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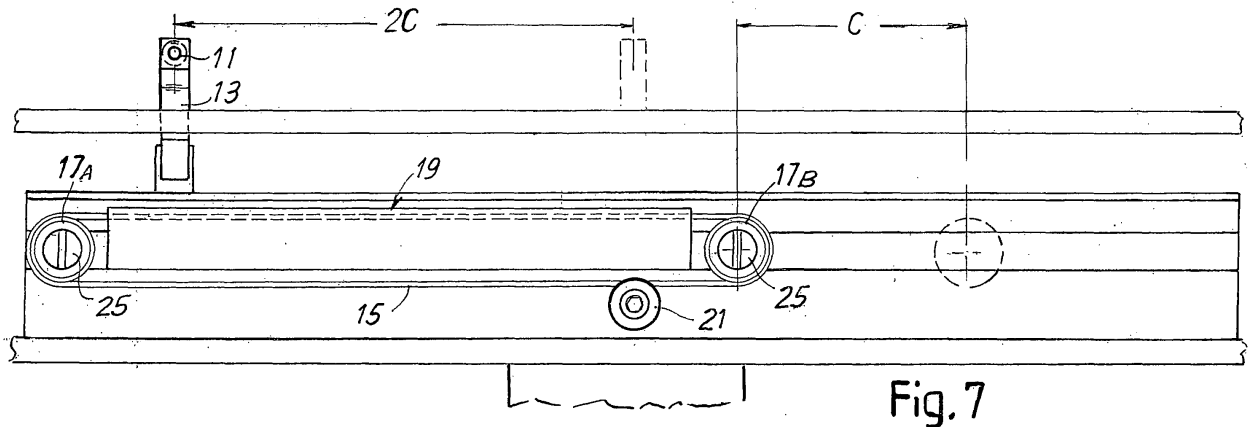
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(54) **Device for distributing yarn on a spool being wound and machine comprising said device**

(57) The device includes a thread guide (11) provided with an alternate movement, an actuator member (31) to supply motion to the thread guide, and a mechanical transmission between the actuator member and said thread guide. The mechanical transmission includes a

slider (19) operated with alternate motion by means of the actuator member, which supports idle guide pulleys (43, 45) for a flexible element (15) to which the thread guide (11) is attached, said flexible member being in turn attached to a fixed structure with respect to said slider.



**Fig. 7**

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**Description**Technical field

**[0001]** The present invention relates to improvements to devices for processing textile threads or yarns. More specifically, the present invention relates to a device for the distributing yarn or thread on a winding spool or reel, of the type comprising: a thread guide provided with an alternate movement for distribution of the yarn, an actuator member to provide motion to the thread guide, and a mechanical transmission between the actuator member and the thread guide.

**[0002]** The invention also relates to a machine or appliance for producing spools or reels which utilizes a distribution device of the aforesaid type.

State of the art

**[0003]** To produce spools or reels of yarn, to be used, for example, to feed knitting or hosiery machines, or other textile machines, appliances are used in which a winding tube is made to rotate and yarn is wound therearound in turns to form the finished spool or reel. Associated to the winding system is a device that distributes the thread or yarn on the spool according to a suitable law, based on the characteristics of the spool or reel to be obtained. In general, the distributing device of the yarn has a thread guide provided with alternate movement transmitted by means of suitable kinematic means by an actuator member, synchronized with the movement of the tube or spool in order to obtain specific winding parameters of the yarn, such as wind ratio, pitch of the turns and variations of said parameters to guarantee that reel formation is suitable for the subsequent processing processes.

**[0004]** Different systems have been studied to control movement of the thread guide. Some of the particularly important problems in the design of devices to distribute thread or yarn to form spools or reels include the high winding speed and consequently movement speed of the thread guide and the need for precise control of movement in order to obtain a spool or reel of the desired form, and noteworthy accelerations at inversion of the alternate movement of the thread guide without exasperating the electronic and/or electric controls of the motor.

**[0005]** EP-A-403927 (US-A-5082193) describes a device for distributing yarn on a spool being wound, in which the thread guide is supported at the end of a rod provided with an alternate translational movement. Movement of the rod is imparted by a wheel controlled by a motor with electronic control.

**[0006]** In another category of devices, the thread guide is supported by a flexible member running around two or more pulleys, one of which is motorized. The alternate movement of the motorized pulley, obtained by an electric motor with electronic control, imparts a corresponding alternate movement to the thread guide. Examples of yarn distribution devices based on this technology are

described in EP-A-0950627; EP-A-829443, EP-A-1125878, EP-A-1209114, EP-A-1219559, EP-A-1318097, EP-A-1319622, EP-A-1520825, EP-A-1520826, EP-A-1520827, EP-A-1048601, EP-A-453622, EP-A-1048601, EP-A-311827 and EP-A-1044917.

**[0007]** In designing this type of device, particular attention has been paid to control of the drive motor of the flexible member to obtain high precision and high production speeds.

**[0008]** Nonetheless, with these devices it is not possible to exceed the speed limits set by the production and control technologies of the electric motors.

15 Objects and summary of the invention

**[0009]** The object of the present invention is to produce a device of the type described with which results can be obtained in terms of control precision and/or speed and/or reduction in stresses, exceeding those of conventional devices.

**[0010]** In substance, the invention is based on the idea of providing a slider which is part of the mechanical transmission between the actuator member and the thread guide, which is operated with alternate motion by means of said actuator, combined with a motion multiplier to which the thread guide is attached. In substance, the motion of the thread guide is multiplied with respect to the normal motion of the slider operated by the actuator member. The speed of the thread guide with respect to the speed of the slider can thus be multiplied by a suitable factor, for example 2 or 3, without having to increase the operating speed of the actuator member, typically the electric motor with electronic control.

**[0011]** In substance, according to the invention a device is provided for distributing yarn on a spool, comprising: a thread guide provided with an alternate movement, an actuator member to supply motion to said thread guide, and a mechanical transmission between said actuator member and said thread guide; characterized in that the mechanical transmission includes a slider operated with alternate motion by means of said actuator member, which supports idle guide pulleys for a flexible element to which said thread guide is attached, said flexible member being in turn attached to a fixed structure with respect to said slider.

**[0012]** In this way multiplication of the movement of the thread guide is obtained with respect to the slider. The multiplication factor can be equal to 2 or greater, as will be illustrated hereunder with reference to some examples of embodiments. This allows double speeds of the thread guide to be obtained with the same speed of the actuator motor.

**[0013]** According to an advantageous embodiment of the device according to the invention, the thread guide is arranged along a rectilinear portion of the flexible member extending between the two guide pulleys, the axes of which are aligned longitudinally along the direction of

movement of the slider.

**[0014]** In an advantageous embodiment, the slider supports two guide pulleys. The flexible member can be fixed to a point of the fixed structure, or can run around idle pulleys mounted with a fixed axis on the load-bearing structure.

