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(54) **Multi-needle machine for knotted stitch and/or double-chain stitch stitching/quilting**

(57) Multi-needle machine able to perform alternatively quilting with stitches (18) of the knotted stitch type (n. 301) and stitches (18a) of the double-chain stitch type (n. 401) adopting, in cooperation with upper stitching elements (12), alternatively interchangeable lower stitching elements (15) consisting either of shuttle-bearing bars (16) to perform the knotted stitch, or of hook-bearing bars (17) to perform the double-chain stitch and reconfiguring, simply and quickly, the command travels of the upper (12) and lower (15) stitching elements.

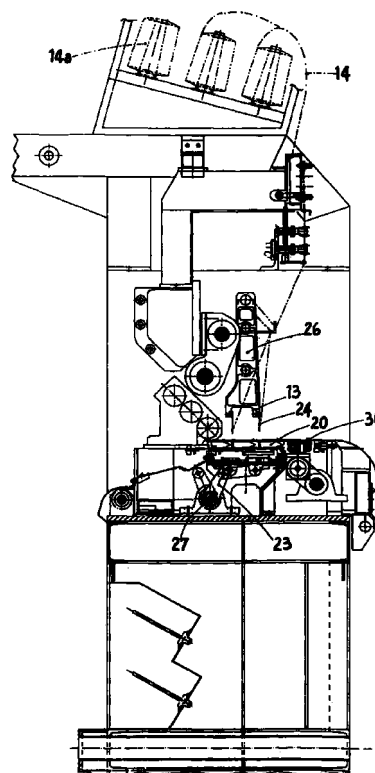


fig.4

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Description

FIELD OF THE INVENTION

[0001] This invention concerns a multi-needle machine for stitching/quilting both with a knotted stitch (n° 301) and with a double-chain stitch (n° 401) as set forth in the main claim.

[0002] The machine is applied in general in the field of stitching/quilting machines, for clothing, quilts and mattresses, and refers more particularly, though not exclusively, to multi-needle quilting machines suitable to achieve multi-layer quilted textile products, consisting of at least an upper fabric and at least an inner layer of padding.

[0003] The multi-needle stitching/quilting machine according to the invention allows to use at will both the knotted stitch technique and the double-chain stitch technique with simple and quick operations to prepare and adapt the machines.

[0004] When used as a quilting machine, the machine according to the invention makes it possible to achieve any kind of pattern, even very sophisticated, similar to embroidery and made with stitches made even very close together.

[0005] Moreover, in the application as a quilting machine, the multi-needle machine according to the invention allows to make both small and large quilting patterns, and every type of stitch, both single, double, intercalated, etc.

[0006] The invention hereafter shall be described in a specific application on a quilting machine, but it is understood that this application is not restrictive.

BACKGROUND OF THE INVENTION

[0007] Sewing machines, either single or multi-needle, are classified according to the type of stitches they are able to make.

[0008] Among the various types of stitches, there are two main techniques which for some time now have become more commonly used internationally: the knotted stitch (n° 301) and the double-chain stitch (n° 401).

[0009] Both these technologies are characterised by the presence of two distinct groups of threads carried, respectively, by upper stitching elements and by lower stitching elements.

[0010] In the state of the art, in order to do the knotted stitch n° 301, after passing through the fabric, the eyelet or heddle eye formed by a first thread carried by the upper stitching elements, or needles, is knotted by a second thread carried by the lower stitching elements, consisting of rotary crochets or shuttles containing spools of thread.

[0011] In the state of the art, in order to do the double-chain stitch n° 401, after passing through the fabric, the eyelet or heddle eye formed by a first thread carried by the upper stitching elements, or needles, is woven in

a desired manner with a second thread carried by the lower stitching elements, consisting of hooks or loopers, and arriving from a relative reel arranged on a creel which forms part of the machine.

[0012] In the field of sewing/quilting machines the state of the art includes those which are suitable to achieve products with the knotted stitch technique and those suitable to achieve products with the double-chain stitch technique.

[0013] These machines are completely distinct and different from each other, in their structures and kinematics.

[0014] No-one has ever thought of, and no-one has ever achieved, sewing machines in general, and certainly not multi-needle machines with their greater complexity, suitable to achieve both techniques, either knotted stitch or double-chain stitch, as desired.

[0015] Multi-needle quilting machines generally comprise:

- an inlet assembly to feed the multi-layered fabric which is to be quilted, for example consisting of an upper fabric, at least an inner layer of padding material and a lower fabric or lining;
- a stitching assembly including a plurality of upper stitching elements and a mating plurality of lower stitching elements;
- an outlet assembly to collect and/or measure and/or cut the semi-finished quilted product.

[0016] The upper stitching elements generally consist of parallel longitudinal bars endowed with alternating ascending/descending motion and bearing a plurality of needles which are spaced lengthwise at fixed distances.

[0017] Each of the needles carries a respective stitching thread, denominated needle thread, and cooperates with a mating gripping mean provided on the lower stitching elements.

[0018] The gripping mean, for the knotted stitch, consists of a shuttle which feeds the thread of a spool contained inside; for the double-chain stitch, the gripping mean consists of a hook (looper) which feeds the thread from a relative reel of thread arranged on a creel which forms part of the machine.

[0019] The gripping means, either shuttle or hook, grasp the eyelet or heddle eye of the needle thread and knot it or weave it in the desired manner, with the thread of the spool (shuttle) in one case, or with the thread of the reel (hook) in the other case, in order to achieve the specific type of stitch.

[0020] The shuttles, or hooks, are made to move with a generally alternate movement on sliding guides with substantially straight movements coordinated with the ascending/descending movements of the needle-carrier bars.

[0021] A fundamental difference between the technology of the knotted stitch (n° 301) and that of the dou-

ble-chain stitch (n° 401) is that in the latter it is necessary (especially to be able to perform stitching in all directions) to use a third element, to discard or deflect the threads, which is not included in machines for knotted stitching.

[0022] There are therefore substantial technological and kinematic differences between sewing/quilting machines using a knotted stitch (n° 301) technique and those using a double-chain stitch (n° 401) technique, and so these machines belong to two quite distinct categories.

[0023] In order to satisfy the requirements of the market, however, producers have to be equipped with many machines, each of which adopts a specific technology and which are used alternatively according to requirements, to produce quilted products with knotted stitches (n° 301) or with double-chain (n° 401) stitches.

[0024] This obviously entails great problems of investment, functionality, management, maintenance and still other problems.

[0025] This invention solves these problems economically and in a technically innovative manner, offering the market a single machine (in this case a multi-needle quilting machine) suitable to sew/quilt indifferently both with the knotted stitch (n° 301) technique and also with the double-chain stitch (n° 401) technique, and therefore a single machine which can produce quilted products of every type and kind.

SUMMARY OF THE INVENTION

[0026] The invention is set forth and characterised in the main claim, while the dependent claims describe other characteristics of the main embodiment.

[0027] The purpose of the invention is to provide a single multi-needle machine which will allow to achieve, alternatively and by means of simple and rapid preparatory operations, stitched or quilted textile products both with the knotted stitch technique and also with the double-chain stitch technique.

[0028] To be more exact, the multi-needle machine according to the invention allows to achieve, with one technique or the other, quilted patterns which may even be very sophisticated and made with the lines of stitches placed even very close together.

[0029] The multi-needle machine according to the invention comprises upper stitching elements consisting, in a manner already known in the state of the art, of one, two or more needle-bearing bars which can move with an alternative ascending/descending movement, synchronised with the movements of the lower stitching elements.

[0030] According to the invention, the lower stitching elements consist of supporting bars suitable to receive the shuttles, cooperating with shuttle-guiding shoulders, to do the knotted type stitches (n° 301), or the hooks to do the double-chain stitches (n° 401).

[0031] There are two types of bars, shuttle-bearing

bars and hook-bearing bars, and they are equipped with unified rapid attachment means to make them solid with sliders which can move in a substantially rectilinear direction in coordination with the ascending/descending movements of the needle-bearing bars.

[0032] According to the invention, each bar is suitable to contain one, two or more shuttles, or one, two or more hooks, located one behind the other at a desired distance, wherein each of the shuttles, or each of the hooks, cooperates with a respective needle mounted on corresponding needle-bearing bars arranged at the same distance.

