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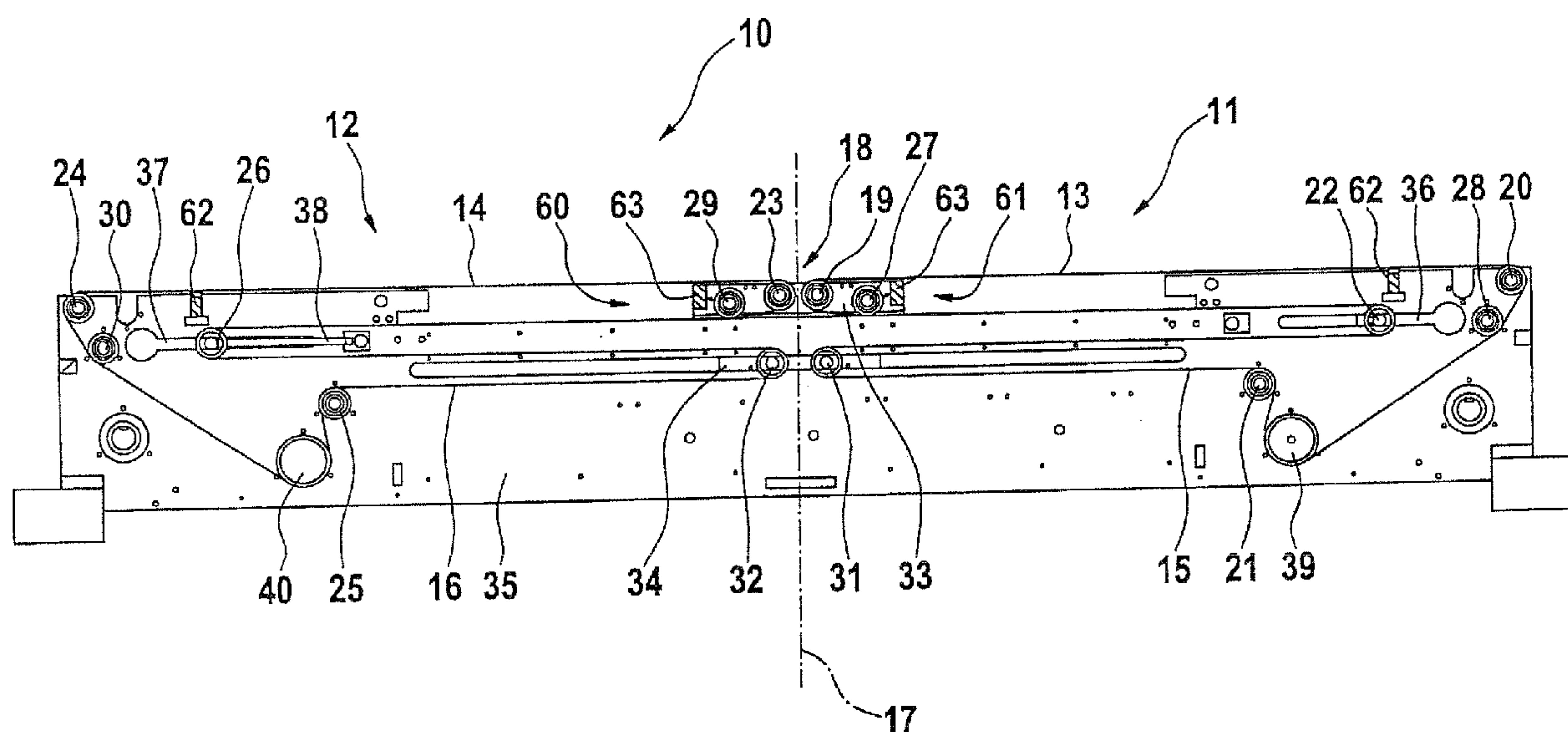
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(54) Titre : APPAREIL POUR LE TRANSPORT TRANSVERSAL DE RAMES

(54) Title: APPARATUS FOR TRANSVERSE CONVEYANCE OF REAMS



(57) **Abrégé/Abstract:**

The invention concerns an apparatus for conveying objects transversely to their direction of initial transport. In apparatuses of this kind there are provided two conveying elements which are arranged on a common sliding element in the region of a dividing gap. The sliding element is simultaneously also the equalising element for the conveying elements in case of displacement of the sliding element. As both tensioning or guiding rollers and the equalising rollers are arranged on the sliding element, it has a long length, so that the path of displacement is limited. It is now the object of the invention to provide an apparatus which ensures a longer path of displacement of the conveying elements, so that more flexible separation of a stream of reams deposited on the apparatus can take place. This is achieved by the fact that the sliding element and the equalising element are separate elements. As a result, an arrangement which is very compact and so allows a longer path of displacement is provided.

Abstract

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This is achieved by the fact that the sliding element and the equalising element are separate elements. As a result, an arrangement which is very compact and so allows a longer path of displacement is provided.

Apparatus for transverse conveyance of reams

Description

The invention concerns an apparatus for conveying objects transversely to their direction of initial transport, essentially including two conveying elements which each have a transport region and a return region and can be driven independently of each other by means of a drive and are located opposite each other, forming a dividing gap with an imaginary centre axis, in each case a set of deflecting rollers for guiding, tensioning and equalising the conveying elements, a sliding element for changing the transport region or return region, whereby the sliding element connects the conveying elements to each other, and an equalising element for compensating for the change in the return region or transport region.

Known apparatuses of this kind are used e.g. in the paper-making industry for the transport of stacked pages, sheets or the like made of cardboard, paper, plastic or other stackable materials from a collecting station mounted behind a production machine, to packing machines or the like.

Within a usually multiple-up or multiple yield production machine, so-called reams of paper in the form of layers of sheets or stacks of sheets are formed continuously by longitudinal and/or transverse cutting of webs of material, e.g. webs of paper. Several reams of paper located closely adjacent to each other form a row of reams, which is hereinafter also referred to as a stream of reams. This stream of reams is deposited in a collecting station. By suitable means, appropriately a gripper system, the stream of reams is pulled onto or deposited on an apparatus for conveying the reams transversely to their direction of initial transport. A stream of reams consists of at least two reams, but can be extended to a multiple thereof. Each stream of reams is however as a rule further processed, namely, preferably packed. The individual apparatuses, e.g. the production machine and the packing machine, are therefore adapted to each other with their respective production capacities. For example, a 14-up production machine usually produces

more reams than a single packing machine can accept. In order to increase the productivity of such product lines, i.e. to adapt acceptance to production, packing machines are preferably arranged on both sides of the production machine or collecting station. As a rule, both packing machines are supplied with reams uniformly. By way of example, this means that a stream of ten reams, that is, e.g. stacks of 500 sheets of paper of DIN A4 format composed of ten yields, is divided uniformly, so that the apparatus for conveying the reams transversely to their direction of initial transport carries away five reams each on both sides. For this purpose the apparatus is divided in the region of a dividing gap, so that conveying of a number of reams to either side is ensured. This dividing gap is slidable to allow unequal delivery to the packing machines arranged on both sides, e.g. in the event that one of the packing machines stops due to a defect or because the packing machines are to be loaded differently. For sliding the dividing gap, the sliding element is slid in one or the other direction. As a result, there is a lengthening of the supporting surface or, to be more precise, of the transport region, of one conveying element, while at the same time the transport region of the other conveying element is shortened by the same amount. For this, equalising rollers are also arranged on the sliding element. Both a lengthening of the transport region of one conveying element and the shortening of the transport region of the other conveying element are compensated by suitable adaptation of the return regions of the conveying elements.

A drawback of the known apparatus, however, is that, due to the dimension of the sliding element which is used to receive guiding or tensioning rollers, on the one hand, and equalising rollers, on the other hand, only a short path of displacement can be produced. With a standard yield width of e.g. DIN A4, only one displacement by one copy width out of the centre position is possible. In other words, the known apparatus ensures a division of 6:4, 5:5 and 4:6. The division of the stream of reams is therefore very limited. Furthermore, it is of course also possible for both conveying elements to be driven in the same direction, so that a division of 10:0 or 0:10 is possible. However, as the capacity of the packing machines is limited, and so the production machine produces more reams than can be accepted by a packing machine, the throughput of the production machine must inevitably be throttled, which in turn leads to production losses.

It is therefore the object of the present invention to provide a simple and compact apparatus which ensures more flexible distribution of the reams supplied, to the subsequent packing machines.