**[0015]** In a possible configuration, at least two guide pulleys supported idle by the slider and at least two guide pulleys supported idle by the fixed structure are provided, said flexible member running around said pulleys supported by the slider and around said pulleys supported by the fixed structure.

**[0016]** The slider can be made to move by various kinematic mechanisms. For example, a rack and pinion mechanism can be provided, where the rack is integral with the slider. Alternatively to the toothed wheel, a friction wheel which cooperates with a friction surface integral with the slider can be provided.

**[0017]** When a rack is provided, said rack can be produced on a rod forming the slider or a part thereof, sliding in a guide integral with said fixed structure.

**[0018]** Alternatively, drive systems with a cam and tappet, a cam and rocker arm, a flexible member and guide pulleys, or other mechanisms, which provide the slider with alternate movement, can be used.

**[0019]** In substance, the invention provides a device for distributing yarn on a spool, comprising: a thread guide provided with an alternate movement; an actuator member to supply the motion to said thread guide; and a mechanical transmission between said actuator member and said thread guide; wherein said mechanical transmission comprises a slider operated with alternate motion by means of said actuator member and a motion multiplier, to which said thread guide is attached.

**[0020]** The invention also relates to an appliance for winding reels or spools of yarn, comprising a rotation system for the spool or reel and a device for distributing yarn on said spool or reel, produced as described above and as will be better illustrated hereunder with reference to some examples of embodiment.

#### Brief description of the drawings

**[0021]** The invention will be better understood by following the description and accompanying drawing, which shows a non-limiting practical embodiment of the invention. More specifically, in the drawing:

Figure 1 shows a side view of an appliance for forming spools or reels, incorporating the device for distributing yarn according to the invention;

Figure 2 shows an enlargement of Figure 1;

Figure 3 shows a view according to III-III in Figure 2;

Figures 4, 5 and 6 show sections according to IV-IV, V-V and VI-VI in Figure 3;

Figures 7 and 8 show front views analogous to the view in Figure 3, with the slider in two distinct and opposite end positions;

Figure 9 shows a front view of a modified embodiment of the device according to the invention;

Figure 10 shows a plan view of a modified embodiment of the device according to the invention; and

Figures 11 and 12 show, in two distinct positions, a further embodiment of the device according to the invention.

#### Detailed description of the preferred embodiments of the invention

**[0022]** Figure 1 schematically shows an appliance, indicated as a whole with 1, for producing spools or reels R of yarn F coming from a suitable processing machine, not shown.

**[0023]** In this example of embodiment, as will be described hereunder, movement of the thread guide is multiplied by a factor of 2 with respect to the speed of the actuator.

**[0024]** The spool R is formed around a winding tube supported by arms 5 above a winding roller 7. The roller 7 rotates in the direction indicated by the arrow in the figure and is in contact with the cylindrical or conical surface of the spool R being formed. This can have any suitable shape, e.g. cylindrical, conical, biconical or the like, as a function of the use for which it is intended. The motorized roller 7 transmits motion to the spool being formed through friction. Alternatively, with so-called positive collection of thread, movement of the spool is imparted by a motor which can be mounted on the spool arm and coaxial with the reel or driven by a motor mounted with fixed axis by means of a belt or the like to a pulley supported on the spool arm and coaxial with said spool.

**[0025]** The yarn F is fed and distributed in helical turns on the spool R by means of a device 9, shown and described in detail hereunder with particular reference to Figures 2 to 6. The device 9 includes a thread guide 11 (for example made of a ceramic material) supported by a bracket 13 provided with an alternate movement in a direction orthogonal to the plane in Figure 1, and consequently parallel to the axis of the spool R being formed. The bracket 13 with the thread guide 11 is attached to a branch of a flexible element 15, running around two pulleys 17A, 17B supported idle around respective axes supported by a substantially rectilinear (in the drawing) slider 19. The absolute position of the thread guide is determined by a sensor 16 (Figure 3) and a corresponding feeler 18 integral with the pinion or a notch therein, or also by an electronic control device, already available on the market, provided with its own set-point. These references correspond to a position, for example although not exclusively mean, on the tube from which to implement the count of movement of the thread guide to allow tubes of different lengths to be mounted without mechanical adjustments.

**[0026]** In the position in Figure 3, the slider 19 is in the intermediate point of its excursion and the thread guide 11 supported by the bracket 13 is on the mean plane

between the two pulleys 17A, 17B. The branch of the flexible element 15 opposite the branch on which the bracket 13 is fixed is fastened in a fixed point 21 to the load-bearing structure, indicated as a whole with 23. In this example of embodiment the flexible element 15 is a continuous element, i.e. endless. Nonetheless, this is not necessary, as the ends of the flexible element could also be separated from each other and attached in appropriate points of the fixed structure 23, with an arrangement suitable to allow movement of the thread guide 11 as illustrated hereunder.

**[0027]** The slider 19 is composed of two portions 19A and 19B attached to each other by means of screws 25 which also attach the pulleys 17A, 17B to said slider. The portion 19A of the slider forms a seat inside which the upper branch of the flexible element 15 is housed and in which the lower part of the bracket 13, with which the thread guide 11 is attached to the flexible element 15, slides. The portion 19B of the slider is, on the other hand, composed of a rack which meshes with a pinion 27 keyed onto the output shaft 29 of an electric motor 31 with electronic control. Rotation in alternate directions of the motor 31 consequently causes an alternate translational movement of the slider 19. During this movement the slider is guided by the portions 19A, 19B inside a guide 33 produced in the fixed structure 23.

**[0028]** As a point of the flexible element 15 running around the pulleys 17A, 17B supported idle on the slider 19 is fixed with respect to the structure 23, a double movement of the flexible element 15 and therefore of the bracket 13 and consequently of the thread guide 11 corresponds to each movement of the slider 19 in one or other direction. This can be easily understood by observing and comparing Figures 3, 7 and 8.

**[0029]** In Figure 3 the slider 19 is in its intermediate position between two end positions (shown in Figures 7 and 8) that said slider can take during operation through alternate rotation of the electric motor 31 forming the actuator member of the device.

**[0030]** In the layout in Figure 3, the thread guide 11 is on the mean plane of the slider 19, equidistant from the pulleys 17A and 17B. Conversely, in Figure 7 the slider 19 is moved to the left (observing the figure) performing a movement C with respect to the mean position. A double movement, equal to 2C, of the thread guide 11 corresponds to this movement. In Figure 8 the slider 19 is moved to the right to a second end position thereof, again performing a movement C with respect to the intermediate position in Figure 3, while the thread guide has performed (again with respect to the intermediate position) a movement 2C.

