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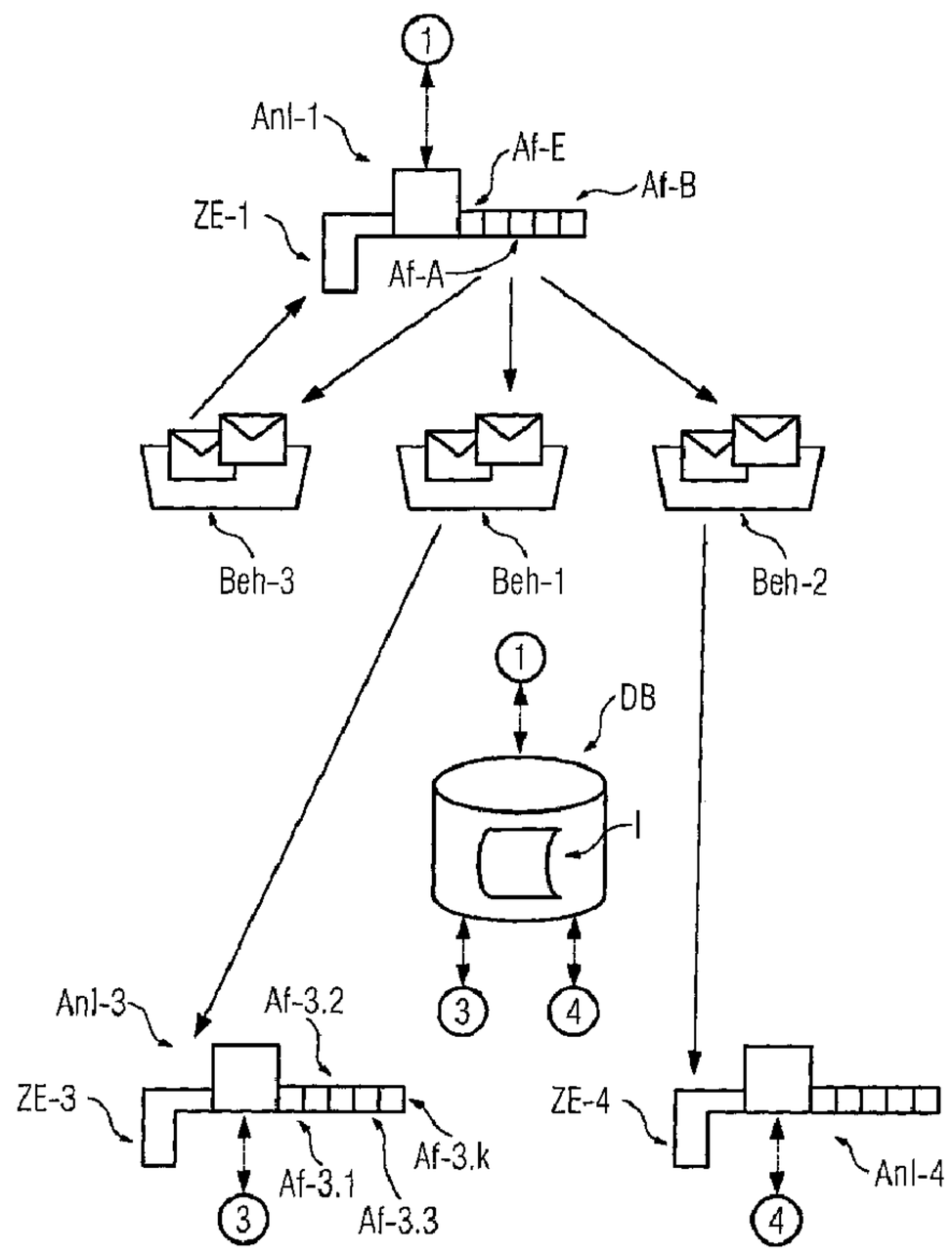
(54) **Titre : METHODE ET DISPOSITIF PERMETTANT DE TRAITER ET DE TRANSPORTER DES ARTICLES EN SEQUENCE**
(54) **Title: METHOD AND DEVICE FOR PROCESSING AND TRANSPORTING ITEMS IN A SEQUENCE**



(57) **Abrégé/Abstract:**
The invention relates to a method and a device for handling and transporting articles (1, 2,..., 29), especially postal items. A handling attribute is measured for every article. First, the measurement relates to the value which every given feature assumes for

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(57) **Abrégé(suite)/Abstract(continued):**
the given article. A data record for the article is generated and comprises the at least two measured feature values and the measured handling attribute value. The article is transferred to an intermediate storage area (Af-A). The article is then transferred from the intermediate storage area (Af-A) to a transport means (Beh-1) and is transported in the transport means (Beh-1) to a handling system (Anl-3). Once the article reaches the handling system (Anl-3), it is again measured which value every given feature assumes for the given article. The data record generated for the article is determined, using the feature values obtained during re-measurement. If the article is provided with a label that is unambiguously read during re-measurement, the data record is determined using said label. Otherwise, a search with a search area restriction is carried out. The handling system (Anl-3) handles the article. For doing so, the handling system uses the handling attribute value contained in the determined data record.

