooked needle arranged externally with respect to the point dial and the looper arranged internally with respect to the point dial, or on linking machines with beak needle and auxiliary means constituted by a thread loading element that faces the needle and is arranged opposite thereto with respect to the point dial.

[0056] In this case, due to the fact that the needle does not have a motion with a tangential component in order to follow the point dial, there is no need for a retrograde motion of the point dial in order to return the last point at the needle, but it is sufficient to block the point dial with the last point affected by the article at the needle.

[0057] Moreover, it should be noted that the method for locking the linking chain-stitch to prevent unraveling taught by the present invention can also be used in other types of linking machine other than the ones described above.

[0058] In practice it has been found that the linking machine according to the invention fully achieves the intended aim, since it is capable of locking the linking chain-stitch, once linking has been completed, so as to prevent its unraveling.

[0059] In the examples of embodiment cited above, individual characteristics, given in relation to specific examples, may actually be interchanged with other different characteristics that exist in other examples of embodiment.

[0060] The machine thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; all the details may further be replaced with other technically equivalent elements.

[0061] In practice, the materials used, as well as the dimensions, may be any according to the requirements and the state of the art.

[0062] The disclosures in Italian Patent Application No. MI2002A002442 from which this application claims priority are incorporated herein by reference.

[0063] Where technical features mentioned in any claim are followed by reference signs, those reference

signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

## Claims

1. A linking machine, comprising a frame that supports, so that it can rotate about its own axis, a point dial that is provided peripherally with multiple points that are orientated radially and are distributed uniformly around the axis of said point dial; said frame supporting, proximate to a peripheral region of said point dial, a needle that can move on command along its own axis with an alternating motion that has a radial component with respect to said point dial in order to enter one of said points in each instance; auxiliary means being provided which cooperate with said needle in the forming of chain-stitches; means being further provided for actuating said point dial with a rotary motion about its own axis, for actuating said needle with an alternating translational motion along its own axis, and for actuating said auxiliary means with a motion that is correlated to the motion of the needle in order to form a chain-stitch at each forward and return motion of the needle along its own axis; **characterized in that** it comprises unraveling prevention means that are adapted to return or retain a same point along the path of said needle during the execution of at least two consecutive forward and return motions of said needle along its own axis.
2. The machine according to claim 1, **characterized in that** said unraveling prevention means comprise means for actuating said point dial that are different from the actuation means of said needle and of said auxiliary means.
3. The machine according to claims 1 and 2, **characterized in that** said unraveling prevention means comprise first actuation means for actuating said point dial with a rotary motion about its own axis and second actuation means for the actuation of said needle with an alternating translational motion along its own axis and of said auxiliary means; said first actuation means being able to be synchronized on command with said second actuation means for a synchronized actuation of said point dial, of said needle and of said auxiliary means, and being disengageable from said second actuation means in producing said at least two consecutive forward and return motions of said needle.
4. The machine according to one or more of the preceding claims, **characterized in that** said first ac-

tuation means comprise a first electric motor that is kinematically connected, by way of its output shaft, to said point dial.

5. The machine according to one or more of the preceding claims, **characterized in that** said second actuation means comprise a second electric motor, which is kinematically connected, by way of its output shaft, to said needle and to said auxiliary means. 5
6. The machine according to one or more of the preceding claims, **characterized in that** it comprises electronic means for synchronizing the rotation rate of the output shaft of said first electric motor with the rotation rate of the output shaft of said second electric motor, said electronic means being controllable so as to provide or interrupt said synchronization. 10
7. The machine according to one or more of the preceding claims, **characterized in that** said electric motors are constituted by step motors. 15
8. The machine according to one or more of the preceding claims, **characterized in that** said needle is constituted by a needle provided with an eye and **in that** said auxiliary means comprise a looper that is arranged opposite the tip of said needle with respect to said point dial. 20
9. The machine according to one or more of the preceding claims, **characterized in that** said needle is constituted by a hooked needle and said auxiliary means comprise a thread loading element that is arranged opposite the tip of said needle with respect to said point dial and is movable in order to provide the thread to the beak of said needle. 25
10. The machine according to one or more of the preceding claims, **characterized in that** said needle is arranged internally with respect to said point dial and said looper or thread loading element is arranged externally to said point dial. 30
11. The machine according to one or more of the preceding claims, **characterized in that** said needle is arranged externally with respect to said point dial and said looper or thread loading element is arranged internally with respect to said point dial. 35
12. The machine according to one or more of the preceding claims, **characterized in that** said needle can move on command along a direction that has a tangential component with respect to said point dial in order to follow the rotation of said point dial once it has been inserted in one of said points and in or-

der to arrange itself at the next point upon insertion in said next point.