This object is achieved by an apparatus of the kind mentioned hereinbefore by the fact that the sliding element and the equalising element are separate elements. As a result, an increase in flexibility is provided in a surprisingly simple and effective manner. The provision of an equalising element which is separate from the sliding element separates from each other the functions of displacing the dividing gap and equalising the conveying elements on account of displacement of the dividing gap, so that with the same size of apparatus a longer path of displacement of the sliding element is produced. With the solution of the invention it is e.g. also possible to divide a stream of ten reams in a ratio of 3:7 or 7:3.

Advantageously, the sliding element can be driven actively and the equalising element can be moved passively. As a result, only one drive is required. By driving the sliding element it is possible to change the transport region, namely, lengthen or shorten it, at the same time shortening or lengthening the return region, whereby equalisation takes place automatically, retaining the tension of the conveying elements.

In a preferred embodiment, the sliding element and the equalising element are functionally connected via the conveying elements, so that the displacement of the sliding element can be transmitted directly to the equalising element without additional means.

Particularly preferred is the apparatus in which on the sliding element or sliding carriage is arranged in each case only one tensioning or guiding roller of each set of deflecting rollers. As a result, a particularly compact construction of the apparatus can be achieved, at the same time leading to an increase in the path of displacement of the sliding element.

Preferably, a common tensioning device is provided for both conveying elements, with the result that firstly costs are saved and secondly a compact design of the apparatus is produced.

Advantageously, each transport region is assigned a supporting device which for its part is in each case variable in length in the direction of transport of the sliding element. Thus support of the transport regions is obtained, so that, particularly when the transport regions are subjected to a load in the form of stacks of reams or acted upon by operators, sagging of the transport regions is effectively prevented.

Further characteristics and embodiments of the invention are apparent from the subsidiary claims and the description. A particularly preferred embodiment as well as the basic principle of the invention are described in more detail with the aid of the attached drawings. The drawings show:

- Fig. 1 a side view of the whole apparatus without side panelling,
- Fig. 2 a schematic view of part of the apparatus, namely, the partial view of the conveying elements with sliding carriage and equalising carriage in the symmetrical position of the conveying elements,
- Fig. 3 the view of Figure 2 with the sliding carriage slid to the right,
- Fig. 4 the view of Figure 2 with the sliding carriage slid to the left,
- Figs. 5a to 5d a sequence of steps of conveying reams transversely to their direction of initial transport with uniform ream separation,
- Figs. 6a to 6d a sequence of steps of conveying reams transversely to their direction of initial transport with non-uniform ream separation, and

Fig. 7 a perspective view of a supporting device for supporting the transport regions of the apparatus in Figure 1.

The invention concerns an apparatus for the transport of reams of paper transversely to their direction of initial transport from a production machine.

Figure 1 shows an apparatus 10 for conveying layers of sheets or stacks of sheets, so-called reams, transversely to their direction of initial transport from a production machine (not shown). The apparatus 10 includes two separate conveying elements 11, 12 which in the preferred embodiment are designed as transport cloths. It is, however, also possible for the conveying elements 11, 12 to be composed of other ordinary conveying means, e.g. conveyor belts, toothed belts or the like. The conveying elements 11, 12 are each designed to rotate endlessly and have a transport region 13 or 14 and a return region 15 or 16. The transport regions 13, 14 each face towards the reams to be conveyed and form, as it were, the supporting surface for the reams, whereby the supporting surfaces of both conveying elements 11, 12 are located in the same plane and all together form a transport region of constant length. The return regions 15, 16 are of loop-like construction and serve to compensate for the change in the transport regions 13, 14 and for holding the tension of the conveying elements 11, 12.

The two conveying elements 11, 12 are located opposite each other and form between them, in the region of an imaginary centre axis 17, a dividing gap 18. For guiding, tensioning and equalising the conveying elements 11, 12, they each have a set of deflecting rollers. In the embodiment shown, each set of deflecting rollers consists of several, preferably four tensioning or guiding rollers 19, 20, 21, 22 or 23, 24, 25, 26, respectively, two control rollers 27, 28 or 29, 30, respectively, and one equalising roller 31 or 32 each. It is, however, also conceivable for each set of deflecting rollers to have additional tensioning, guiding, control or equalising rollers. In particularly simple embodiments, individual tensioning, guiding and equalising rollers can also be dispensed with. Furthermore, instead of the control rollers 27, 28 or 29, 30, the use of other control elements for the conveying elements 11, 12 is possible. Thus e.g. so-called profile/groove connections

may be provided for control of the conveying elements 11, 12. For this purpose, at least some of the rollers wrapped by the conveying elements 11, 12 have radially oriented grooves in which run corresponding profiles which are located on the conveying elements 11, 12 on the side facing towards the rollers in the longitudinal direction. As a result, the conveying elements 11, 12 are effectively prevented from coming off the rollers laterally, and a simple form of control is achieved.

The dividing gap 18 is variable in position, this being by a sliding element 33. The sliding element 33, which is preferably designed as a sliding carriage, connects the conveying elements 11, 12 to each other in the region of the dividing gap 18. On the sliding element 33 are arranged the tensioning or guiding roller 19 and the control roller 27 of the conveying element 11, as well as the tensioning or guiding roller 23 and the control roller 29 of the conveying element 12, wherein the dividing gap 18 is formed between the two tensioning or guiding rollers 19 and 23. Alternatively, the control rollers 27 and 29 can be dispensed with. The sliding element 33 is slidable or movable in both directions in a horizontal plane. For actively driving the sliding element 33, the latter is assigned an actuating mechanism (not shown). By the arrangement described, displacement of the sliding element 33 without loss of tension of the conveying elements 11, 12 is ensured.

As the conveying elements 11, 12 in each case have a constant length, upon displacement of the sliding element 33 compensation for shortening or lengthening of the transport region 13 or 14 is required. For this purpose there is provided an equalising element 34 which is designed as a separate element and movable parallel in the opposite direction to the sliding element 33. The equalising element 34 is also preferably designed as an equalising carriage. On the equalising element 34 are arranged the two equalising rollers 31, 32. The equalising element 34 is free from drive means and connects the conveying elements 11, 12 in their return regions 15, 16. By the conveying elements 11, 12, the sliding element 33 and the equalising element 34 are functionally connected to each other in such a way that driving of the sliding element 33 is transmitted to the equalising element 34. The equalising element 34 is entrained by the sliding element 33, so to speak, however in the opposite direction.

The tensioning or guiding rollers 20, 21, 22 or 24, 25, 26, respectively, are arranged stationarily on a supporting element, appropriately on a side wall 35 or in a guide 36, 37. The guides 36, 37 are designed as oblong holes, so that the position of the tensioning or guiding rollers 22, 26 is adjustable. In the region of one of the two guides 36, 37, in the embodiment in the region of the guide 37, is provided a tensioning device 38 by means of which the tension of the conveying elements 11, 12 is adjustable. Further, it is also possible for the tensioning device 38 to be provided in the region of the guide 36 or on two guides 36, 37 simultaneously.

Each conveying element 11, 12 has a separate drive means. The conveying element 11 is therefore assigned a drive shaft 39, and the conveying element 12 is assigned a drive shaft 40. The drive shafts 39, 40 are in each case arranged in the return region 15, 16 of the conveying elements 11, 12. Each drive shaft 39, 40 allows, independently of each other, movement of the conveying means 11, 12 in both directions and at a freely selectable speed. In the region of the drive shafts 39, 40 is arranged in each case a deflecting roller, namely, the tensioning or guiding roller 21 or 25, for maintaining the tension of the respective conveying element 11 or 12.

Optionally, in the region of the transport regions 13, 14 can be provided in each case a supporting device 60, 61 which can also be referred to as a cover. Each supporting device 60, 61 in the embodiment shown is variable in length telescopically in the longitudinal direction of the path of displacement in arrow direction 47 and 48 of the sliding element 33. An example of a supporting device 60 is shown in Figure 7. The supporting device 60 shown is reproduced in the left half of Figure 1 and has a stationary crossbar 62 and a movable crossbar 63. Between the crossbars 62, 63 are arranged finger-like supporting elements 64 which extend in the direction of movement of the sliding element 33 and interlock. The movable crossbar 63 is arranged on the sliding element 33 and functionally connected thereto. This means that upon movement of the sliding element 33 the nested supporting elements 64 are pushed together in one direction and pulled apart in the other direction, so that the transport region 14 located over the supporting elements 64 is per-

manently supported. The supporting device 61 has a corresponding construction. Instead of the nested, interlocking supporting elements 64, collapsible flat plates or the like located one above or under the other can be provided. Further embodiments, not shown, have fully movable and/or flexible supporting devices, e.g. cable systems or the like.

