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(54) **Machine for winding a fibreoptic ribbon onto bobbins**

(57) The machine (22) for winding onto bobbins a ribbon (10) containing at least two optical fibres arranged mutually parallel and aligned comprises a support element (28) for rotatably supporting two bobbins (27,29) having a common centre plane, the two bobbins being able to be rotated in the same direction, said support element (28) being rotatable about an axis (30) between the axes of rotation of the two bobbins (27,29) and coplanar with these axes, so as to be able to replace one bobbin (27) when full of ribbon (10) with the empty other bobbin (29) by simply rotating the support element (28), the ribbon (10) hence making contact with the core of the empty bobbin (29) along a circular arc of predetermined width, and further comprises means (38) for gripping the ribbon (10), for cutting it and for retaining the initial end of the ribbon (10) on the still empty bobbin (29), these means acting on that ribbon portion in contact with the core of the empty bobbin (29).

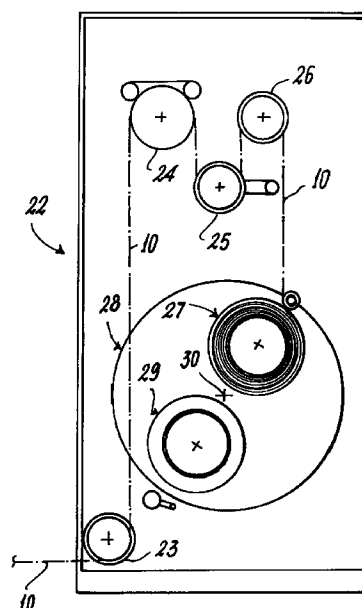


Fig. 3

Description

This invention relates to a machine for winding onto bobbins a ribbon containing at least two optical fibres arranged mutually parallel and aligned.

It is currently not possible to form said ribbon by applying the relative sheath to the optical fibres and then to wind it directly onto bobbins without interrupting the winding of the ribbon when passing from a now full bobbin to a still empty new bobbin.

This is however possible if winding a cable of substantially circular cross-section onto bobbins. In this respect, machines exist for coupling and cutting the cable by moving this latter to the outside of the bobbin flanges and then returning it between the flanges after cutting.

Attempts have been made to use such machines for winding said fibre optic ribbon. It has however been found that the machine cannot ensure the absence of twist during the transfer of the continuous ribbon from one bobbin to the next. This is not a drawback in the case of cables which have a circular cross-section, but is unacceptable in the case of fibre optic ribbons in which a twist in the ribbon causes various problems apparent to the expert of the art, and in particular the disordered arrangement of the ribbon on the bobbin.

The object of the present invention is to solve this problem by providing a machine for automatically, and without interruption, winding a fibre optic ribbon onto bobbins, which ensures complete absence of ribbon twist.

This object is attained by the machine of the present invention, comprising a support element for rotatably supporting two bobbins having a common centre plane, the two bobbins being able to be rotated in the same direction, said support element being rotatable about an axis intermediate between the axes of rotation of the two bobbins and coplanar with these axes, so as to be able to replace one bobbin when full of ribbon with the empty other bobbin by simply rotating the support element, the ribbon hence making contact with the core of the empty bobbin along a circular arc of predetermined width, and further comprising means for gripping the ribbon, for cutting it and for retaining the initial end of the ribbon on the still empty bobbin, these means acting on that ribbon portion in contact with the core of the empty bobbin. The invention will be more apparent from the description of one embodiment thereof given hereinafter by way of non-limiting example with reference to the accompanying drawings, in which:

Figure 1 is a very enlarged cross-section through a fibre optic ribbon of the type to be wound on bobbins; Figure 2 is a schematic front view of a plant for producing fibre optic ribbon and for winding it onto bobbins, the plant also comprising the winding machine according to the invention;

Figure 3 is an enlarged front view of the winding machine according to the invention, showing the

bobbin support element in the angular position which it assumes when the ribbon is being wound onto one of the two bobbins;

Figure 4 is a view of the bobbin support element with relative bobbins, it being shown in an intermediate angular position which it assumes when changing its angular position from that of Figure 3 to that of Figure 5;

