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(54) Clamping device for releasably clamping a sheet around a drum

(57) A clamping device for releasably clamping a sheet which is fitted around the peripheral surface of a drum (1), with the aid of two clamping bars (10), the clamping bars (10) extending axially along the drum (1) and being able to be moved essentially in the radial direction between a clamping position and a release position, and there being provided, for each clamping bar (10), underlying clamping parts (11). Each clamping bar (10) is movably connected to a sliding element (12) which can move essentially in the radial direction and is provided with a locking mechanism for locking the sliding element (12) in a first or second locking position, intermediate means (13) being arranged between the clamping bar (10) and the sliding element (12), which intermediate means (13) press the clamping bar (10), at least in one of the two locking positions of the sliding element (12), against the underlying clamping parts (11).

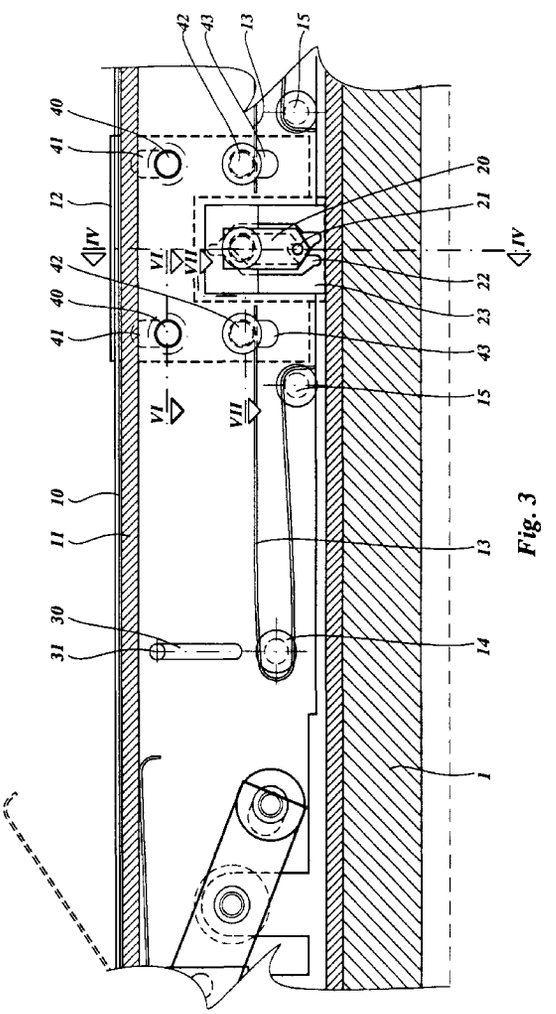

Fig. 3

EP 0 741 043 A1

Description

The invention relates to a clamping device for releasably clamping a sheet which is fitted around the peripheral surface of a drum, with the aid of two clamping bars, the clamping bars extending axially along the drum and being able to be moved essentially in the radial direction between a clamping position and a release position, and there being provided, for each clamping bar, underlying clamping parts.

Such a clamping device is disclosed in EP-A-0,272,802. This shows a clamping device in which, at all times, a first clamping bar rotates conjointly with the drum, while a second clamping bar can be held in a fixed, protruding release position while the drum rotates. By this means, one end of a sheet can be held by the first clamping bar, the sheet can be guided through between the second clamping bar and the drum, and the drum can be rotated to such an extent that the other end of the sheet lies beneath the second clamping bar and can be clamped underneath it. At opposite ends of the drum, both clamping bars are connected to support plates. These plates are provided with specific operating mechanisms for moving the clamping bars radially.

This known clamping device is disadvantageous in that the operating mechanisms are complicated, expensive and difficult to operate.

The object of the present invention is to provide a clamping device in which these disadvantages are obviated.

According to the invention, this object is achieved in that each clamping bar is movably connected to a sliding element which can move essentially in the radial direction and is provided with a locking mechanism for locking the sliding element in a first or second locking position, intermediate means being arranged between the clamping bar and the sliding element, which intermediate means press the clamping bar, at least in one of the two locking positions of the sliding element, against the underlying clamping parts.

This clamping device is simple to operate, since the sliding element simply has to be brought from one locking position to the other, as a result of which the clamping bar is either brought from its release position into its clamping position or can be brought from its clamping position into its release position. Because the clamping bar is not locked directly, sheets of varying thicknesses can easily be clamped.

In particular, the locking mechanism is formed by projecting parts which are connected to the sliding element and can follow a track in which the first and the second locking position are incorporated.

The sliding element now locks automatically in the first or the second locking position, as soon as the projecting parts in the track have reached one of these positions. Unlocking can take place easily by pressing the sliding element, and thus also the projecting parts connected thereto, out of the locking position in the radial direction.

In a preferred embodiment, a system is incorporated which allows the clamping force to increase as the drum rotates more quickly. To this end, each clamping bar is connected to at least one centrifugal weight by means of a lever system in such a way that, when the drum is rotating, the radially outwardly directed force acting on the centrifugal weight is converted into a radially inwardly directed force acting on the clamping bar.