**[0031]** In substance, therefore, movement of the slider imparted by the actuator member 31 is multiplied, in this configuration, by a factor of 2 on the thread guide 11. This means that the thread guide can reach double the speed it would reach if the flexible element 15 to which the thread guide is attached were controlled directly by one of the guide pulleys motorized by means of the elec-

tric motor 31. This allows greater production speeds to be reached, or simpler and slower motors and controls to be used, to reach the same production speeds which can currently only be reached with faster and more costly actuators and mechanisms.

**[0032]** It will be understood that motion transmission with which the movement of the actuator member is transmitted to the slider can differ with respect to the rack and pinion mechanism shown in Figures 1 to 8.

**[0033]** As alternative example of embodiment of the kinematic transmission from the actuator member to the slider 19, Figure 9 shows a solution in which the slider 19 is attached to a flexible member 41 guided around two pulleys 43 and 45, the axes of which are carried by the fixed load bearing structure 23. One of the two pulleys (for example the pulley 43) is motorized, that is, it can, for example, be keyed directly onto the output shaft of an actuator, composed for example of the electric motor 31.

**[0034]** With this configuration the alternate movement according to the double arrow f19 of the slider 19 is imparted by the alternate rotation of the pulleys 43, 45 and therefore by the flexible member 41. Nonetheless, and contrary to the case of conventional devices, the thread guide 11 is attached in this case (as in the previous embodiment) by means of the bracket 13 to the flexible element 15 running around the pulleys 17A, 17B with idle axis supported by the slider 19, so that a double movement of the flexible member 15, and consequently the thread guide 11, corresponds to each movement of the slider, 19 and consequently of the flexible member 41.

**[0035]** It is known that in some cases movement is supplied to the thread guide by a grooved cam shaped so that rotation of the cam imparts an alternate movement to a feeler engaged in the groove of the cam. In conventional devices the thread guide is integral with the feeler directly (see for example US-A-5344090). The present invention can also be implemented using a mechanical transmission of this type, as shown schematically in the example in Figure 10, with the advantage of reducing the dimensions and speeds of the cam.

**[0036]** In this embodiment, 51 indicates a motor shaft which can be made to rotate by an actuator, for example an electric motor 31. The shaft 51 supplies rotational motion to a grooved cam 53, with 53A indicating the groove inside which a feeler 55 engages. In this example, the feeler 55 is integral with the slider, again indicated with 19, which consequently moves with alternate motion according to the double arrow f19 guided on a fixed structure, again indicated with 23. The slider 19 supports two idle pulleys 17A, 17B, running around which is the flexible element 15, integral with which, by means of the bracket 13, is the thread guide 15 in which the thread F is guided to be wound on the spool R.

**[0037]** Other kinematic mechanisms can be used instead of a grooved cam, such as a simple cylindrical cam combined with a tappet with rocker arm or the like.

**[0038]** It is clear from the above that the device accord-

ing to the invention can be used in various existing appliances or machines, adapting the device to the specific motion transmission mechanism of each machine or appliance in which the device is incorporated.

[0039] In the examples illustrated above, the thread guide 11 is provided with a movement multiplied by a factor of 2 with respect to the movement of the slider 19. However, the same inventive concept can be further developed to allow multiplication ratios greater than 2, to the detriment of the constructional simplicity of the device. A possible embodiment in which a greater thread guide speed with respect to the speed of movement of the slider is obtained is shown in Figures 11 and 12, which show a front view analogous to the one in Figure 3 of the device with the slider in an intermediate position and in one of the end positions it can take. The same numbers indicate the same or equivalent parts to those in the previous embodiments.

[0040] In this example of embodiment the flexible element 15 is not fastened to the structure 23 in a fixed point, but is attached to said structure due to the fact that it runs around pulleys 61A, 61 B supported idle on the fixed structure 23, and around the pulleys 17A, 17B supported idle by the slider 19 and translating therewith. The flexible element 15 has two ends 15A, 15B fixed at the level of the axes of rotation of the pulleys with movable axis 17A, 17B supported by the slider 19. In practice, the flexible member 15 runs twice around each of the four pulleys 17A, 17B, 61A, 61B. As can be seen by comparing Figures 11, 12, the consequence of this particular arrangement of the fixed element 15 is the fact that each single translation of the slider 19 corresponds to a triple translation in the same direction of the thread guide 11 supported by the bracket 13, through which said thread guide is fastened to the flexible element 15.

[0041] Also in this case, as in the previous examples of embodiment, the alternate movement can be imparted to the slider 19 by means of kinematic mechanisms differing from the rack and pinion mechanism 27, 19B. For example systems with grooved cams (Figure 10) or a belt transmission (Figure 9) or the like can be used.

[0042] It is understood that the drawing only shows an example provided as a practical embodiment of the invention, which can vary in shapes and arrangements without however departing from the scope of the concept on which said invention is based. Any reference numbers in the appended claims are provided to facilitate reading of the claims with reference to the description and to the drawing, and do not limit the scope of protection represented by the claims.

## Claims

1. A device for distributing yarn on a spool, comprising: a thread guide provided with an alternate movement, an actuator member to supply motion to said thread guide, and a mechanical transmission between said

actuator member and said thread guide; **characterized in that** said mechanical transmission includes a slider operated with alternate motion by means of said actuator member, which slider supports idle guide pulleys for a flexible element to which said thread guide is attached, said flexible member being in turn connected to a fixed structure with respect to said slider.

2. Device as claimed in claim 1, **characterized in that** said thread guide is arranged along a rectilinear portion of said flexible member extending between two guide pulleys, the axes of which are aligned longitudinally in the direction of motion of the slider.

3. Device as claimed in claim 1 or 2, **characterized in that** said slider supports two guide pulleys.

4. Device as claimed in claim 1, 2 or 3, **characterized in that** said flexible member is fastened to at least one fixed point of said structure.

5. Device as claimed in claim 1, 2 or 3, **characterized in that** said flexible member is attached to said fixed structure through pulleys supported idle by said fixed structure, around which said flexible member runs.

6. Device as claimed in claim 1, 2 or 3, **characterized in that** it includes at least two guide pulleys supported idle by said slider and at least two guide pulleys supported idle by said fixed structure, said flexible member running around said pulleys supported by the slider and around said pulleys supported by the fixed structure.

7. Device as claimed in claim 5, **characterized in that** said flexible member is attached with its ends to the slider and runs twice around each axis of the respective pulleys.

8. Device as claimed in claim 7, **characterized in that** said ends of the flexible member are fastened approximately at the level of the axes of the pulleys supported idle by said slider.

9. Device as claimed in one or more of the previous claims, **characterized in that** said slider is integral with a rack meshing with a pinion which provides said slider with the translational movement.

10. Device as claimed in claim 9, **characterized in that** said rack is produced on a rod forming said slider or a part thereof, sliding in a guide integral with said fixed structure.

11. Device as claimed in one or more of claims 1 to 8, **characterized in that** said slider cooperates with a friction wheel which provides said slider with the

translational movement.

