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(54) Conveying appliance.

(57) Conveying appliance which forms part of a conveying system for separate flat objects, such as letters, in which successive objects are each conveyed at a separately variable speed. Said separately variable speed is possible owing to the fact that for each of the objects to be conveyed through the appliance there is present a conveying element (T1, T2, T3). The appliance further comprises means for selectively carrying an object along using a chosen conveying element.

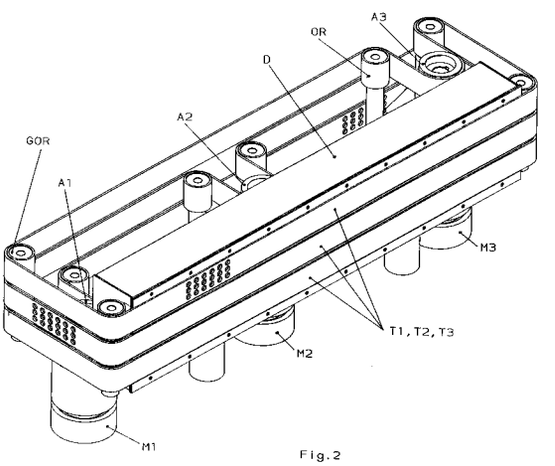

Fig.2

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A. Background of the invention

The invention relates to a conveying appliance for conveying, at a controllable variable speed, separate flat objects (2), such as letters and the like, in an intermediate section between a feed section (1), in which the objects are fed in at a first conveying speed, and a discharge section (3), in which the objects are discharged at a second conveying speed, which conveying appliance comprises a first conveying element (T1) and a second conveying element (T2), suitable for accepting objects from the feed section (1), for further conveying along the intermediate section at a third, variable speed, and for handing over the accepted objects to the discharge section (3), together with a conveying system for conveying flat objects (2), such as letters and the like, in a stream of such objects, comprising:

- a feed section (1) along which the objects are conveyed separately at an indeterminate spacing between two successive objects in the stream;
- a discharge section (3) along which the objects are conveyed with a spacing between two successive objects in the stream, which is between two predefined limits;
- an appliance for controlling the spacing between two successive objects in the stream, situated in an intermediate section between the feed section (1) and the discharge section (3), which appliance comprises a first conveying element (T1) and a second conveying element (T2), for accepting objects from the feed section (1), for further conveying along the intermediate section at a third, variable speed, and for handing over the accepted objects to the discharge section (3),
- detection means (C1, 5) for determining the presence of successive objects and, as a function thereof, emitting signals (S1) which are indicative for the spacing to be controlled,
- controlling means (6) for controlling the speeds of the conveying elements (T1 and T2) as a function of the signals (S1).

An appliance of this type and a system of this type are disclosed by US Patent 4 331 328.

In the appliance according to this known technique, two spatially successive (placed "in series") conveying sections are used for conveying documents, being driven by one motor, whose speed can be controlled, in such a way that the documents in one section are conveyed at a relatively low speed and in the second section are conveyed at a higher speed. Said speeds differ by a constant factor. This difference in speed in two sections placed in series in the document stream results in a spacing being generated between two successive documents; the size thereof is measured in the second conveying section. Depending on the measurement result, the conveying speed in the two appliance sections, whose speed is jointly controllable, is adjusted in order to ensure that the spacing between a document which, after leaving the appliance, moves at a constant speed, and a document following thereafter which is still within the appliance, will have the desired magnitude.

The known appliance is used in a conveying system for documents, in which the appliance has the function of controlling the mutual spacing between two successive documents. In this arrangement, the spacing is measured while the first of a pair of successive documents has already left the appliance; the spacing is controlled during that time in which the second document is situated in the second conveying section of the appliance, by adjusting the speed in the second conveying section during that time. In doing so, the speed in the first conveying section, incidentally, is also varied since the said speeds can only be controlled jointly. The drawback of the method in the known appliance is that only a limited time is available for controlling the spacing, which, together with the maximum permissible value for acceleration or retardation of documents in the appliance, results in limited scope for controlling the magnitude of the spacing. Moreover, an in-series connection of the two conveying sections in the appliance makes it difficult to achieve a compact construction of the appliance.