This is especially advantageous for rapidly rotating drums, because the clamping force would otherwise gradually decrease under the influence of the centrifugal forces acting on the clamping bars. An alternative is to instal relatively heavy springs. However, this entails a correspondingly greater operating force.

Further preferred embodiments of the invention are defined in claims 4-8.

The invention will be explained in more detail with reference to the appended drawing, in which:

Fig. 1 is a perspective view of a drum with a clamping device according to the invention;
Fig. 2 is a top view, partially in section, of part of a drum with a clamping device according to the invention;
Fig. 3 is an axial cross-section on the line III-III of Fig. 2;
Fig. 4 is a cross-section on the line IV-IV of Fig. 3;
Fig. 5 is a view of a component of the locking means according to the invention;
Fig. 6 is a cross-section on the line VI-VI of Fig. 3;
Fig. 7 is a cross-section on the line VII-VII of Fig. 3;
Fig. 8 is a top view, partially in section, which adjoins the drum part shown in Fig. 2; and
Fig. 9 is an axial cross-section on the line IX-IX of Fig. 8, which adjoins the drum part shown in Fig. 3.

The drum 1 depicted in Fig. 1, part of which is depicted in Figs. 2 and 3, comprises an axial recess in which a clamping device is arranged. The clamping device comprises two clamping bars 10 which extend axially along the drum 1. Each clamping bar 10 can be moved in the radial direction between a clamping position and a release position, the release position of which is depicted in Fig. 1 and the clamping position in Fig. 3. A sheet can be clamped between the clamping bar 10 and an underlying clamping part 11. The clamping bar 10 is movably connected to a sliding element 12. The sliding element 12 is likewise displaceable essentially only in the radial direction and can be locked in a first or second locking position, i.e. an inner or outer locking position in the radial direction. In a manner which will be explained in more detail below, two springs 13 are arranged between the sliding element 12 and the clamping bar 10, which springs press the clamping bar 10 and the sliding element 12 away from one another, at least in the inner locking position of the sliding element 12. If the sliding element 12 is locked in the inner position, and

thus cannot move radially outwards, the clamping bar 10 is pressed against the underlying clamping part 11 by means of the springs 13.

In this case, the locking mechanism is formed by a pendulum block 20 which is connected rotatably to the sliding element 12 and in which a projecting pin part 21 is arranged. This pin part 21 can follow a groove 22 which is arranged in a block element 23 connected to the drum 1. The pendulum block 20 and the groove 22 have a shape which is such that the pin part 21 is guided through the entire groove 22 under the influence of the displacement of the sliding element 12. As a consequence of the springs 13, the pin part 21 is alternately caught in the inner and outer locking positions.

In Fig. 4, it can be seen that the pendulum block 20 can rotate about a pin 24 which is welded to the sliding element 12. As a result, the pin part 21 can run along the entire track of the groove 22 in the block element 23, despite the fact that the sliding element 12 can only be displaced in the radial direction. A compression spring 25 holds the pendulum block 20 pressed lightly against the sliding element 12, and provides some extra friction. As a result, a small force is always necessary in order to change the position of the pendulum block 20.

The groove 22 in the block element 23 is depicted more clearly in Fig. 5. The groove 22 has a shape such that the pin part 21, under the influence of vertical movements, is always moved to the right in the inner part of the groove 22, and is always moved to the left in the outer part of the groove 22. As a result, a long movement from the top to the bottom is followed by a short movement from the bottom to the top, then a short movement from the top to the bottom and subsequently a long movement from the bottom to the top. The long movement downwards can then be recommenced. The inner and outer locking positions are indicated by the reference numerals 26 and 27.

In order to ensure that the clamping bar 10 cannot move to the left or to the right, a slot 30 is provided in the clamping bar 10, through which a guide pin 31 connected to the drum 1 projects (see Fig. 3).

The clamping bar 10 and the sliding element 12 are connected to one another by means of a pin-and-slot connection. In the embodiment shown, pins 40, which are connected to the clamping bar 10, project through a pair of slot holes 41 provided in the sliding element 12 (see also Fig. 6), and pins 42, which are connected to the sliding element 12, project through a pair of slot holes 43 provided in the clamping bar 10 (see also Fig. 7). As a result, the sliding element 12 and the clamping bar 10 can be moved only to a limited extent with respect to one another. When the sliding element 12 is not locked in the inner position, it is pressed upwards by the springs 13 to such an extent that the pins 40, 42, come to bear against the ends of the slot holes 41, 43.

In Figs. 6 and 7, the pin-and-slot connection of the clamping bar 10 and the sliding element 12 is depicted in more detail. The pin 40 is in this case welded to the rear of the clamping bar 10 and runs through a slot hole 41 provided in the sliding element 12. The pin 42 is welded to the rear of the sliding element 12 and runs through a slot hole 43 provided in the clamping bar 10. By means of this connection, the clamping bar 10 and the sliding element 12 can be displaced in the radial direction with respect to one another.