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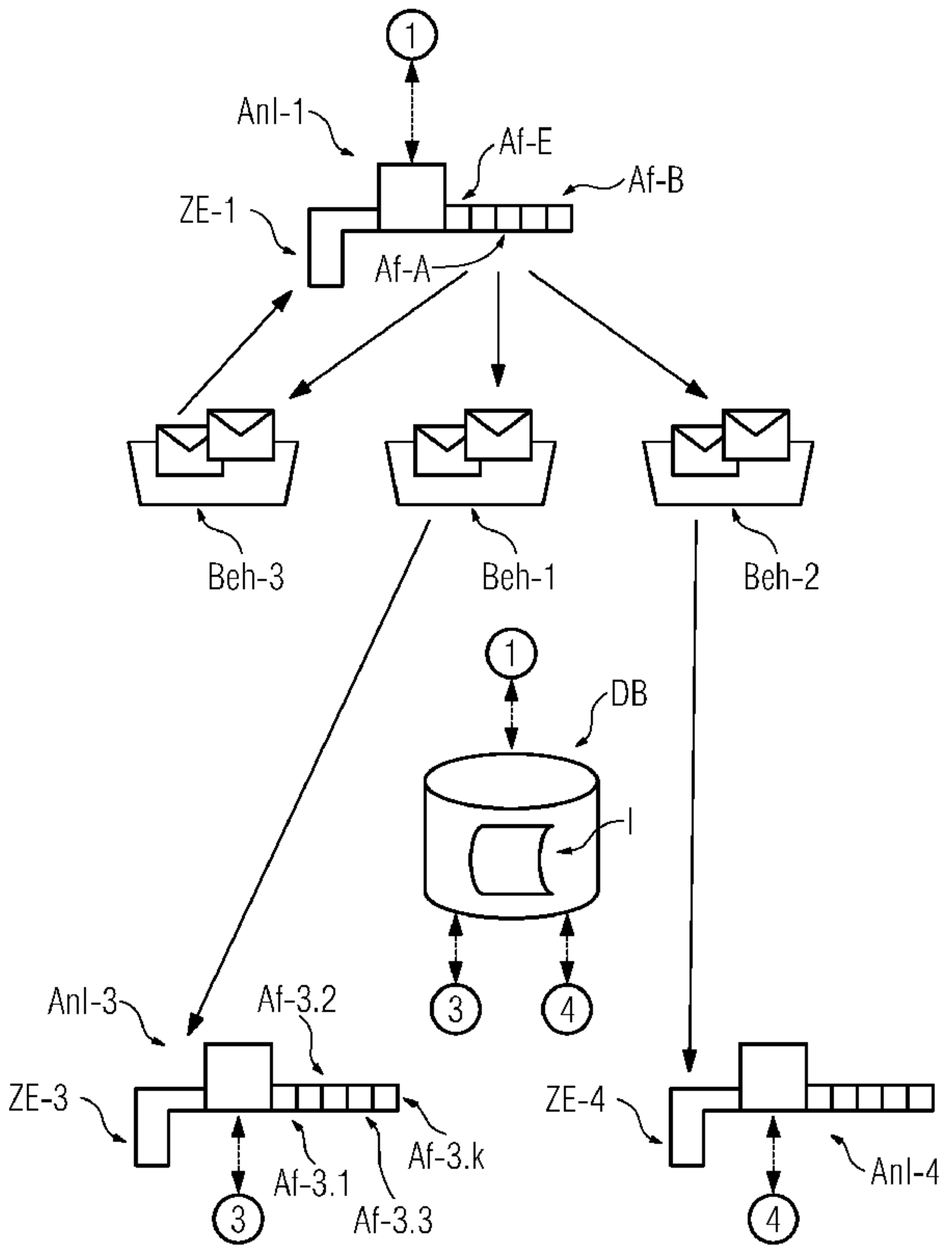
(54) Title: METHOD AND DEVICE FOR HANDLING AND TRANSPORTING ARTICLES IN A GIVEN ORDER

(54) Bezeichnung: VERFAHREN UND VORRICHTUNG ZUM BEARBEITEN UND TRANSPORTIEREN VON GEGENSTÄNDEN IN EINER REIHENFOLGE

FIG 1



(57) Abstract: The invention relates to a method and a device for handling and transporting articles (1, 2,..., 29), especially postal items. A handling attribute is measured for every article. First, the measurement relates to the value which every given feature assumes for the given article. A data record for the article is generated and comprises the at least two measured feature values and the measured handling attribute value. The article is transferred to an intermediate storage area (Af-A). The article is then transferred from the intermediate storage area (Af-A) to a transport means (Beh-1) and is transported in the transport means (Beh-1) to a handling system (Anl-3). Once the article reaches the handling system (Anl-3), it is again measured which value every given feature assumes for the given article. The data record generated for the article is determined, using the feature values obtained during re-measurement. If the article is provided with a label that is unambiguously read during re-measurement, the data record is determined using said label. Otherwise, a search with a search area restriction is carried out. The handling system (Anl-3) handles the article. For doing so, the handling system uses the handling attribute value contained in the determined data record.