13. The machine according to one or more of the preceding claims, **characterized in that** said electronic means comprise a programmable electronic control and actuation element, which is functionally connected to said first actuation means and to said second actuation means. 40
14. The machine according to one or more of the preceding claims, **characterized in that** it comprises first sensor means that are adapted to detect the position of said needle in its alternating translational motion along its own axis. 45
15. The machine according to one or more of the preceding claims, **characterized in that** it comprises second sensor means that are adapted to detect the angular position of said point dial in its rotation about its own axis. 50
16. The machine according to one or more of the preceding claims, **characterized in that** it comprises third sensor means, which are adapted to detect the trailing end of the article being linked and fitted on said points of the point dial. 55
17. The machine according to one or more of the preceding claims, **characterized in that** said third sensor means are functionally connected to said control and actuation element in order to stop the rotation of said point dial about its own axis after said needle has been inserted and extracted from the point that supports the trailing end of the article being linked.
18. The machine according to one or more of the preceding claims, **characterized in that** said first sensor means and said second sensor means are connected to said actuation and control element.
19. A method for preventing the unraveling of the linking chain-stitch in the linking of knitted articles on a linking machine, **characterized in that** it consists in producing at least two linking stitches in succession at a same point of the linking machine.
20. The method according to claim 19, **characterized in that** said linking machine is a circular linking machine.