In the embodiment shown, each spring 13 is formed by a leaf spring which extends around a pin 14 connected to the clamping bar 10 and is supported, on the one hand, against a pin 15, which is likewise connected to the clamping bar 10, and, on the other hand, is supported against the pin 42, which is connected to the sliding element 12.

The clamping device according to the invention can be used, for example, in a rotatable drum which serves to tension a sheet which is to be printed in, for example, an inkjet printing device. A problem with rapid rotation is that the clamping bars can bend outwards as a consequence of centrifugal forces. As a result, the clamping force may decrease when the drum rotates more quickly, while it would be preferable for a larger clamping force to be exerted, since centrifugal forces likewise act on the sheet to be printed.

In Figs. 8 and 9, a mechanism is depicted which ensures that the clamping force will remain essentially constant, or even increase, when the drum 1 rotates rapidly. Each clamping bar 10 is to this end connected to at least one centrifugal weight 50 by means of a lever system 59. As a result of the rotation of the drum 1, the centrifugal weight 50 is propelled outwards. Via the lever system 59, the associated force is converted into a radially inwardly directed force which acts on the clamping bar 10. Since the clamping bar 10 is also subjected to centrifugal forces, the centrifugal weight 50 should be as heavy as, or heavier than, the clamping bar 10. When the drum 1 stops in a position in which the clamping bars 10 are at the top with respect to the ground, and the sliding element 12 is not locked in the inner position, each clamping bar 10 can be brought into the release position more easily under the influence of the force of gravity acting on the centrifugal weight 50. If the centrifugal weight 50 is heavy enough, this movement can even take place without external assistance. In practice, however, it has been found that the friction is too high to achieve this. In a preferred embodiment, a spring 51 is therefore arranged between the clamping bar 10 and the centrifugal weight 50. The spring 51 is precompressed such that, when the drum 1 is stationary and the sliding element 12 is not locked in the inner position, it presses the centrifugal weight 50 radially inwards and, via the lever system 59, presses the clamping bar 10 radially outwards.

The lever system 59 is in this case formed by two levers 60. At their centre, the levers 60 are rotatably connected to the drum 1. To this end, bushes 61 are welded to the levers 60, located in which bushes are plastic bearings 62, which can rotate about pins 63 connected

to the drum 1. Fitted on the bushes 61 are rings 64 which partly guide the clamping bar 10. One end of each lever 60 is provided with a slot 70, in which a plastic ring 71, which is fitted on a pin 72 connected to the clamping bar 10, can slide. The other end of each lever 60 is likewise provided with a slot 80, in which a plastic bush 81, which is fitted on a pin 82 connected to the centrifugal weight 50, can slide. Each ring 71 and bush 81 is enclosed between two plastic rings 85.

In order to prevent the centrifugal weight 50 from veering sideways and slipping out of the slots 70, 80, a radial groove 90 is provided in the side of the centrifugal weight 50, in which groove a guide pin 91, which is connected to the drum 1, runs.

The line indicated by IV-IV in Fig. 3 is, in the embodiment shown, a line of symmetry for all components of the clamping device, except for the groove 22 in the block element 23. This means, in this case, that the sliding element 12 and the locking means are situated in the centre of the drum 1, and that spring means 13, centrifugal weight 50, lever systems 59, etc. are situated on both sides thereof. This is particularly advantageous with respect to symmetrical support for the clamping bars 10. However, the invention also relates to embodiments having one, or more than two, spring means, centrifugal weights, lever systems, etc., which are arranged at other locations in a drum.

Preferably, a separate, lockable sliding element is provided for each clamping bar, so that each end of the sheet to be printed can be clamped separately. It is, of course, also possible to allow parts of a lockable sliding element, or one entire lockable sliding element, to act simultaneously on both clamping bars.

The displacement of the clamping bars and the sliding element can be carried out manually as well as with the aid of control devices (not shown).

The mechanism described above for keeping the clamping force constant, or allowing it to increase, is not limited to the embodiment of the clamping device described above having a lockable sliding element, but can also be used in rotatable drums with clamping bars which are locked in another, possibly known, manner.

Claims

1. Clamping device for releasably clamping a sheet which is fitted around the peripheral surface of a drum, with the aid of two clamping bars, the clamping bars extending axially along the drum and being able to be moved essentially in the radial direction between a clamping position and a release position, and there being provided, for each clamping bar, underlying clamping parts, characterized in that each clamping bar (10) is movably connected to a sliding element (12) which can move essentially in the radial direction and is provided with a locking mechanism for locking the sliding element (12) in a first or second locking position, intermediate means (13) being arranged between the clamping bar (10) and the sliding element (12), which intermediate means press the clamping bar (10), at least in one of the two locking positions of the sliding element (12), against the underlying clamping parts (11).