(57) Zusammenfassung: Die Erfindung betrifft ein Verfahren und eine Vorrichtung zum Bearbeiten und Transportieren von Gegenständen (1, 2,..., 29), insbesondere von Postsendungen. Für jeden Gegenstand wird ein Bearbeitungs-Attribut gemessen. Erstmals wird gemessen, welchen Wert jedes

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— *vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eintreffen*

vorgegebene Merkmal jeweils für den Gegenstand annimmt. Ein Datensatz für den Gegenstand wird erzeugt, welcher die mindestens zwei gemessenen Merkmalswerte und den gemessenen Bearbeitungs-Attributwert umfasst. Der Gegenstand wird in einen Zwischenspeicher (Af-A) verbracht. Anschließend wird der Gegenstand aus dem Zwischenspeicher (Af-A) in ein Transportmittel (Beh-1) verbracht und im Transportmittel (Beh-1) zu einer Bearbeitungsanlage (Anl-3) transportiert. Nachdem der Gegenstand die Bearbeitungsanlage (Anl-3) erreicht hat, wird erneut gemessen, welchen Wert jedes vorgegebene Merkmal für diesen Gegenstand jeweils annimmt. Der für diesen Gegenstand erzeugte Datensatz wird unter Verwendung der beim erneuten Messen gewonnenen Merkmalswerte ermittelt. Falls dieser Gegenstand mit einer Kennzeichnung versehen ist, die beim erneuten Messen eindeutig gelesen wird, so wird der Datensatz anhand dieser Kennzeichnung ermittelt. Ansonsten wird eine Suche mit Suchraumeinschränkung durchgeführt. Die Bearbeitungsanlage (Anl-3) bearbeitet den Gegenstand. Hierfür verwendet die Bearbeitungsanlage den Bearbeitungs-Attributwert, der im ermittelten Datensatz enthalten ist.

54106-497

Description

Method and device for processing and transporting items in a sequence

The invention relates to a method and a device for processing and transporting items, in particular postal consignments.

A postal consignment typically passes through a sorting installation at least twice and is then transported to the respectively predefined destination address. The destination address of the postal consignment is read during the first pass. The read destination address is determined again during the second pass.

Traditionally, a coding of the destination address is printed onto the postal consignment during the first pass. This coding is read during the second pass. In order to avoid printing on postal consignments, it is proposed in DE 4000603 C2 that a feature vector of the postal consignment be measured during the first pass and this feature vector stored together with the read destination address. During the second pass, the postal consignment is measured afresh, a further feature vector being generated by this means. This further feature vector is compared with the stored feature vectors in order to find the stored feature vector of the same item. The destination address which is stored together with the found feature vector is used as the destination address to which the postal consignment is to be transported.

This search requires that many feature vectors be compared with one another, which is time-consuming. As the number of transported postal consignments grows, the risk that the wrong feature vector will be found among the stored feature vectors increases. Restrictions on the search space have therefore already been proposed.

Existing methods and devices are

known from EP 1222037 B1. The items there are likewise postal consignments which pass through sorting machines. Such a sorting machine discharges postal consignments into sorting terminals which function as intermediate stores. In order to reuse read results, a method is used which is known as fingerprinting and which is presented e.g. in DE 4000603 C2.

For each postal consignment a data record is generated and filed in a central database. This data record comprises the read delivery address. In order to restrict the search space when searching for this data record, a record is stored of which postal consignment is transported in which container. This approach requires that it be known precisely which postal consignment is transported in which container. In reality, this can sometimes not be established with sufficient certainty.

It is proposed in DE 102005040689 A1 that a postal consignment be identified in two steps. Firstly, the postal consignment is registered e.g. in a central database by means of a visual feature and an external piece of information. As soon as this postal consignment passes through a sorting installation for a second time, an attempt is made firstly to identify this postal consignment on the basis of the visual feature. If this is unsuccessful, the postal consignment is identified on the basis of the external feature.

From US 20050269395 A1 a method for checking a bar code on a postal consignment is known. In a first sorting pass, a unique identification in the form of a bar code is printed on the postal consignment. In addition, a feature vector is generated for the postal consignment, for which purpose an image of the postal consignment is analyzed. A data record comprising the feature vector and the identification is stored in a database. The postal consignment passes through a sorting installation for a second time. If this sorting installation is unable to read the bar code successfully, then a feature vector is generated afresh, and the postal item is identified on the basis of the feature vector.

In the method in accordance with the solution, at least one measurable processing attribute and at least two measurable features are predefined. One of the predefined features is an identification. An item may or may not be furnished with such an identification. If an item is actually furnished with an identification, then this identification distinguishes the item from all other processed items.

A processing installation is used.

For each item, the following steps are executed:

- The processing attribute of the item is measured, i.e. the attribute value of the processing attribute is determined.