B. Summary of the invention

The object of an appliance and a conveying system according to the invention is to overcome the above drawbacks, namely to extend the scope for controlling the spacing and to permit compact construction of the appliance. To this end, an appliance according to the invention is characterized in that the first and second conveying elements (T1 and T2) are separately controllable and are aligned essentially parallel to one another. To this end, a conveying system according to the invention is characterized in that the first and second conveying elements (T1 and T2) are separately controllable and are aligned essentially parallel to one another and in that the detection means (C1) are located along the feed section.

In the description of the invention, the dimension of an object in the conveying direction will be designated as the length of that object, and the dimension of an object transversely thereto, not being the thickness of the object, will be designated as the height of that object.

The appliance can be used advantageously in a conveying system for flat objects; a stream of

such objects is situated in said conveying system during use. A first object is accepted from the conveying system in the appliance by the first conveying element. Since the second conveying element is aligned essentially parallel to the first and is therefore able to accept, in virtually the same manner as the first conveying element, objects from the feed section, the next object can be accepted by the second conveying element in the appliance. Given the separate speed controls, the speeds of the conveying elements can be tailored to each other by the control means in such a way that the spacing between the first and the second object, at the instant where both have left the appliance, has the desired magnitude. The spacing control can therefore take place even while the first object has not yet completely left the appliance. Even if, for the sake of compact construction of the appliance, a value is chosen for the length of the appliance which is little more than the minimum length, being the length of the longest object plus twice the nominal object spacing, it is still possible thus to correct a considerable deviation from the desired spacing.

According to a preferred embodiment of the invention, the conveying elements in the appliance are situated next to one another, seen in the conveying direction. This is possible if, in this arrangement, they can jointly stay, in the direction transverse to the conveying direction, within the height of the objects to be conveyed, which implies that, in that direction, they must each have a dimension which is less than half the minimum height of an object. This has the advantage that the two objects of a pair, between which the spacing is to be controlled, may continue to follow the same conveying track; thus without having to be steered through the appliance along different, parallel tracks by means of switches or similar deflection elements, whereafter, at the end of the appliance, they would again have to be moved into the same track behind one another. This contributes not only to making the appliance even more compact, but also permits a simpler construction from a mechanical point of view. It will then, however, be necessary to make provisions to ensure that the process of whether or not an object is picked up by a conveying element is effected selectively, under the control of a controlling element. To this end, the conveying elements are each provided with pick-up means which, in the appliance, engage an object over a part, which differs for each of the conveying elements, of the height of that object and thus pick up the object through the appliance.

If, as is found in practical processing of postal articles, the length of the appliance, as a result of complying with the requirement that this must have at least the length of the longest object plus twice the nominal object spacing, has a value such that this is at least equal to twice the minimum length of an object plus once the nominal object spacing, two objects can be situated completely within the appliance at the same time, while a third object is already imminent. In a further preferred embodiment of the invention, the appliance therefore comprises a third conveying element whose speed can likewise be controlled, quite independently of the speeds of the first and the second conveying element. This is because, at that instant, when two objects are completely situated within the appliance, a third conveying element "in the wait state" should be available to receive an arriving third object. So as to remain able to derive the full benefit of the advantages of the invention, the dimension of each of the three conveying elements transversely to the conveying direction must be less than one third of the minimum height of an object. This is found to be achievable in practice.

In a conveying system according to the invention, the means, which supply the signals indicative for the spacing to be controlled, are positioned "upstream" of the appliance, along the feed section. Said signals are then available before the first of a pair of documents, between which there is a spacing to be controlled, is accepted from the feed section in the appliance. This has the advantage that more time is available for making a suitable choice of the speeds of the conveying elements as a function of time. Moreover, more intermediate spacings can be considered in that case than that between two successive documents, so that, in controlling the speed, the situation in a larger part of the conveying system outside the appliance can be taken into account.