2. Clamping device according to claim 1, characterized in that the locking mechanism is formed by projecting parts (21) which are connected to the sliding element (12) and can follow a track (22) in which the first and the second locking position are incorporated.

3. Clamping device according to claim 1 or 2, characterized in that each clamping bar (10) is connected to at least one centrifugal weight (50) by means of a lever system (59) in such a way that, when the drum (1) is rotating, the radially outwardly directed force acting on the centrifugal weight (50) is converted into a radially inwardly directed force acting on the clamping bar (10).

4. Clamping device according to claim 3, characterized in that a spring (51) is arranged between the clamping bar (10) and the centrifugal weight (50) with such a tension that when the drum (1) is stationary, the spring (51) presses the clamping bar (10) radially outwards.

5. Clamping device according to one or more of the preceding claims, characterized in that the intermediate means (13) are formed by spring means.

6. Clamping device according to one or more of the preceding claims, characterized in that the clamping bar (10) and the sliding element (12) are connected to one another by means of a pin-and-slot connection (40, 41, 42, 43).

7. Clamping device for releasably clamping a sheet which is fitted around the peripheral surface of a drum, with the aid of two clamping bars, the clamping bars extending axially along the drum and being able to be moved essentially in the radial direction between a clamping position and a release position, and there being provided, for each clamping bar, underlying clamping parts, characterized in that each clamping bar (10) is connected to at least one centrifugal weight (50) by means of a lever system (59) in such a way that, when the drum (1) is rotating, the radially outwardly directed force acting on the centrifugal weight (50) is converted into a radially inwardly directed force acting on the clamping bar (10).

8. Clamping device according to claim 7, characterized in that a spring (51) is arranged between the

clamping bar (10) and the centrifugal weight (50) with such a tension that when the drum (1) is stationary, the spring (51) presses the clamping bar (10) radially outwards.