- Firstly, a measurement is made of what value each predefined feature assumes for the item respectively.

- A data record for the item is generated which comprises the at least two measured feature values and the measured processing attribute value.

- The item is transferred to an intermediate store.

- The item is then transferred from the intermediate store into a transport means and transported in the transport means to the processing installation.

- After the item has reached the processing installation, a fresh measurement is made of the value which each predefined feature assumes for this item respectively.

- The data record generated for this item is determined using the feature values obtained in the fresh measurement. If this item is furnished with an identification which is read clearly during the fresh measurement, then the data record is determined on the basis of this identification. Otherwise, a search is executed, with a restriction on the search space.
- The processing installation processes the item. For this purpose, the processing installation uses the processing attribute value which is contained in the data record determined.

For each intermediate store used, an item sequence is measured respectively. This measured item sequence is the sequence in which the items are transferred to the intermediate store.

During transportation of the items to the processing installation, multiple loading processes are executed. In each loading process, multiple items are transferred respectively from one of the intermediate stores into a transport means. This occurs such that the item sequence measured for this intermediate store is retained among those items which are transferred into the transport means in this loading process. The overall item sequence can, on the other hand, be modified by various loading processes.

The processing installation measures each item afresh. This fresh measurement is executed in a measuring sequence among the items.

As explained previously, the data record for an item with identification is determined by means of the read identification.

If, on the other hand, it is established during the fresh measurement that the item has no identification or no clearly legible identification, then a restriction on the search space is implemented in order to determine the data record for this item. This restriction on the search space comprises the following steps:

- At least one preceding item in the measurement sequence with a clearly legible identification is determined.

- At least one succeeding item in the measurement sequence with a clearly legible identification is determined.
- For each item determined in this manner, a partial sequence of a measured item sequence is determined respectively. This partial sequence comprises the determined item with the unique identification, an item which precedes the determined item with the unique identification in the item sequence and an item which follows the determined item with the unique identification in the item sequence.
- The data record for the item without a legible identification is sought among the data records of those items which are contained in at least one determined partial sequence. The search is thus restricted to the data records of the items in the partial sequences.
- At least one further feature value of the item without a legible identification, which feature value has been measured during the fresh measurement, is used in the search for the data record.

This solution does not use the sequence of the items in the measurement sequence. The search space is preferably further restricted in that deviations between the item sequence and the measurement sequence are utilized.

The processing attribute is, for example, an identification of a destination address to which the item is to be transported, or a dimension or the weight of the item. The processing attribute can also be the result of an analysis of the shipping fee with which the item is furnished.

In one embodiment, each item is furnished with details of the respectively predefined destination point to which this item is to be transported. In particular, the item is a postal consignment or a freight consignment. In another embodiment, the item is a luggage item of a passenger and is furnished with details relating to the owner. This luggage item is to be transported to a destination address which depends on the identity of the passenger.

According to one aspect of the present invention, there is provided a device for processing multiple items, wherein the device comprises

- a first processing installation,
- a second processing installation,
- a database connected to both processing installations,
- at least one transport means and
- at least one intermediate store,

at least one measurable processing attribute and at least two measurable features are predefined, the first processing installation is configured, in respect of each item,

- to measure the value which the processing attribute assumes for the item,
- to measure the value which each predefined feature assumes for the item,
- to generate and to store in the database a data record for the item which comprises the measured feature values and the measured processing attribute value,
- to transfer the item into an intermediate store,

the device is configured such that the item is transferred from the intermediate store into a transport means and is transported in the transport means to the processing installation,

the second processing installation is configured, in respect of each item,

- to measure afresh, after the item has reached the processing installation, the value which each predefined feature assumes for this item respectively,

- to determine the data record generated and stored for this item using the feature values obtained in the fresh measurement,

- to process the item using the processing attribute value of the data record determined,

wherein

- the first processing installation is configured furthermore to measure for each intermediate store used, a respective item sequence in which it transfers the items into the intermediate store,

- the transporting of the items to the processing installation comprises multiple loading processes,

- in each loading process, multiple items are transferred from an intermediate store into a transport means such that the item sequence measured for this intermediate store is retained among these items, and

- the second processing installation is configured furthermore to execute the fresh measurement in a measurement sequence among the items,

wherein one of the predefined features is an identification with which the item can be furnished and which distinguishes an actually identified item from all other processed items, the second processing installation is configured to determine, when during the new measurement in respect of an item its identification is read, the data record for this item by means of the read identification and the second processing installation is configured so as, if during the fresh measurement it is established that the item has no identification or no clearly readable identification,

- to determine at least one preceding item in the measurement sequence with a clearly readable identification and at least one succeeding item in the measurement sequence with a clearly readable identification,

- to determine for each item determined in this fashion respectively a partial sequence of a measured item sequence such that the partial sequence comprises the determined item and at least one item which precedes and one which succeeds the determined identified item in the item sequence respectively,

- to search for the data record for the item with no readable identification among the data records of those items which are contained in at least one determined partial sequence,

wherein the second processing installation uses for the search for the data record at least one further feature value of the

item, which feature value has been measured during the fresh measurement.

