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(54) Apparatus for the automatically changing of the cones for feeding the yarn to a textile machine and method thereof

(57) An apparatus 10 for automatically effecting the change of the cones for feeding the weft yarn 12 to a textile machine 14 such as, for instance, a loom or a warper, comprising a rotating magazine 21 on which the various cones of weft yarn are loaded, a known yarn feeding device 22 adjacent to the machine 14, and an intermediate assembly 23, arranged between the magazine 21 and the feeding device 22, for effecting the cutting and the knotting of the weft yarn 12 during the change of the cones. Upon attainment of the predetermined length for the fabric manufactured by the machine 14 and at the consequent stop of the latter, a control assembly 24 of the apparatus 10 actuates successively the cut of the weft yarn 12 by means of the intermediate assembly 23, the rotation of the magazine 21 for removing an old cone 11a and arranging a new cone 11c in place of the old cone 11a near the intermediate assembly 23, and the activation of said assembly for re-establishing the continuity of the yarn 12 to be fed to the loom 14, by knotting the end of the yarn coming from the new cone 11c with the end of the yarn previously cut and positioned on the side of the feeding device 22. The apparatus 10 allows to change the cones for feeding the weft yarn 12 in a completely automatic way, without requiring any overseeing by an operator. Besides the normal weaving production, the apparatus 10 is particularly advantageous and useful in the manufacturing of fabric samples, allowing to change quickly, and without any manual intervention, the cones for feeding the yarn on the basis of the specific pattern of the various fabric samples.

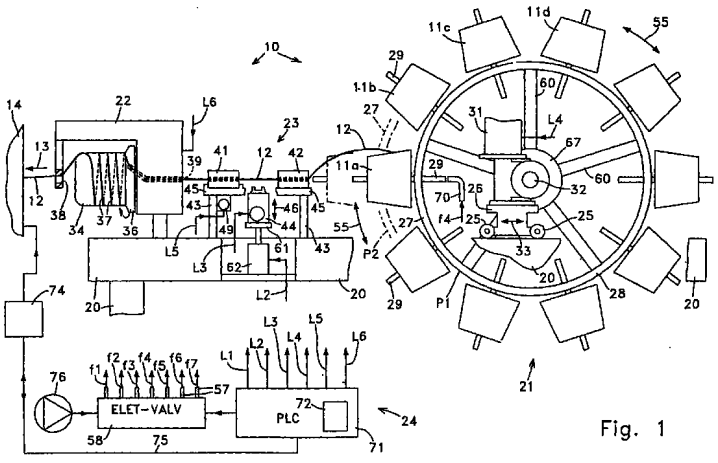

Fig. 1

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Description

[0001] The present invention refers to an apparatus for the automatically changing of the cones for feeding the yarn to a textile machine as for instance a loom or a warper during the manufacturing of a fabric, and to a method thereof.

[0002] In the textile field of the production and trading of fabrics, it is frequently necessary to realize limited lengths or samples of fabric, which are commercially used for the presentation and promotion of the same fabrics to the customers.

[0003] The weaving of these samples is made generally on one or more dedicated looms and is generally fairly expensive because it is necessary to prepare differently the loom for the weaving of each sample.

[0004] In fact various fabrics and therefore the relative samples differ from one another, being characterised by different patterns, that is by different weave modes between the weft yarns and the warp yarns, and by the fact that they are realised with different types of yarns, differing in colour, material, for instance wool yarns, cotton, synthetic fibers, etc., and also in structure, for instance woollen, worsted, twisted yarns, etc.

[0005] Therefore it is frequently necessary to replace the cones for feeding the yarns to the textile machine, for instance weft yarns to a loom used for manufacturing a sample, with other cones on which the weft yarns necessary for the manufacturing of the next sample are wound, as well as to arrange differently said cones depending on the pattern of the sample to be woven.

[0006] Moreover, the fabric samples have, as previously explained, a limited length, hence the actual time for the weaving of each of them is rather reduced, while the time for the preparation of the loom between the weaving of two samples becomes remarkable and such as to affect heavily on the manufacturing cost of these samples.

[0007] Particularly such cost is higher than the cost of the manufacturing of the fabrics by means of the normal mass production.

[0008] Moreover the replacement of the cones of the weft yarns is generally made manually, and thus involves a continuous overseeing of the loom by an operator during the manufacturing of the samples, with a consequent considerable manpower use, and moreover a remarkable decrease in the loom efficiency.

[0009] Currently the problem of changing in a reliable and inexpensive way the cones on which the weft yarn is wound and/or of pre-arranging differently such cones in a loom for the manufacturing of fabric samples has not found an adequate solution yet.

[0010] Generally systems or devices suitable for warning the operator when a cone is empty, or when the pre-established length of the sample has been reached, are adopted.

[0011] Particularly creels have been produced for facilitating the handling of the cones for feeding the weft yarn, and especially for their substitution with other cones.

[0012] These solutions however, always involve the presence of the operator and therefore involve manpower costs that weigh heavily on the manufacturing costs of the samples.

[0013] It is an object of the present invention to realize an apparatus for automatically changing the cones for feeding the yarn to a textile machine such as a loom or a warper.

[0014] Advantageously, according to the invention, it is possible to automatically change the cones for feeding the weft yarn in the manufacturing of fabric samples, so that the cost of these fabric samples is considerably reduced, and the overall efficiency of this textile operation is generally improved in comparison with the systems currently adopted.

[0015] Another object is to provide an apparatus for automatically changing the cones for feeding the weft yarn or yarns to a loom during the normal series production, so that every manual intervention is eliminated and the overall yield of the loom is consequently raised.

[0016] These objects are reached by the apparatus having the characteristics listed in the main claim.

[0017] These and other characteristics, objects and advantages of the present invention will result clearly from the following description, presented as a non-limitative example, and with reference to the attached drawings, in which:

Fig. 1 shows a schematic side view of an apparatus, in accordance with the present invention, for the automatic change of the cones for feeding the weft yarn to a loom;
Fig. 2 shows a schematic plan view, partly in section, of the apparatus of Fig. 1;
Fig. 3 is an over-scale side view of a cutting-knotting assembly of the apparatus of Fig. 1;
Fig. 4 is a detailed plan view of the cutting-knotting assembly of Fig. 3 in a first stand-by position;
Fig. 5 is a detailed plan view of the cutting-knotting assembly of Fig. 3 in a second working position, in which the weft yarn is prepared for knotting;
Fig. 6 is a view of a section taken along line VI-VI of Fig. 5;
Fig. 7 is a view of the cutting-knotting assembly of Fig. 5, at the end of the knotting of the weft yarn;
Fig. 8 is a detailed view of a portion of Fig. 5; and
Fig. 9 is a flow diagram that illustrates the operation of the apparatus of Fig. 1.

Description of a preferred embodiment of the apparatus of the invention.

[0018] With reference to Figures 1 and 2, an apparatus, according to the present invention and suitable for automatically changing the cones for feeding a weft

yarn to a loom, is indicated as a whole with the reference numeral 10; the weft yarn is shown as 12; the loom, only partially represented, is shown as 14; while the cones for feeding, each obtained by winding a suitable quantity of the weft yarn 12, are shown with 11a, 11b, 11c.

[0019] The weft yarn 12 is scheduled to be fed according to the direction of the arrow 13 towards an insertion assembly of the loom 14.

[0020] In Figures 1 and 2 the apparatus 10 is shown in its stand-by position, between a cone change and the following one, i.e. when it does not intervene for changing the cones 11a, 11b, etc., and the weft yarn 12 is normally fed to the loom 14 for the manufacturing of the fabric. Moreover some chain lines point out the position of certain parts of the apparatus 10 in the relative working position, during its intervention for changing the cones 11a, 11b, etc., as better described later on.