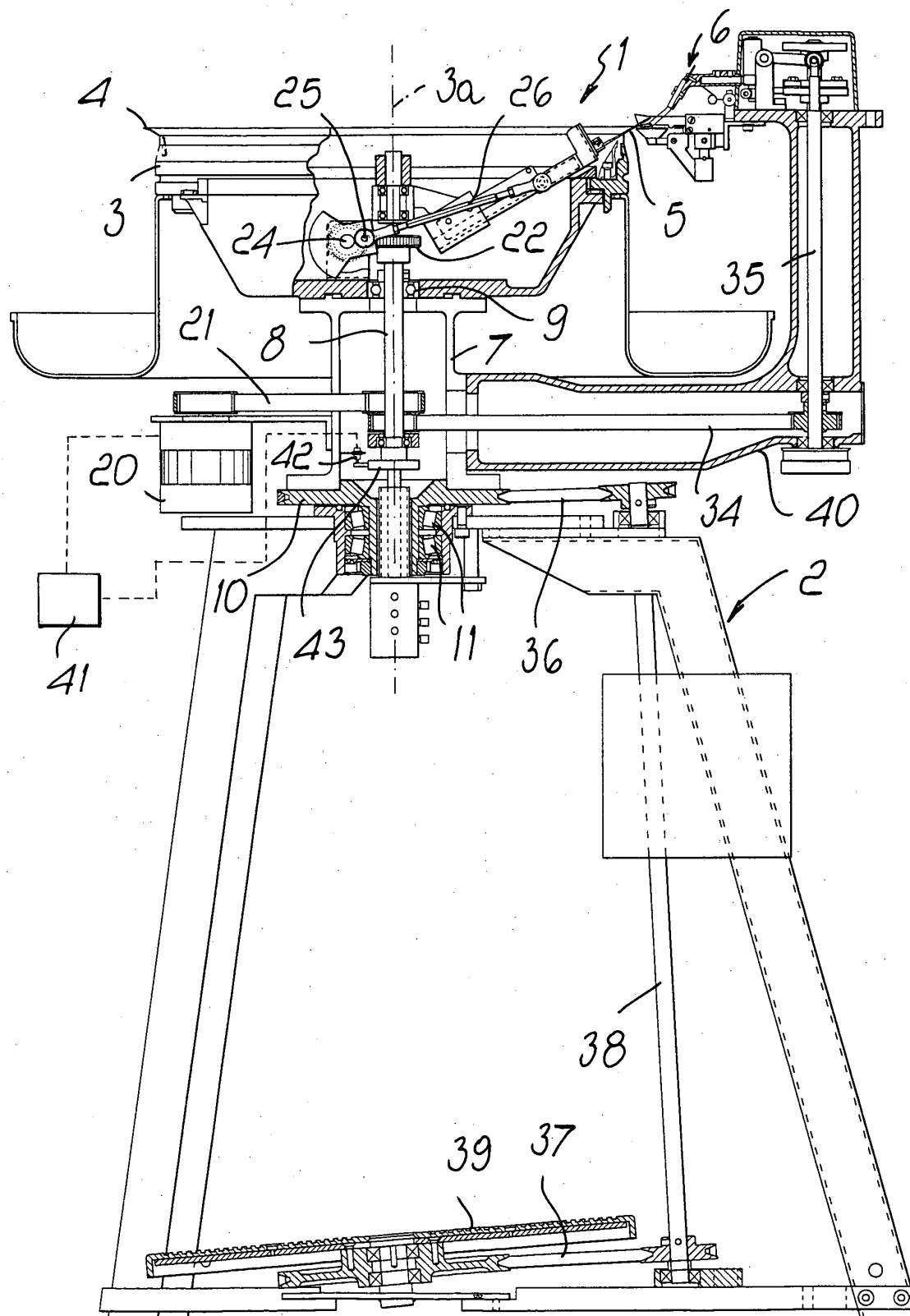
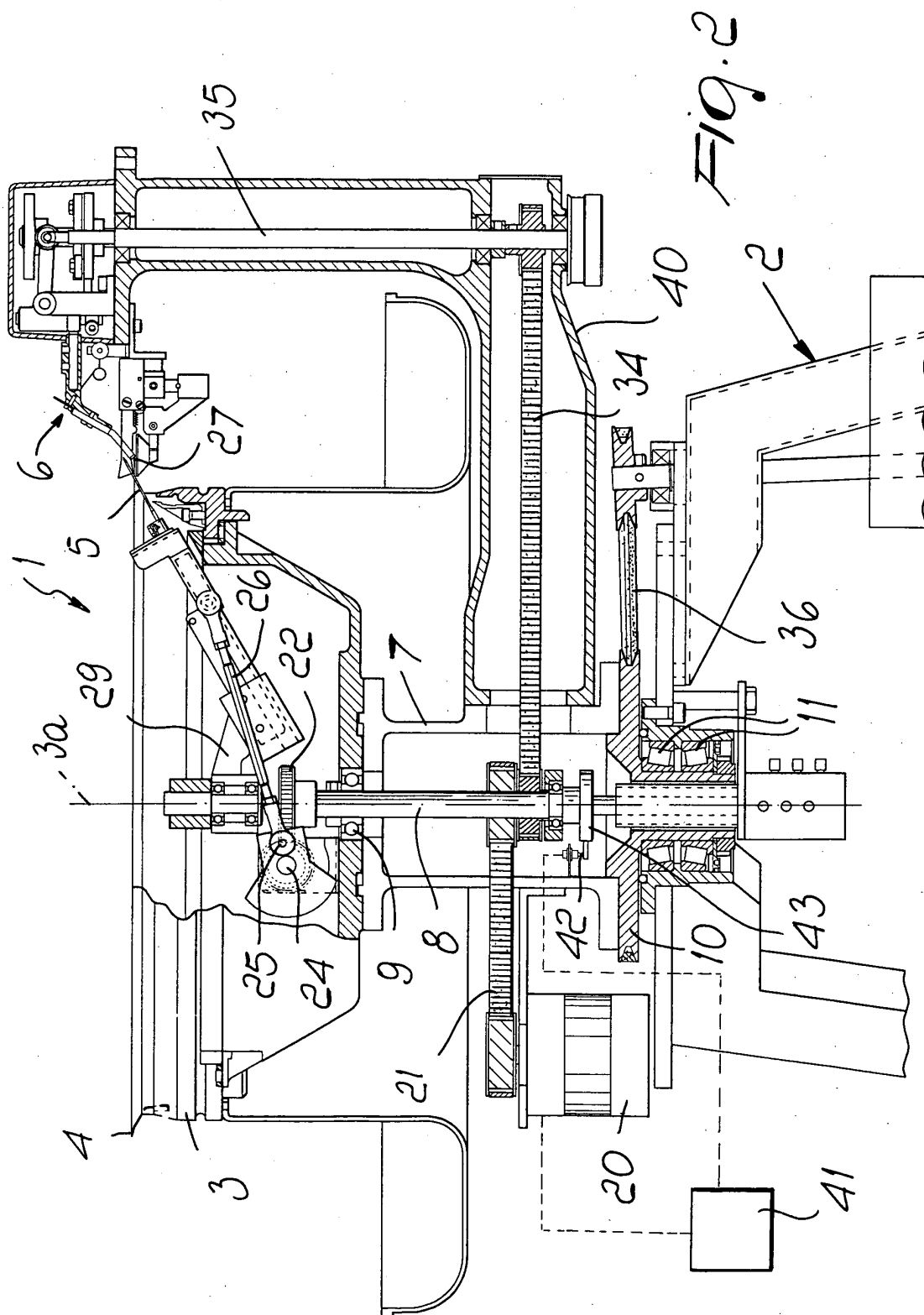