[0033] In the double-chain stitch (n° 401) technique, each needle and relative hook cooperate with a third element, a thread-discarding or thread-deflecting element which, during a particular step of the stitch formation, grips the hook thread and the two ends of the needle thread with a plane rotatory movement, and displaces them from one side of the hook to the other so as to form a triangle into which the needle is threaded during the subsequent descending movement.

[0034] This system makes quilting possible in every stitching direction.

[0035] Fulfilling this requirement without having a negative effect on the knotted stitch (n° 301) technique is one of the main obstacles which this invention overcomes.

[0036] The solution to this problem has been obtained by inserting, below the plate on which the multi-layer fabric rests during the quilting operation and above the shuttle-guiding shoulders, a plurality of thin thread-deflecting plates, connected to each other and endowed with a plane rotational movement.

[0037] Each of the plates has individual thread-deflecting elements, each of which cooperates with a respective needle and a respective hook when double-chain stitches (n° 401) are done.

[0038] According to the invention, to do a knotted stitch (n° 301), shuttle-bearing bars are used whose shuttles cooperate with the upper stitching elements.

[0039] During this operation, the orbital movement of the thread-deflecting plates is disconnected and the plates are left inactive in place, in such a position that they do not interfere with the needles and the shuttles when the knotted stitch (301) is done.

[0040] According to the invention, to do a double-chain stitch (n° 401), hook-bearing bars are used which cooperate with the thread-deflecting elements and the upper stitching elements.

[0041] During this operation, the orbital movement of the thread-deflecting plates is activated and they perform their plane rotational movement so as to participate in the stitching of the double-chain stitch (n° 401).

[0042] The multi-needle machine quilting according to the invention comprises means to control and command the upper and lower stitching elements.

[0043] These means allow to vary the travels of the needles, and the relative shuttles or hooks, according to

the stitching technique employed.

[0044] When used as a quilting machine, the multi-needle machine also has means to feed the material to be quilted which are electronically controlled and managed by a command software which allows to achieve any quilting pattern whatsoever.

BRIEF DESCRIPTION OF THE DRAWINGS

[0045] These and other characteristics of the invention will become clear from the following description of a preferred form of embodiment of a multi-needle machine quilting, given as a non-restrictive example, with reference to the attached drawings wherein:

- Fig. 1 is a three-dimensional view of a multi-needle quilting machine according to the invention, wherein the enlarged detail shows a section of stitching with knotted stitch and a section of stitching with double-chain stitch;
- Fig. 2 is a part view of a longitudinal section of the multi-needle quilting machine in Fig. 1;
- Fig. 3 is a part view of the needle-bearing bars with the respective movement arms of the multi-needle quilting machine in Fig. 1;
- Fig. 4 is a cross section of a multi-needle machine according to the invention in the configuration for doing knotted stitches (n° 301);
- Fig. 5 is a cross section of a multi-needle machine as in Fig. 4 in the configuration for double-chain stitching (n° 401);
- Fig. 6 shows a shuttle-bearing bar of the multi-needle machine according to the invention;
- Fig. 7 shows a hook-bearing bar of the multi-needle machine according to the invention;
- Fig. 8 shows a detail of Fig. 5;
- Fig. 9 is a longitudinal cross section of the lower stitching elements, shuttles or hooks, of the multi-needle machine according to the invention;
- Fig. 10a is a three-dimensional view of a detail of the multi-needle machine according to the invention;
- Fig. 10b is a part view from above of Fig. 10a;
- Fig. 11 shows an enlarged detail of Fig. 4;
- Fig. 12 shows an enlarged detail of Fig. 5.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

[0046] Fig. 1 shows a multi-needle machine 10 according to the invention used as a quilting machine.

[0047] The multi-needle machine 10 comprises, as its essential parts, an inlet assembly 10a, a stitching assembly 10b and an outlet assembly 10c.

[0048] The inlet assembly 10a is used to feed the

textile material 11 on which the quilting is to be performed; the textile material 11, in this case, consists of an upper fabric 11a, a lower fabric 11c, and an intermediate layer of padding 11b so as to achieve a so-called "quilted sandwich".

[0049] The inlet assembly 10a is managed and commanded by a command software, and is therefore able to move the textile materials 11 in any direction, so as to achieve quilted products 19 with very complex quilting patterns.

[0050] The stitching assembly 10b comprises upper stitching elements 12 consisting of a desired number, in this case two 13a and 13b, of needle-bearing bars 13, parallel to each other, cooperating with mating lower stitching elements 15.

[0051] The needle-bearing bars 13 are associated with respective movement arms 26 equipped with alternate ascending/descending movement, and comprise a plurality of stitching needles 24 each of which cooperates with a respective thread 14, or needle thread, fed from reels 14a (Fig. 3).

[0052] The cooperation between the upper stitching elements 12 and the lower stitching elements 15 causes the simultaneous formation, on the textile material 11, of a plurality of stitches 18/18a which achieve the desired quilting patterns to obtain the quilted textile product 19 with both knotted stitch and double-chain stitch.

[0053] The quilted textile product 19 is then collected in a desired manner by the outlet assembly 10c.

[0054] The assemblies 10a, 10b and 10c are controlled and driven by an electronic control assembly 25 equipped with interface means for the operator, such as a key board, display, possible peripherals such as a printer etc.

[0055] The multi-needle machine 10 according to the invention is suitable to use, alternatively, lower stitching elements 15 either of the shuttle type 20, so as to achieve knotted (n° 301) stitches 18, or of the hook type 21 (looper), so as to achieve double-chain (n° 401) stitches 18a.

[0056] The lower stitching elements 15 may therefore consist either of a plurality of shuttles 20 mounted in alignment on relative shuttle-bearing bars 16 (Fig. 6), or of a plurality of hooks 21 mounted in alignment on relative hook-bearing bars 17 (Fig. 7).

[0057] The shuttle-bearing bars 16 and the hook-bearing bars 17 are suitable to be alternatively attached, in this case by means of rapid attachment elements 42, to sliders 22 arranged in a position mating to the needle-bearing bars 13 positioned above (Figs. 11 and 12), of a unified type and mounted sliding on guides 43.

[0058] The rapid attachment means 42 can be of the mechanical type, the magnetic type or of any other known type.

[0059] The sliders 22 are suitable to be moved, with an alternating rectilinear movement, in step together and synchronised with the alternating ascend-

ing/descending movements of the needle-bearing bars 13, by means of command levers 23 mounted on a main shaft 27 (Figs. 4 and 5).

[0060] The sliders 22 are arranged in the intermediate spaces between a plurality of guiding shoulders 28 defining the lateral surfaces on which the shuttles 20 slide when the multi-needle machine 10 is in the configuration for knotted stitch stitching (Fig. 9).

[0061] The guiding shoulders 28 are attached on suitable supports 29 and are associated at the upper part with a needle-plate 30 on whose upper surface the textile material 11 rests during the quilting operation.

[0062] During the working of the machine, the needles 24 move with an ascending/descending movement, penetrate the textile material 11 and emerge therefrom.

[0063] In their movement the needles 24 pass through mating holes 31, made on the needle-plate 30, and slide between corresponding vertical hollows 32 made on the guiding shoulders 28, cooperating with the shuttles 20 so as to do knotted stitches 18, or with the hooks 21 to do double-chain stitches 18a.

[0064] The multi-needle machine 10 according to the invention also comprises a plurality of thread-deflecting plates 39, each of which has a plurality of deflector elements 37 cooperating with needles 24 and hooks 21 to do the double-chain stitches 18a.

[0065] The thread-deflecting plates 39 are arranged below the needle-plates 30 in a position above the hooks 21 and guiding shoulders 28, which in this case act as a sliding plane for the thread-deflecting plates 39 (Figs. 11 and 12).

[0066] The thread-deflecting plates 39 are connected together and are suitable to rotate on a substantially horizontal plane (see detail in Fig. 10a), so as to drive, in the case shown here as an example, one or more command cams 40 associated with a relative autonomous drive assembly 41 shown in Figs. 5 and 10.

[0067] According to a variant, the thread-deflecting plates 39 are driven by suitable means to impart two coordinated movements so as to oblige the plates 39 to perform a plane rotary movement.

[0068] According to the invention, in order to do double-chain stitches 18a, the hook-bearing bars 17 are attached onto the sliders 22 by means of the rapid attachment elements 42; apart from the hooks 21, as in the state of the art, a plurality of needle-saver elements 34 are mounted on the hook-bearing bars 17.