The invention will be described below with reference to an exemplary embodiment.

Fig. 1 shows a network comprising three processing installations;

Fig. 2 shows the item sequence in which 29 postal consignments are discharged into the output compartment Af-A;

Fig. 3 shows the sequence in which the 29 postal consignments are transferred from the output compartment Af-A into the container Beh-1;

Fig. 4 shows the sequence in which the 29 postal consignments from Af-A in Fig. 3 pass through the sorting installation An1-3;

Fig. 5 shows the determined partial sequences and the search space for the example from Fig. 4 and the postal consignment 8.

Fig. 6 shows the reduction of the partial sequences from Fig. 5 with the aid of the item sequence;

Fig. 7 shows the determined partial sequences and the search space for the example from Fig. 4 and the postal consignment 27.

Fig. 8 shows the reduction of the partial sequences from Fig. 7 with the aid of the item sequence.

In the figures, material flows are represented by solid lines and data flows by dashed lines.

In the exemplary embodiment, the items to be transported are postal consignments. Each postal consignment is furnished with an identification of the delivery address to which the postal item is to be transported. The delivery address functions as the destination point of the postal consignment. The identification has usually been affixed to the postal consignment before the

commencement of transportation. It is, however, also possible that it will be affixed only during transportation.

Each postal consignment passes through a sorting installation at least twice. It is possible for a postal consignment to pass through the same sorting installation several times or through one sorting installation three times.

During the first pass, the destination address of each postal consignment passing through is read.

Preferably, a reading device of the sorting installation used during the first pass firstly attempts to determine the delivery address automatically by means of optical character recognition (OCR). If this is unsuccessful, then a person reads the delivery address and inputs at least a part of the read delivery address, e.g. the zip code.

A delivery area is assigned to each possible delivery address. During each pass, all postal consignments to the same delivery area are discharged into the same output compartment. It is possible for postal consignments to different delivery areas to be discharged into the same output compartment. It is possible for a postal consignment to pass through the same sorting installation several times, for example because the number of output compartments is lower than the number of predefined delivery areas. In this case, n-pass sequencing, where n >= 2, is preferably executed. Such a method is known from EP 948416 B1. After the first pass, the postal consignments which the sorting installation has discharged into an output compartment are transferred into a container. The container is transported to the feeding device of the second sorting installation, and the postal consignments are fed into the sorting installation for the second pass.

It is also possible for a container with postal consignments which have passed through a sorting installation for the first time to be transported to a different location and for the postal

consignments to be fed there into a further sorting installation. It is also possible for some postal consignments to be transported in a container from an output compartment of the further sorting installation to a feeding device of another sorting installation and for these postal consignments to be fed into the other sorting installation.

It would be highly impractical if each further sorting installation had to read afresh the delivery address which the first sorting installation has already read. The traditional procedure for avoiding this is for the first sorting installation to print a coding of the delivery address on to the postal consignment, e.g. in the form of a bar code. Each further sorting installation reads this bar code.

However, it is frequently not desirable for a postal consignment to be furnished with a bar code. An agreement of the Universal Postal Union (UPU) provides that cross-border postal consignments shall not be furnished with a bar code, since different postal service providers normally use different coding systems.

Therefore, in the exemplary embodiment a method is used which has come to be known by the name of "fingerprinting" or "virtual ID" and is described e.g. in DE 4000603 C2 and EP 1222037 B1 and which enables each further sorting installation to determine without a bar code the delivery address which the first sorting installation has read.

In the exemplary embodiment, m different features of a postal consignment are predefined which, as the postal consignment passes through a sorting installation, can be measured optically without the postal consignment being damaged. Examples of such features are:

- a bar code on the front of the postal consignment,
- a bar code on the back of the postal consignment,
- dimensions of the postal consignment,

- the distribution of gray levels and/or color tones on a surface of the postal consignment,
- the position and dimension of the franking mark (e.g. stamp or franking machine),
- the position and size of the address block and/or of the details relating to the sender,
- a logo on the postal consignment, e.g. a logo of the sender or an advertising imprint, and
- features of the delivery address, e.g. the zip code.

In the exemplary embodiment, the sorting installation furnishes during the first pass some of the postal consignments with a unique identification, e.g. in the form of a readable number, an ID bar code or a matrix code. This ID bar code or this matrix code distinguishes the postal consignment from all other postal consignments which pass through one of the sorting installations within a predefined period of time, and is thus a machine-readable identification of the postal consignment. The other postal consignments are not furnished with such a unique identifier but are identified during the second sorting pass with the aid of a fingerprinting method.