[0021] The apparatus 10 comprises a fixed base 20; a magazine 21 on which the cones 11a, 11b. etc... are loaded; a feeding device 22 adjacent to the loom 14 and provided for feeding the weft yarn 12 to the latter, after having received said yarn from the cones 11a, 11b, etc...; an intermediate assembly 23, arranged between the magazine 21 and the feeding device 22, and suitable for effecting the cutting and the knotting of the weft yarn 12; and an electro-pneumatic control assembly 24 suitable for controlling the operation of the apparatus 10.

[0022] The magazine 21 comprises a circular structure 27 revolving according to the sense of the arrows 55, formed by an external ring 28 connected to an inner hub 67 through a plurality of spokes 60. The cones 11a, 11b, etc... are supported by a plurality of shafts 29 fixed according to a radial orientation along the periphery of the external ring 28 of the structure 27.

[0023] Such shafts 29 are hollow in order to allow the passage of the weft yarn 12, as it will be seen later on describing the operation of the apparatus 10. Particularly each of them is provided, as shown in detail in Figure 8, with a through hole 59, having a first extremity 68 disposed outside the ring 28, and a second extremity 69 disposed inside it.

[0024] The inner extremity 69 is provided so as to be, at the end of each rotation of the circular structure 27 for the change of a cone with the following one, perfectly lined up with and at short distance from a nozzle 70 integral to the trolley 26, in order to receive from the same nozzle 70 an air flow f4, as better described later on. Particularly the nozzle 70 is placed at an appropriate distance from the spokes 60 so that it does not interfere with them during the rotation of the circular structure 27, while the inner extremity 69 is shaped, relative to the remaining part of the shaft 29, so that it projects from the spokes 60 and can be placed near the nozzle 70.

[0025] The various shafts 29 define corresponding predetermined positions for the cones that are loaded on the magazine 21, and that are made of various types of weft yarn, different both in colour and structure, that serve for the manufacture of the fabric, or the fabrics, by means of the loom 14. Therefore each of the positions occupied by the various cones 11a, 11b, 11c, etc. on the magazine 21 corresponds univocally to a specific weft yarn used for producing the fabric, and it is coherently controlled, together with the other positions, by the program that controls the apparatus 10, as will be described later.

[0026] A ratio-reduction assembly 31 is fixed vertically on a trolley 26, which is in turn suitable for moving in contact with and along the base 20, according to the direction of the arrows 33, by means of small wheels 25 provided in the trolley. Moreover the ratio-motor assembly 31 is provided on the output of a central shaft 32 on which the circular structure 27 is keyed with its hub 67. In this way the magazine 21 can be moved integral to the trolley 26 relative to the fixed base 20.

[0027] The movement of the trolley 26 along the base 20 is arranged for being driven by an actuator 30 (Figure 2), consisting for instance of a pneumatic cylinder lodged into the same base 20. Particularly the pneumatic cylinder 30 has a rod 50 connected with the trolley 26 through a slot 35 obtained in the base 20.

[0028] The feeding device 22, frequently called also pre-feeder, is a usual yarn feeder currently available on the market, and it comprises a drum 34 on which the yarn 12 is wound for forming a plurality of turns 37 that will be drawn by the loom 14; a disk 36 which can rotate relatively to the drum 34 for forming the turns 37; and a guide eyelet 39 suitable for conveying towards the loom 14 the yarn 12 coming from the drum 34. Particularly the disk 36 forms the coils 37 by the yarn 12, through a hole 39 arranged coaxially to the drum 34, from the cone currently used among those loaded in the magazine 21.

[0029] The cutting-knotting assembly 23 comprises two blocks 41 and 42, which are arranged along the path of the weft yarn 12 after the magazine 21 and are mounted on a fixed frame 45 connected to the base 20 by means of uprights 43; a cut-knotting device 44 placed between the blocks 41 and 42 and vertically movable relatively to them according to the direction of the arrows 46; and a tensioning device 51 for tensioning the weft yarn 12 during the cutting and knotting operations described below.

[0030] The block 41 is arranged near the feeding device 22 and it is capable of sliding, along suitable guides 47 (Figure 3) placed on the loom 45, in a direction, shown by the arrow 48 of Figure 5, perpendicular to the plane of Figure 1 and therefore to the direction of advancement of the weft yarn 12, under control of a pneumatic actuator 49.

[0031] The block 42 is arranged on the side of the intermediate assembly 23 adjacent to the magazine 21 and it is fixedly mounted on the loom 45.

[0032] Each block 41, 42 is provided, as clearly vis-

ible in Figures 3 and 4, with a through hole, respectively shown as 52 and 54, for the passage of the weft yarn 12 during the normal feeding from the cone of the magazine 21 currently used to the feeding device 22; and of an additional duct, shown respectively with 53 and 56, disposed parallel to the correspondent through hole, or in order 52 and 54. Both the through holes 52, 54, and the additional ducts 53, 56 are pneumatically connected with a series of small pipes 57, forming a pneumatic network and coming from an electro-pneumatic valve assembly 58 (Figures 1 and 2) belonging to the control assembly 24, which have the function of sending suitable air flows through the through holes 52, 54 and the additional ducts 53, 56, with the purpose of preparing the yarn 12 for the cutting and knotting operations, as described in detail later on.

[0033] The additional ducts 53 and 56 of each block 41 and 42 have an extremity faced to the other block and the other extremity communicating with a corresponding container, not shown in the drawings, having the function of receiving the scraps produced by the knotting of the weft yarn 12 and that the air flows convey through the additional ducts 53 and 56.

[0034] The realisation of the cutting-knotting device 44 is known and therefore it will not be described in details; it is installed on a support 61 which can be moved vertically by an actuator 62, for instance a pneumatic cylinder, and it comprises a motor 63 which can be controlled by the control assembly 24 for activating a cutting and knotting cycle, according to well known and fully tested methods. More in detail the cutting-knotting device 44 can approach or move away relative to the trajectory of the yarn 12 moving vertically, according to the direction of the arrows 46, under control of the actuator 62 through a hole 64 (Figure 4) provided in the support 45.

[0035] The tensioning device 51 (Figure 5) comprises two sinking rods 66 pivoted on the support 45 by means of a shaft 65 and further connected to the cutting-knotting device 44 through a lever mechanism, not represented in the drawings, which actuates the rods 66 so that they rotate automatically relatively to the support 45 in synchronism with the vertical movement of the cutting-knotting device 44, as better described later on.

[0036] The electro-pneumatic control assembly 24 comprises, in addition to the valve assembly 58 above mentioned, a programmable logic control unit 71, commonly known as PLC, provided with a memory 72 storing a program for the management of the apparatus 10.

[0037] Particularly the control unit 71 is connected, by means of a plurality of lines L1-L6, to the various members and devices of the apparatus 10 for activating them according to a predetermined sequence.

[0038] The control unit 71 of the apparatus 10 is also connected by means of a line 75 to a control device 74 suitable for governing the general operation of the loom 14. In this way the control unit 71 and the control device 74 can exchange data in a bi-directional way along the line 75, and particularly the program stored in the memory 72 of the control unit 71 can manage the apparatus 10 in conjunction with and according to the specific program, selected through the control device 74, that controls the formation of the desired pattern of the fabric in the loom 14, and therefore the sequence of the weft yarns that are fed to the loom 14.