Figure 5 is a view analogous to that of Figure 4 in which the angular position of the support element is that in which winding of the ribbon onto the new bobbin commences without any interruption in winding; Figure 6 is an axial section through the empty bobbin already mounted on the support element, the section being taken at the ribbon retention and cutting device;

Figure 7 is an enlarged section on the line 7-7 of Figure 6 showing, in their relative angular positions, the three stages in which the ribbon is gripped, is cut, and its end retained on the still empty bobbin;

Figure 8 is an enlarged view of said ribbon gripping, cutting and retention device, the casing in which it is contained being cut away to enable its interior to be seen, the device being shown in its rest position;

Figure 9 is a view analogous to that of Figure 8, the device being however shown in the position just preceding that in which it grips the ribbon;

Figure 10 is a view analogous to that of Figures 8 and 9, but with the device shown in the position in which it grips the ribbon;

Figure 11 is a view thereof in which the device is shown at the moment of cutting the ribbon.

As can be seen from Figure 1, the fibre optic ribbon 10, the cross-section of which is shown considerably enlarged compared with reality, consists of four optical fibres 12, 14, 16 and 18, each covered with a cladding - indicated by 13, 15, 17 and 19 respectively - of transparent material with a lower refractive index. The four optical fibres covered in this manner and arranged adjacent and aligned are incorporated into a common plastic sheath, to hence form the ribbon 10.

Figure 2 shows very schematically a plant 21 for producing a fibre optic ribbon wound onto bobbins, the plant being formed from various machines including a winding unit 22. This latter, shown alone in enlarged view in Figure 3, receives the ribbon 10 which then passes successively about a first deviation roller 23, a flywheel 24, a take-up roller 25 and a second deviation roller 26, to finally wind onto a first bobbin 27 which is shown nearly full in the figure. The bobbin is rotatably carried by a support device 28 in the form of a vertically arranged disc, this latter being rotatable clockwise (arrow A of Figure 4) about its central horizontal axis, indicated in the figure. An empty second bobbin 29 is rotatably carried on the same support device. Each of the two bobbins 27 and 28 is rotatable on a spindle 32 on which a rotated faceplate 33 is also rotatable. In conventional manner, the bobbin is kept pressed against the faceplate 33 so that

when this latter is rotated the bobbin also rotates by being dragged. In one side of each bobbin there is provided a circular hole 34 into which, on mounting the bobbin onto the spindle 32, there is inserted an overall cylindrical hollow projection 35 whose hole extends through a hole in the faceplate 33, said projection 35 forming part of a gripping, cutting and retention device for the ribbon 10, this device being indicated overall by 36 and being fixed to the faceplate. The device 36 is described in detail hereinafter.

From the foregoing, the support device 28 can be rotated through 180° clockwise to pass from the position shown in Figure 3 to the position shown in Figure 5, and passing through the intermediate position shown in Figure 4. The result is an exchange of positions between the full bobbin 27 and the still empty bobbin 28. As shown in Figure 5, the ribbon 10 makes contact with the core 31 of the empty bobbin 29 along a circular arc subtended by the angle B. In the meantime the bobbin 27 continues to receive ribbon 10.

The ribbon gripping, cutting and retention device 36 shown overall in Figure 6 is illustrated enlarged and by itself in Figure 8, in which the casing 37 of the device 36 is cut away to allow its interior to be seen.

Continuing the description of the device 36, reference should be made to Figure 7 which represents an enlarged view of the detail C of Figure 5. In this respect, the gripping of the ribbon, its cutting and the retention of the initial end of the ribbon on the bobbin take place along that portion of ribbon 10 subtended by the angle B (in which the ribbon makes contact with the core 31 of the still empty bobbin 29). Figure 7 shows the three most significant angular positions of the device 36 as the bobbin rotates through the angle B. During the entire stage prior to a first angular position defined by the angle C (starting from the radius R passing through the point T in which the ribbon touches the core 31 of the bobbin 29) the state of the cutting and retention device 36 is as shown in Figure 8. As can be seen from this figure, the casing 37 contains a gripper 38 formed from two jaws 39, 40 pivoted on a common pivot 41 carried by a slide 42. This latter is supported by two connecting rods 43, 44, indicated schematically in the figure, to form a parallelogram. Consequently the slide 42 can move relative to the bobbin spindle 32 while always remaining parallel to this latter.