With the aid of Figures 2 to 4, the basic principle of the invention is described in more detail. The conveying elements 11, 12 are connected to each other on the upper side, that is, in the transport region 13 or 14, via tensioning or guiding rollers 19 and 23 on the sliding element 33. To put it another way, each conveying element 11, 12 is arranged on the common sliding element 33, so that the two conveying elements 11, 12 are functionally connected to each other. Below the sliding element 33 is arranged the equalising element 34 to which are attached the equalising rollers 31, 32. To form a loop-like or S-shaped path, that is, a so-called S-lay, of the conveying elements 11, 12 to form tension of the conveying elements 11, 12, the tensioning or guiding rollers 22, 26 are offset inwards, that is, away from the centre axis 17. In other words, the centre axes 41, 42 of the guiding rollers 22, 26 are a greater distance from the centre axis 17 than the centre axes 43 and 44 of the tensioning or guiding rollers 19 or 23 and the centre axes 45, 46 of the equalising rollers 31, 32.

If the sliding element 33, starting from the centre axis 17, is now driven to the right in the direction of the arrow 47 (see Figure 3), the transport region 13 of the conveying element 11 is shortened, while the transport region 14 of the conveying element 12 is lengthened by the same amount. There is a corresponding change in the length of the supporting elements 61, 62. To compensate for shortening, on the one hand, and lengthening, on the other hand, the equalising element 34 which is functionally connected to the sliding element 33 is moved to the left in the opposite direction to the latter, so that the return region 15 of the conveying element 11 is lengthened, while the return region of the conveying element 12 is shortened. Upon displacement of the sliding element 33 to the left in the direction of the arrow 48 (see Figure 4) starting from the centre axis 17, the compensation is reversed accordingly. In all movements of the sliding element 33 it is necessary to limit the path of displacement in both directions in such a way that the centre axes 41

and 42 of the tensioning or guiding rollers 22, 26 are always at a greater distance from the centre axis 17 than the centre axes 43 to 46.

Various options for dividing a stream 49 consisting of several reams 50 are illustrated with the aid of Figures 5 and 6. Both figures describe the conveying of a stream 49 which consists of ten reams. In Figures 5a to 5d is shown the simultaneous division of the stream 49. A phase of the production machine, that is, the stream 49, is deposited on the apparatus 10. This can be done by a gripper carriage 51 or the like. The conveying elements 11, 12 are symmetrical to the centre axis 17, so that the respective transport regions 13, 14 have the same length. The stream 49 is therefore uniformly separated during driving of the conveying elements 11, 12, so that five reams 50, each, are transported on both sides. The separated ream streams 52 and 53 are then moved to an output, e.g. a conveyor belt. As soon as the apparatus 10 is free, i.e. there are no more reams 50 on the transport regions 13, 14, the next phase can be deposited on the apparatus 10.

Figures 6a to 6d describe conveying with a stream 49 to be separated non-uniformly. The stream 49 is pulled onto the apparatus 10 by means of the gripper carriage 51 or the like, and deposited on the apparatus 10. Firstly, however, the conveying elements 11, 12 have been adjusted in such a way that the transport region 13 of the conveying element 11 is decreased and the transport region 14 of the conveying element 12 is increased, this being by a length which roughly corresponds to the width of two copies or reams 50. Thus, division of the apparatus 10 is effected in a ratio of 70:30 or 30:70. As soon as the drive shafts 39, 40 set the conveying elements 11, 12 in motion, the partial streams 55 and 56 are transported to outputs. When the partial streams 55, 56 have completely departed from the apparatus 10, a new stream 49 can be guided into the region of the apparatus 10.

With the apparatus 10, partial streams other than the shown partial streams 52, 53, 55, 56 can also be formed. This essentially depends on the respective assignment at the subsequent packing machines. Furthermore, it is also possible to drive both conveying elements 11, 12 in the same direction, so that a complete stream can be conveyed to one side.

Claims

1. Apparatus for conveying objects transversely to their direction of initial transport, essentially including two conveying elements (11, 12) which each have a transport region (13, 14) and a return region (15, 16) and can be driven independently of each other by means of a drive and are located opposite each other, forming a dividing gap (18) with an imaginary centre axis (17), in each case a set of deflecting rollers for guiding, tensioning and equalising the conveying elements, a sliding element (33) for changing the transport region (13, 14) or return region (15, 16), whereby the sliding element (33) connects the conveying elements (11, 12) to each other, and an equalising element (34) for compensating for the change in the return region (15, 16) or transport region (13, 14), characterized in that the sliding element (33) and the equalising element (34) are separate elements.
2. Apparatus according to claim 1, characterized in that the equalising element (34) connects the conveying elements (11, 12) to each other independently of the sliding element (33).
3. Apparatus according to claim 1 or 2, characterized in that the sliding element (33) can be driven actively and the equalising element (34) can be moved passively.
4. Apparatus according to claim 3, characterized in that the sliding element (33) and the equalising element (34) are movable parallel and in opposite directions to each other in a horizontal plane, whereby the movement of the sliding element (33) can be transmitted automatically to the equalising element (34).
5. Apparatus according to any one of claims 1 to 4, characterized in that the sliding element (33) is functionally connected to the equalising element (34) via the conveying elements (11, 12).

6. Apparatus according to any one of claims 1 to 5, characterized in that a displacement of the sliding element (33) and hence of the dividing gap (18) can be compensated by means of the equalising element (34).
7. Apparatus according to any one of claims 1 to 6, characterized in that the sliding element (33) is designed as a sliding carriage and the equalising element (34) is designed as an equalising carriage.
8. Apparatus according to any one of claims 1 to 7, characterized in that each set of deflecting rollers consists of at least three tensioning or guiding rollers (19, 20, 22; 23, 24, 26) and at least one equalising roller (31; 32).
9. Apparatus according to claim 8, characterized in that the equalising rollers (31; 32) are arranged on the equalising element (34) or equalising carriage.
10. Apparatus according to claim 8 or 9, characterized in that on the sliding element (33) or sliding carriage is arranged in each case a tensioning or guiding roller (19; 23) of each set.
11. Apparatus according to any one of claims 1 to 10, characterized in that the other deflecting rollers of each set are arranged stationarily on a supporting element, preferably a side wall (35), or in the region of guides (36, 37).
12. Apparatus according to any one of claims 8 to 11, characterized in that the tensioning or guiding rollers (19, 22; 23, 26) and equalising rollers (31; 32) of each set are arranged in the region of the dividing gap (18) in such a way that the conveying elements (11, 12) have an S-shaped path.
13. Apparatus according to any one of claims 1 to 12, characterized in that each set of deflecting rollers has in addition at least one control roller (27, 28; 29, 30), whereby the control rollers (27; 29) are arranged on the sliding element (33).

14. Apparatus according to any one of claims 1 to 13, characterized in that a common tensioning apparatus (38) is provided for both conveying elements (11, 12).
15. Apparatus according to any one of claims 1 to 14, characterized in that the conveying elements (11, 12) are designed as rotating, endless conveyor belts or transport cloths.
16. Apparatus according to any one of claims 1 to 15, characterized in that the apparatus (10) is additionally assigned means whereby the objects can be transported in the direction of the conveying elements (11, 12) running transversely to the direction of initial transport of the objects, and deposited thereon.
17. Apparatus according to claim 16, characterized in that the additional means includes a conveying element running transversely to the apparatus (10) or to the conveying elements (11, 12), and/or a gripper carriage (51).
18. Apparatus according to any one of claims 1 to 17, characterized in that each transport region (13, 14) is assigned a supporting device (60, 61) which for its part is in each case variable in length in the direction of transport of the sliding element (33).