Fig. 1 shows a network comprising three processing installations An1-1, An1-3 and An1-4. These three processing installations are configured in the exemplary embodiment as sorting installations. Each sorting installation has a feeding device in the form of a feeder, a reading device and a multiplicity of output compartments. Postal consignments are fed into the feeder of such a sorting installation. The feeder separates the postal consignments. The separated postal consignments then pass through the sorting installation. The reading device generates an image of the postal consignment. Using the image, the sorting installation determines the delivery address and, depending on the delivery address recognized, discharges the postal consignment into one of the output compartments. Each of the three sorting installations An1-1, An1-3 and An1-4 is connected to a central database DB and has read and write access to this database DB. Transport information I is

stored in the database DB. This information comprises the measured item sequences and measurement sequences.

In the example shown in Fig. 1, postal consignments are firstly fed into the feeder ZE-1 of the sorting installation Anl-1. The sorting installation Anl-1 generates a digital image of each postal consignment and determines the delivery address. The sorting installation Anl-1 firstly attempts to determine the delivery address automatically by means of optical character recognition (OCR). If this is unsuccessful, the image is transmitted to a video coding station, and an operator inputs the delivery address - or at least the zip code - manually. Depending on the delivery address determined respectively, the sorting installation Anl-1 discharges the postal consignment into one of the output compartments.

In the example from Fig. 1, three output compartments Af-A, Af-B and Af-E of the sorting installation Anl-1 are shown. These three output compartments function in the exemplary embodiment as intermediate stores into which the items are discharged and buffered before being transported further.

The postal consignments which the sorting installation Anl-1 has discharged into the output compartment Af-E are transferred in the example from Fig. 1 into a container Beh-3. The container Beh-3 with these postal consignments is transported again to the feeder ZE-1 of the sorting installation Anl-1. The postal consignments from the container Beh-3 are separated by the feeder ZE-1 and pass afresh through the sorting installation Anl-1.

In the example from Fig. 1, the postal consignments are fed from the output compartment Af-E to the feeding device ZE-1 and pass afresh though the installation Anl-1. A reason for this may be that n-pass sequencing is being executed, as just described. It is also possible for individual postal consignments to pass through the sorting installation Anl-1 several times because off-line video coding is executed. During the first pass, a digital image of the

postal consignment is generated. If the address in this image cannot be recognized automatically, the image is transmitted to a video coding station. There, the address is input manually. After this has happened, the postal consignment passes through the sorting installation afresh and is discharged into an output compartment, depending on the address input. It is also possible for postal consignments to be consigned within a location or delivery area, and for these postal consignments the first sorting installation An1-1 therefore executes both the incoming sorting and the subsequent outgoing sorting.

In the exemplary embodiment, containers are used in order to transport the postal consignments from the output compartment Af-E to the feeding device ZE-1. The container is transported manually or e.g. by means of a reloading bridge. It is also possible to use instead of containers e.g. a conveyor belt, onto which stacks of postal items are placed.

The postal consignments which the sorting installation An1-1 has discharged into the output compartment Af-A are transferred in the example from Fig. 1 into a container Beh-1. The container Beh-1 with these postal consignments is transported to the feeder ZE-3 of the sorting installation An1-3. The postal consignments from the container Beh-3 are separated by the feeder ZE-3 and pass through the sorting installation An1-3. Analogously, the same occurs with the postal consignments which the first sorting installation An1-1 has discharged into the output compartment Af-B. These are transported in the container Beh-2 to the feeder ZE-4 of the third sorting installation An1-4. The postal consignments which the sorting installation An1-1 discharges into the output compartment Af-E are transported in the container Beh-3 to the feeding device ZE1 and pass afresh through the sorting installation An1-1.

The two remaining sorting installations An1-3 and An1-4 use afresh the reading result which the sorting installation An1-1 has obtained. In order to make this possible, the sorting installation

Anl-1 generates for each postal consignment that passes through the sorting installation Anl-1 a data record and stores it in the central database DB as part of transport information I. This data record comprises:

- an internal identifier of the postal consignment and
- a coding for the processing attribute value, i.e. here the delivery address, which the first sorting installation Anl-1 has read.

Each further sorting installation through which the postal consignment passes, recognizes this postal consignment. The aforementioned m features which are optically measurable are predefined for this purpose.

The first sorting installation Anl-1 determines, for each postal consignment which passes through the sorting installation Anl-1, what value each predefined feature assumes respectively in this postal consignment. In this way, the first sorting installation Anl-1 generates a feature vector which, where n features are predefined, consists of n feature values. The first sorting installation Anl-1 supplements the data record for the postal consignment with the feature vector, i.e. with a coding of the n feature values.

The third sorting installation Anl-3 also measures, for each postal consignment which passes through the sorting installation Anl-3, what value each predefined feature assumes for this postal consignment. In this way, the third sorting installation Anl-3 also generates a feature vector comprising n feature values. The third sorting installation Anl-3 performs a read access to the central database DB. The feature vectors of stored data records are compared with the currently measured feature vector. In this way, the data record which originates from the postal consignment currently under examination is determined. This data record comprises the delivery address of the postal consignment which the first sorting installation Anl-1 has read.