[0039] Particularly the control device 74 can moreover receive a signal from a sensor, not represented in the drawings, which is fixed on the base 20 in a such position that it can sense the status of the cone that is currently being used for feeding the weft yarn 12 to the loom 14. In this way, when said cone is empty, the control device 74 can opportunely actuate at first the stop of the loom 14, and then the activation of the apparatus 10 for replacing the empty cone with a full new one of the same type.

[0040] The valve assembly 58 comprises a set of well known solenoid valves, and it can be controlled by the control unit 71 for sending, according to a predetermined sequence, a plurality of air flows, better defined later on when the operation of the apparatus 10 will be described, to the blocks 41 and 42 of the intermediate assembly 23 and to the nozzle 70, through the pneumatic network consisting of the various small pipes 57.

[0041] The pressure necessary for generating the air flows through the small pipes 57 is provided by a pressure source 76, comprising typically a compressor, connected pneumatically with the valve assembly 58.

Description of the operation of the apparatus of the invention

[0042] The operation of the apparatus 10 will be now described with reference to the flow diagram shown in Figure 9.

[0043] Initially the magazine 21 of the apparatus 10 is loaded with different cones of the different types of weft yarn that can be used by the loom 14 for manufacturing the fabric or the fabrics in conformity to the desired patterns and colours. Particularly the various cones are mounted, on the shafts 29 of the magazine 21, in respective predetermined positions recognised by the program that controls the apparatus 10, whereby each of such positions corresponds to a specific cone and consequently to a specific type of weft yarn 12.

[0044] During the normal production of the fabric by means of the loom 14 the apparatus 10 does not intervene, and remains in a static stand-by configuration in which the magazine 21 with an old cone 11a, used up to that moment for feeding the yarn 12 to the loom 14, is arranged at a certain distance from the intermediate assembly 23, in the position P1 represented by a continuous line in Figures 1 and 2.

[0045] Particularly, in the stand-by configuration, the two blocks 41 and 42 of the intermediate assembly 23 are arranged on the support 45 so that they present the respective through holes 52 and 54 axially aligned

with each other, as shown in Figure 4. In this way the weft yarn 12 follows, during the normal operation of the loom 14, a substantially rectilinear path through the intermediate assembly 23 for entering the feeding device 22 from the cone 11a in the direction of the arrow 80. Particularly the feeding device 22, rotating intermittently the disk 36, unwinds the weft yarn 12 from the cone 11a, making it available, as a reserve of coils 37 wound on the drum 34, to the loom 14, that in turn draws the weft yarn 12 from the device 22.

[0046] The apparatus 10 starts its operation and leaves the initial stand-by configuration after, in phase 81, the loom 14 stops essentially for the followings two reasons.

[0047] A first reason for the stop of the loom 14, that occurs very often during the normal production of a fabric, is the depletion of the cone on the magazine 21, currently used for feeding the loom 14. In fact this depletion, opportunely signalled by the sensor adjacent to the cone or in any other way, stops the loom 14 by means of the control device 74.

[0048] A second reason for the stop of the loom, that typically occurs very often during the manufacturing of fabric samples, but occurs also, although more rarely, during the normal fabric production, is the attainment of the desired length for the fabric or sample manufactured by the loom 14. In fact, when such length is verified by the program that controls the operation of the loom 14 through the control device 74 or in any other way, the loom 14 is automatically stopped, so that it can be prepared for the manufacturing of a sample or fabric different from the previous one, and particularly characterised by a pattern involving the use of different weft yarns 12.

[0049] Subsequently, in phase 82, when the loom 14 is halted, the control unit 71 actuates the pneumatic cylinder 30 by means of the line L1 for moving the trolley 26 along the base 20, so that the magazine 21 is approached to the intermediate assembly 23 and the old cone 11a is consequently arranged in the position P2 indicated by the chain line in Figures 1, 2 and 4. It follows that the extremity of the tube 29 carrying the old cone 11a stays in proximity to and perfectly aligned with the through hole 54 of the block 42.

[0050] Contemporaneously, still in phase 82, the control unit 71 actuates, by means of the line L2, the actuator 62 in order to lift the cutting-knotting device 44 and to arrange it near the yarn 12, as shown by the chain line in Figure 3. The lifting of the device 44 also causes the lowering of the sinking rods 66, that thus come into contact with the weft yarn 12 putting it slightly in tension. At this point the control unit 71 actuates, by means of the line L3, the cutting-knotting assembly 44 for performing the cut of the yarn 12 between the two blocks 41 and 42, and subsequently activates, again by means of the line L3, the actuator 62 for lowering the cutting-knotting assembly 44 and returning it to the initial position. Contemporaneously the sinking rods 66 lift from the yarn loosing it.

[0051] Then, in phase 83, the control unit 71 actuates the valve assembly 58 for activating an air flow f1 through the through hole 54, in order to eject the cut end of the yarn coming from the old cone 11a and to insert it in the through hole 59 of the pipe 29 on which the same old cone 11a is mounted, as shown in Figure 4.

[0052] In this way the old cone 11a is correctly placed, with the corresponding weft yarn end 12, for being used during a following changing operation with another cone loaded on the magazine 21.

[0053] Then, in phase 84, the control unit 71 actuates, by means of the line L4, the ratiomotor 31 for operating a predetermined rotation of the structure 27 in order to position near the block 42, in place of the old cone 11a, a new cone. The latter is for instance a new cone that, among those currently loaded on the magazine 21, is formed by the kind of weft yarn that, on the basis of the program of the loom 14, must now be fed to the loom 14 for manufacturing the desired fabric.

[0054] Particularly the new cone 11c is made up of a yarn having colour and/or characteristics different from that of the old cone 11a, if the loom 14 will produce a fabric or a fabric sample with a pattern different from that previously produced, but it could also be made up of a yarn identical to that of the old cone 11a, particularly if the pattern of the fabric does not change, and the activation of the apparatus 10 has been caused only by the depletion of the old cone 11a. The new cone 11c is pre-set with a free end C2, of the weft yarn of which it is made up, inserted in the hollow shaft 29, as represented with a chain line in Figure 4. Particularly, if the new cone 11c has already been moved previously by means of the apparatus 10 for replacing another cone, the threading of the yarn end C2 in the shaft 29 has been made by means of an operation similar to that described with reference to the cone 11a.

[0055] Once the phase 84 is finished, the control unit 71 actuates, in phase 86 by means of the line L5, the actuator 49 for moving the block 41 in the working position in order to have the through holes 52 and 54 of the block 41 and respectively of the block 42 misaligned in respect to each others, but each one aligned with the accessory duct, respectively 56 and 53, of the other block, as represented in Figure 4.

[0056] Then, in phase 87, the control unit 71 sends a signal through the line L6 to the feeding device 22 for commanding a pre-set rotation of the disk 36 with a direction of rotation opposite to that used, during the normal operation of the loom, for drawing the yarn towards the feeding device 22 and forming the coils 37 on the drum 34.

[0057] Contemporaneously the electro-pneumatic assembly 58 is activated by the control unit 71 for generating, along the through hole 52, a flow f2 having a direction opposite to the direction of advancement of the weft yarn 12 for entering the feeding device 22, and moreover, through the accessory duct 56 aligned with

the through hole 52, a flow f3 directed towards the external container connected with the block 42. In this way the flow f3 creates in the accessory duct 56 a depression that, with the flow f2 and the counter-rotation of the disk 36, causes the drawing of the weft yarn end 12, previously cut by the device 44, towards the block 42 and from there into the external container, determining a partial emptying of the yarn reserve on the drum 34.