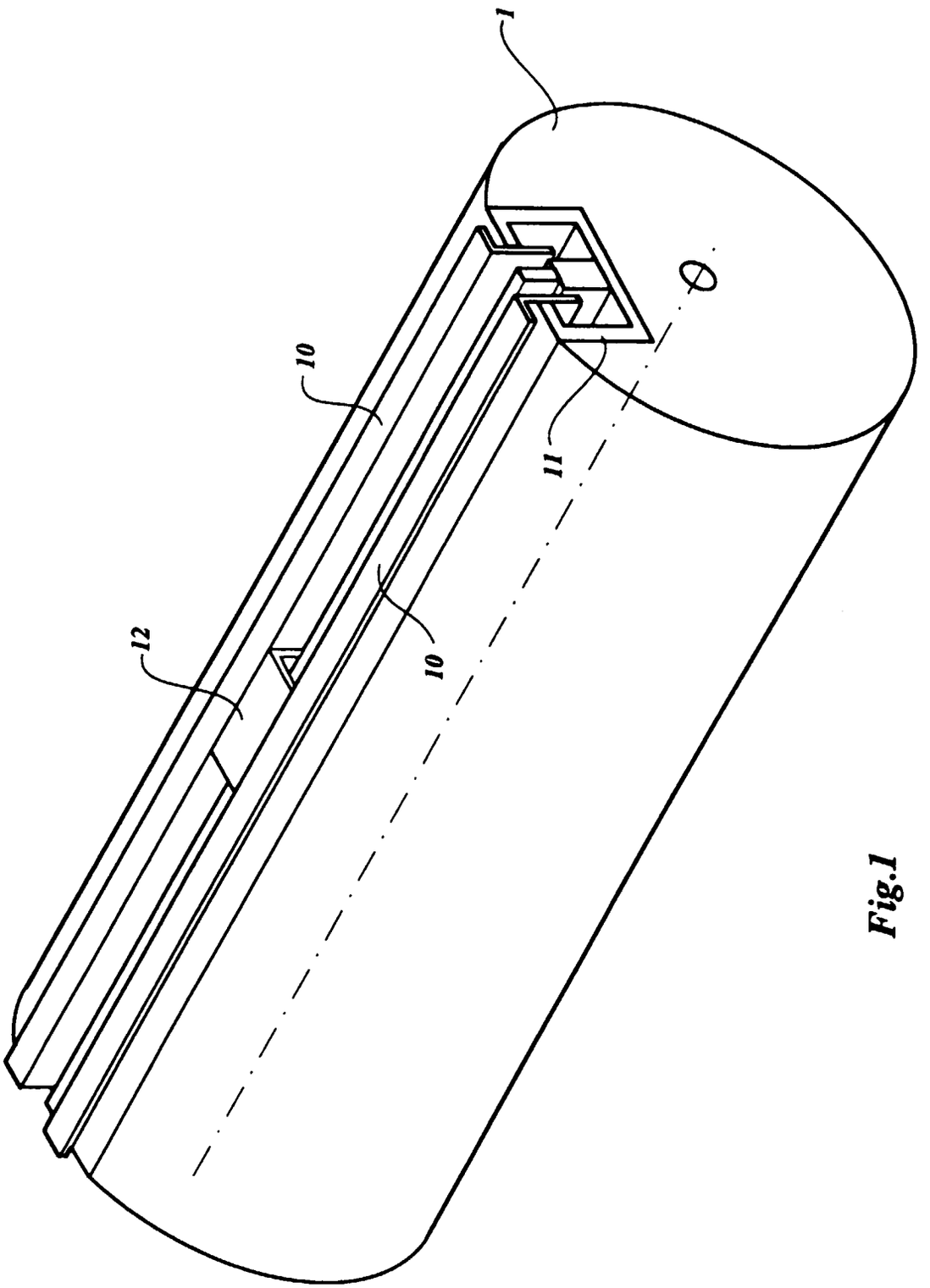

Fig.1

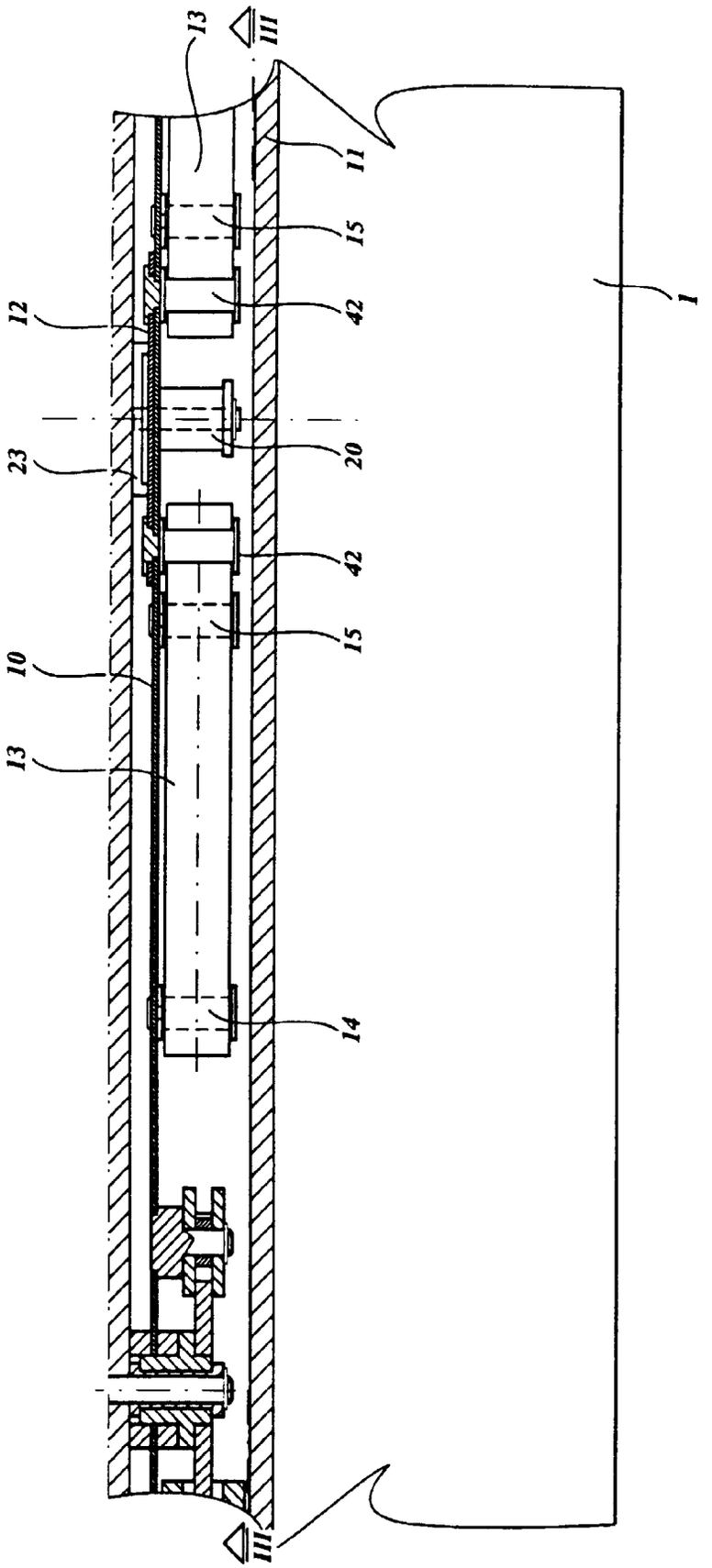

Fig. 2