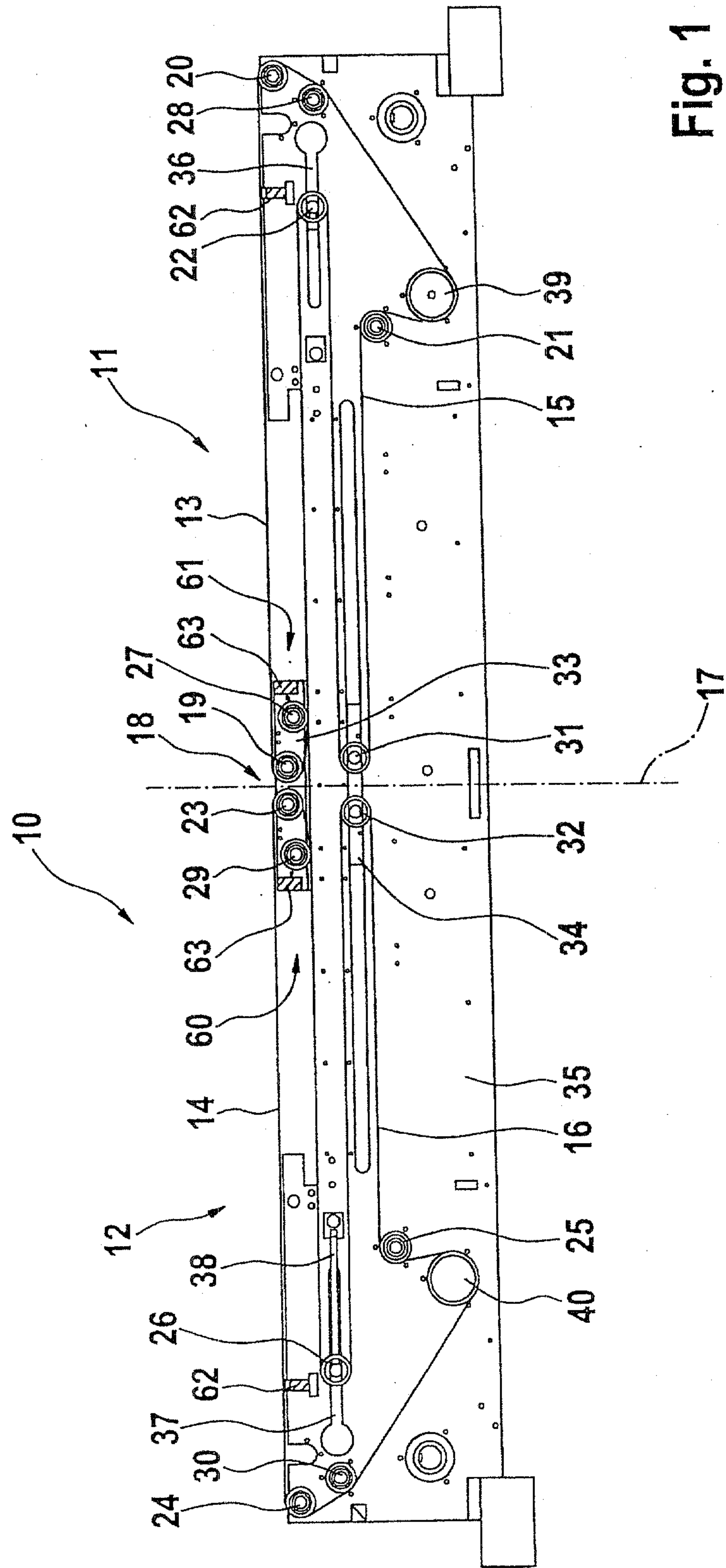


Fig. 1

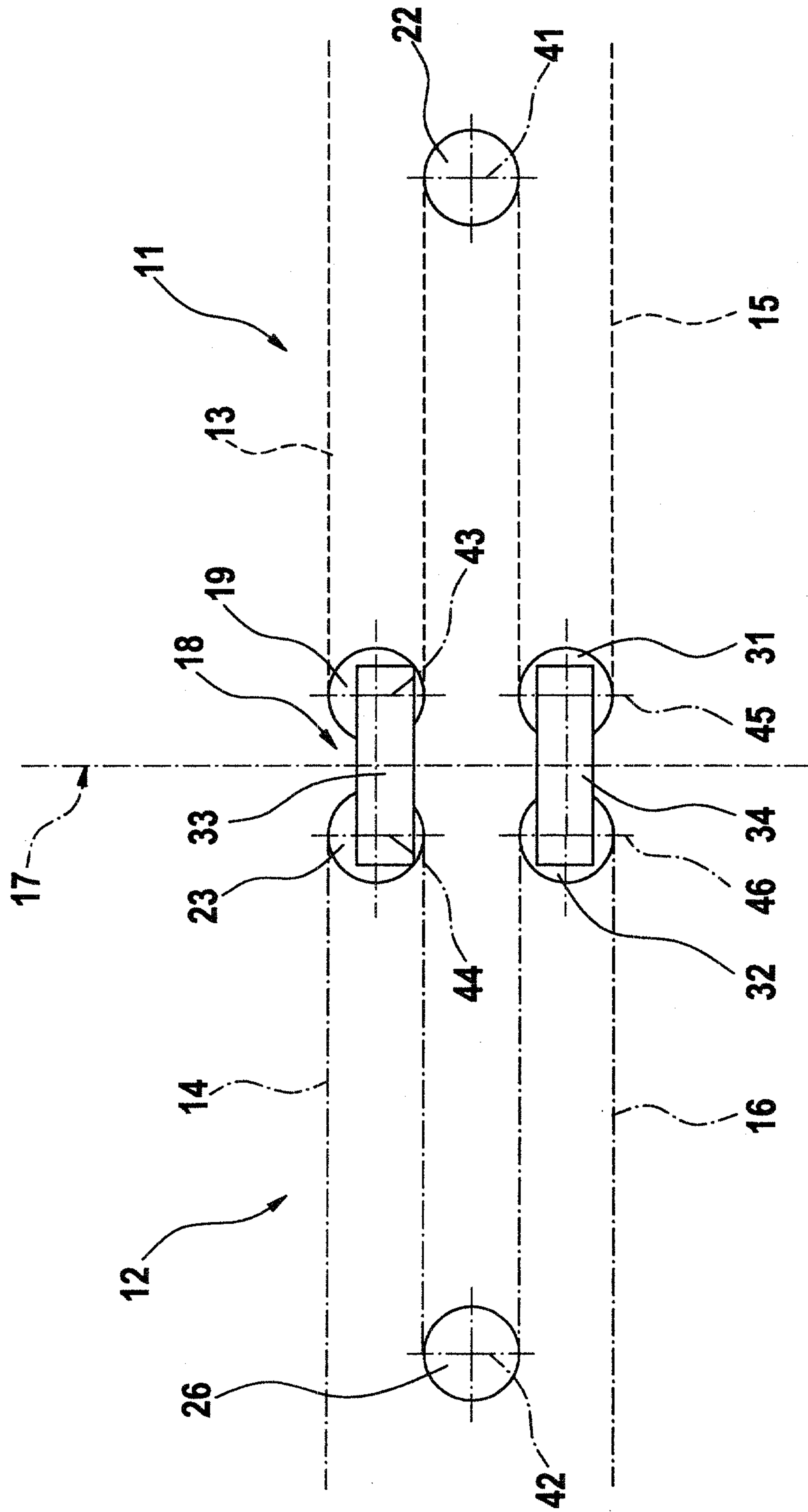


Fig. 2