[0058] The quantity of weft yarn 12 evacuated from the drum 34 depends obviously on the entity of the counter-rotation of the disk 36 and it is however such that it allows the weft yarn end, shown as C1 in Figure 5, coming from the feeding device 22, to pass through the blocks 41 and 42. Then, at the end of the pre-set rotation of the disk 36, the flows f2 and f3 are stopped, and, through the accessory duct 56, an air flow f6 is activated on the weft yarn end C1 for directing it towards the container. In this way the yarn end C1 is arranged, without unwinding from the feeding device 22 and being moreover subject to a light tension due to the flow f6, along the rectilinear trajectory between the blocks 41 and 42 represented in Figure 5, so that it is ready for the following knotting operation.

[0059] At the same time, again in phase 87, the control unit 71 controls through the electro-pneumatic assembly 58 an operation, analogous to that described above, for preparing the weft yarn end C2 coming from the new cone 11c for the knotting.

[0060] Particularly a flow f4 is activated through the nozzle 70, and a flow f5, directed towards the container connected with the block 41, is activated through the accessory duct 53. The flow f4 of the nozzle 70 is received by the through hole 59 of the shaft 29, on which the new cone 11c is mounted, in order to push out of the through hole 59 the yarn end C2 of the cone 11c and insert it into the through hole 54 of the block 42, while in turn the flow f5 creates, in the accessory duct 53, a depression that draws into the accessory duct 53 the yarn end C2 from the hole 54. In this way the yarn end C2 passing through the blocks 41 and 42 is drawn towards the container connected with the block 41.

[0061] At this point, with the yarn end C2 firmly inserted in the accessory duct 53, the flows f4 and f5 are interrupted, and an air flow f7, directed towards the container connected with the block 41, is activated through the accessory duct 53, therefore the yarn end C2, being subject to a light tension due to the flow f7, is placed parallel to the end C1 along the rectilinear trajectory between the blocks 41 and 42 represented in Figure 5.

[0062] At the same time the actuator 62 is controlled for approaching the knotting device 44 to the zone where the ends C1 and C2are arranged.

[0063] Particularly, with reference to Figure 6, the vertical approaching movement of the knotting device 44 causes the downward rotation of the sinking rods 66, that move from the position represented by the chain line to the position represented by a continuous line, in order to cooperate with the flows f6 and f7 for holding and preparing the weft yarn 12 for the knotting.

[0064] Therefore, with the ends of yarn C1 and C2 thus prepared, in phase 88 the knotting of the yarn 12 is performed, by activating through the line L3 the device 44 for performing a knotting cycle that consists in joining, according to a known technique, the two ends of yarn C1 and C2.

[0065] During the knotting cycle the redundant portions of the ends of yarn C1 and C2 are cut and evacuated by the flows f6 and f7 in the external containers connected with the ducts 56 and 53.

[0066] The final result of this knotting cycle is the reestablishment of the yarn 12, that is therefore arranged according to the trajectory, represented in Figure 7, oblique relatively to the blocks 41 and 42. After the knotting the actuator 62 brings back again to its stand-by position the knotting device 44, causing contemporaneously the lifting of the sinking rods 66 from the yarn 12.

[0067] Subsequently, in phase 89, the magazine 21 is moved away from the block 42 and brought back to the initial position, by actuating the pneumatic cylinder 30 through the line L1.

[0068] Moreover, in phase 91, the block 41 is moved and brought back to the original position, by actuating the actuator 49 by means of the line L5, in order to arrange again the through hole 52 in alignment with the through hole 54.

[0069] It follows that the yarn 12 assumes again a rectilinear trajectory through the blocks 41 and 42, for entering the feeding device 22 and from there being recalled by the loom 14, without substantially being restrained by the intermediate assembly 23.

[0070] Finally, in phase 92, at the end of the operation cycle of the apparatus 10, the loom 14 is restarted.

[0071] It is well understood that modifications and/or improvements of the apparatus are possible, without departing from the scope of the present invention.

[0072] Particularly the apparatuses 10 used on a single loom may be more than one, each corresponding to a specific feeding line of the weft yarn to the loom.

[0073] In this way it is possible to obtain a full automatism in the change of the feeding cones also in the case of the so-called more colours weaving, when, in order to get the desired pattern of the fabric, it is necessary to feed the loom with different yarns at the same time, each along a different line.

[0074] It is also possible to realise different degrees of integration between the apparatus 10 and the loom 14.

[0075] For instance the control program of the apparatus 10 can be totally integrated into the main program, controlled by means of the control device 74, that controls the operation of the loom 14, and that therefore defines the patterns of the fabric/fabrics produced, as also the relative desired length, and particularly those of

the fabric samples. In this way the change of the cones is effected automatically, without any intervention of the operator, by the apparatus 10, on the basis of the instructions formulated by the main program, and particularly depending on the desired pattern of the fabric that will be produced.

[0076] To this purpose, a single electronic control unity can be provided incorporating the functions of the control device 74 and the functions of the control unit 71, suitable for being controlled by a single program.

[0077] Although the invention has been described with particular reference to a loom, however, the same invention could be easily used by a skilled man for effecting automatically the change of the cones for feeding the yarn in other type of textile machine, as for instance a warper.

Claims

1. Apparatus (10) for effecting automatically the change of the cones (11a, 11b, 11c, ...) for feeding the yarn (12) to a textile machine as for instance a loom (14) suitable for the manufacturing of a fabric or a warper, comprising:

   a magazine (21) containing a plurality of said cones and provided with handling means (30, 31) for handling said cones,
   a feeding device (22) suitable for accumulating a certain length of yarn (12) drawing it from the cones of said magazine (21), and for subsequently feeding the yarn (12) thus accumulated to said textile machine (14),
   an intermediate assembly (23) arranged between said magazine (21) and said feeding device (22) and provided with a cutting device (44) and with a knotting device (44), and
   a control assembly (24),
   wherein, when said textile machine (14) stops either due to the exhaustion of an old cone (11a) contained in said magazine (21) and currently used for feeding said yarn to said textile machine (14), or due to the attainment of the desired length for the fabric or warp produced by said textile machine (14), said control assembly (24) controls both the activation of said cutting device (44) for cutting said yarn (12) between said old cone (11a) and said feeding device (22), and the activation of said handling means (30, 31) for moving away said old cone (11a) from said intermediate assembly (23) and for positioning near the latter a new cone (11c) replacing said old cone (11a);
   wherein subsequently said control assembly (24) controls the activation of said knotting device (44) for re-establishing the continuity of said yarn (12) between said new cone (11c) and said feeding device (22), by knotting an end (C2) of the yarn coming from said new cone (11c) with an end (C1) of the yarn previously cut by said cutting device and positioned on the side of said feeding device (22), and
   wherein finally said control assembly (24) controls the restarting of said textile machine (14).

2. Apparatus according to claim 1, characterised in that said intermediate assembly (23) further comprises a first block (42) positioned near said magazine (21), and a second block (41) positioned near said feeding device (22), each of said blocks (41, 42) being provided with a corresponding through hole (52, 54) for the passage of said yarn, and with corresponding auxiliary ducts (53, 56), and

   in that said control assembly (24) comprises a control unit (71) and an electro-pneumatic assembly (58) suitable for activating, according to a predetermined sequence defined by said control unit, a set of air flows (f1-f7) through a pneumatic network (57) connected with said blocks (41, 42),
   wherein said through holes (52, 54) and said auxiliary ducts (53, 56) of said blocks are provided for receiving and conveying said air flows (f2-f7) in such a way as to prepare the yarn (12) for the knotting operation, during the change between a cone and the other.