In this embodiment, a coding of the delivery address to which a postal consignment is to be transported is stored respectively in the data record of the postal consignment. This delivery address functions as the processing attribute of the item. In other embodiments, other processing attributes, e.g. a weight or a dimension or a surface characteristic of the postal consignment, are additionally measured and stored during the first sorting pass. The processing attribute can also be a forwarding address or an endorsement which is filed in a database. The result of an analysis of a franking mark with which the postal consignment is furnished, e.g. the result of the check as to whether a letter is adequately franked, can also be used as the processing attribute.

The method according to the solution is applied to each output compartment of the first sorting installation An1-1. For each output compartment, an item sequence is measured respectively. The method will be explained below, taking the output compartment Af-A as an example.

In the example from Fig. 2, the first sorting installation An1-1 discharges the 29 postal consignments 1, 2, 3, 4, … 28, 29 consecutively into the output compartment Af-A. The discharge sequence 1, 2, 3, 4, … 28, 29 is labeled A in Fig. 2 and is an integral part of the item sequence for the output compartment Af-A. These 29 postal consignments are then again fed consecutively into a sorting installation - in the exemplary embodiment into the feeding device ZE-3 of the sorting installation An1-3 - in the following sequences:

- firstly, the first sequence A1 comprising the postal consignments 10, 11, … , 15
- then, the second sequence A2 comprising the postal consignments 1, 2, … , 9
- then, the third sequence A3 comprising the postal consignments 22, 23, … , 27
- then, the fourth sequence A4 comprising the postal consignments 16, 17, … , 21 and

- finally, the fifth sequence A5 comprising the postal consignments 28 and 29.

Each sequence of postal consignments is transferred into a container in this order after the first sorting pass. It is possible for several sequences to be transferred consecutively into the same container. Each loading of a container with a sequence of postal consignments functions as a loading process of the container.

Fig. 3 shows the sequence in which the 29 postal consignments are transferred from the output compartment Af-A into the container Beh-1. Firstly, the first sequence is transferred into the container Beh-1, then the second sequence and so forth. The 29 postal consignments in the container Beh-1 are in this order. They are transported together in the container Beh-1 to the feeding device ZE-3 and then pass through the sorting installation An1-3.

The container used respectively is unloaded such that the order is retained among the postal consignments of a sequence, but the order among the sequences can be changed. The sequences in the exemplary embodiment are used in the loading processes, but are not determined.

In the second pass, the 29 postal consignments pass through the sorting installation as follows: firstly the postal consignments of the first sequence, then those of the second sequence, then of the third sequence and so on until the final sequence 28, 29. This order functions as the measurement sequence, since the postal consignments are measured in this order during the second sorting pass.

Fig. 4 shows the order in which the 29 postal consignments from Af-A from Fig. 3 pass through the sorting installation An1-3.

During the second pass, an attempt is made initially to identify each postal consignment passing through with the aid of a globally unique feature. In the exemplary embodiment, this feature is an imprinted unique identification. This unique identification

distinguishes a marked postal consignment from all other postal consignments which pass through one of the sorting installations within a predefined time period. The identification can be printed on the front or on the back of the postal consignment and take the form of a number, a bar code or a matrix code containing encrypted information. The identification can also be printed on a label which is affixed to the postal consignment.

In the example, the postal consignments 1, 2, 3, 5, ... can be uniquely identified in the second sorting pass. The remaining postal consignments cannot be identified during the second sorting pass from an imprinted and globally unique identification, e.g. because they have no unique identification or because this is not machine-readable without errors. These postal consignments without a unique readable identification are marked gray in Fig. 2 and the figures that follow.

A number n_la (la = look ahead) is predefined. In the exemplary embodiment, n_la = 2. This number n_la is predefined so as to be as large as possible and as small as necessary and depends on the following features, which restrict the number n-la to an upper limit:

- the maximum response time which may lapse between the time at which the postal consignment passed the reading device and the determining of the data record for this postal consignment,
- the transportation speed with which the postal consignments are transported,
- the gap between two postal consignments and
- the processing time required in respect of one postal consignment for reading an identification on the postal consignment and calculating the feature vector if no clearly readable identification is present.

In addition, a number n_lb (lb = look back) is predefined. This depends solely on the computational capacity. In the example, n_lb = n_la = 2.

In the example from Fig. 2 and the figures that follow, the postal consignment 8 has no identification that can be deciphered clearly in the second sorting pass. The following steps are therefore executed:

- An attempt is made to read the n_la identifications of those postal consignments which follow the postal consignment 8 in the second sorting pass.
- In the example from Fig. 5, the postal consignments 9 and 22 are determined by this means, as n_la is equal to 2 and their unique identifications are recognized, and the postal consignments 9 and 22 are the two succeeding postal consignments and have clearly readable identifications. A "look ahead" of two postal consignments is thus executed.
- It is also determined which identifications of the n_lb preceding postal consignments have been read. In the example from Fig. 3, these are the identifications of the n_lb = 2 postal consignments 6 and 7.

Fig. 5 illustrates which four partial sequences are determined in the example from Fig. 3 and Fig. 4.