C. Reference

US Patent 4 331 328; title: Controller for a servo driven document feeder.

D. Brief description of the drawing

The invention will be explained in more detail by means of a description of an illustrative embodiment, reference being made to a drawing, in which:

Figure 1 provides a diagrammatic representation of a part of a conveying system in which a conveying appliance according to the invention is employed;

Figure 2 shows the mechanical design of an illustrative embodiment of a conveying appliance according to the invention, having three conveying elements;

Figure 3 provides a picture of a low-pressure chamber which is used in the illustrative embodiment according to Figure 2;

Figure 4 shows the mechanical design of an illustrative embodiment of a conveying appliance according to the invention, in which the use of a low-pressure chamber is combined with the pair-wise arrangement of conveyor belts and the use of resilient pressure elements.

E. Description of an illustrative embodiment

The appliance according to the invention may, for example, form part of a conveying system for letters which is located in a sorting appliance for this type of flat object. Such a sorting appliance is in general provided with an input unit which takes off the letters with a fixed spacing between the trailing edge of a first letter and the leading edge of a second letter, which in principle is independent of the length of the two letters, with a fixed gap between the letters, therefore. Owing to differences in weight and surface roughness, deviations in the gaps between the letters do arise, however. In no case must these result in too small a gap, owing to which the setting of switches in the conveying section would not be able to change in time, which would lead to conveying malfunctions. On the other hand, a spacing between letters which is much larger than the minimum is undesirable, as the number of letters which can be processed per unit of time decreases as the spacing increases. The function of the appliance according to the invention is to ensure that a stream of letters is produced in which the spacings between successive letters comply with the specifications stipulated. Thus, a spacing which is too small can be set to the desired value by accelerating the letter before the intermediate spacing which is too small, by retarding the letter after the intermediate spacing which is too small, or by a combination of both measures.

In Figure 1, 1 is the feed section of a conveying system for objects 2, which objects in the illustrative example have the form of letters. The discharge section is designated as 3 in Figure 1. The part of the spacing control appliance which contains the conveying elements bears the number 4.

In Figure 1, control element 5 is also present. Based on signals (S1), supplied by a photocell C1 which is present along the feed section 1, the control element 5 determines the spacings between documents 2 in the stream before the conveying portion 4 of the appliance. Control element 5 further receives a signal (S2) from a photocell C2, which indicates the presence of a document at the start of the spacing-correction section, and selects a free conveying element (a conveying element which at that instant is not used to pass a document through the appliance). The control element also receives signals (S3.1, S3.2, S3.3) from photocells C3.1, C3.2 and C3.3 at the start positions of the conveying elements and, based on consecutively received signals (S1) of the photocell C1, selects a rotational-speed function for the relevant drive motor (M1, M2 or M3) for a conveying element, in which function the course of the rotational speed as a function of time is defined. The motors M1, M2 and M3 are coupled to check-back elements E1, E2 and E3 which provide the control element 5 with information on the actual rotational-speed course of the relevant motor.

Figure 2 shows that part of the conveying appliance which contains the conveying elements. Here, M1, M2 and M3 are drive motors for conveyor belts T1, T2 and T3, with drive rollers A1, A2 and A3. The conveyor belts T1, T2 and T3 are supported at the four corners of a rectangle by means of stacked revolving rollers, of which one in Figure 2 is designated as GOR. Where necessary, the conveyor belts are each separately supported by revolving rollers, of which OR is one.