12. Device as claimed in one or more of claims 1 to 8, **characterized in that** said slider is operated by a cam supported in rotation by said actuator member. 5
13. Device as claimed in one or more of claims 1 to 8, **characterized in that** said slider is attached to a further flexible member, running around pulleys, at least one of which is motorized by said actuator member. 10
14. Device as claimed in one or more of the previous claims, comprising means to define a set-point in the travel of the thread guide. 15
15. A device for distributing yarn on a spool, comprising: a thread guide provided with an alternate movement, an actuator member to supply motion to said thread guide, and a mechanical transmission between said actuator member and said thread guide; **characterized in that** said mechanical transmission includes a slider operated with alternate motion by means of said actuator member and a motion multiplier, to which said thread guide is attached. 20 25
16. An appliance for winding reels or spools of yarn, comprising a rotation system for the spool or reel and a device for distributing yarn on said spool or reel, produced according to one or more of the previous claims. 30

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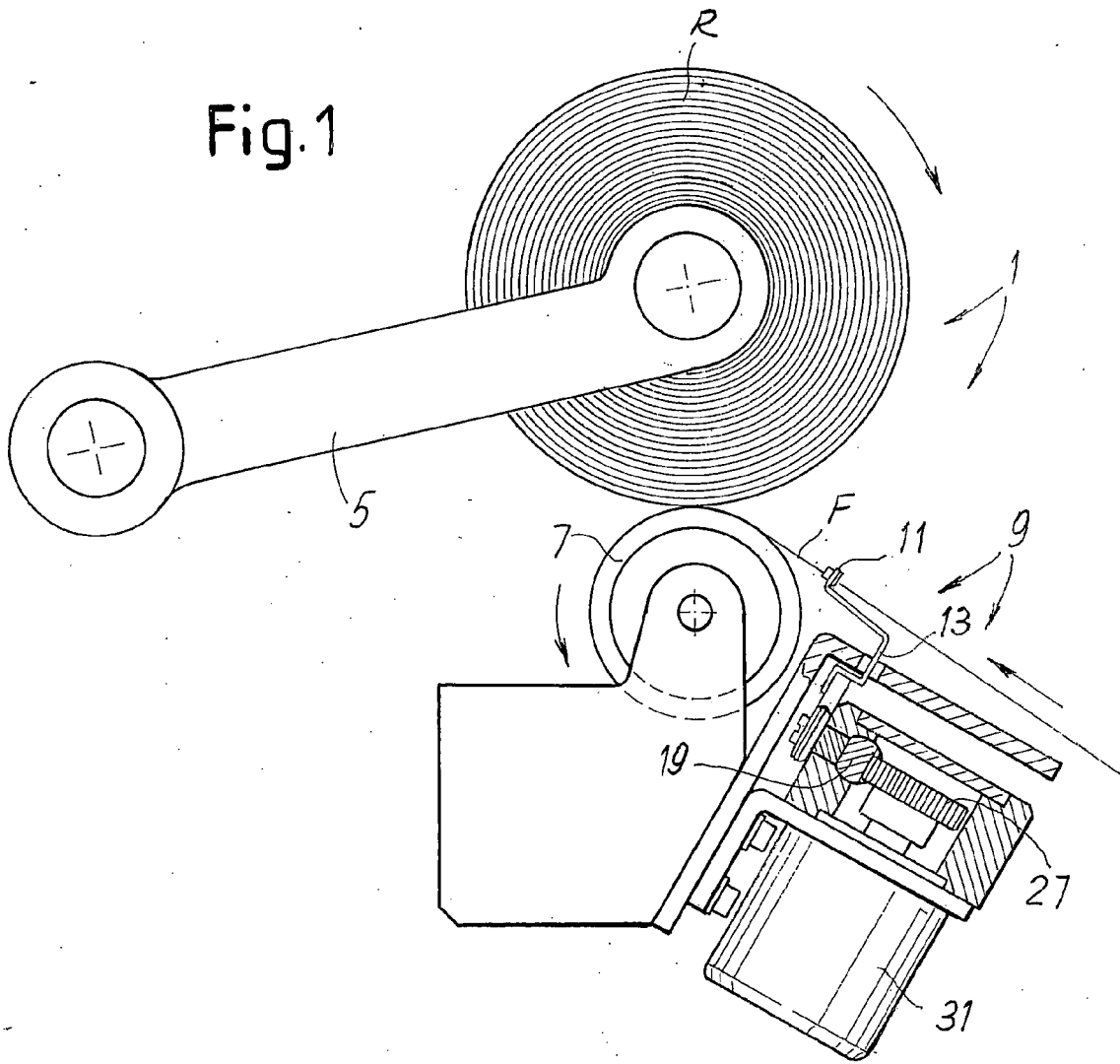
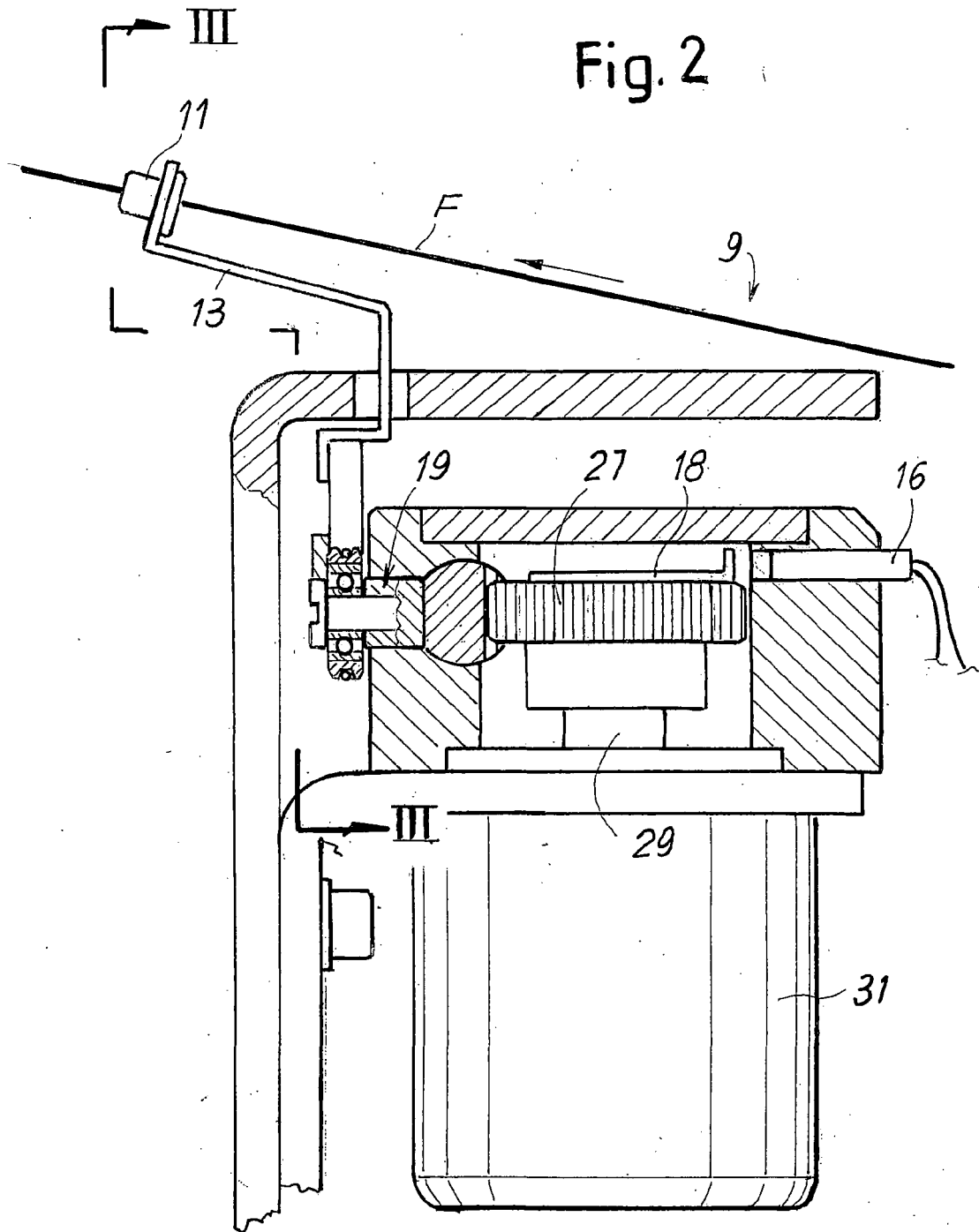
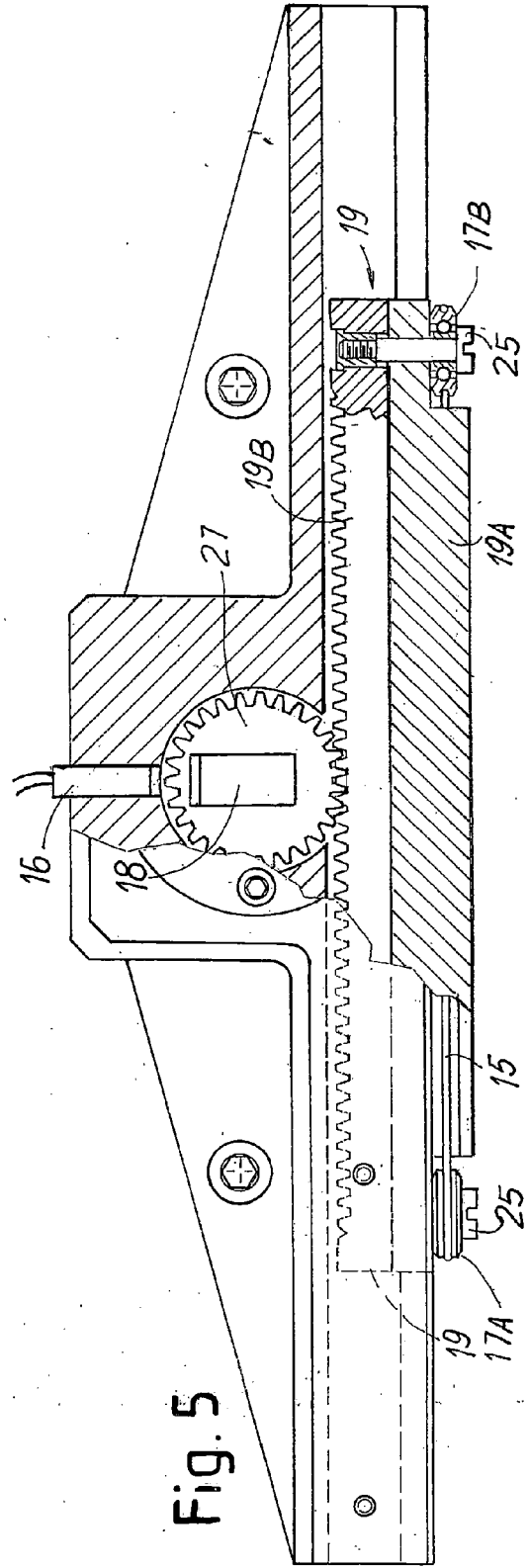
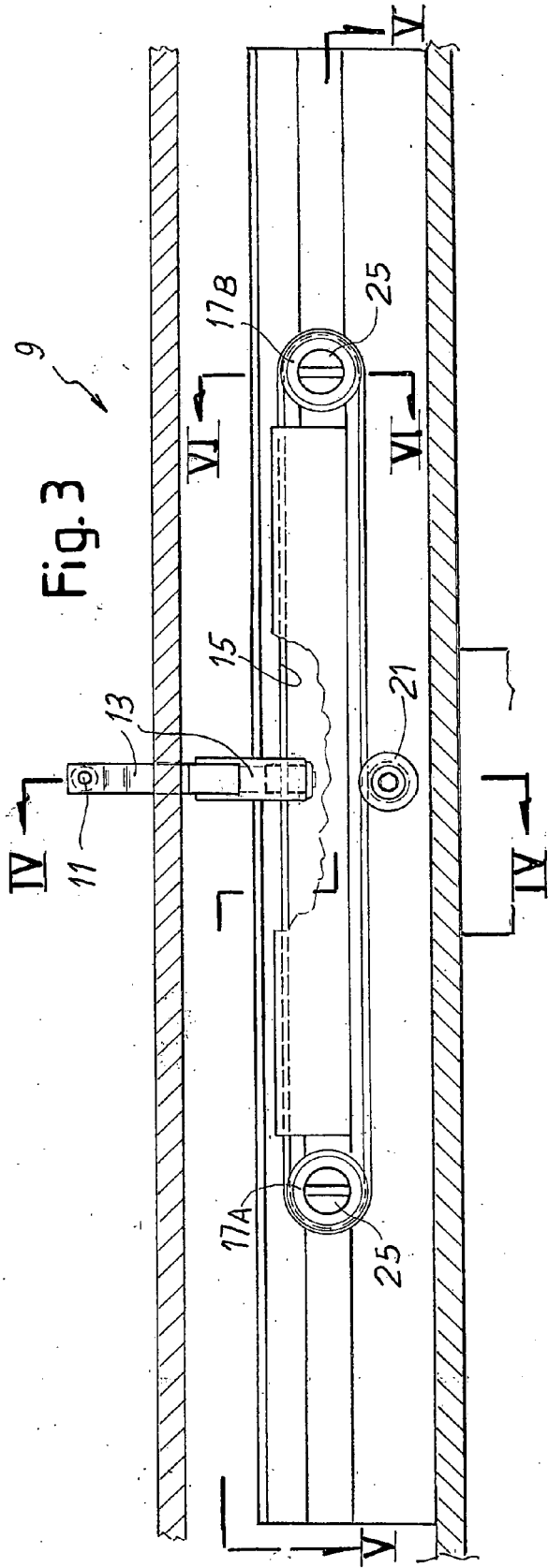