[0069] Respective lower threads 35 are associated on the hooks 21, and are fed from relative reels 36 arranged on a lower creel which is part of the multi-needle machine 10 (Fig. 5).

[0070] The command assembly 41 which drives the cam 40 to make the thread-deflecting plate 39 rotate can be activated by means of the electromagnetic switch 44 when double-chain stitches 18a are done.

[0071] The command assembly 41 is de-activated by means of the same electromagnetic switch 44 when

knotted stitches 18 are done and held in position by the electromagnetic brake 45.

[0072] For double-chain stitching, as the needles 24 ascend vertically, in the step after the penetration of the textile material 11, the needle threads 14 form eyelets or heddle eyes.

[0073] During this step, as they advance, the tips of the hooks 21, moving in coordination with the mating needles 24, enter into the eyelets and weave their lower threads 35 with the needle threads 14, while the needles 24 are ascending.

[0074] As the thread-deflecting plates 39 rotate on the horizontal plane, this causes the lower threads 35 and the two ends of the needle threads 14 to hook up with deflector elements 37, and also to be displaced from one side of the respective hooks 21 to the opposite side.

[0075] In this way, each needle thread 14 and the respective lower thread 35 form a triangle wherein the needle 24 enters in its subsequent descending step so as to close the previous stitch.

[0076] For double-chain stitching 18a, the lower threads 35 are alternately put under tension and then released, by means of a tensioner element 38 oscillating alternately in co-ordination and synchronisation with hooks 21, needles 24 and thread-deflecting plates 39, in order to optimise the binding of the threads.

[0077] In order to vary the configuration of the multi-needle machine 10, so as to do knotted stitching 18, the lower stitching elements 15 are replaced by removing the hook-bearing bars 17 from the sliders 22 and replacing them with the shuttle-bearing bars 16 on which the shuttles 20 are arranged containing the spools 33a of lower thread 33.

[0078] Moreover, the assembly 41 to drive the command cam 40 which makes the thread-deflecting plate 39 rotate is then de-activated, by means of the electromagnetic switch 44.

[0079] The knotted stitch is formed by the shuttles 20 which, as they advance, enter into the eyelets formed by the needle threads 14, opening them and knotting them with the lower threads 33 of the respective spools 33a.

[0080] The subsequent retreat of the shuttles 20 and the simultaneous advance of the fabric 11 completes the knotted stitch.

[0081] When knotted stitches 18 are done, the thread-deflecting plate 39 are kept inactive, by means of the electromagnetic brake 45, in a position where they do not interfere with the needles 24 and shuttles 20.

[0082] The invention thus allows to use the same multi-needle machine both to do stitches 18 with a knotted stitch (n° 301) and also stitches 18a with a double-chain stitch (n° 401) with a simple and rapid variation of the command travels of the needles-shuttles and the needles-hooks.

[0083] In this way, with the multi-needle machine 10 it is possible to do knotted stitches 18 or double-chain

stitches 18a by replacing only the shuttle-bearing bars 16 or the needle-bearing bars 17, without needing any further operations of dismantling/assembling the deflector elements 37.

[0084] All the mechanical/kinematic devices, coordinated and managed by an electronic command assembly, contribute, according to known techniques, to perform, in this case, knotted stitches (n° 301) or double-chain stitches (n° 401).

[0085] In a preferential embodiment, the electronic command assembly 25 of the multi-needle machine 10 is suitable to co-ordinate and synchronise the drive of all the operational elements which intervene in doing the stitches 18, 18a, possibly modifying the activation cycles according to the type of stitch to be done.

[0086] It is obvious that modifications and additions may be made to this invention, yet these shall remain within the field and scope thereof.

Claims

1. Multi-needle machine able to perform alternatively quilting with stitches (18) of the knotted stitch type (n. 301) and stitches (18a) of the double-chain stitch type (n. 401) adopting, in cooperation with upper stitching elements (12), alternatively interchangeable lower stitching elements (15) consisting either of shuttle-bearing bars (16) to perform the knotted stitch, or of hook-bearing bars (17) to perform the double-chain stitch and reconfiguring, simply and quickly, the command travels of the upper (12) and lower (15) stitching elements.
2. Multi-needle machine as in Claim 1, characterised in that the interchangeable lower stitching elements (15) consist of shuttle-bearing bars (16), with associated relative shuttles (20), to perform stitches (18) of the knotted stitch type (n° 301), and of hook-bearing bars (17), with associated relative hooks (21), to perform stitches (18a) of the double-chain type (n° 401).
3. Multi-needle machine as in Claim 1, characterised in that the bars (16, 17) are interchangeable, each shuttle-bearing bar (16) being able to house one or more shuttles (20) to perform stitches (18) of the knotted stitch type (n° 301), and each hook-bearing bar (17) being able to house one or more hooks (21) to perform stitches (18a) of the double-chain type (n° 401), in order to obtain quilting patterns with stitches (18, 18a) even very close together so as to quilt any kind of textile product (19) with the two techniques.
4. Multi-needle machine as in Claim 1, suitable to do stitches, respectively knotted stitches (18) and double-chain stitches (18a), particularly but not exclusively quilting stitches, the machine comprising an inlet assembly (10a) for the controlled feed of the textile material (11) to be stitched, cooperating with a needle-plate (30) on which the material rests, and a stitching assembly (10b), including upper stitching elements (12) and lower stitching elements (15) associated with respective threads (14, 33, 35), the upper stitching elements (12) comprising stitching needles (24) arranged distanced on needle-bearing bars (13) movable longitudinally with alternate ascending/descending movement with respect to the needle-plate (30), the lower stitching elements (15) being organised in longitudinal rows mating with the position of the needle-bearing bars (13) in a position below the needle-plate (30), the machine being characterised in that it has unified sliders (22) suitable to receive, with rapid attachment systems (42), bars (16) bearing shuttles (20) to perform knotted stitches (18) or bars (17) bearing hooks (loopers) (21) to perform double-chain stitches (18a), the sliders (22) being movable with an alternate straight movement coordinated with the ascending/descending movement of the needle-bearing bars (13).
5. Multi-needle machine as in Claim 4, characterised in that the rapid attachment systems (42) are of the magnetic type.
6. Multi-needle machine as in Claim 4, characterised in that the rapid attachment systems (42) are of the mechanical type or of another type suitable to the purpose.
7. Multi-needle machine as in Claim 4, characterised in that the sliders (22) are able to slide on guides (43) associated with movement means consisting of command levers (23) mounted on a drive shaft (27).
8. Multi-needle machine as in Claim 4, characterised in that the sliders (22) are arranged in the spaces between a plurality of shoulders (28) to guide the shuttles (20).
9. Multi-needle machine as in any claim hereinbefore, characterised in that it comprises deflector means (37), made on movable plates (39), cooperating with the hooks (21) to perform double-chain stitches (18a).
10. Multi-needle machine as in Claim 9, characterised in that the plates (39) are associated with movement means (40, 41) suitable to be de-activated by means of an electromagnetic switch (44) and to be maintained in position by means of electromagnetic braking means (45) when the knotted stitches (18) are done.