3. Apparatus according to claim 2, characterised in that said magazine (21) comprises a plurality of supports (29), each provided with a through hole (59), on which said feeding cones (11a, 11b, 11c, etc.) are mounted, and in that said magazine (21), when said textile machine (14) stops, moves towards said intermediate assembly (23) in such a way as to arrange said old cone (11a) in a position closer to said first block (42) with the through hole (54) of the latter aligned with the through hole (59) of the support (29) on which said old cone (11a) is mounted, wherein said electro-pneumatic assembly (58) actuates, while said old cone (11a) is in said closer position, a first air flow (f1) through said through holes (54, 59), for inserting the end of the yarn coming from said old cone (11a) and previously cut by said cutting device (44) through the through hole (59) of the support (29) carrying said old cone (11a).

4. Apparatus according to claim 2, characterised in that said blocks (41, 42) assume, during the operation of the textile machine, a first stand-by configuration in which the corresponding through holes (52, 54) are reciprocally aligned in order to allow the normal advancement of the yarn from said magazine (21) to said feeding device (22) through said through holes (52, 54), and assume, during the

change of the cones, a second working configuration, in which the through holes (52, 54) of said blocks (41, 42) are reciprocally misaligned and each of them is aligned with the auxiliary duct (56, 53) of the other block, in order to allow to prepare, by means of said air flows (f2-f7), for the following knotting operation the end (C2) of the yarn coming from the new cone (11c) and the end (C1) of the yarn previously cut by said cutting device (44) and coming from said feeding device (22) according to a configuration in which said ends (C1, C2) are substantially parallel to each other.

5. Apparatus according to claim 4, wherein said feeding device (22) comprises a drum (34), and a disk (36) adjacent to said drum (34), said disk (36) being suitable for rotating, during the normal operation of the textile machine, in a nominal direction for drawing said yarn from the cone currently used in said magazine, and for wrapping it around said drum in order to form a reserve (37) of said yarn, characterised in that, after the cut in said yarn (12) made by the cutting device (44), with said blocks (41, 42) positioned in said working configuration, and in order to prepare for the following knotting operation the yarn end (C1) coming from said feeding device (22), said control unit (71) controls the latter for providing a rotation of said disk (36) according to a rotating direction opposite to said nominal direction, and further controls contemporaneously by means of said electro-pneumatic assembly (58) a second airflow (f2-f3), through the through hole (52) of said first block (41) and the auxiliary duct (56) of said second block (42), for drawing said yarn (12) from said feeding device (22), therefore determining a partial emptying of the reserve (37) of the yarn wound around said drum (34).

6. Apparatus according to claim 4, characterised in that, after the cut in said yarn (12) made by the cutting device (44), with said blocks (41, 42) positioned in said working configuration, and in order to prepare for the following knotting operation the yarn end (C2) coming from said new cone (11c), said control unit (71) actuates, by means of said electro-pneumatic assembly (58), a third air flow (f4), through the through hole (59) of the support (29) on which said new cone (11c) is mounted, in order to insert said yarn end (C2) into the through hole (54) of said second block (42), and further actuates, through the through hole (54) of said second block (42) and the auxiliary duct (53) of said first block (41), a fourth air flow (f5) for drawing said yarn from said new cone (11c).

7. Apparatus according to claim 6, characterised in that said control unit (71) actuates, after said second (f2-f3) and said fourth (f5) flow, a fifth flow (f6) and a sixth flow (f7) respectively through the auxiliary duct (56) of said second block (42) and through the auxiliary duct (53) of said first block (41) for maintaining in light tension and therefore perfectly straight said yarn ends (C1, C2) in the knotting zone.

8. Apparatus according to claim 7, characterised in that the auxiliary ducts (53, 56) respectively of said first (41) and said second block (42) are connected to an external container for collecting the scraps produced by the knotting of said yarn ends (C1, C2) and are pushed towards said external container by said fifth (f6) and sixth flow (f7).

9. Apparatus according to claim 6, characterised in that said third air flow (f4) is conveyed, into the through hole (59) of the support (29) on which said new cone is mounted, by means of a nozzle (70) that is arranged near said magazine (21), and moves together with the latter, while it moves towards or away from said intermediate assembly (23).

10. Apparatus according to claim 3, characterised in that said magazine (21) comprises a circular structure (27) rotatably mounted on a trolley (26) sliding along a fixed base (20) for approaching or moving away from said circular structure (27) relative to said intermediate assembly (23), and in that the supports (29) for said cones (11a, 11b, 11c, etc.) consist each of an hollow shaft (29) mounted on the periphery (28) of said circular structure (27) according to a radial orientation, wherein said circular structure (27) effects, during the change of a cone with the following one, a predetermined rotation for moving, near said intermediate assembly (23), the cone that will be used for feeding the yarn (12) to the textile machine (14), in place of the cone previously used.

11. Method for effecting automatically the change of the cones for feeding (11a, 11b, 11c.) the yarn (12) into a textile machine, such as a loom (14) for the manufacturing of a fabric or a warper, coupled to a feeding device (22) suitable for accumulating a certain length of yarn (12) coming from said cones, and for subsequently feeding the yarn (12) thus accumulated to said textile machine (14), said method comprising the following phases:

to provide a magazine (21) containing a plurality of said cones and provided with handling means (30, 31) for handling said cones,
to provide, between said magazine (21) and said feeding device (22), an intermediate assembly (23) provided with a cutting device (44) and a knotting device (44),

to activate, when said textile machine (14) stops due to the exhaustion of an old cone (11a) contained in said magazine (21) and currently used for feeding said yarn to said textile machine (14), or due to the attainment of the desired length for the fabric or warp produced by said textile machine (14), said cutting device (44) for cutting said yarn (12) between said old cone (11a) and said feeding device (22),

to actuate said handling means (30, 31) for moving away said old cone (11a) from said intermediate assembly (23) and for positioning near to the latter a new cone (11c) in place of said old cone (11a);

subsequently to actuate said knotting device (44) for re-establishing the continuity of said yarn (12) between said new cone (11c) and said feeding device (22), by knotting an end (C2) of the yarn coming from said new cone (11c) with an end (C1) of the yarn previously cut by said cutting device (44) and positioned on one side of said feeding device (22), and

finally to restart said textile machine (14).

12. Method according to claim 11, further comprising a first pre-arrangement phase intended to arrange an already used cone (11a) for a following use in place of an other cone (11c), and in which said yarn (12), after being cut, is inserted by means of an air flow (f1) into a hollow support (29) on which said already used cone is mounted.

13. Method according to claim 11 or 12, further comprising a second pre-arrangement phase for arranging said yarn for the relative knotting operation, said second pre-arrangement phase being based on the employment of a set of air flows (f2-f7) for arranging said yarn ends (C1, C2) one close to the other.

14. Device and method for effecting automatically the change of the cones for feeding (11a, 11b, 11c, ...) the yarn (12) to a textile machine such as a loom (14) or a warper substantially as described with reference to the attached drawings.