Fig. 2





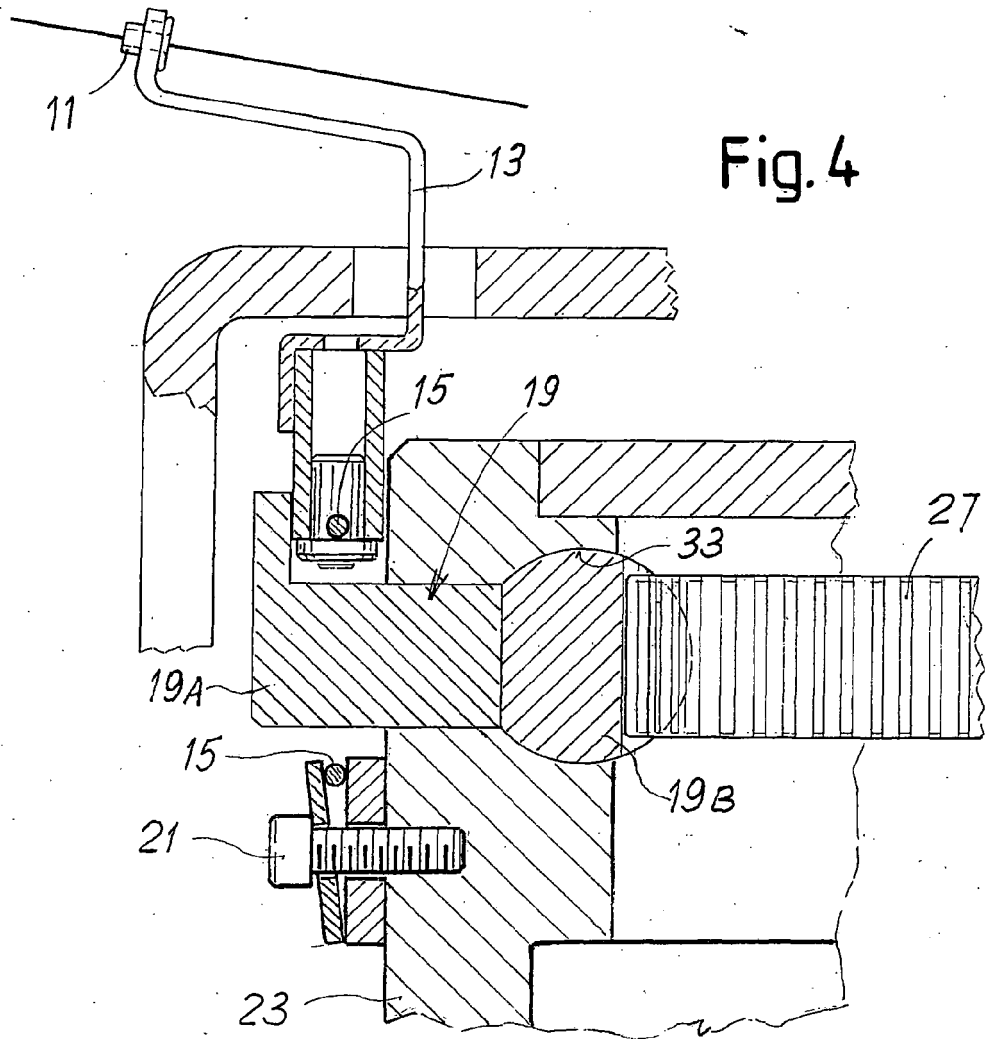
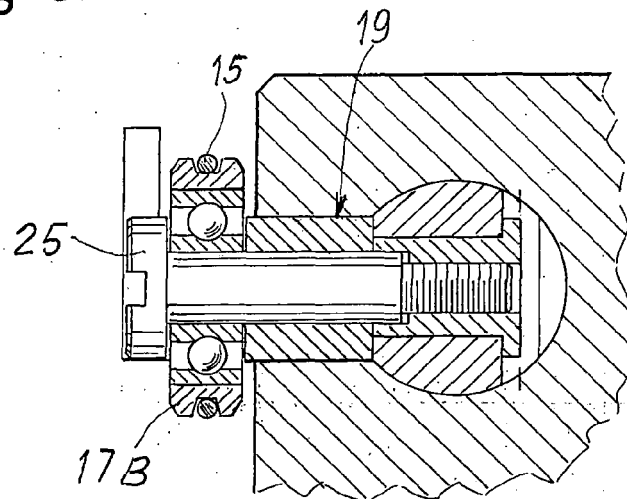