Fig. 1



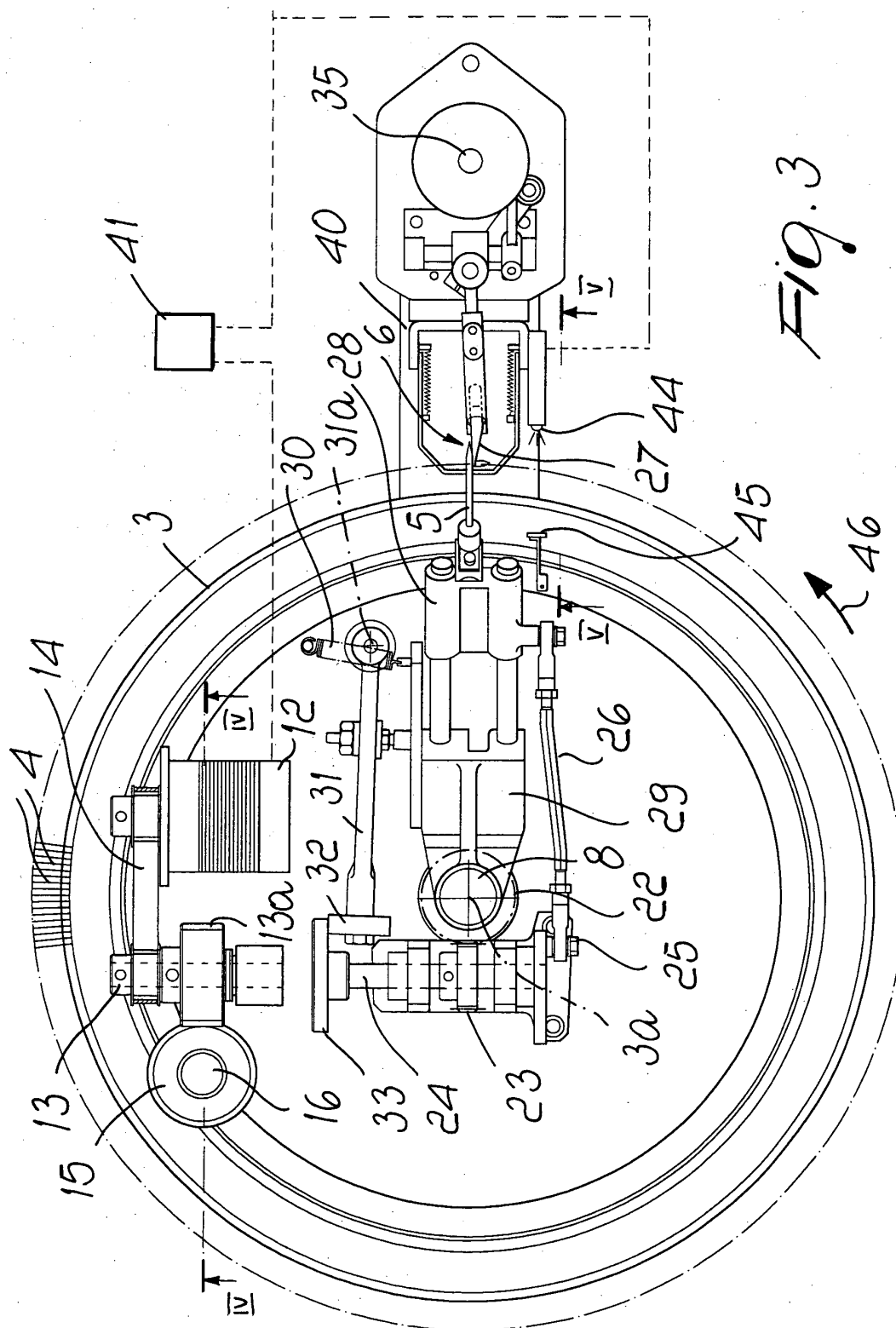


Fig. 3

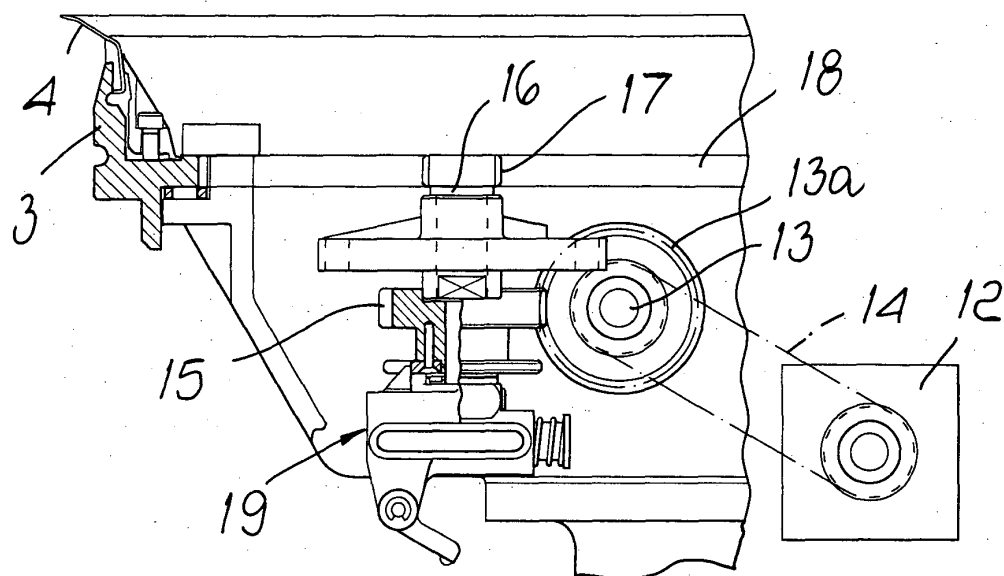


Fig. 4

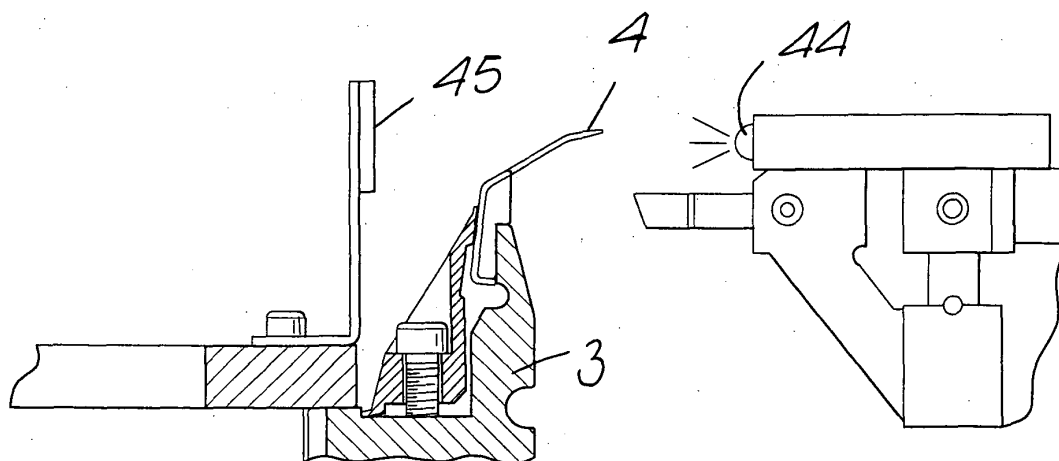


Fig. 5



European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 03 02 4503

| 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.7) |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US 5 487 281 A (FRULLINI PAOLO ET AL)<br>30 January 1996 (1996-01-30)<br>* column 15, line 54 - column 16, line 12;<br>figures 34-39 * | 1,19,20                          | D05B7/00                                     |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                        |                                  | D05B                                         |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                        |                                  |                                              |
| Place of search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                        | Date of completion of the search | Examiner                                     |
| The Hague                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                        | 25 February 2004                 | Van Gelder, P                                |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                                                        |                                  |                                              |

EPO FORM 1503 03 02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 03 02 4503

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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25-02-2004

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