When a document enters the conveying appliance, one of the conveyor belts T1, T2 and T3 in each case is designated to pass that document through the appliance; having the selected conveyor belt carry along that document is effected by the presence of a hole pattern in each conveyor belt, which hole pattern extends over part of each conveyor belt, in interaction with a low-pressure chamber D having a continuous hole pattern. If a conveyor belt does not, at a particular instant, carry a document along, its hole pattern is not positioned in front of the low-pressure chamber D.

Figure 3 shows the low-pressure chamber D which on one side, along which the conveyor belts are passed, is provided with a continuous hole pattern; additionally, G is a guide plate on that side of the low-pressure chamber along which the conveyor belts are passed, and O refers to low-pressure connection points.

Depending on, inter alia, the dimensions of the conveying elements transversely to the conveying direction, other embodiments of the conveying appliance according to the invention may comprise more than three conveying elements.

It is pointed out that, while in the illustrative example described the selective carrying-along of a document by a selected conveying element is effected with the involvement of a low-pressure chamber and of conveyor belts having a hole pattern, this does not mean that it would not be possible (also) to employ in the spacing control appliance other similarly known methods for selective carrying-along. Possibilities to consider include, for example, pairs of conveyor belts, provided with resilient pressure elements, which pairs run synchronously while passing a document through the appliance. Thus, Figure 4 shows an

illustrative embodiment of a conveying appliance according to the invention, in which the use of a low-pressure chamber and conveyor belts T1, T2 and T3, which are each provided with a hole pattern, is combined with synchronously running conveyor belts T1', T2' and T3', which are each provided with resilient pressure elements V (V1 and V2 drawn, V3 not drawn). In this case, T1', T2' and T3' are the "mirrorimage" counterparts of T1, T2 and T3, having the resilient pressure elements in the place of the hole patterns.

Claims

1. Conveying appliance for conveying, at a controllable variable speed, separate flat objects (2), such as letters and the like, in an intermediate section between a feed section (1), in which the objects are fed in at a first conveying speed, and a discharge section (3), in which the objects are discharged at a second conveying speed, which conveying appliance comprises a first conveying element (T1) and a second conveying element (T2), suitable for accepting objects from the feed section (1), for further conveying along the intermediate section at a third, variable speed, and for handing over the accepted objects to the discharge section (3), **characterized in that** the first and second conveying elements (T1 and T2) are separately controllable and are aligned essentially parallel to one another.

2. Conveying appliance according to Claim 1, **characterized in that** the appliance comprises a third, separately controllable conveying element (T3), aligned essentially parallel to the first and second conveying element.

3. Conveying appliance according to Claim 1 or 2, **characterized in that** the conveying elements convey the objects along the same intermediate section and are provided with pick-up means which engage the objects in the intermediate section at various heights.

4. Conveying appliance according to Claim 3, **characterized in that** the conveying elements comprise conveyor belts and the pick-up means comprise hole patterns which are present in each of the conveyor belts along a part of their length, together with a low-pressure chamber, the conveyor belts along virtually the whole intermediate section bearing on the low-pressure chamber which on the side facing the conveyor belts is provided with a hole pattern which is continuous over the length of that side.

5. Conveying system for conveying flat objects (2), such as letters and the like, in a stream of such objects, comprising:
   - a feed section (1) along which the objects are conveyed separately at an indeterminate spacing between two successive objects in the stream;
   - a discharge section (3) along which the objects are conveyed with a spacing between two successive objects in the stream, which is between two predefined limits;
   - an appliance for controlling the spacing between two successive objects in the stream, situated in an intermediate section between the feed section (1) and the discharge section (3), which appliance comprises a first conveying element (T1) and a second conveying element (T2), for accepting objects from the feed section (1), for further conveying along the intermediate section at a third, variable speed, and for handing over the accepted objects to the discharge section (3),
   - detection means (C1, 5) for determining the presence of successive objects and, as a function thereof, emitting signals (S1) which are indicative for the spacing to be controlled,
   - controlling means (6) for controlling the speeds of the conveying elements (T1 and T2) as a function of the signals (S1),

   characterized in that the first and second conveying elements (T1 and T2) are separately controllable and are aligned essentially parallel to one another, and in that the detection means (C1) are located along the feed section.