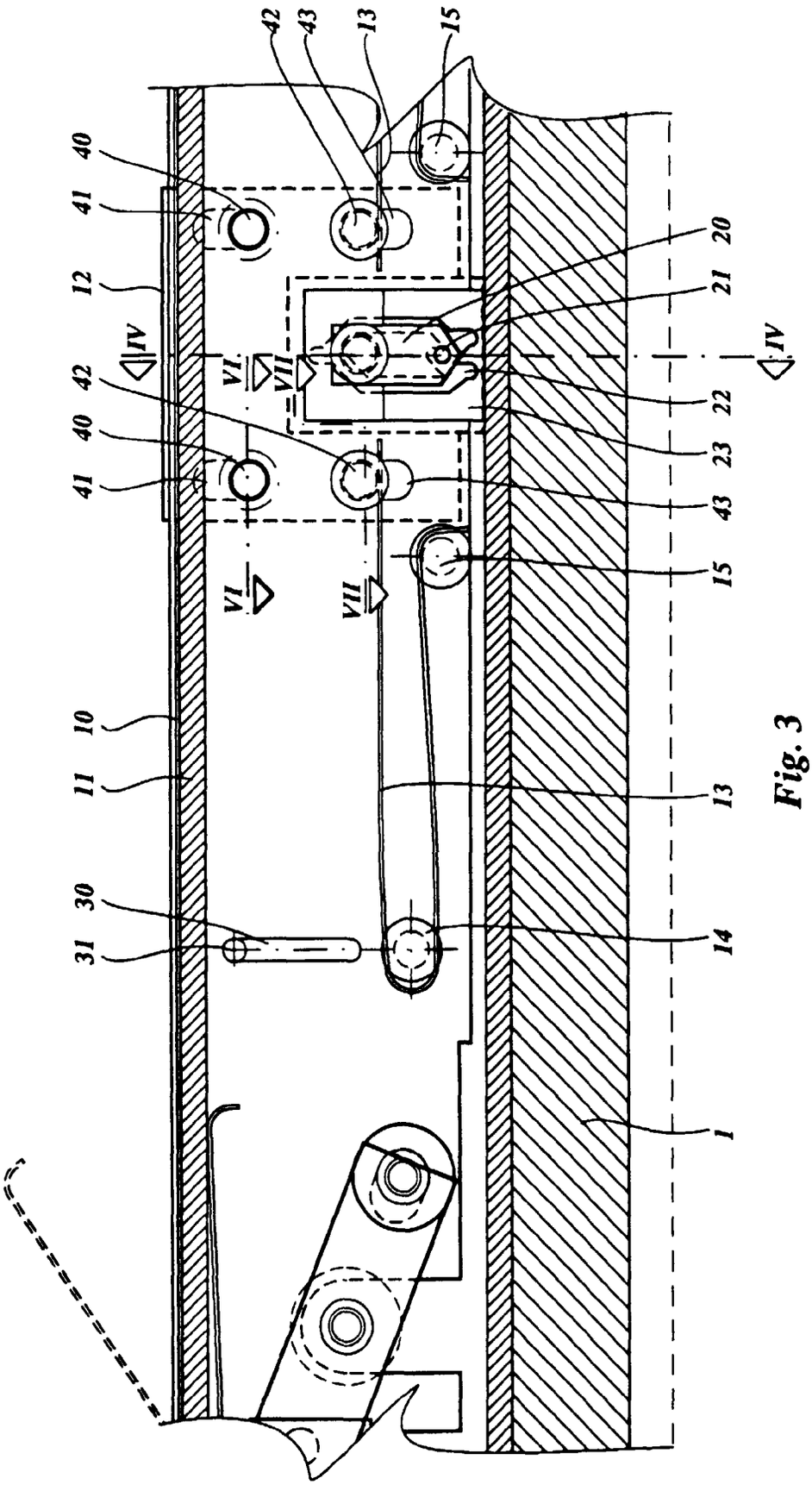
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Fig. 3