A spring 45 maintains the slide 42 in the rest position shown in Figure 8. A control shaft 46 can be rotated by a suitable actuator device, not shown (formed for example from a lever operated by an electromagnet or pneumatically), to rotate the arm 50 rigid with the jaw 39 through a predetermined angle via a lever system comprising connecting rods 47 and 48. A spring 49 acting on the jaw 39 maintains the gripper 38 open. The jaw 40 is rigid with an arm 51 which is retained in a position against a stop 52 by the action of a spring 53. By comparing Figures 6 and 8 it can be seen that when in the situation illustrated in this latter figure the gripper 38 does not

project beyond the inner side 54A of the flange 55 of the bobbin 29.

Figure 9 shows the situation of the cutting and retention device 36 (shown only partially for simplicity) corresponding to the angular position C of Figure 7.

The situation shown is obtained by rotating the shaft 46 anti-clockwise through a predetermined angle. The spring 49 prevents movement of the node 54, so that the slide 42 advances leftwards until it touches the relative side of the faceplate 33, hence elongating the spring 45. Consequently the gripper 38 also advances leftwards, so that the ribbon 10 lies between the jaws 39 and 40. As in Figure 8, the ribbon 10 rests flatly on the lips 55 (see also Figure 7) of the hollow projection 35.

Figure 10 shows the situation of the cutting and retention device 36 corresponding to the angular position defined in Figure 7 by the angle D. Following a second anti-clockwise rotation of the shaft 46 through a predetermined angle the force of the spring 49 is overcome, so that the jaw 39 lowers to press the ribbon 10 against the jaw 40 which has remained at rest because of the reaction of the spring. The gripping force on the ribbon is proportional to the reaction load of the spring 53.

The angular position defined by the angle E in Figure 7 corresponds to the situation illustrated in Figure 11, obtained by a further rotation of the shaft 46 which also overcomes the force of the spring 53. In this manner the ribbon 10, still retained between the two jaws 39 and 40 of the gripper 38, is lowered onto a cutting edge 56 of a knife 57 (not shown in Figures 6 to 10 for simplicity) until the ribbon 10 has been completely cut. The knife 57 is rigid with the slide 42 (even though this is not shown in Figure 11) and consequently moves with it. It should be noted that even in the subsequent angular positions the ribbon 10 remains retained by the gripper 38, to hence wind about the core of the new bobbin 29. The now free end 58 (Figure 7) of the ribbon 10 is wound about the full bobbin 27, which can then be removed and replaced by an empty bobbin.

As is apparent from the aforesaid, the ribbon 10 is cut without any twisting of the ribbon.

It should be noted that by virtue of the machine according to the invention the ribbon remains retained both during and after its cutting, the initial end of the ribbon also remaining retained on the empty bobbin 29, so that the ribbon can wind onto this latter.

Claims

1. A machine for winding onto bobbins a ribbon containing at least two mutually parallel and aligned optical fibres, comprising a support element for rotatably supporting two bobbins having a common centre plane, the two bobbins being able to be rotated in the same direction, said support element being rotatable about an axis intermediate between the axes of rotation of the two bobbins and coplanar with these axes, so as to be able to replace one bobbin when full of ribbon with the empty other bobbin

by simply rotating the support element, the ribbon hence making contact with the core of the empty bobbin along a circular arc of predetermined width, and further comprising means for gripping the ribbon, for cutting it and for retaining the initial end of the ribbon on the still empty bobbin, these means acting on that ribbon portion in contact with the core of the empty bobbin. 5

2. A machine as claimed in claim 1, wherein the gripping, cutting and retention means act through a hole provided in one of the two bobbin flanges. 10

3. A machine as claimed in claim 2, wherein the gripping, cutting and retention means consist of a gripper insertable through the hole provided in the bobbin flange in order to grip the ribbon, the gripper being movable against a cutting edge for cutting the ribbon, to release the final end of the ribbon already wound on the full bobbin and retain the initial end of the ribbon to be wound on the still empty bobbin. 15 20