Fig. 4

Fig. 6



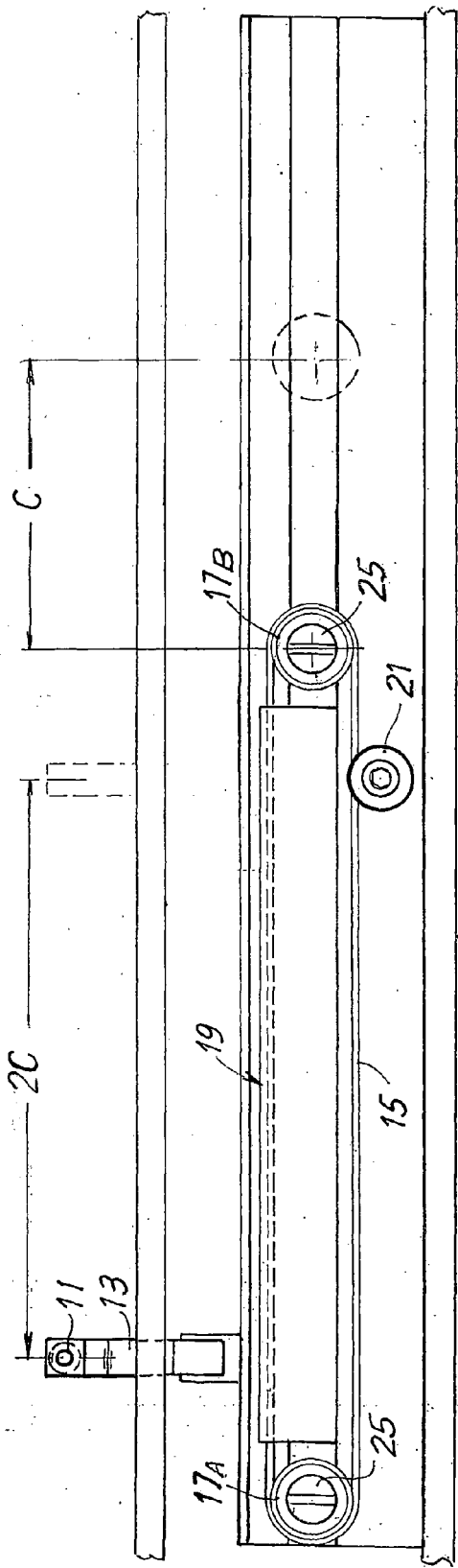


Fig. 7

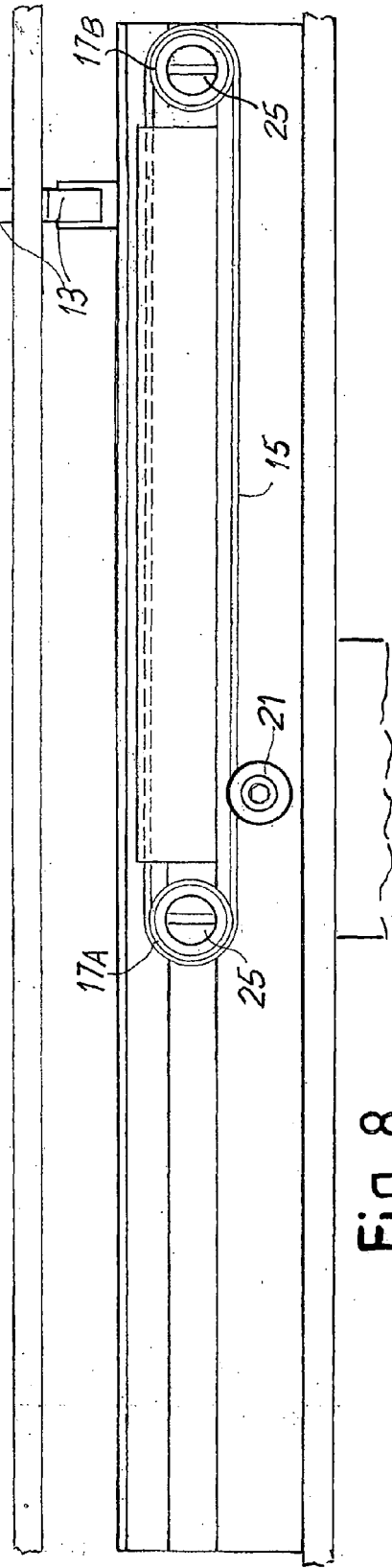
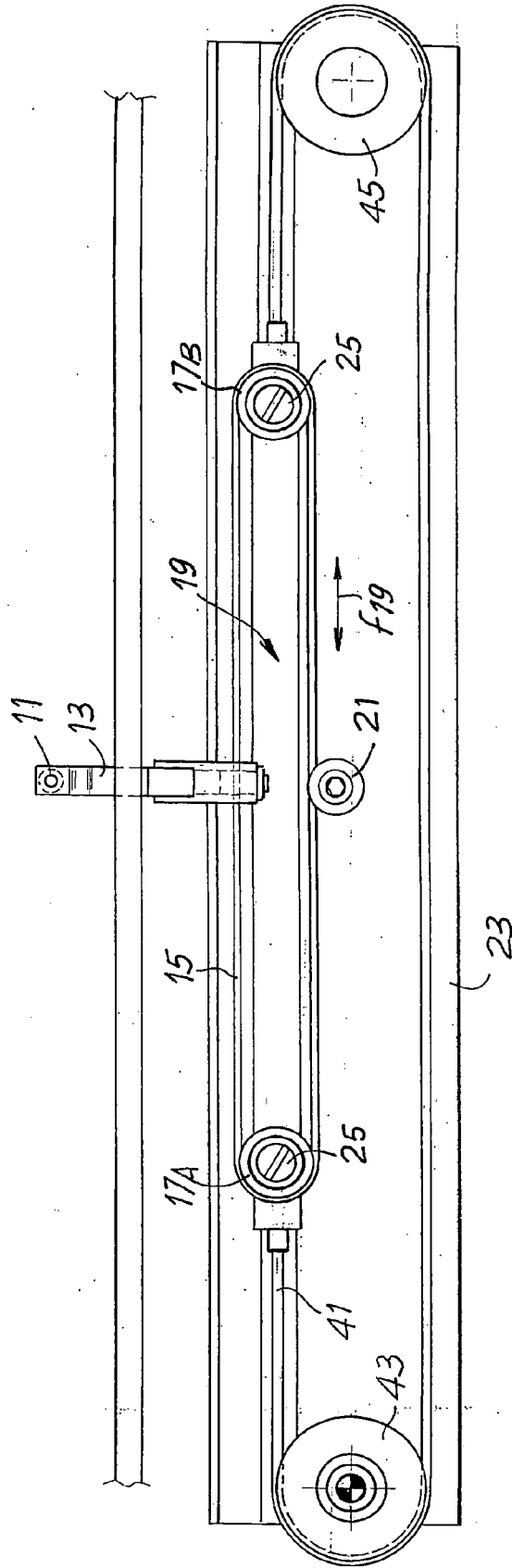