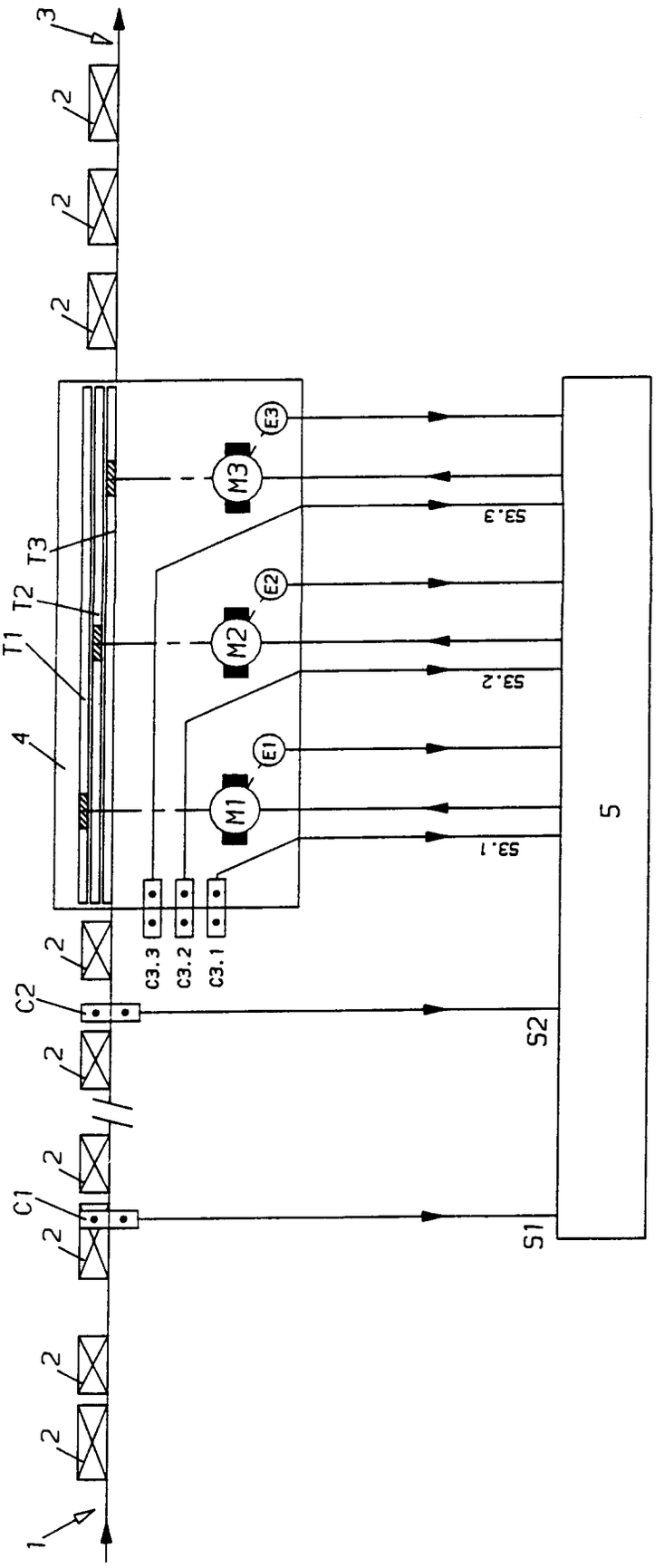

Fig. 1

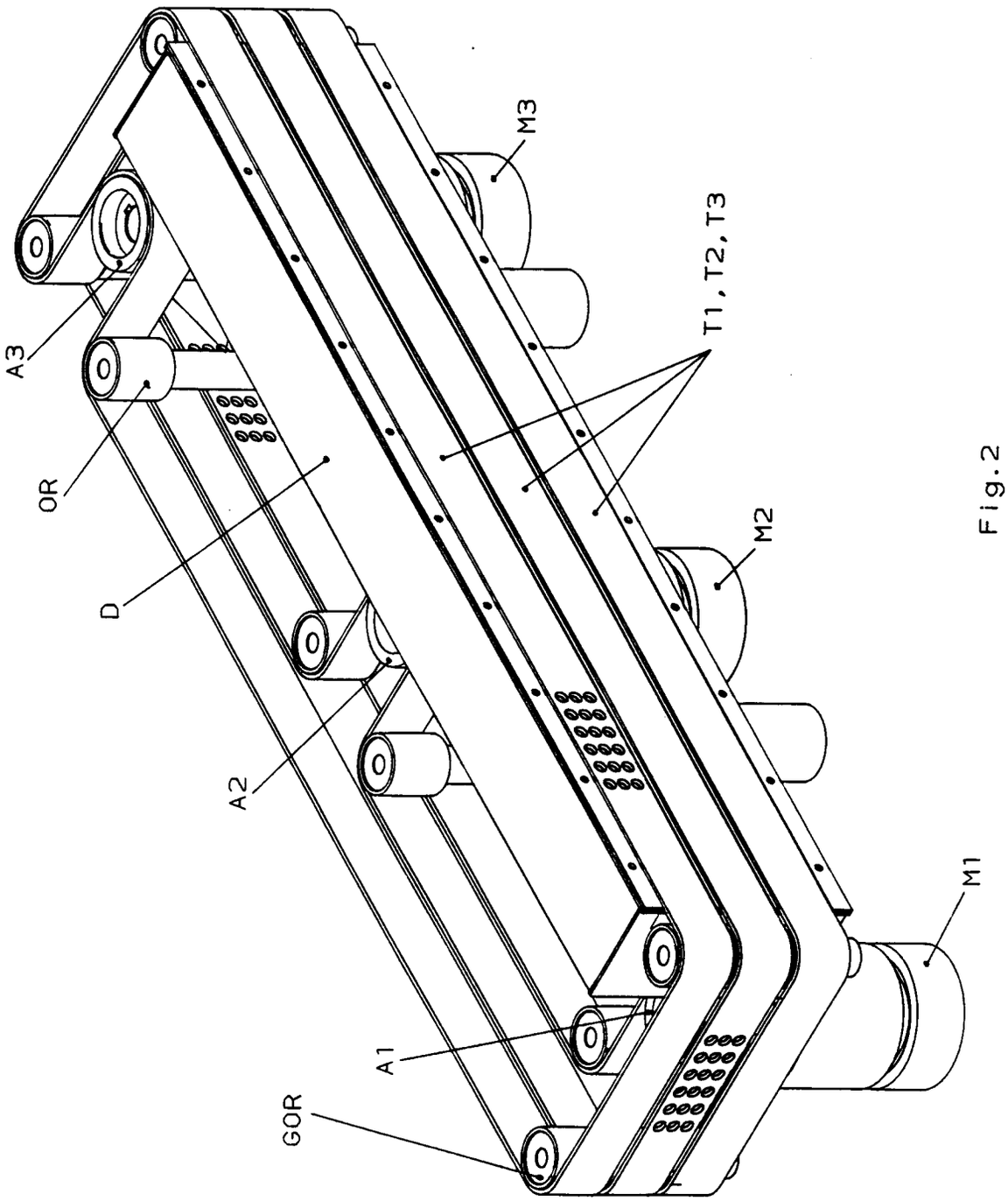

Fig.2

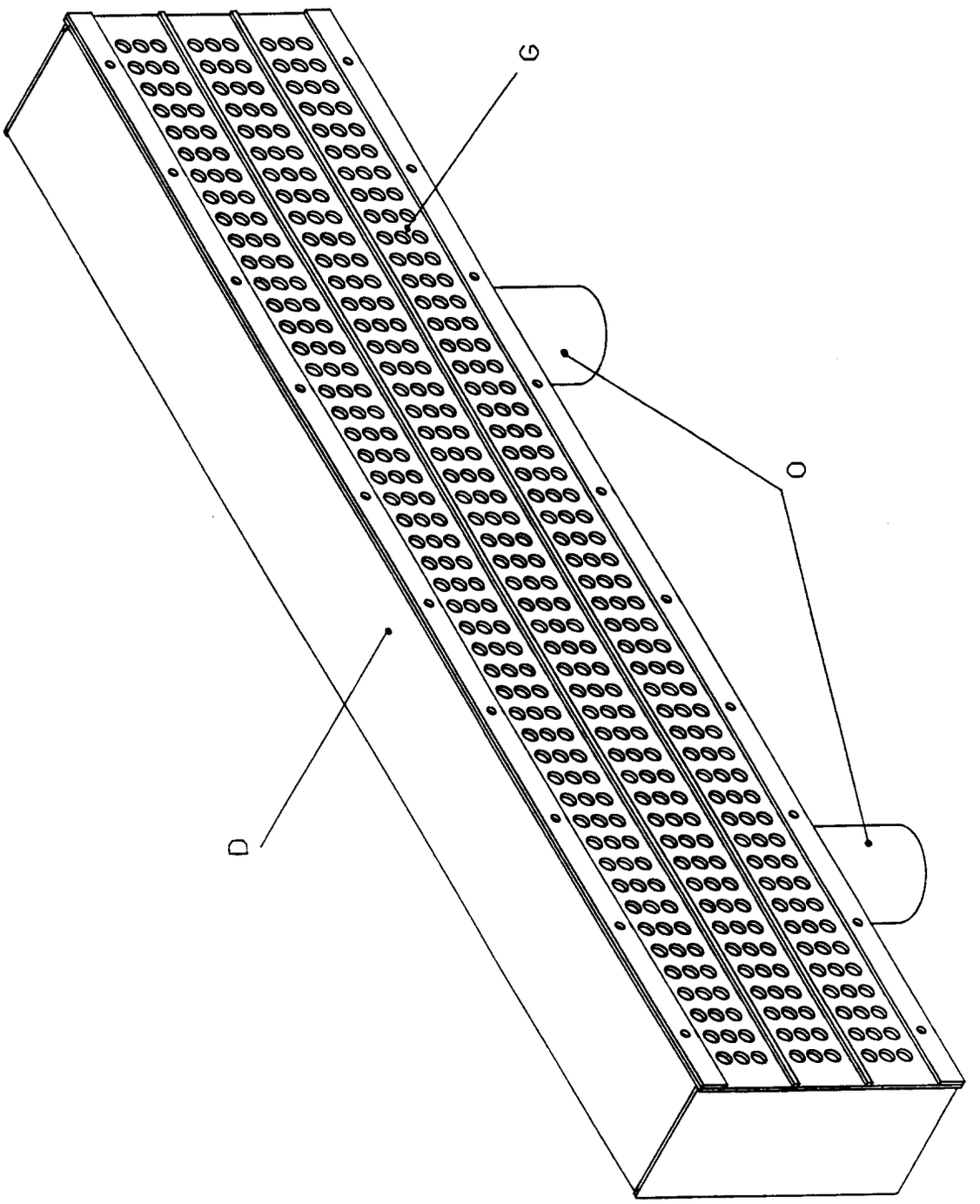

Fig.3

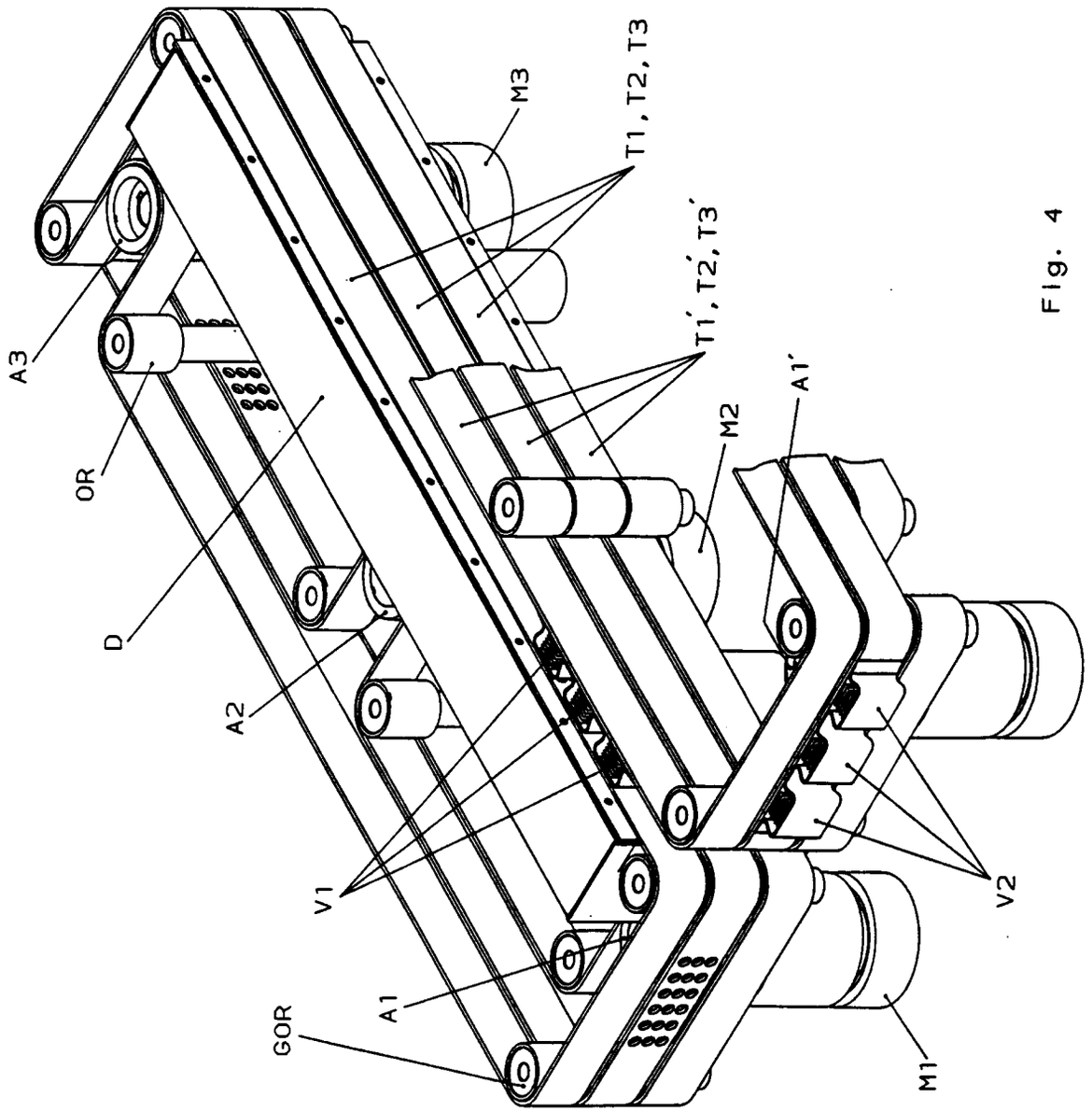

Fig. 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 20 2566

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.5)
A	US-A-3 735 976 (J. P. WATSON)		B65H5/22 B65H43/00 B07C1/02
A	US-A-4 433 774 (R. R. LOPES)		
D,A	US-A-4 331 328 (H. A. FASIG)		

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

B65H
B07C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	9 December 1993	Bourseau, A-M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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