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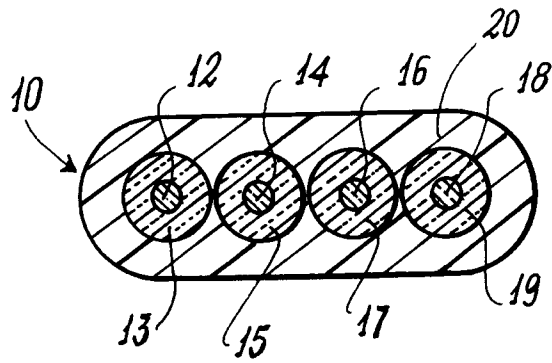


Fig. 1

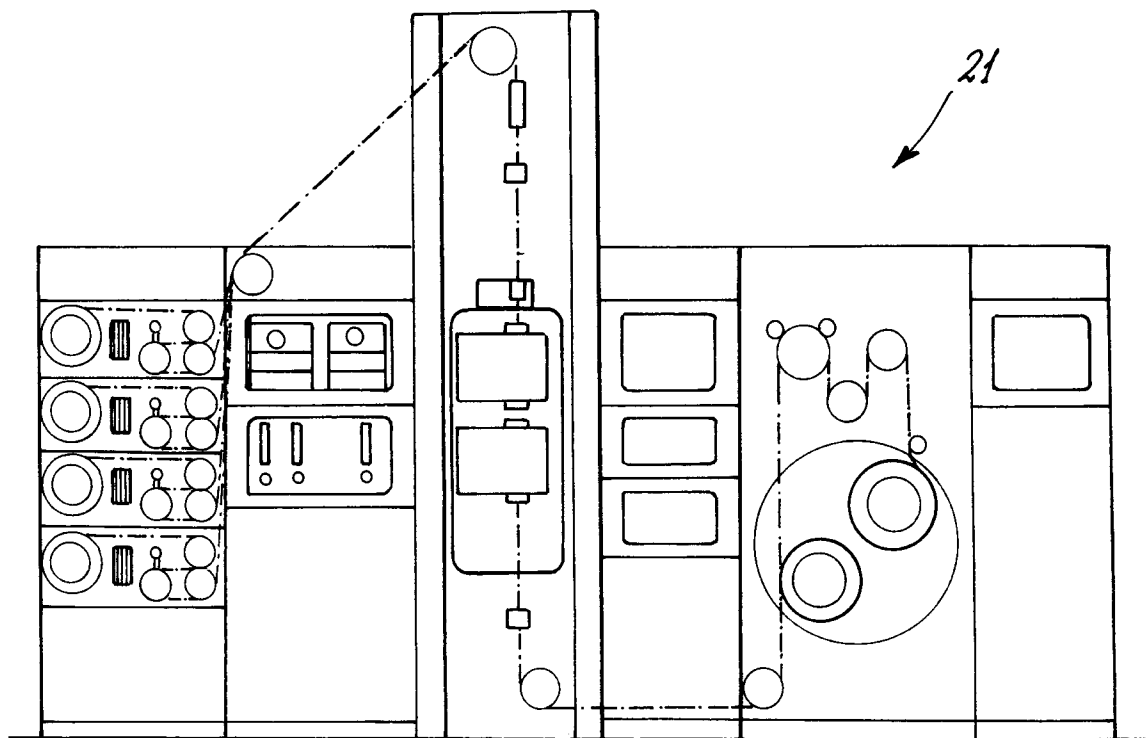


Fig. 2

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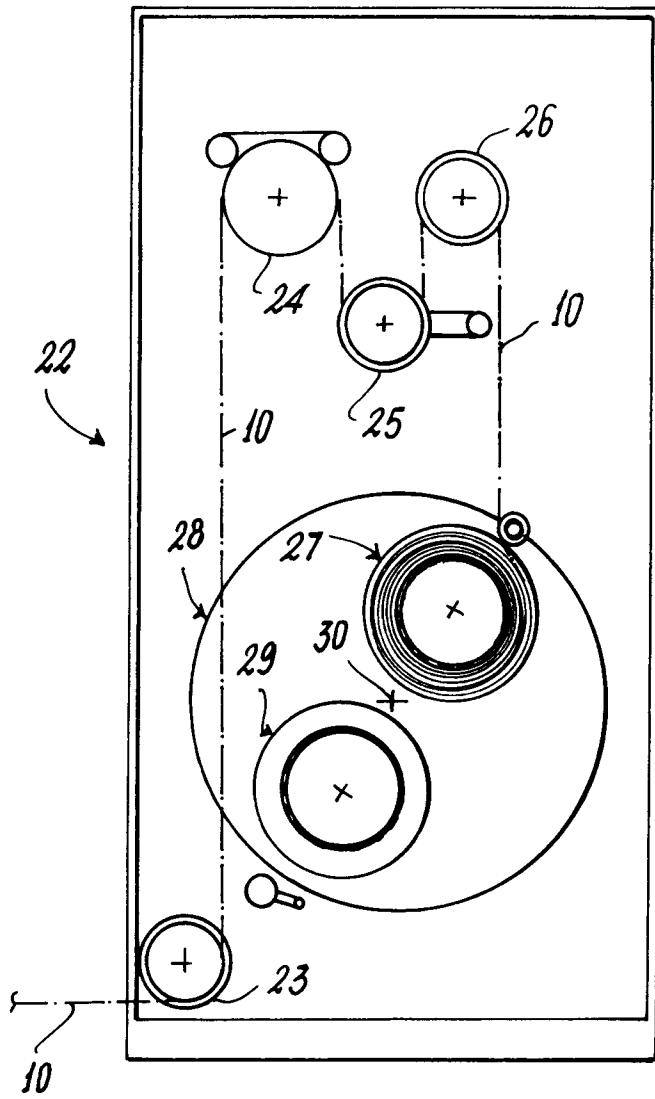