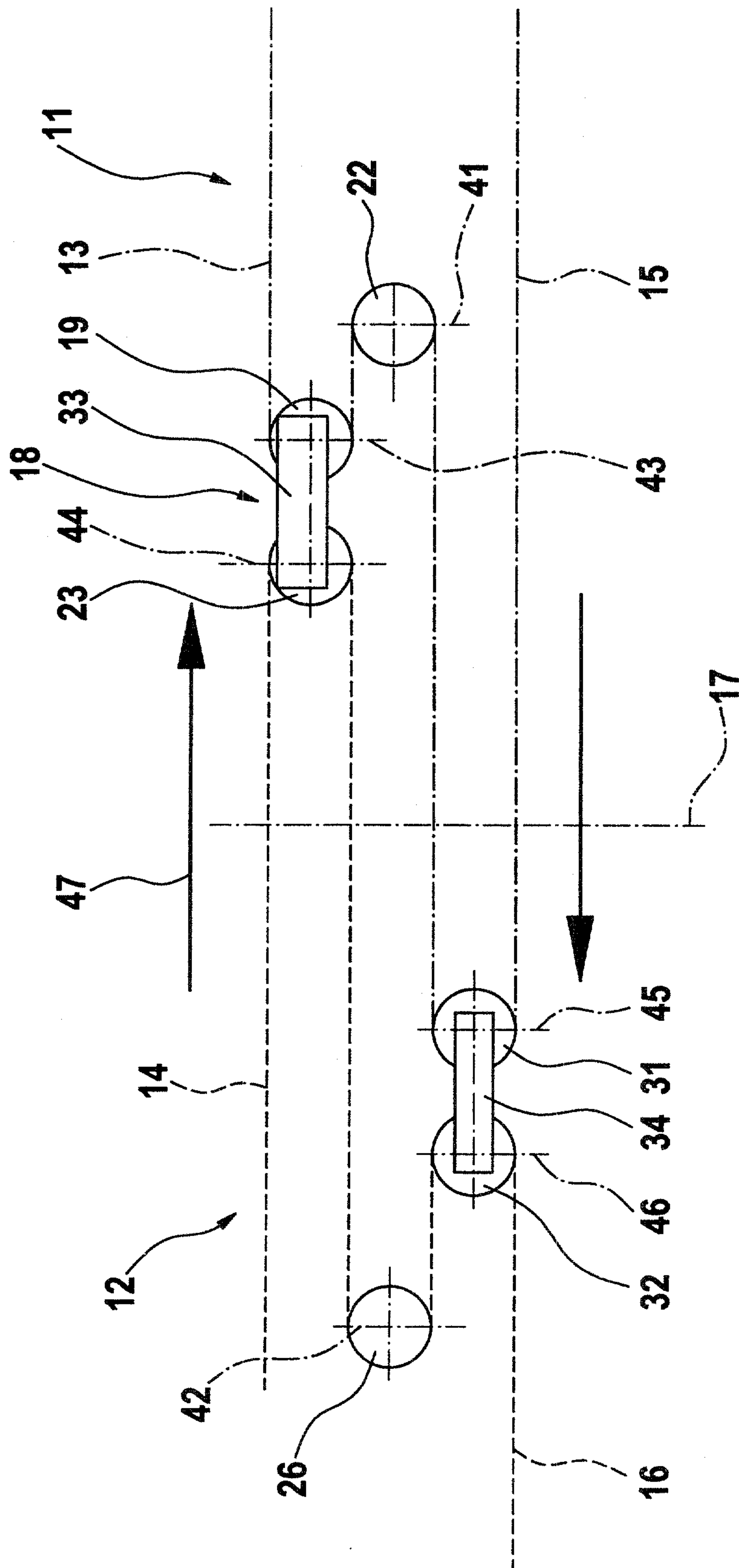


Fig. 3

Fig. 4

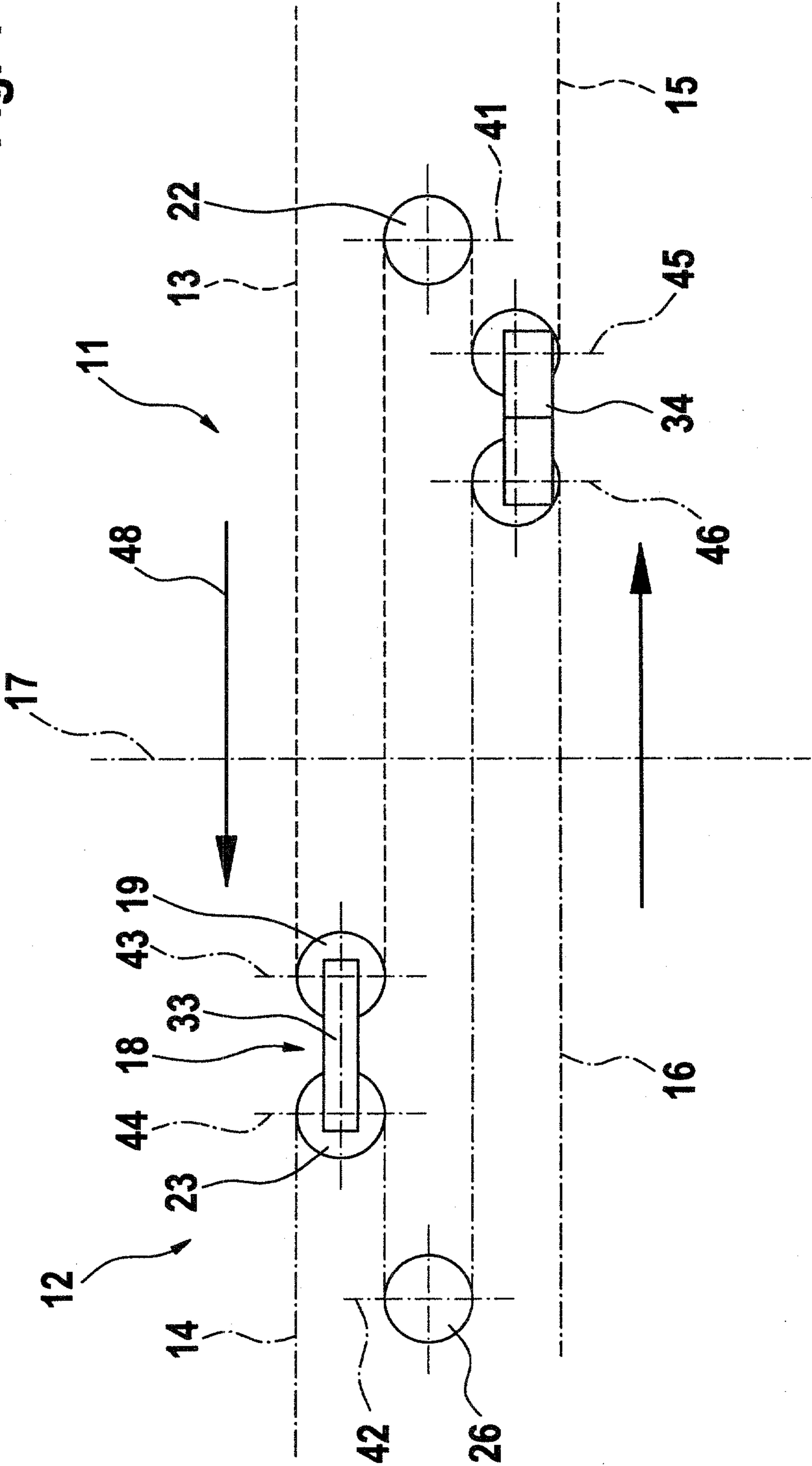


Fig. 5a