11. Multi-needle machine as in Claim 9, characterised in that the deflector means (37) are mounted immediately below the needle-plate (30) and above the guiding shoulders (28) in a position where, after being activated by the electromagnetic switch means (44), they are suitable to cooperate with the hooks (21) to do double-chain stitches (18a). 5
12. Multi-needle machine as in Claim 9, characterised in that the movement means to move the plates (39) comprise one or more command cams (40) associated with a drive assembly (41). 10
13. Multi-needle machine as in Claim 9, characterised in that the movement means to move the plates (39) comprise lever systems, or other similar means suitable to impart a plane rotary movement thereto. 15
14. Multi-needle machine as in Claim 9, characterised in that the plates (39) are suitable to be attached below the needle-plate (30), each of the plates (39) including a plurality of deflector means (37) suitable to hook the thread (35) of the hooks (21) and cooperate with a relative needle (24). 20
25
15. Multi-needle machine as in Claim 1, characterised in that it comprises a tensioner element (38), used to perform double-chain stitching (18a), to tension the lower threads (35) and suitable to oscillate alternately in a coordinated manner with hooks (21), needles (24) and deflector means (37, 39). 30
16. Multi-needle machine as in Claim 1, characterised in that it comprises control and command means (25) suitable to coordinate and synchronise at least the drive of the stitching means (12, 15) and the deflector means (37, 39), possibly modifying the movement times and/or the activation cycle according to the configuration assumed by the multi-needle machine (10). 35
40
17. Multi-needle machine as in Claim 1, characterised in that the command mechanisms of the upper (12) and the lower (15) stitching elements are able to be easily and rapidly reconfigured to adapt the travels of the needles (24) and the sliders (22) to achieve the type of stitching desired, knotted stitch (n° 301) or double-chain stitch (n° 401). 45
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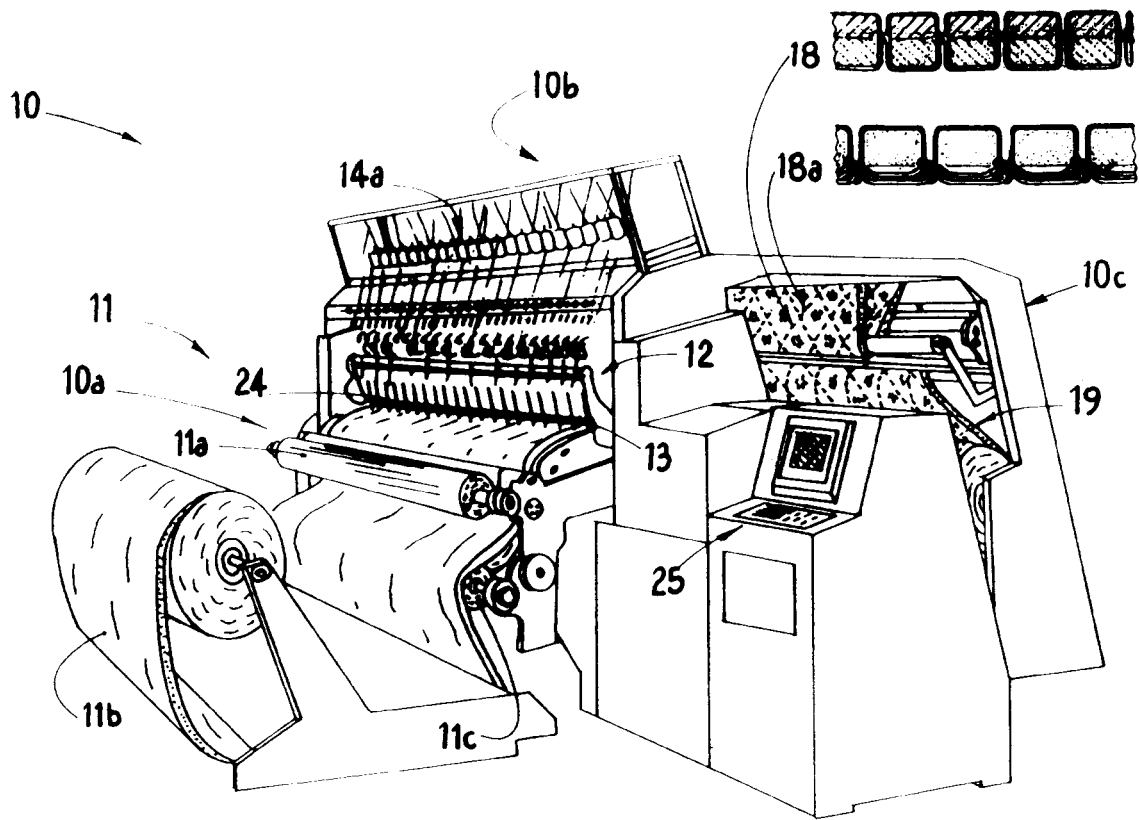