Fig. 3

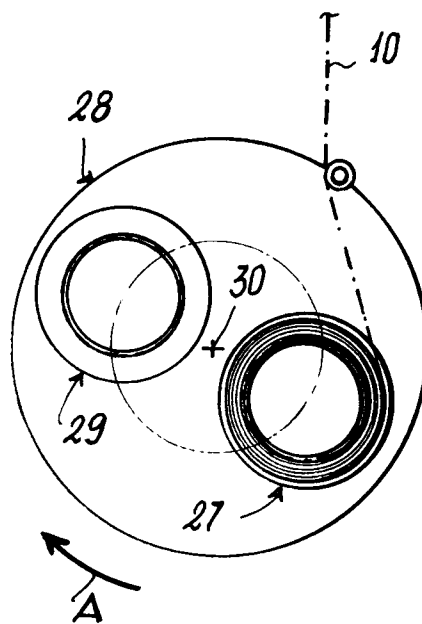


Fig. 4

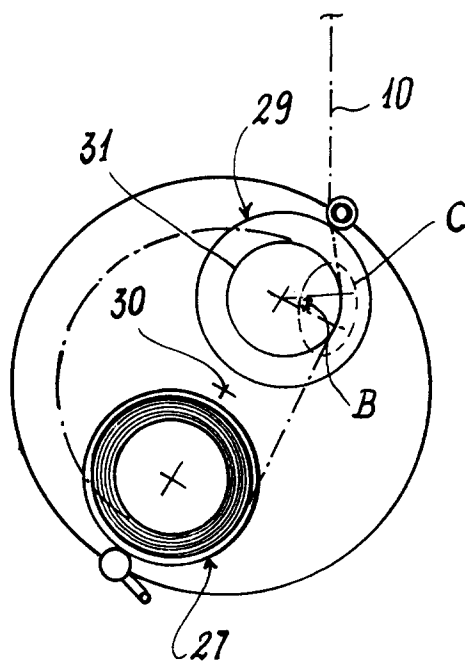


Fig. 5

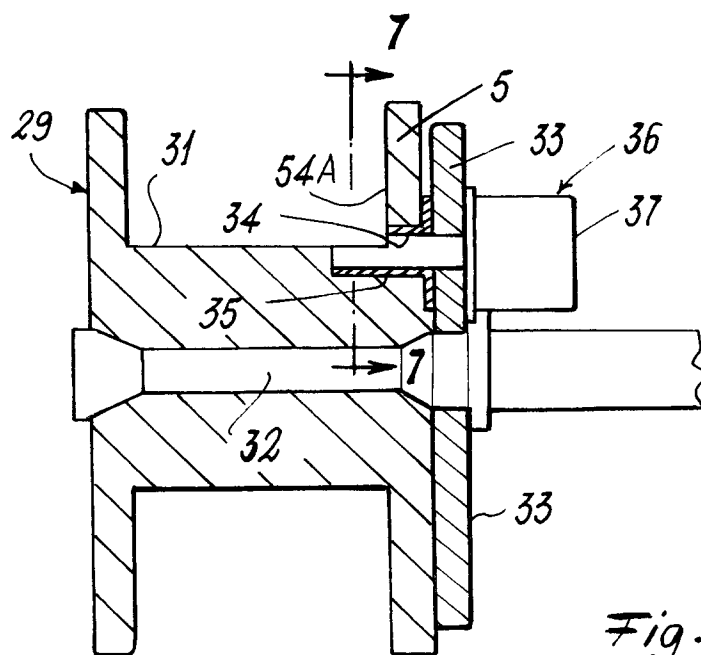
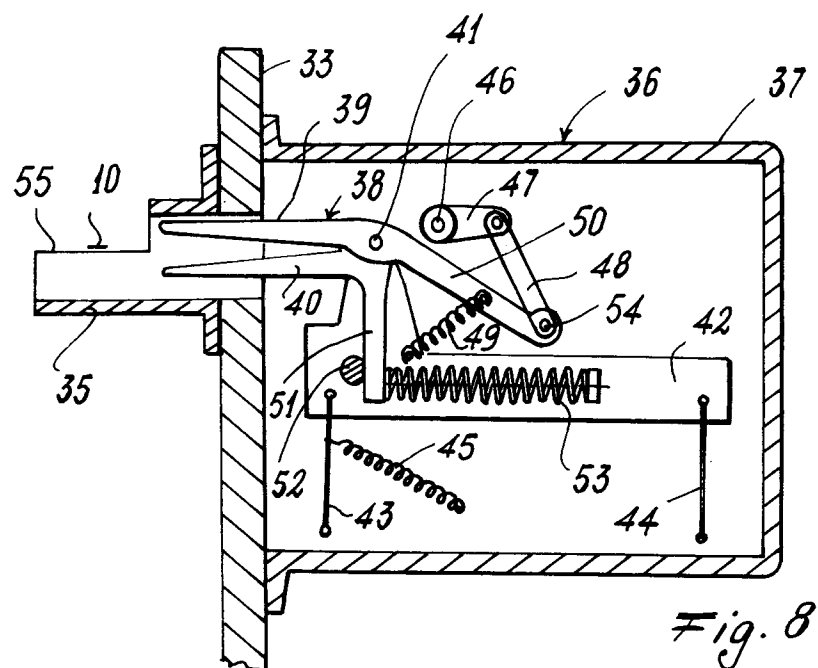
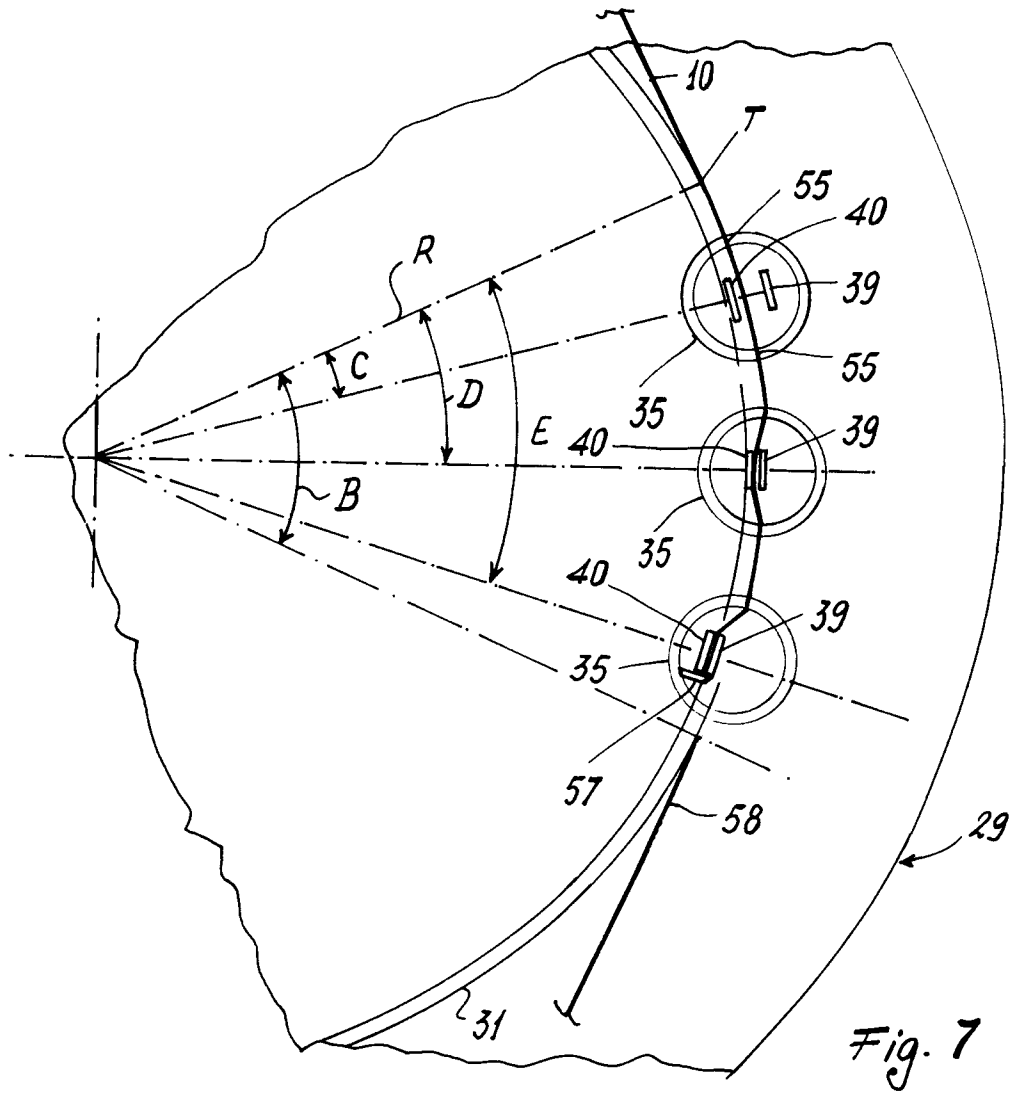
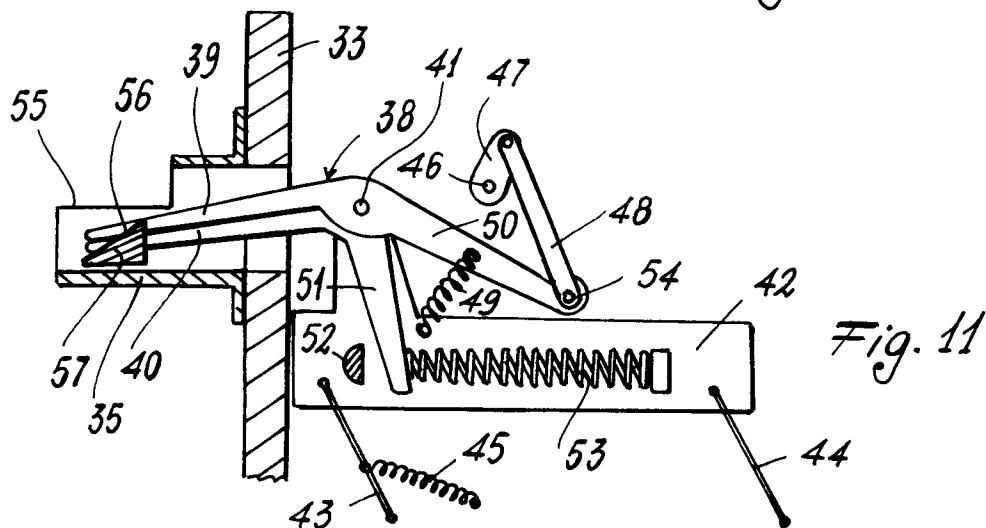