Fig. 8

Fig. 9



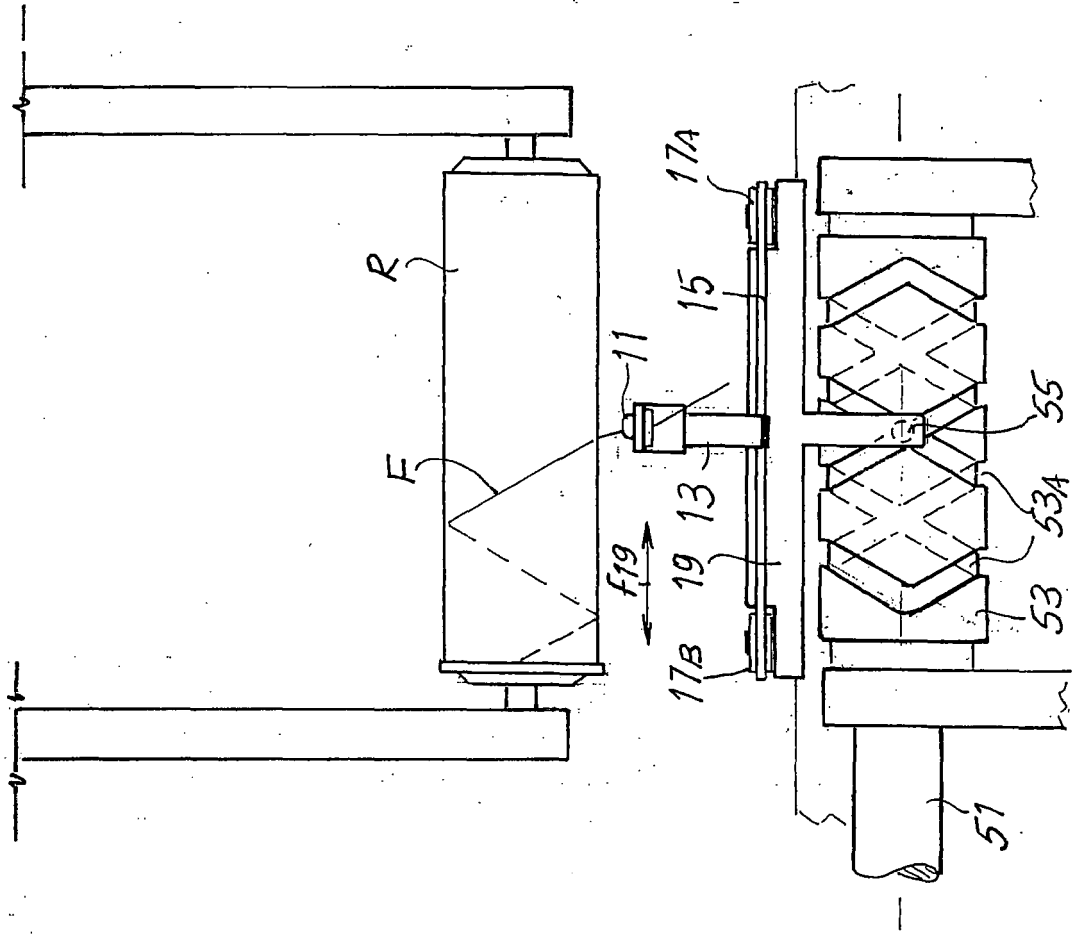
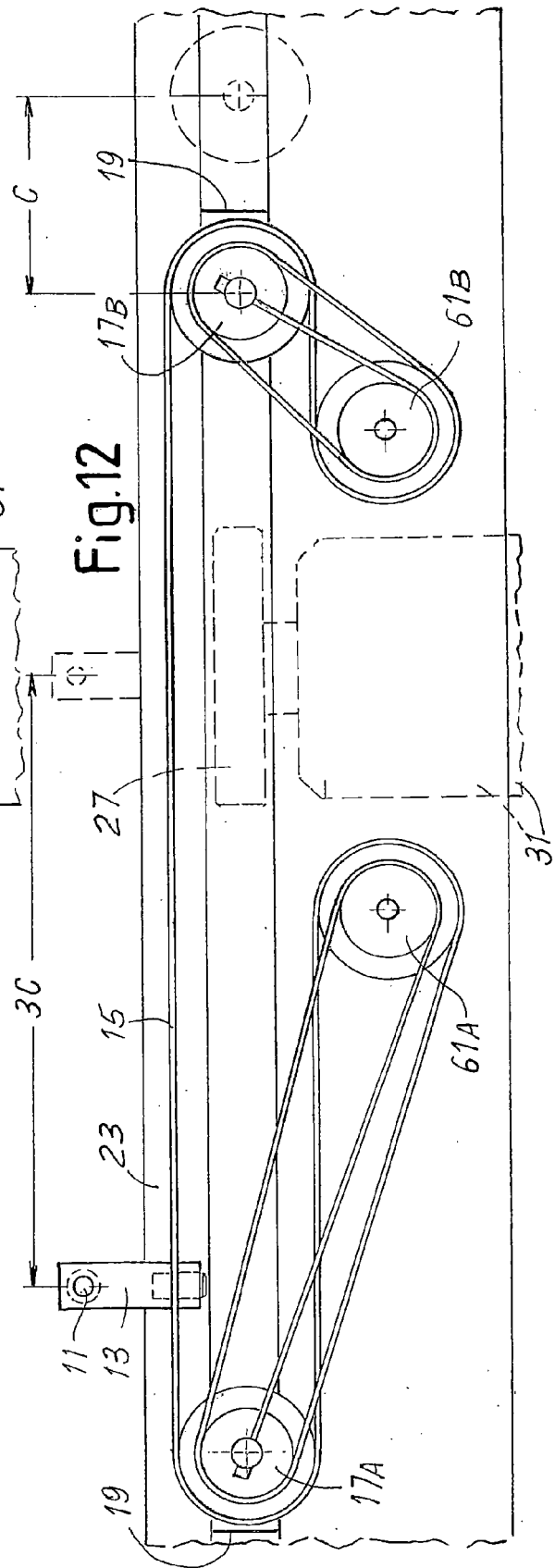
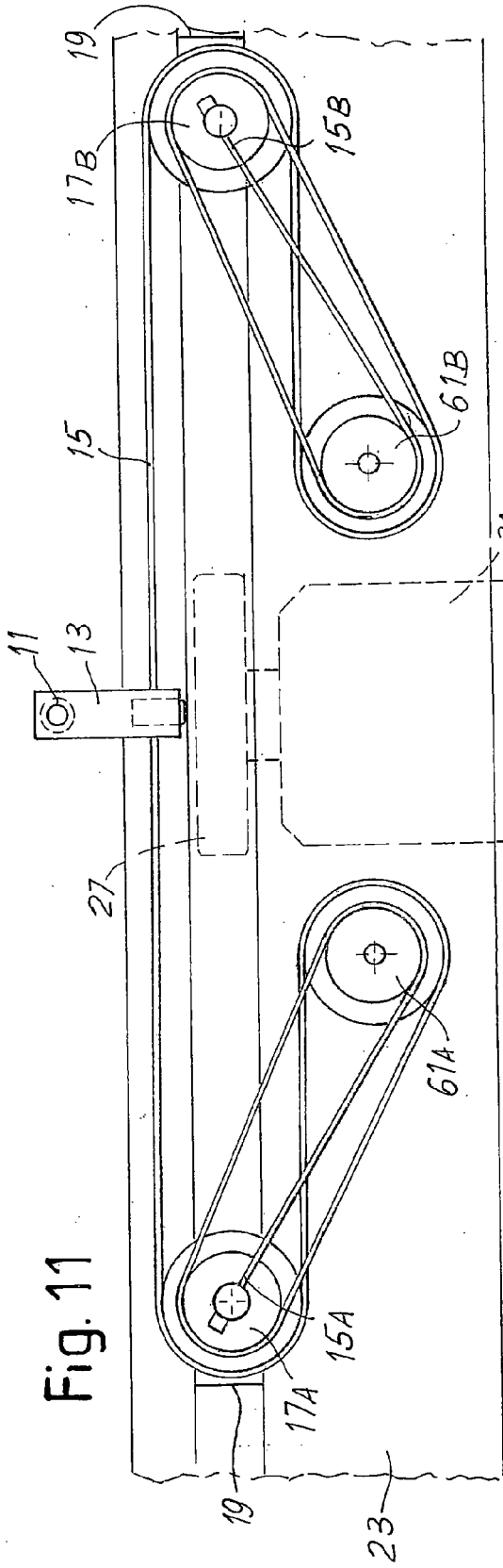


Fig.10





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