fig.1

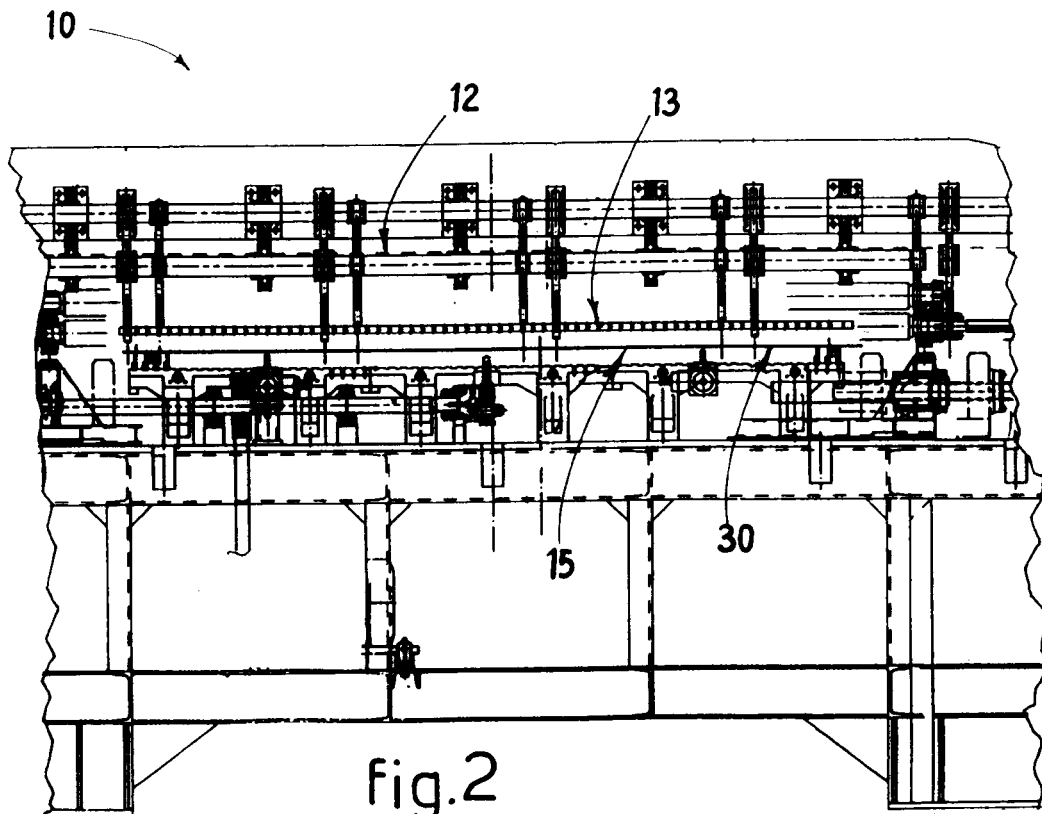


fig.2

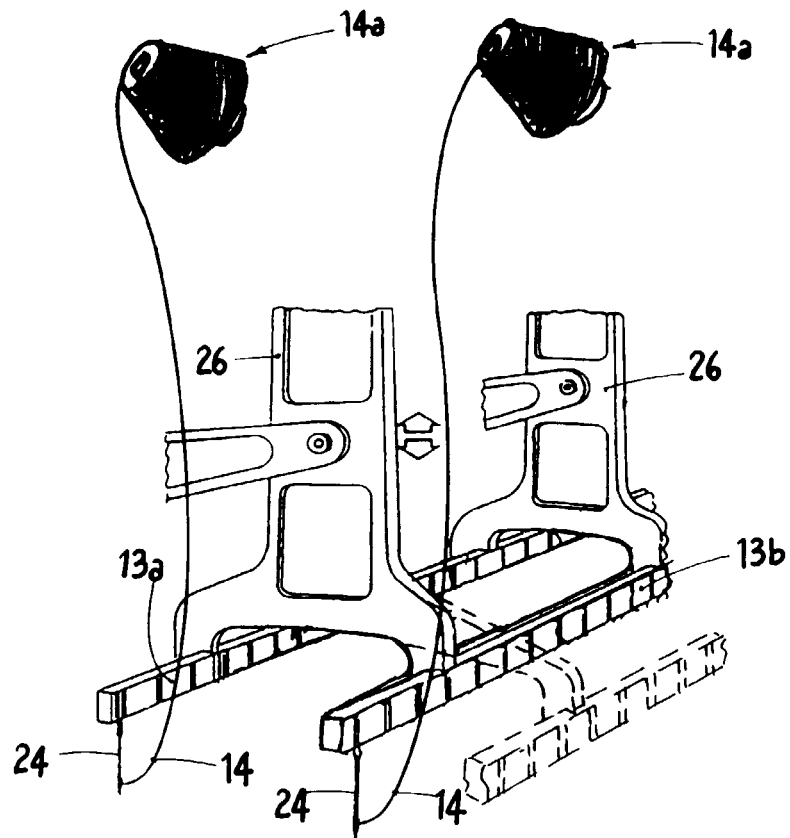


fig.3

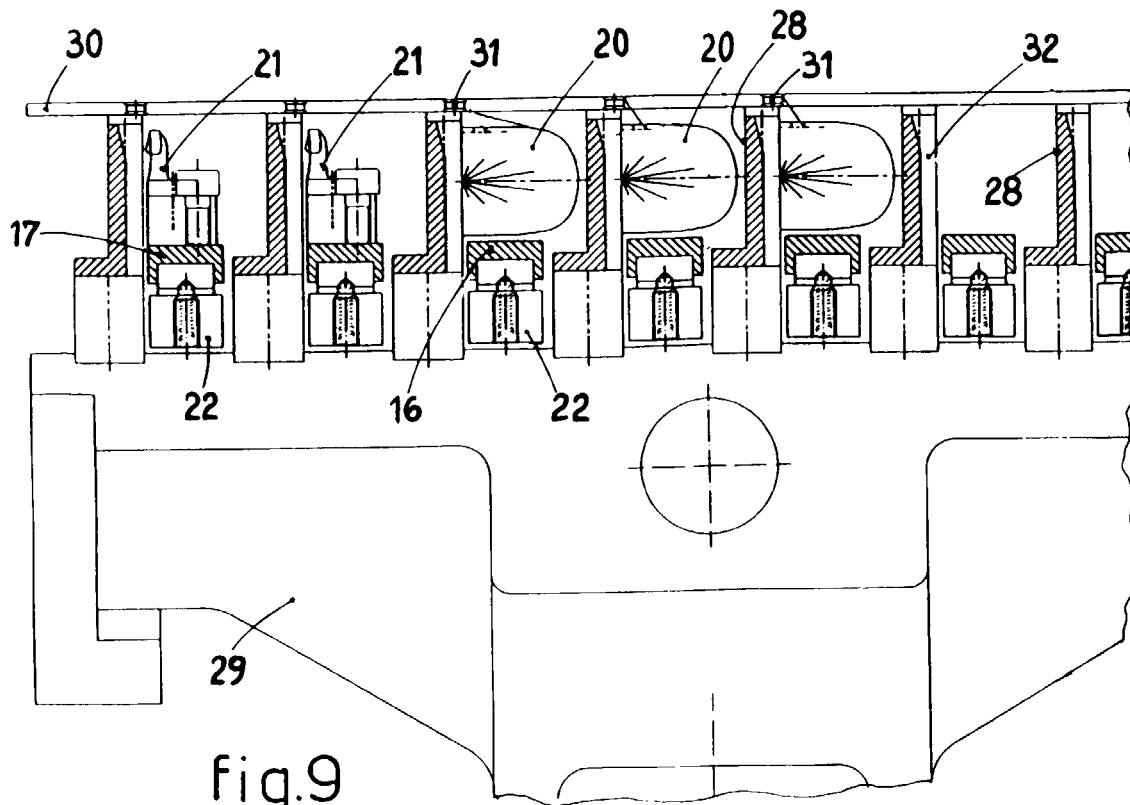


fig.9