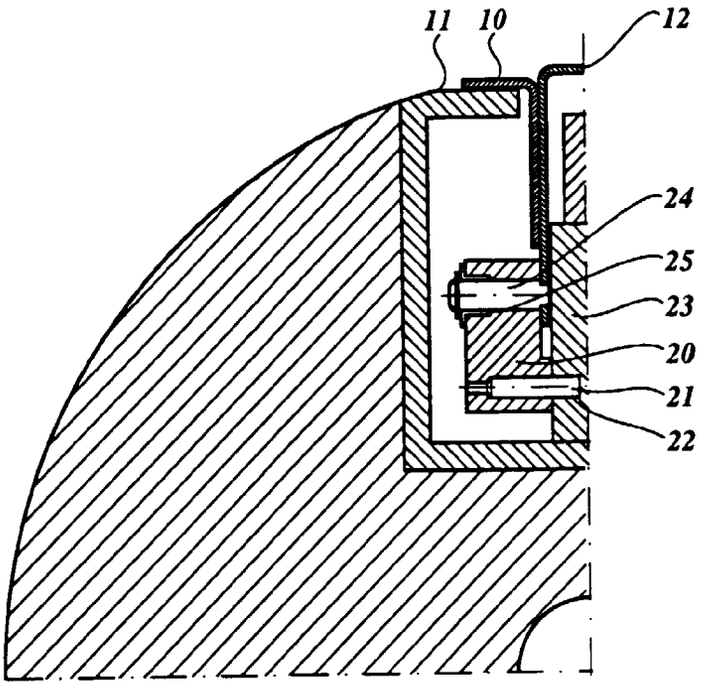

Fig. 4

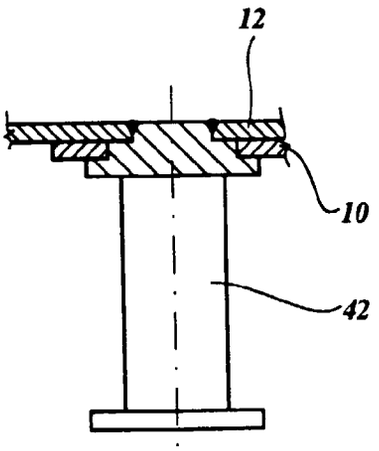

Fig. 7

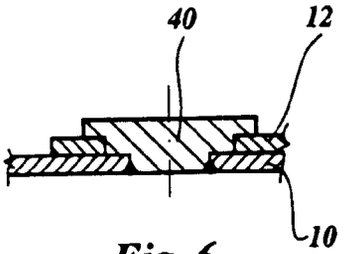

Fig. 6

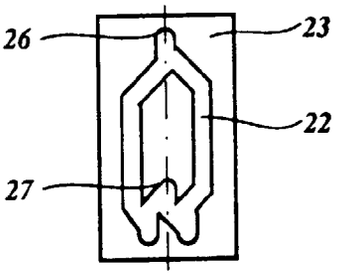

Fig. 5

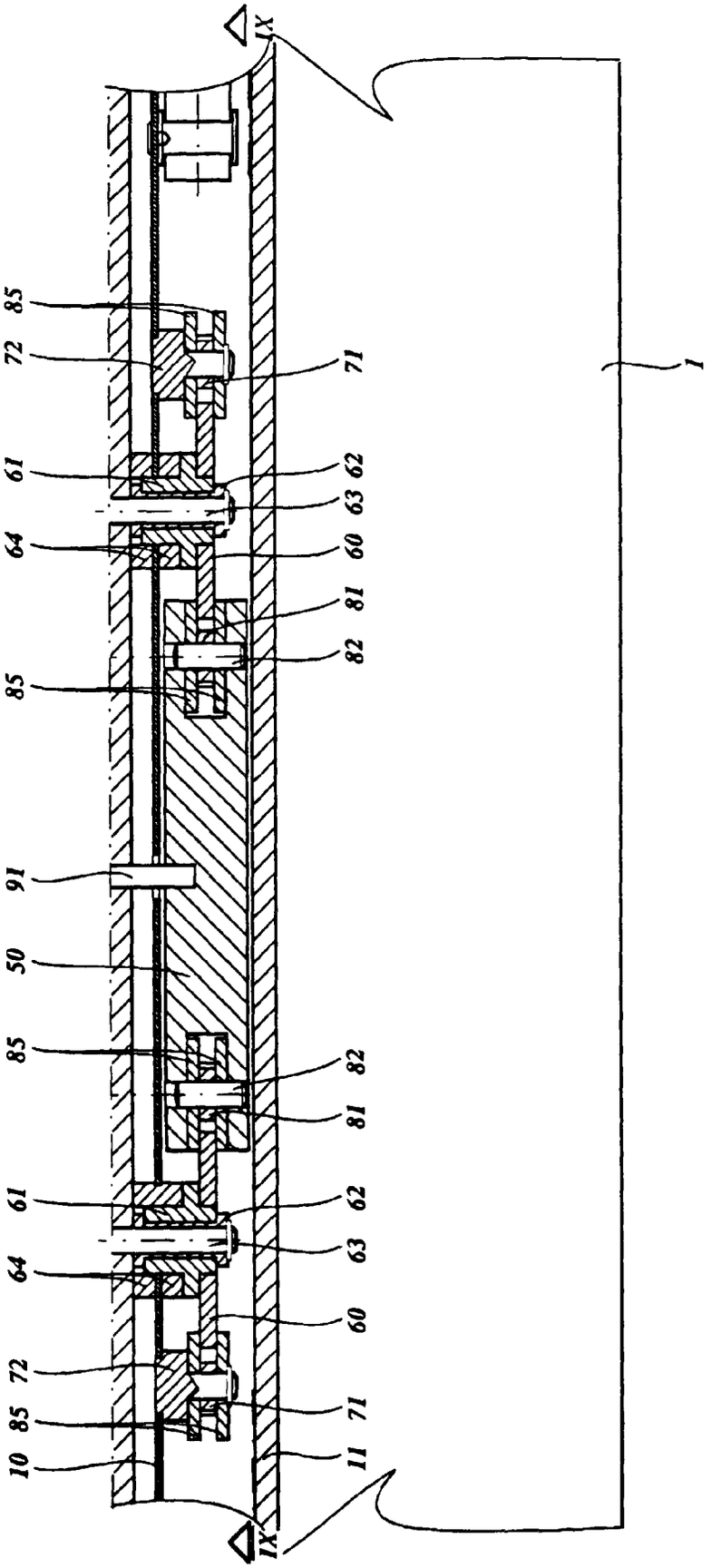
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Fig. 8