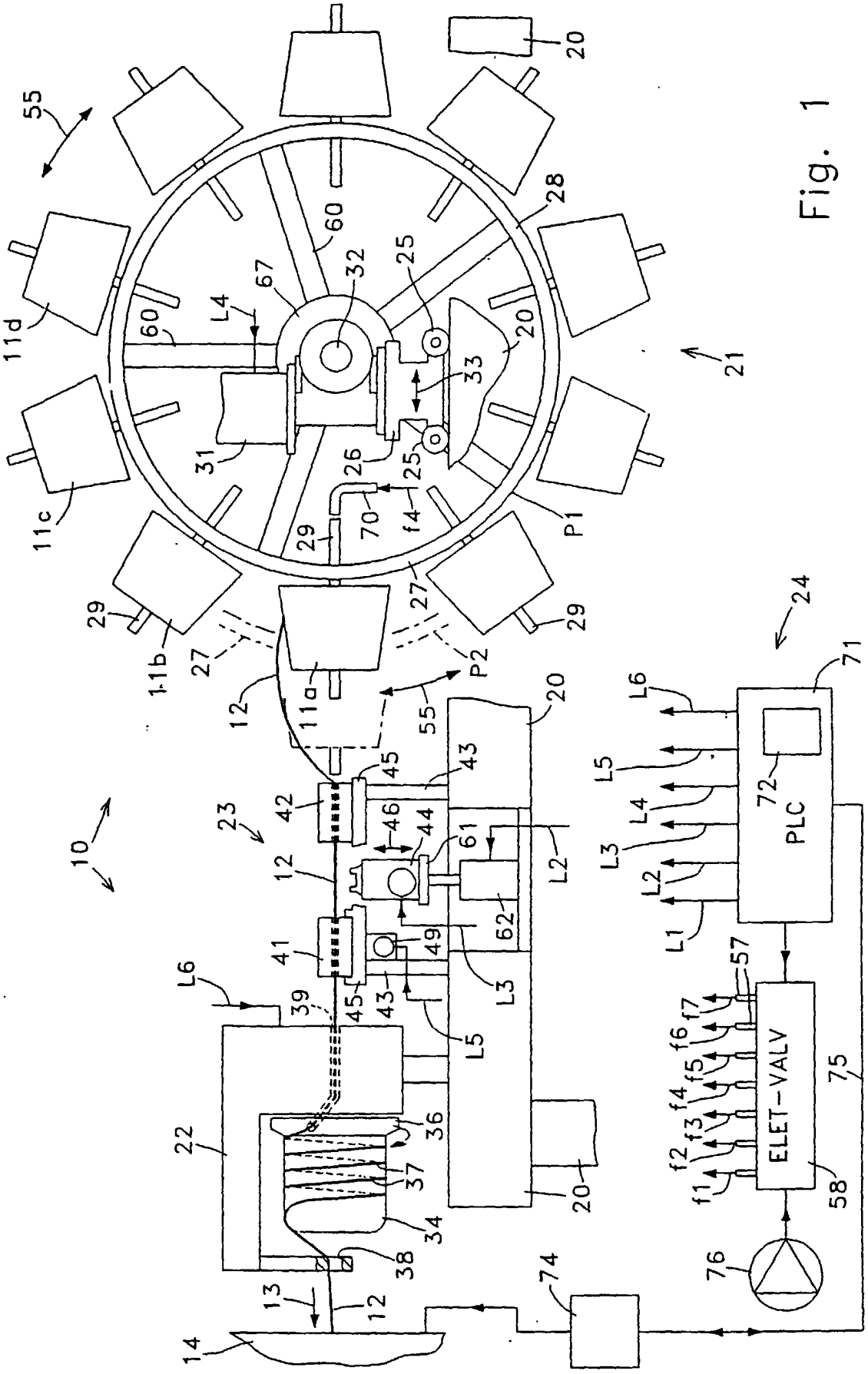

55
11d
11c
11b
11a
60
67
32
25
28
20
L4
31
26
33
29
70
f4
P1
P2
27
12
10
23
42
45
43
46
44
61
L2
41
49
62
L3
L5
L6
39
36
37
34
38
22
13
14
74
24
71
72
PLC
L1
57
f1
f2
f3
f4
f5
f6
f7
ELET-VALV
75
58
76