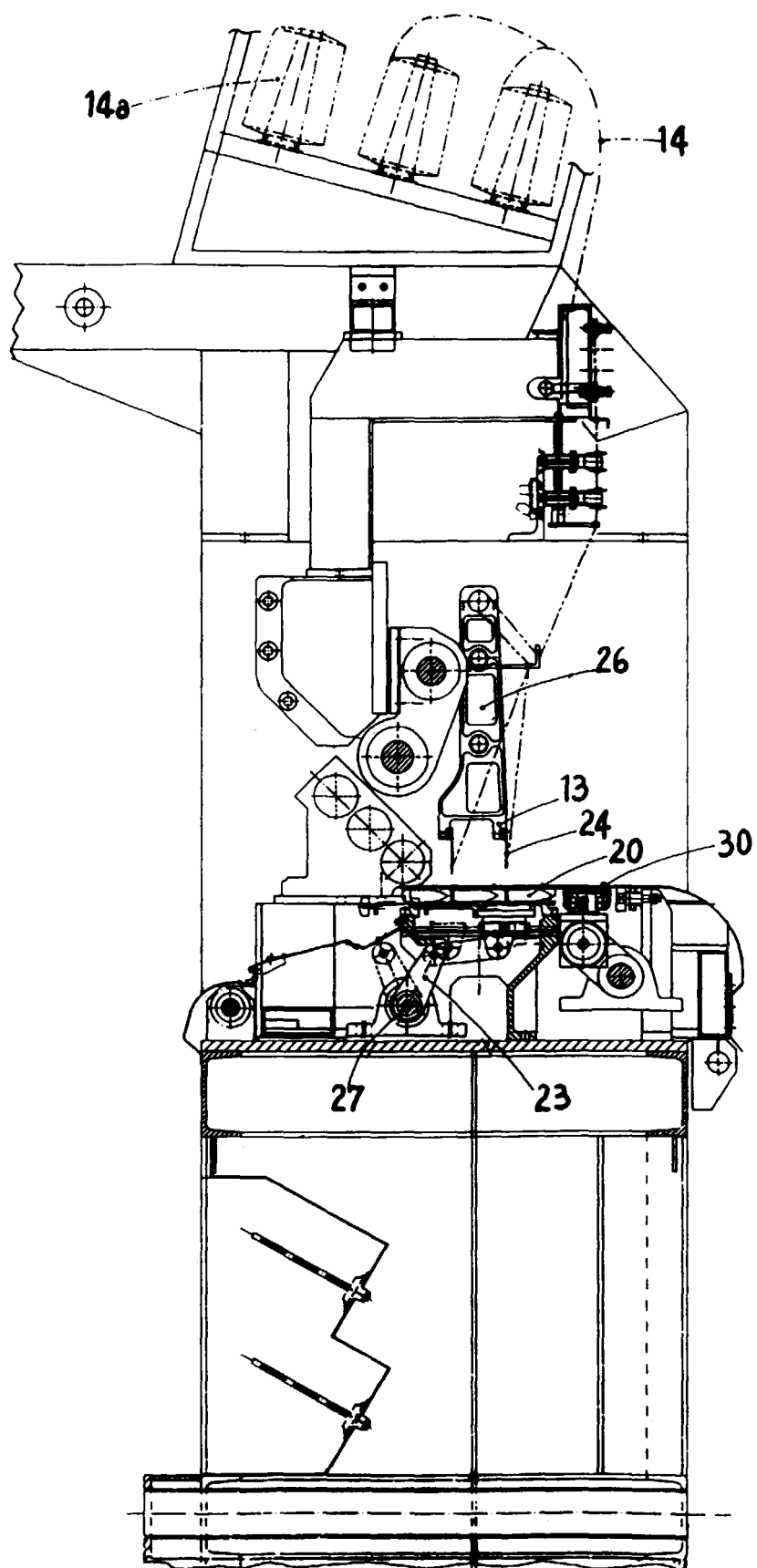
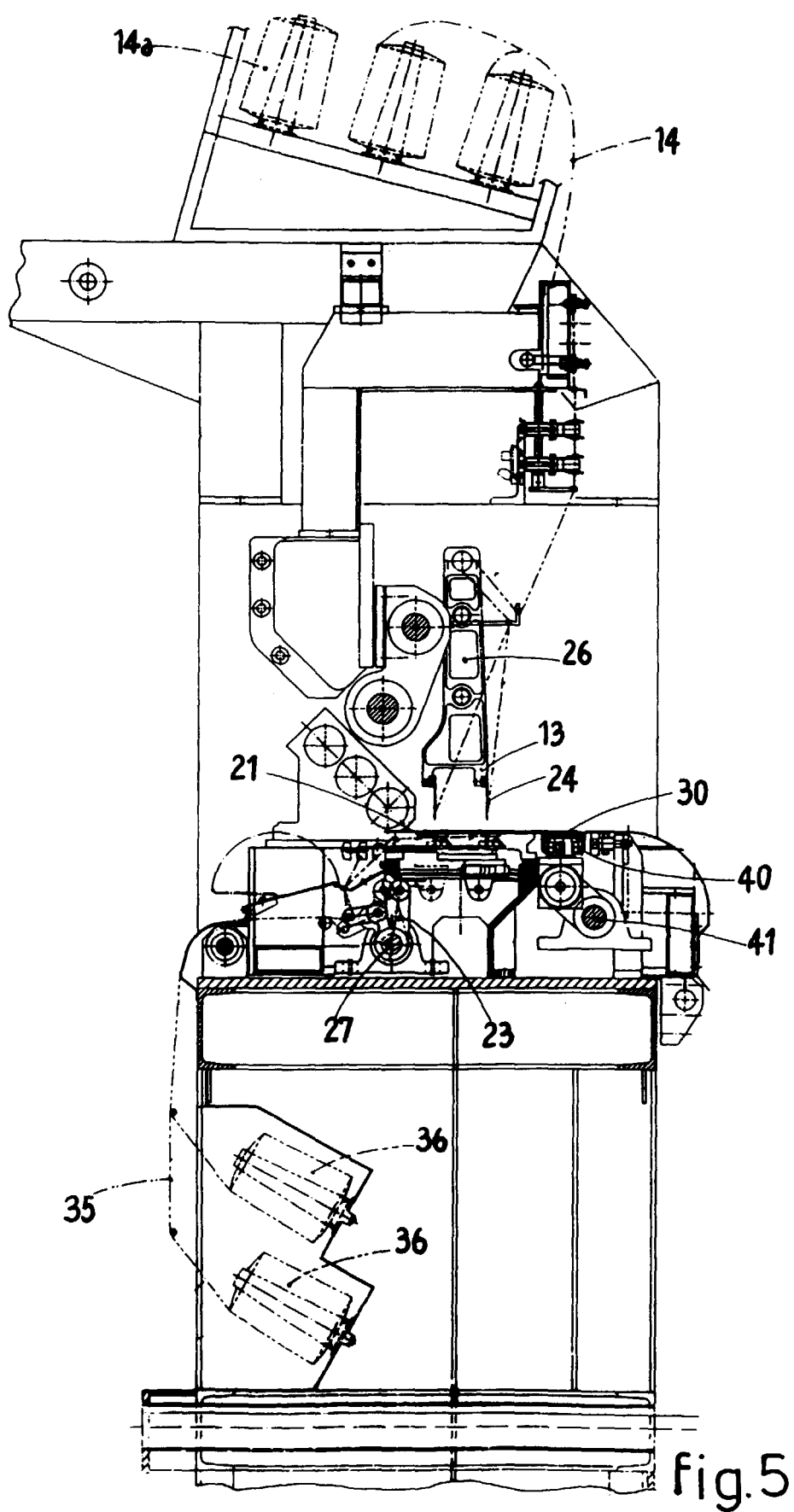
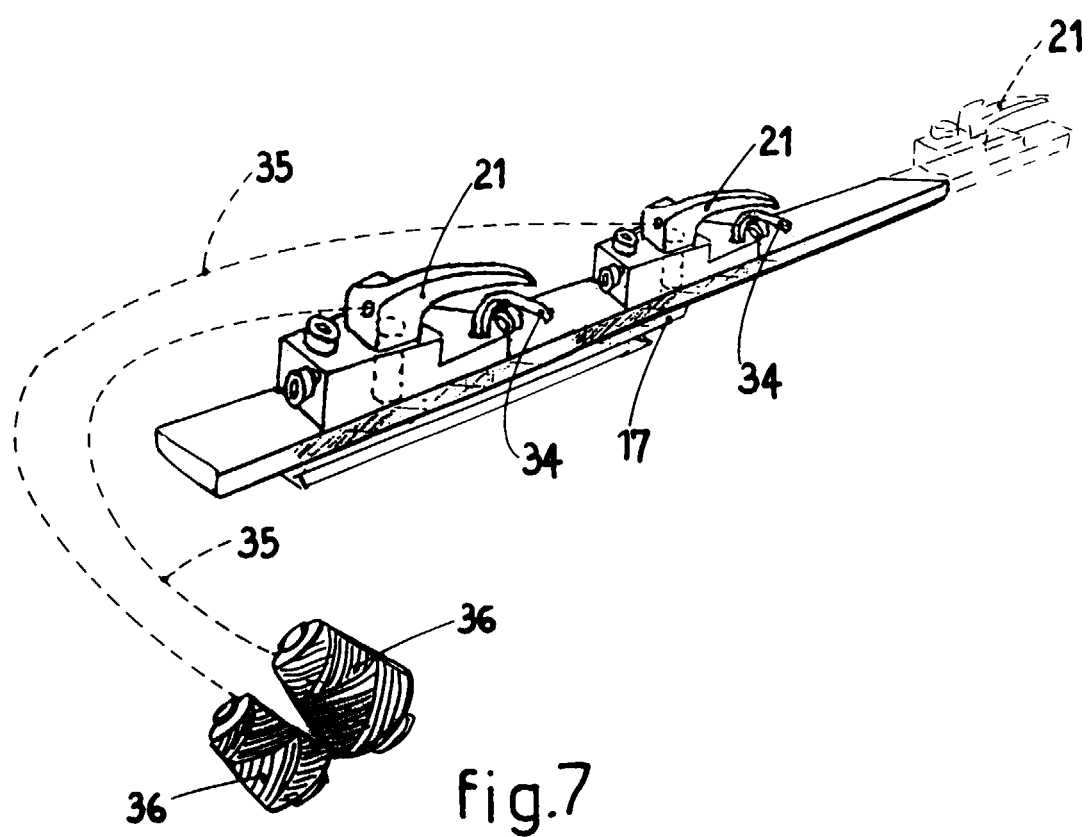
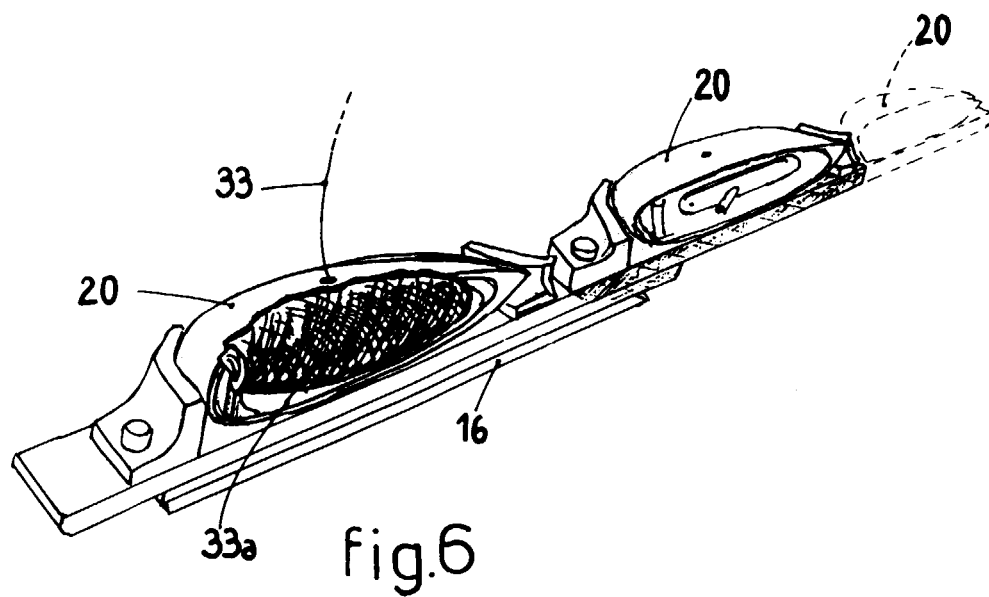