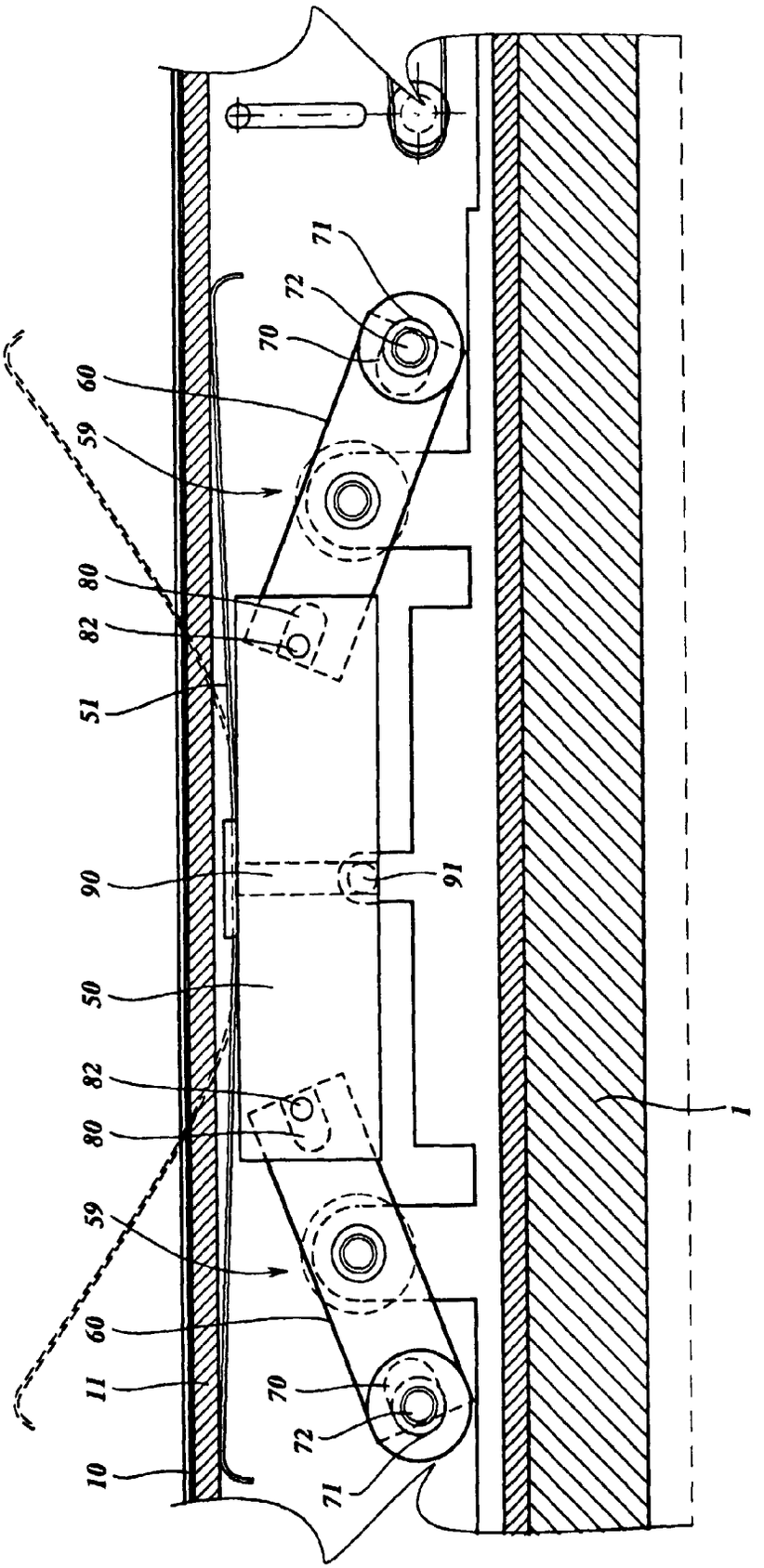

Fig. 9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 20 1196

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	EP-A-0 299 645 (POLAROID CORPORATION) 18 January 1989	7	B41J13/22
Y		8	
A	* column 4, line 12 - column 7, line 17; figures *	1,3	
Y	US-A-5 218 379 (SCHMITT ET AL.) 8 June 1993	8	
A	* column 4, line 12 - line 26 *	1,2	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B41J
H04N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	6 June 1996	De Groot, R

CATEGORY OF CITED DOCUMENTS

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