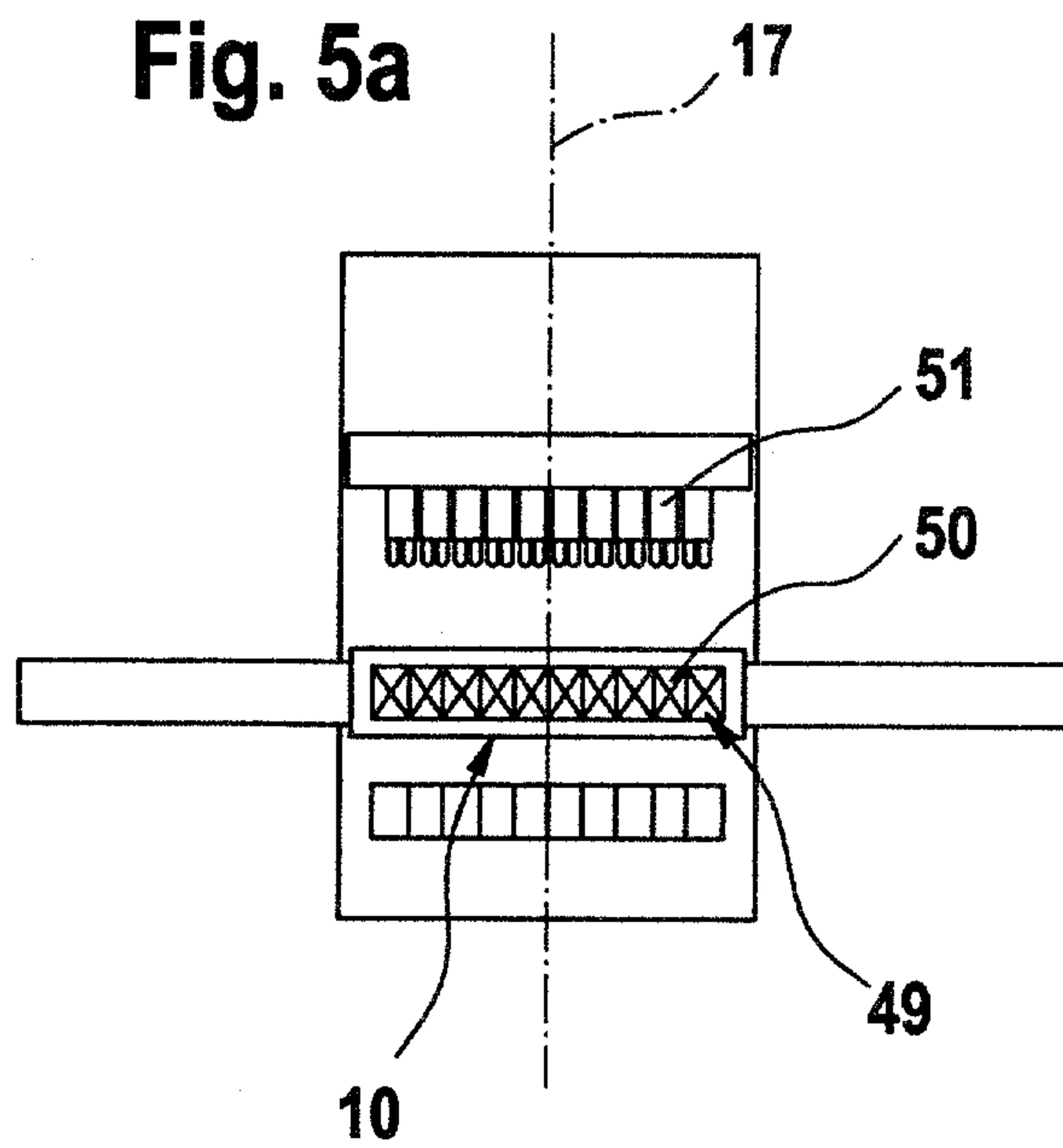


Fig. 5b

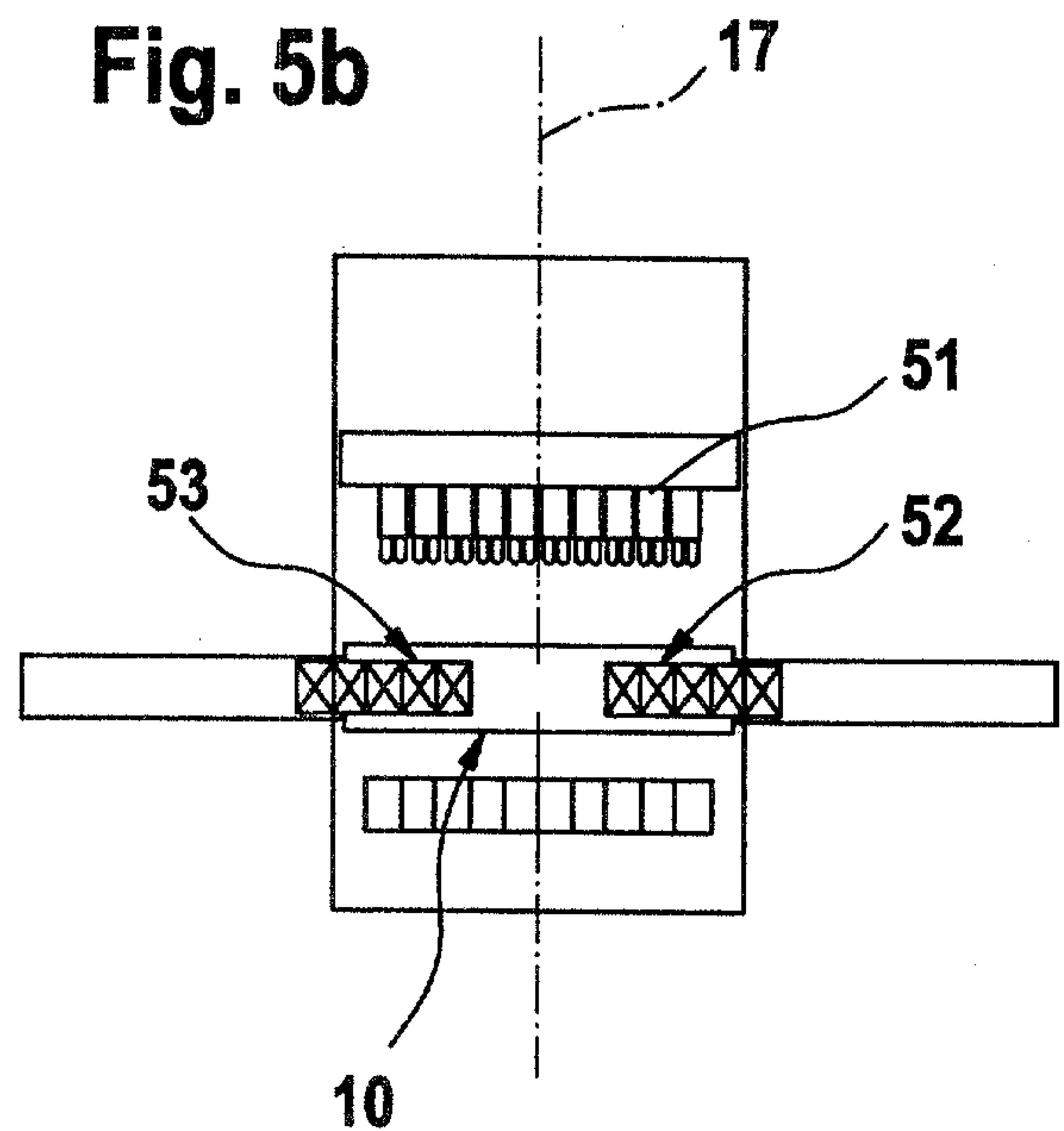


Fig. 5c

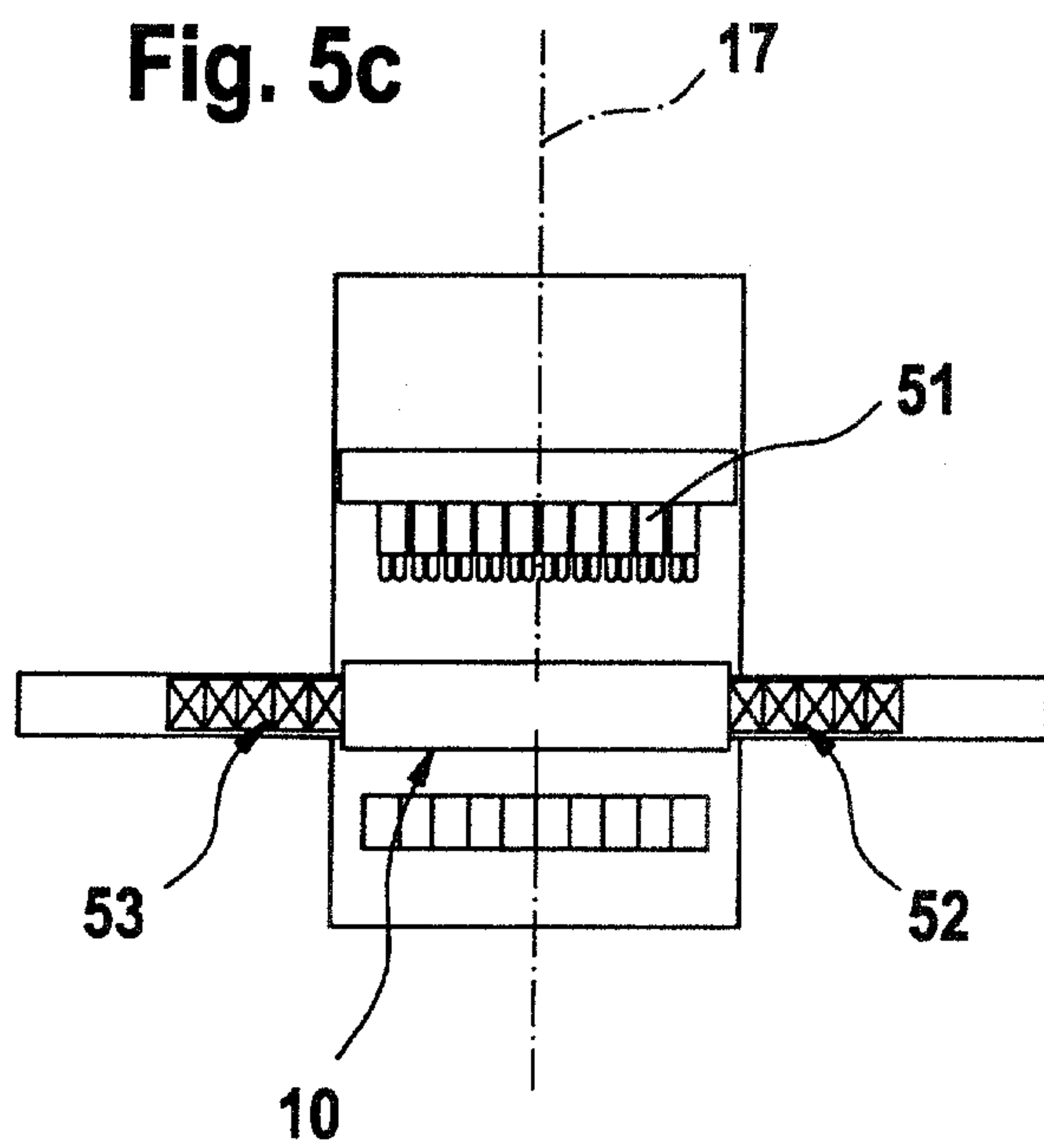