Fig. 1

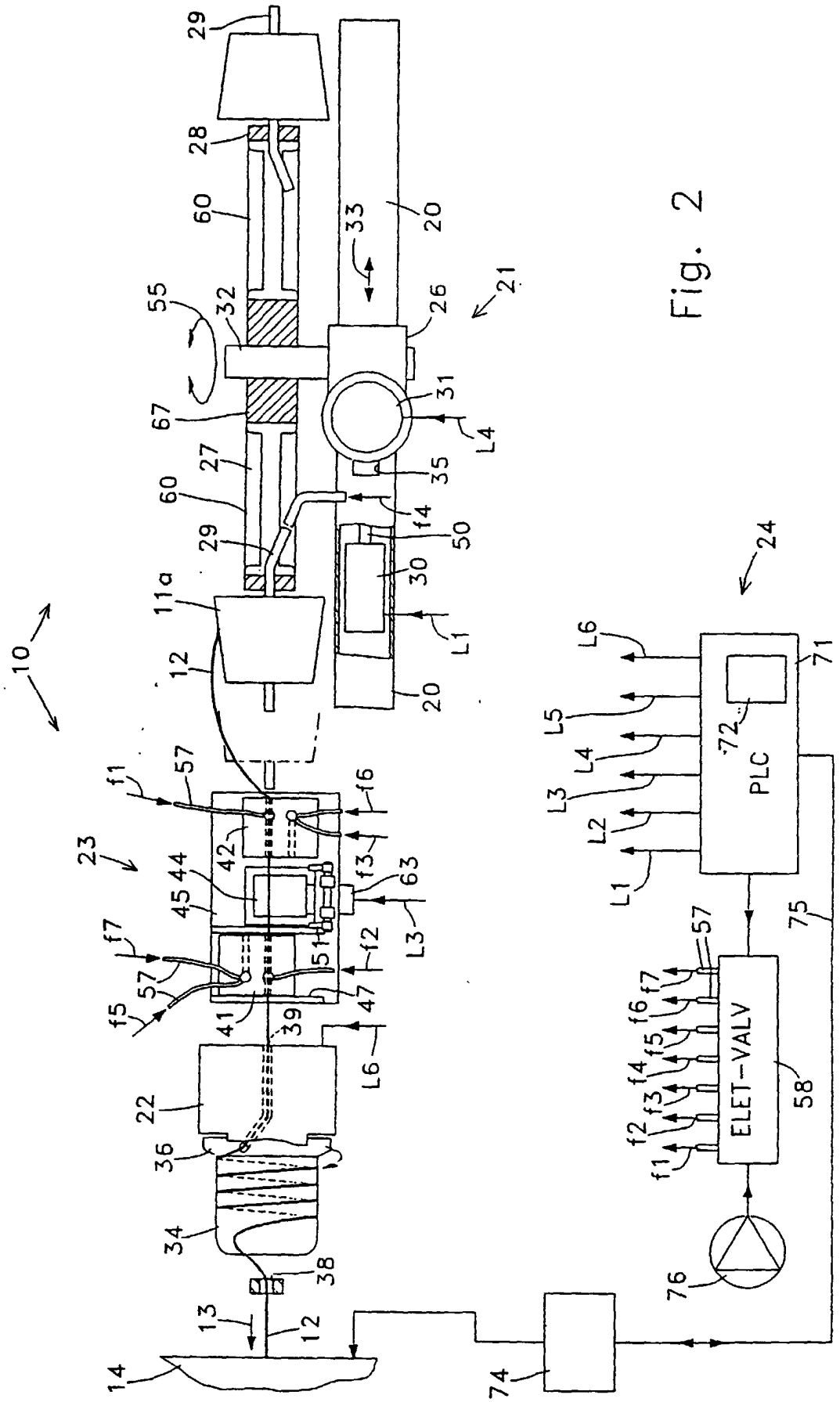


Fig. 2

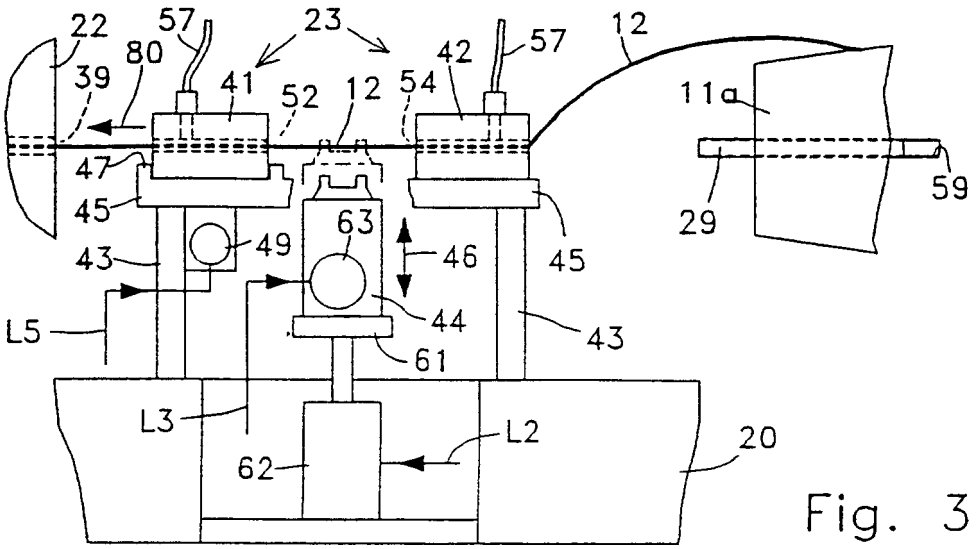


Fig. 3

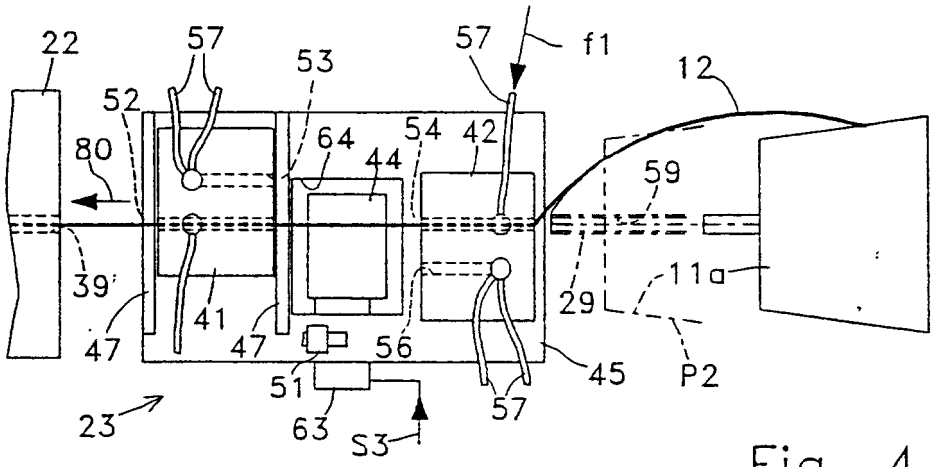


Fig. 4

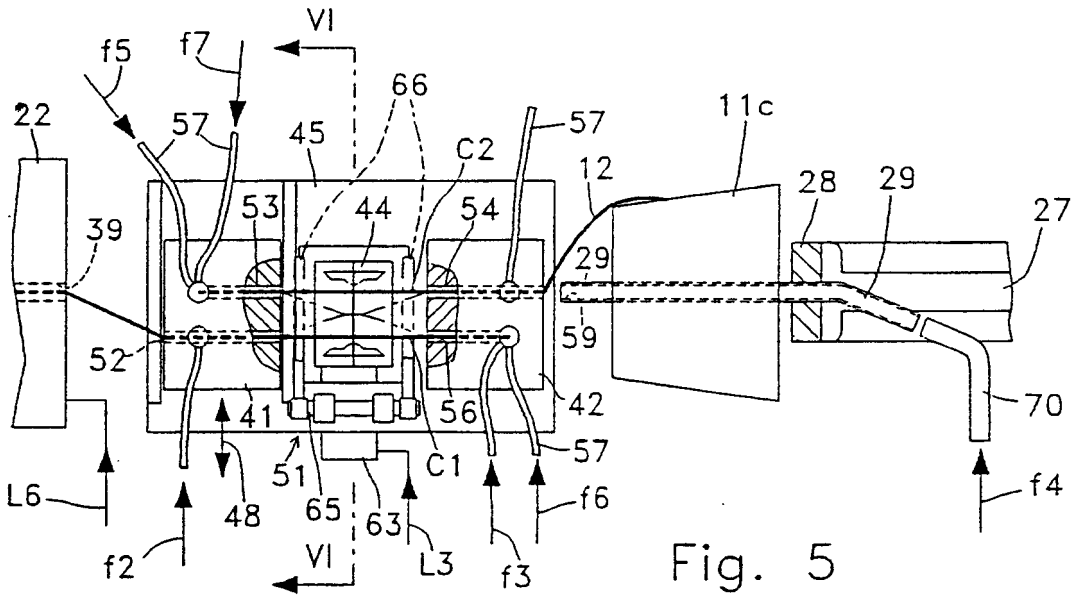
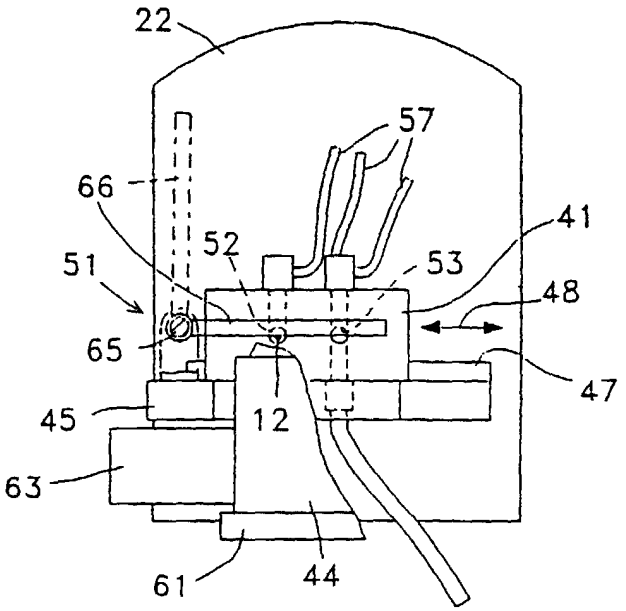


Fig. 5


22
57
66
41
52
53
51
48
65
47
45
12
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61
44