fig.4





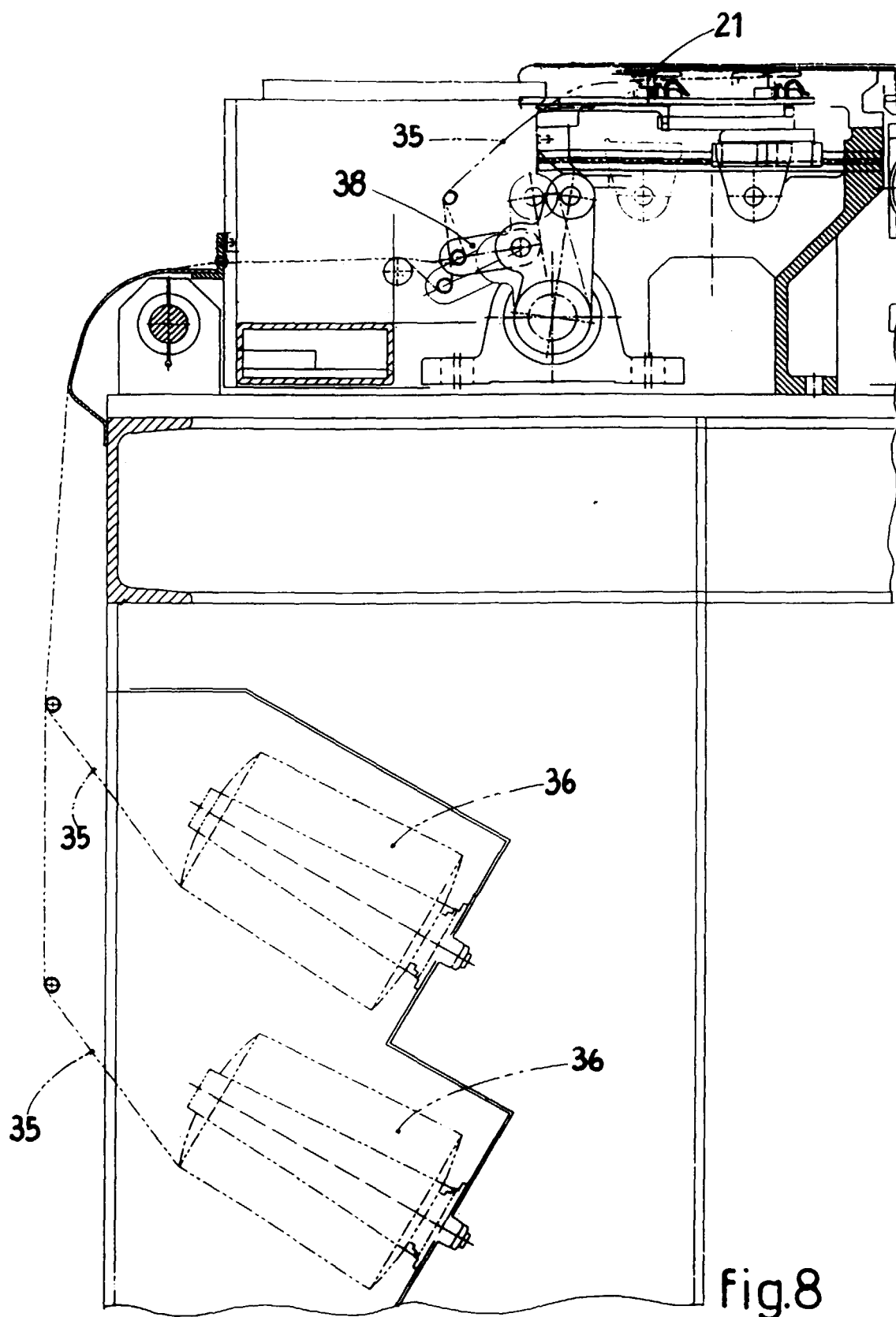
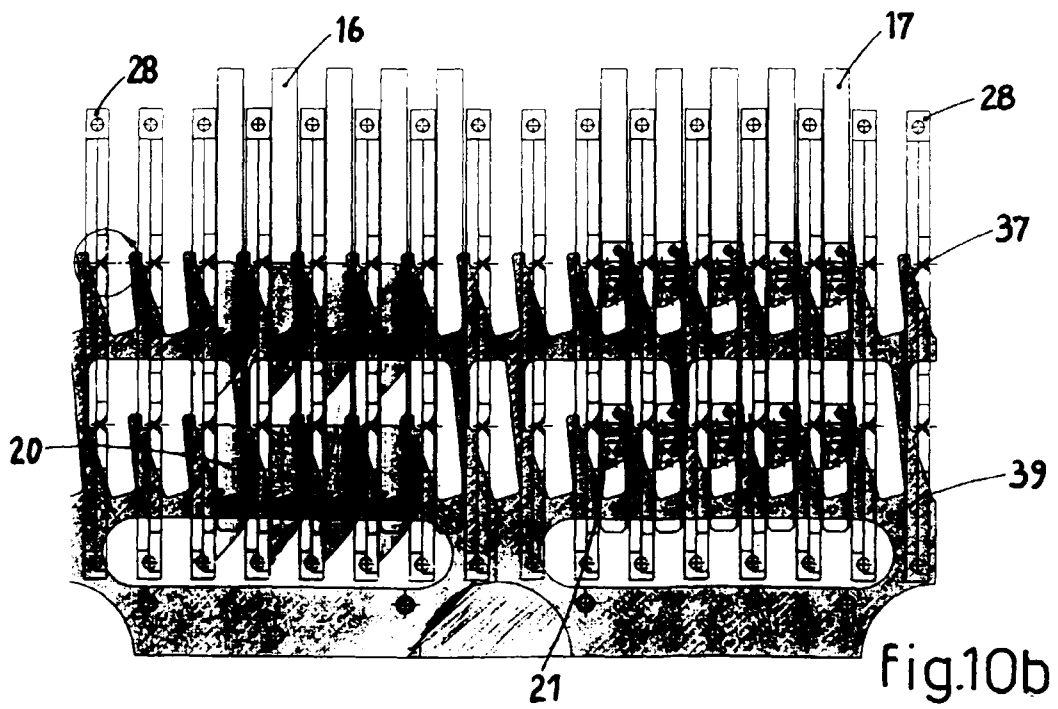
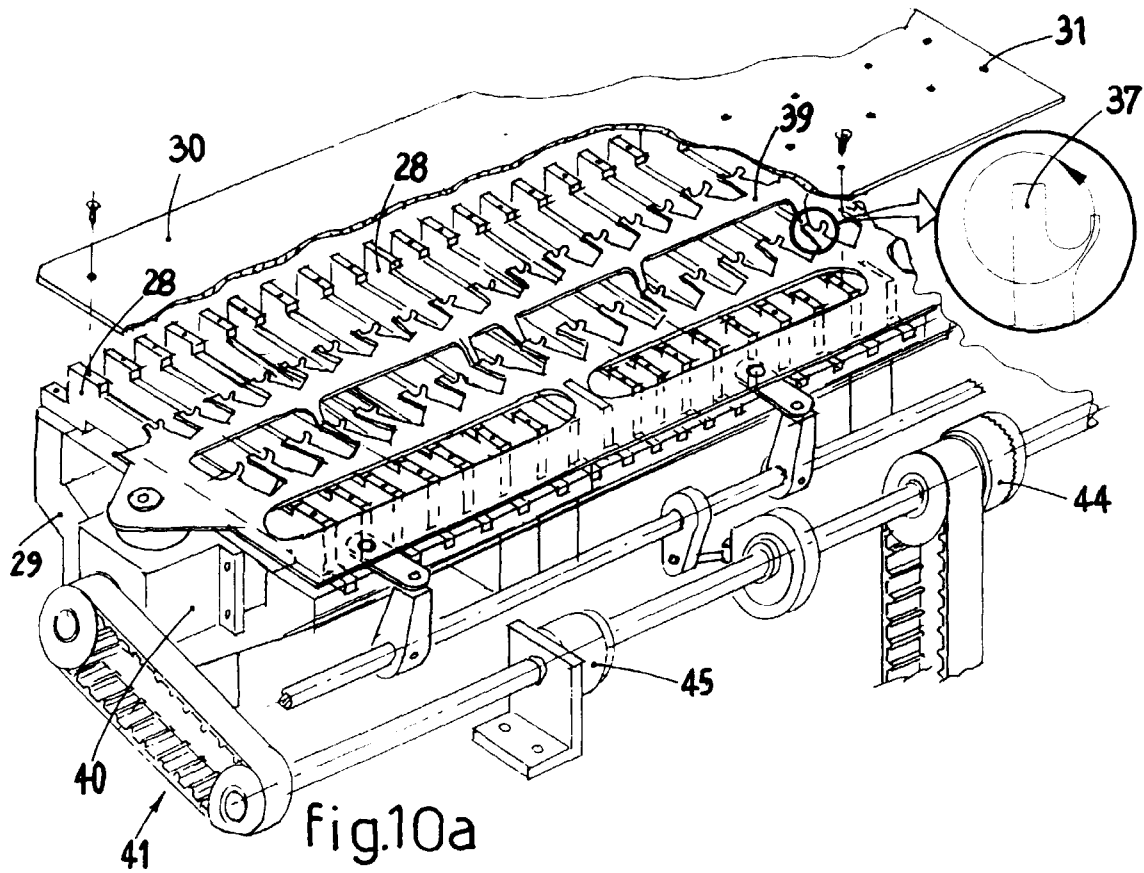