Fig. 5d

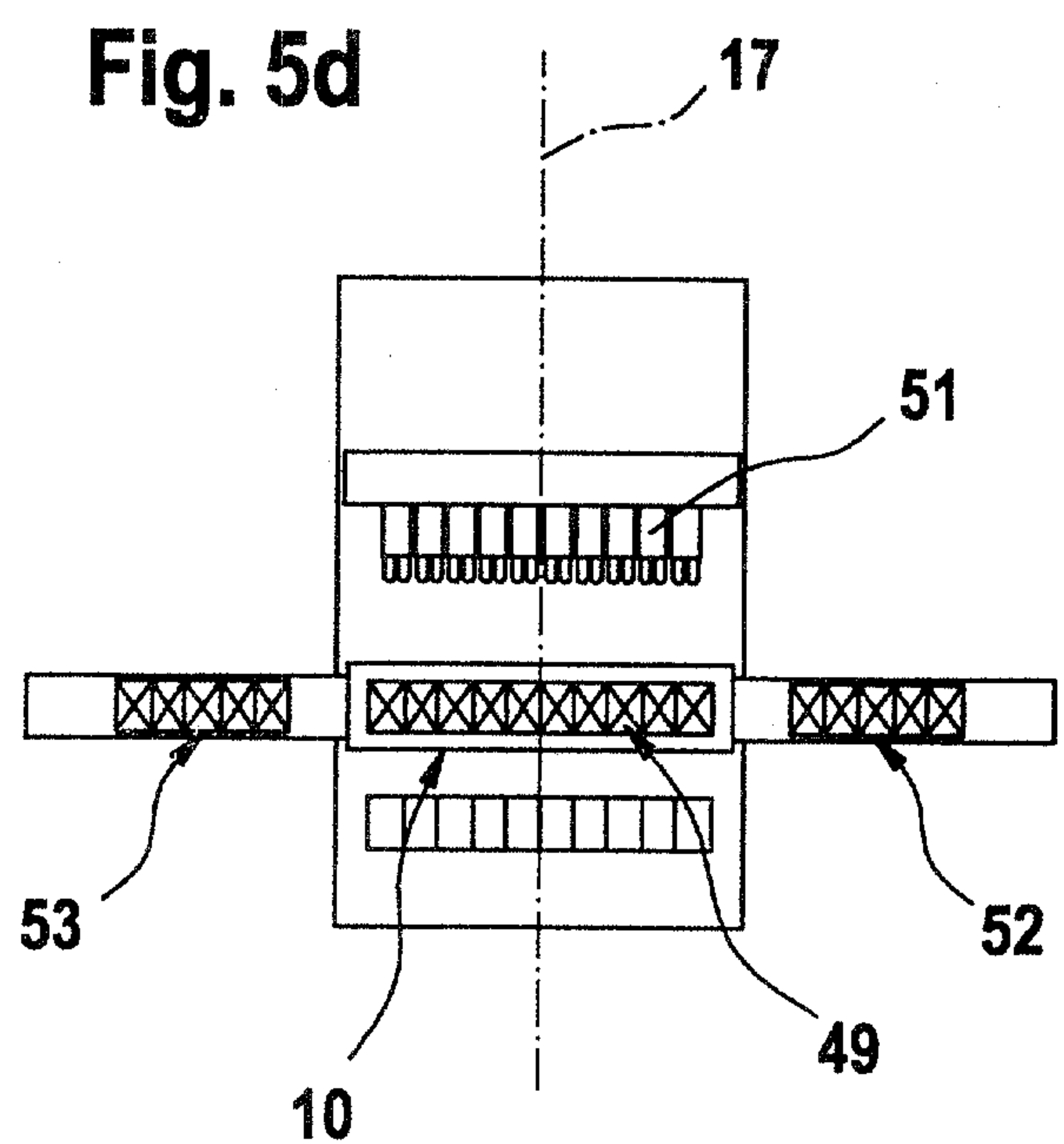


Fig. 6a

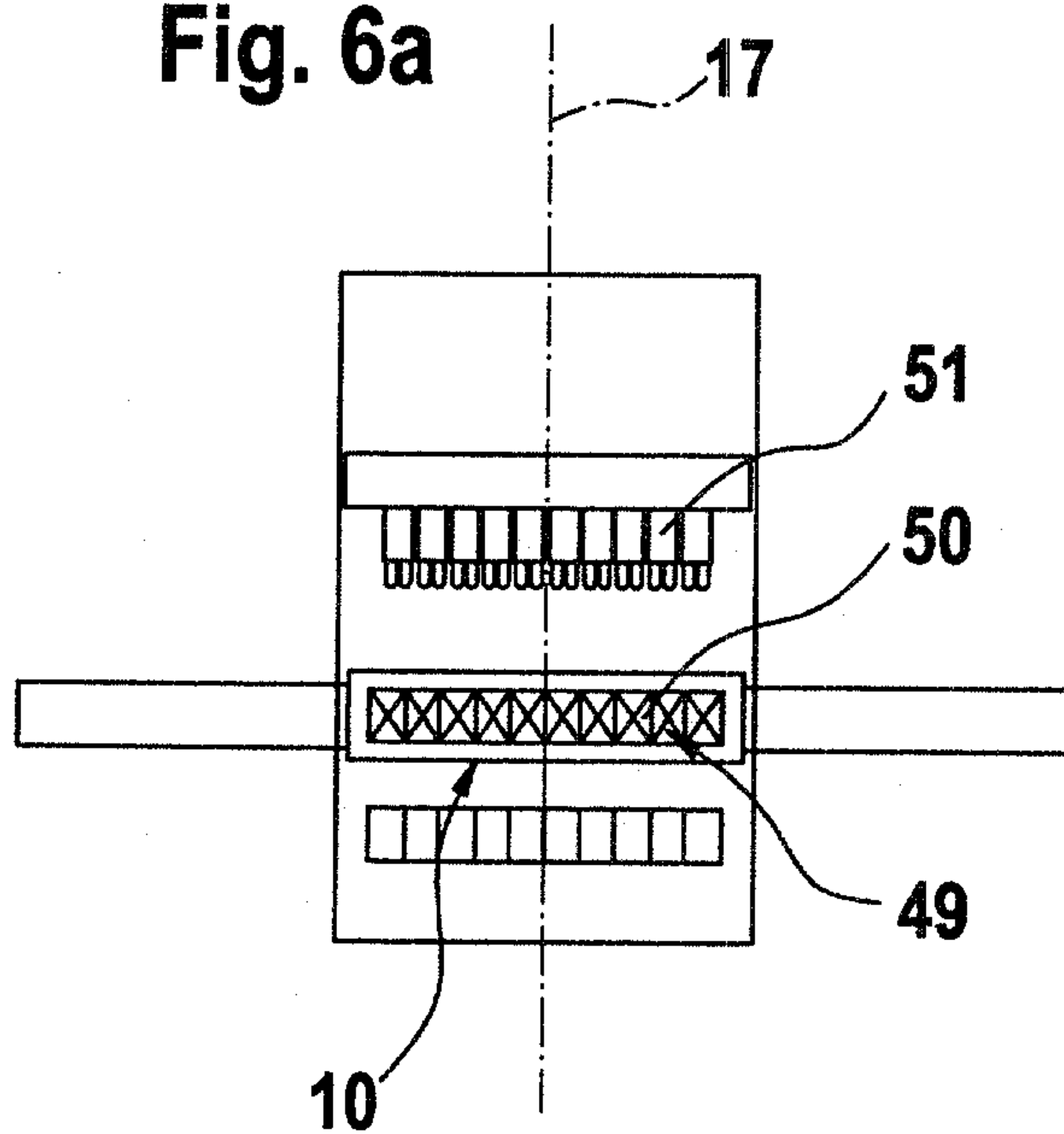