Fig. 6

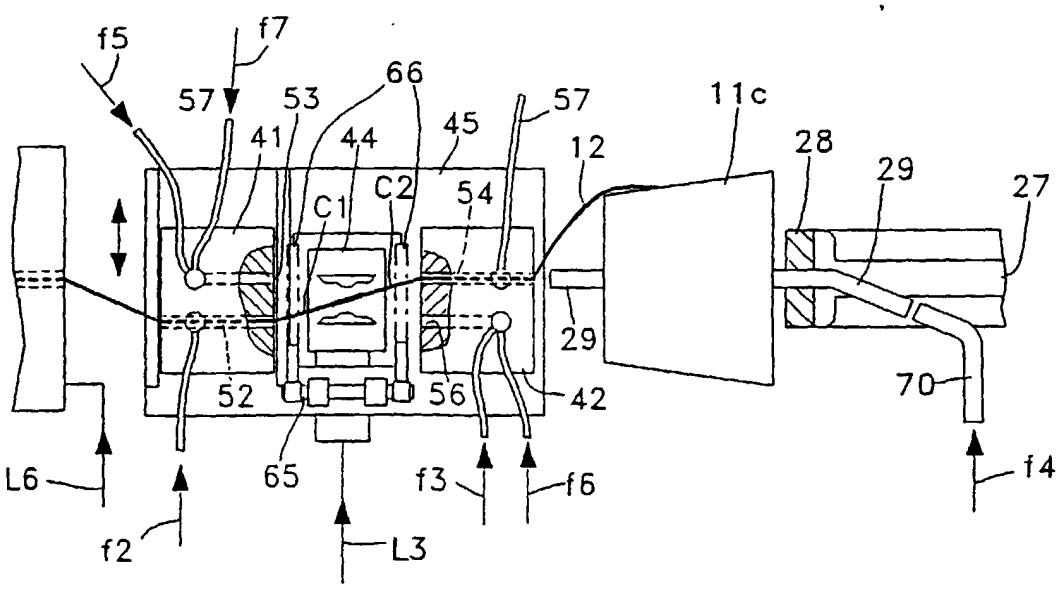
f5
f7
57
53
66
57
11c
41
44
45
12
28
29
27
C1
C2
54
29
52
56
42
70
L6
65
f3
f6
f4
f2
L3

Fig. 7

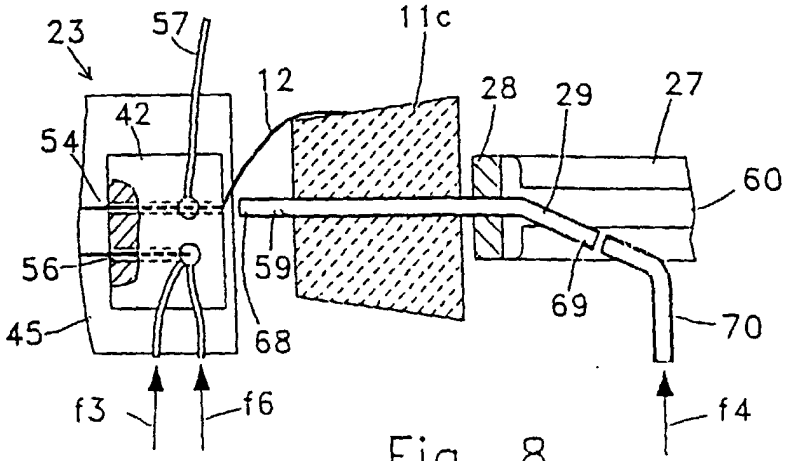
23
57
11c
12
28
29
27
42
54
60
56
59
69
70
45
68
f3
f6
f4

Fig. 8

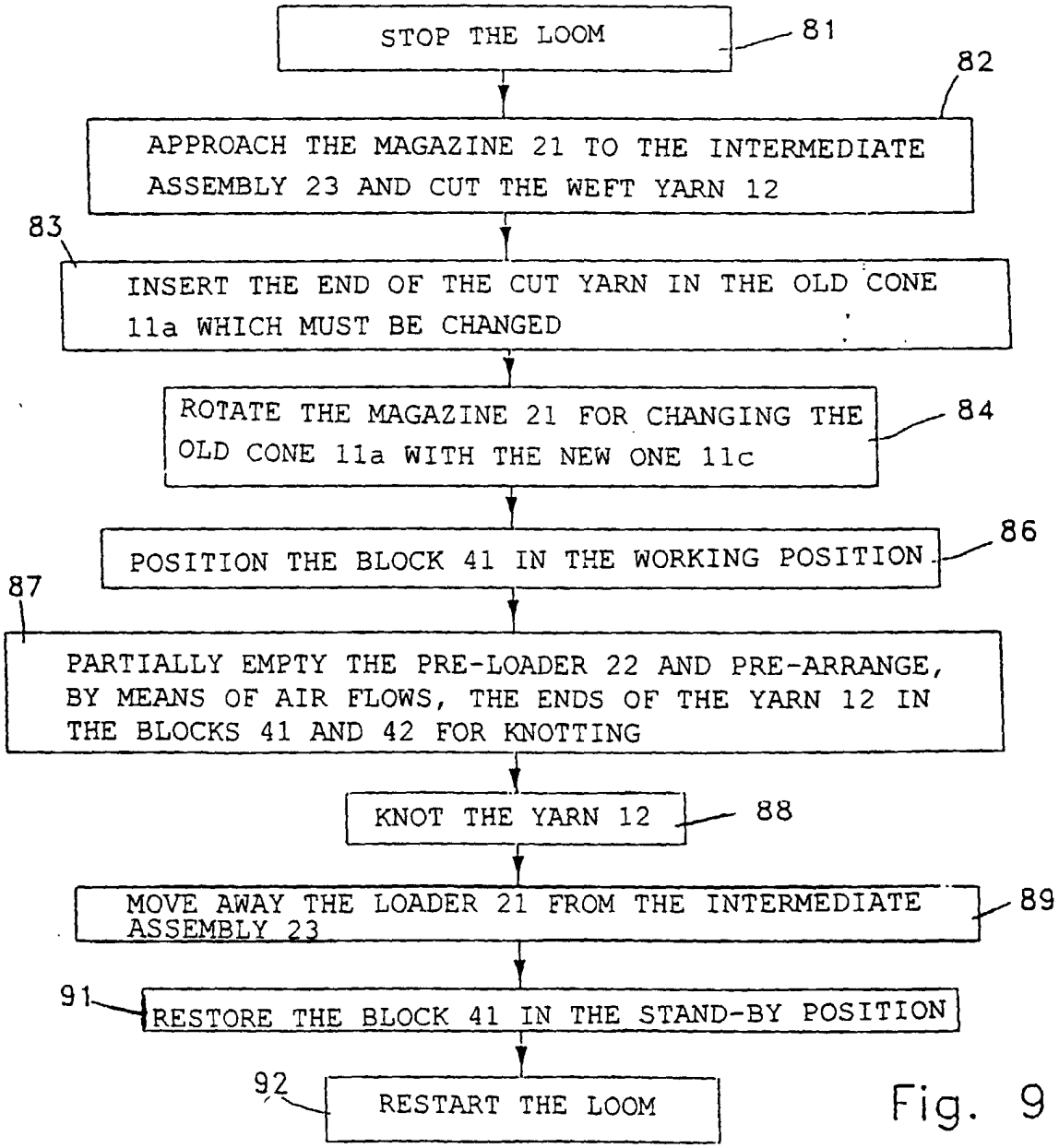
STOP THE LOOM
81
82
APPROACH THE MAGAZINE 21 TO THE INTERMEDIATE ASSEMBLY 23 AND CUT THE WEFT YARN 12
83
INSERT THE END OF THE CUT YARN IN THE OLD CONE 11a WHICH MUST BE CHANGED
ROTATE THE MAGAZINE 21 FOR CHANGING THE OLD CONE 11a WITH THE NEW ONE 11c
84
POSITION THE BLOCK 41 IN THE WORKING POSITION
86
87
PARTIALLY EMPTY THE PRE-LOADER 22 AND PRE-ARRANGE, BY MEANS OF AIR FLOWS, THE ENDS OF THE YARN 12 IN THE BLOCKS 41 AND 42 FOR KNOTTING
KNOT THE YARN 12
88
MOVE AWAY THE LOADER 21 FROM THE INTERMEDIATE ASSEMBLY 23
89
91
RESTORE THE BLOCK 41 IN THE STAND-BY POSITION
92
RESTART THE LOOM

Fig. 9