fig.8



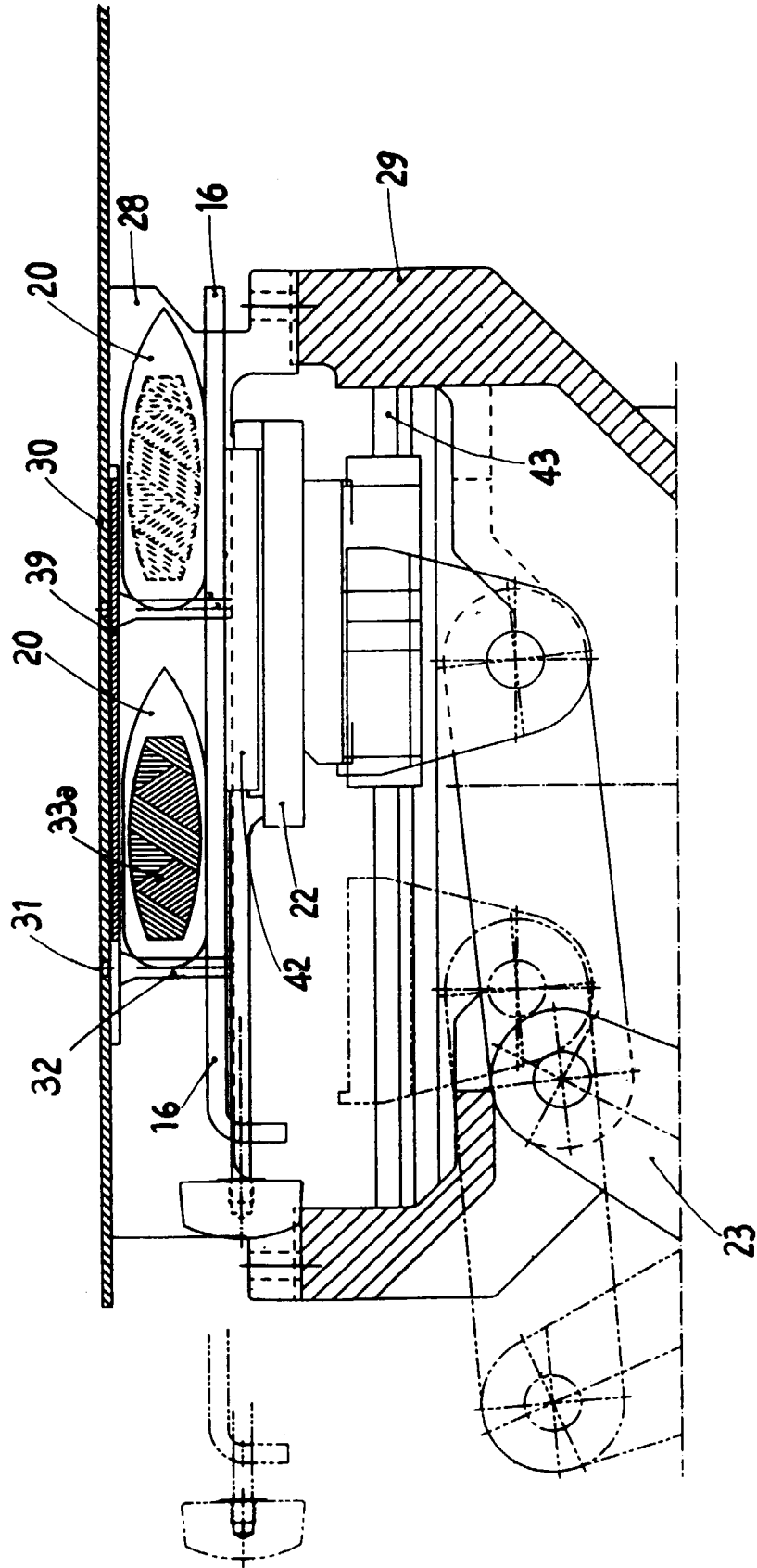


Fig.11

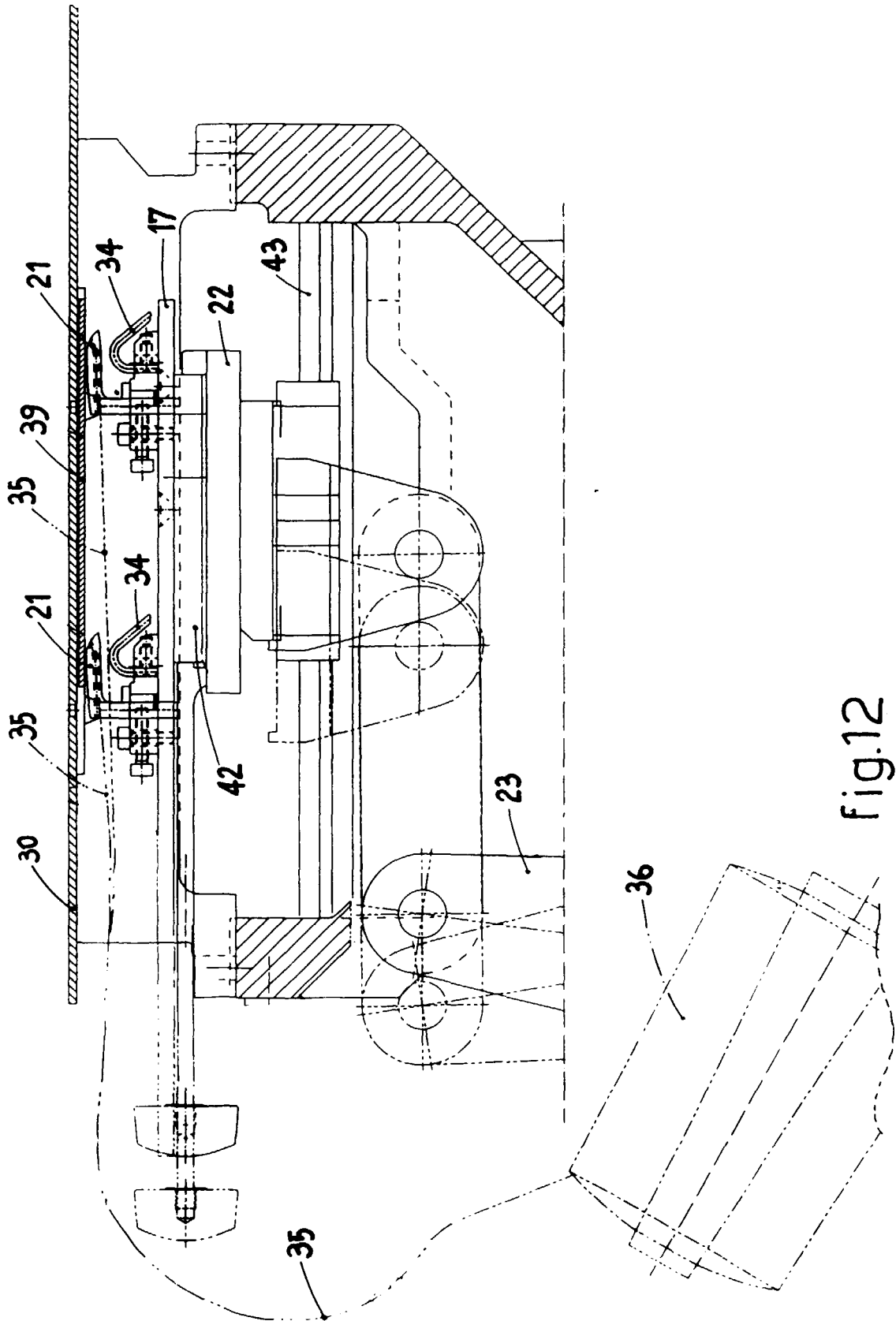


fig.12



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 12 2856

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Place of search THE HAGUE		Date of completion of the search 3 March 2000	Examiner Van Gelder, P
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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