Fig. 6b

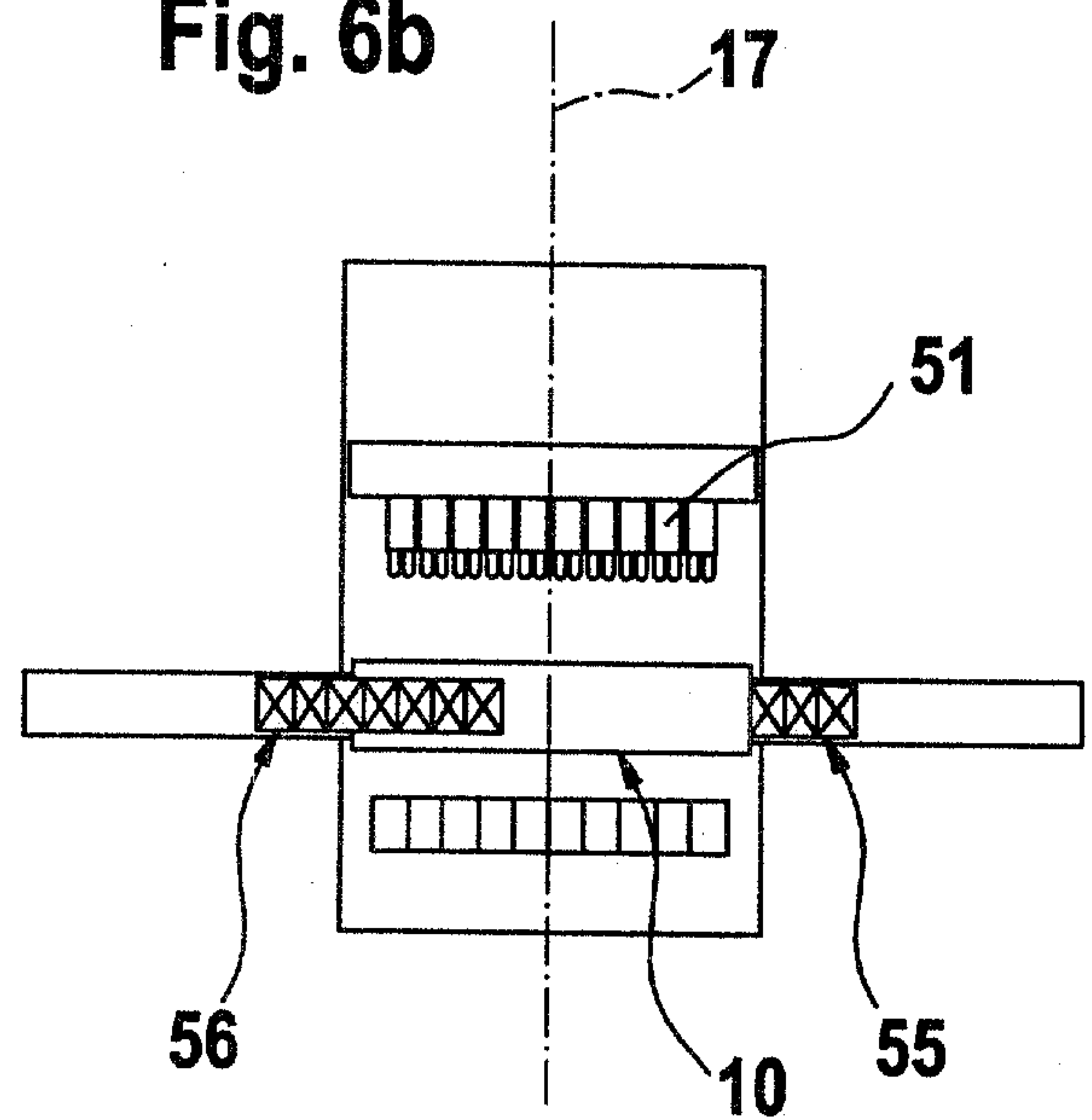


Fig. 6c

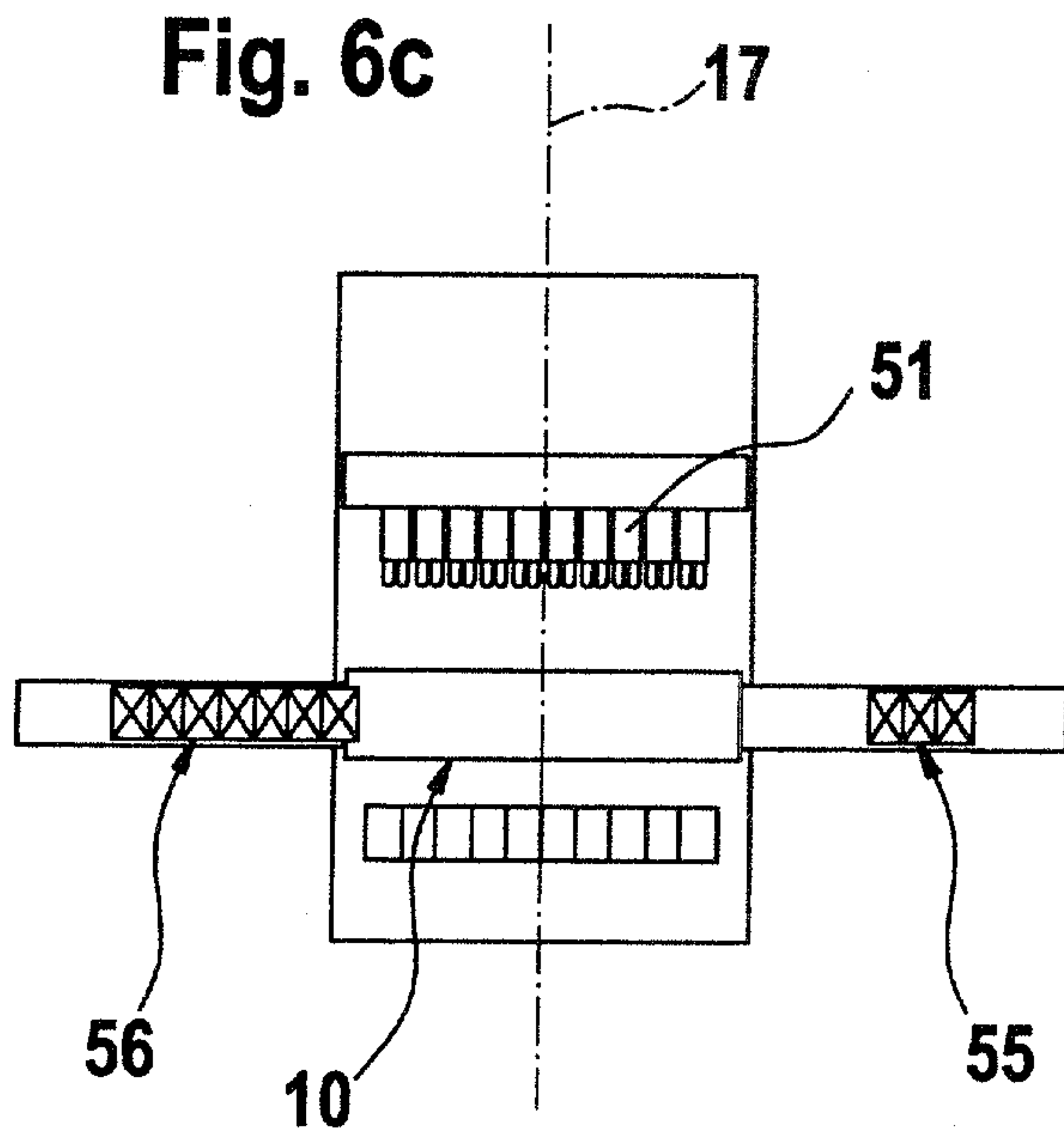


Fig. 6d