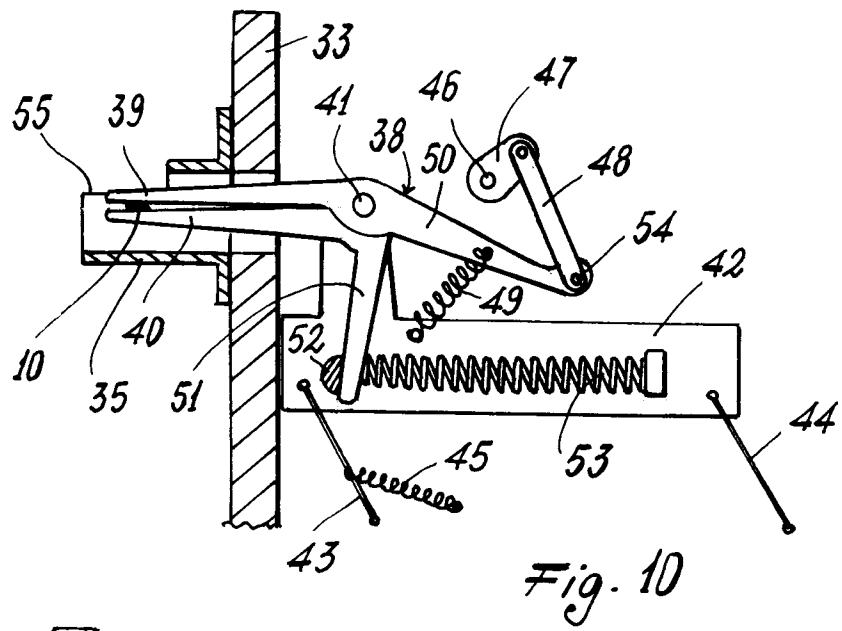
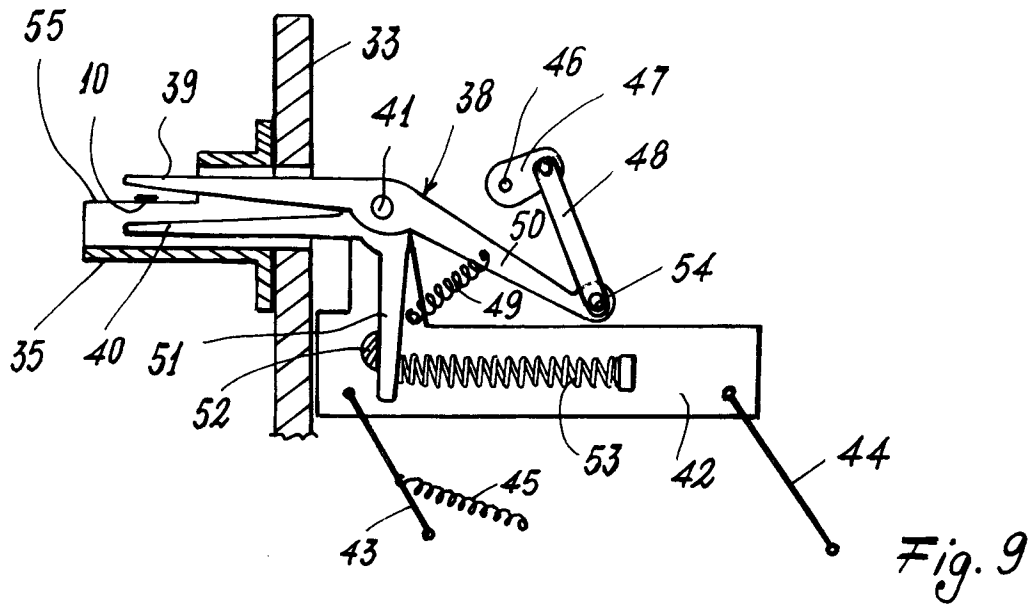


Fig. 6







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EUROPEAN SEARCH REPORT

Application Number
EP 95 11 0063

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DE-A-14 74 231 (W.W.LÜTCHE) * page 12, line 1 - line 12 * * page 12, line 25 - page 13, line 20 * ---	1-3	B65H67/048 B65H65/00
X	GB-A-1 367 513 (VSESOJUZNY NAUCHNOISSLEDOVATELSKY I PROEKTNOKONSTRUKTORSKY INSTITUT) * page 2, line 56 - page 3, line 14 *	1	
A	---	3	
A	DE-A-23 36 755 (MASCHINENFABRIK STAHLKONTOR WESER LENZE KG) * page 3 - page 4 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B65H G02B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 11 October 1995	Examiner Goodall, C
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