It is also possible for at least one of the n_la preceding postal consignments or at least one of the n_lb succeeding postal consignments likewise not to be furnished with an identification that is clearly readable.

The stored item sequence in which the postal consignments are discharged after the first sorting pass is used in order to determine a partial sequence for the n_la succeeding and the n_lb preceding postal consignments respectively.

Let Ps-x be a postal consignment with no legible identification. For each postal consignment Ps which succeeds or precedes the postal consignment Ps-x,

- n_nf postal consignments are determined which follow after Ps in the item sequence, and
- n_vl postal consignments are determined which precede Ps in the item sequence.

Here, n_vl >= n_la and n_nf >= n_lb are two predefined numbers. In the exemplary embodiment, n_vl = n_nf = 3.

It is possible that this sequence will be changed during the second sorting pass.

By means of this approach, a partial sequence of max. (n_vl + n_nf + 1) postal consignments is determined from the item sequence. This partial sequence consists of Ps itself as well as the n_vl postal consignments before Ps and the n_nf postal consignments after Ps. It is possible that fewer than n_vl postal consignments will precede Ps or that fewer than n_nf postal consignments will succeed Ps. Because n_vl >= n_la and n_nf >= n_lb apply, Ps-x is included in this partial sequence.

Thus, in total, (n_la + n_lb) partial sequences, each comprising a maximum of (n_vl + n_nf + 1) postal consignments, are determined. Ps-x is included in each of these partial sequences.

A search-space restriction is undertaken. In one embodiment, the data record for the postal consignment 8 is sought only among the data records for those postal consignments which occur in at least one of the determined (n_la + n_lb) partial sequences. The search space is thus restricted to the data records of the partial sequences. In this embodiment, the order of the postal consignments in these partial sequences is not needed.

Since, during each loading process, multiple postal consignments are respectively transferred into a transport means without the

order of these postal consignments being changed, it suffices if, during the second sorting pass, only two partial sequences are determined, namely the partial sequence of the first preceding postal consignment with a clearly readable identification and that of the first succeeding postal consignment with a clearly readable identification.

Thus, in the example from Fig. 3, it suffices if, when restricting the search space for the postal consignment 8, firstly an attempt is made to read the unique identification of the postal consignment 7. Only if this is unsuccessful is the unique identification of postal consignment 6 read, then that of postal consignment 5, until n_1a preceding postal consignments have been examined. The same applies by analogy to the succeeding postal consignments 9, 22 and so on.

In the example from Fig. 4, using the item sequence, the following (n_1a + n_1b) = 4 partial sequences are determined overall in order to restrict the search space for the postal consignment 8:

- for the preceding postal consignment 6, the partial sequence T(6) comprising the postal consignments 3, 4, 5, 6, 7, 8, 9, wherein the postal consignments 3, 5, 6, 7, 9 have legible identifications,
- for the preceding postal consignment 7, the partial sequence T(7) comprising the postal consignments 4, 5, 6, 7, 8, 9, 10, wherein the postal consignments 5, 6, 7, 9, 10 have legible identifications,
- for the succeeding postal consignment 9, the partial sequence T(9) comprising the postal consignments 6, 7, 8, 9, 10, 11, 12, wherein the postal consignments 6, 7, 9, 10, 11, 12 have legible identifications,
- for the succeeding postal consignment 22, the partial sequence T(22) comprising the postal consignments 19, 20, 21, 22, 23, 24, 25, wherein the postal consignments 19, 21, 22, 23, 24 have legible identifications.

Each of these partial sequences consists of (n_vl + n_nf + 1) = 7 postal consignments, respectively.

The search space is restricted to the data records for those postal consignments which occur in at least one of these determined partial sequences.

In the example shown in Fig. 4, the search space is restricted to the data records for those postal consignments which occur in at least one of the determined four partial sequences T(6), T(7), T(9) and T(22). These are, in total, the data records for the postal consignments 3, 4, … , 12, 19, … , 25.

A development of this embodiment reduces the search space. In this embodiment, the respective order of the postal consignment in each partial sequence is additionally used to restrict the search space.

Fig.6 shows this development, based on the example from Fig. 4. The partial sequence T(7) from Fig. 4 for the postal consignment 7 consists of the postal consignments 4, 5, 6, 7, 8, 9, 10. In the second sorting pass, it is recognized through reading of the unique identifications that after postal consignment 9 does not come postal consignment 10, which follows 9 in the item sequence, but postal consignment 22. The postal consignment 10 is therefore deleted from the partial sequence T(7) comprising postal consignments 4, 5, 6, 7, 8, 9, 10 for postal consignment 7, so that the partial sequence 5, 6, 7, 8, 9 remains. The recognized postal consignment 10 cannot be the postal consignment 8 that is sought.

The partial sequence T(9) for the postal consignment 9 consists of the postal consignments 6, 7, 8, 9, 10, 11, 12. Again, the fact is exploited that in the second sorting pass the postal consignment 9 is not followed by the postal consignment 10. The postal consignments 10, 11, 12 are therefore deleted from the partial sequence 6, 7, 8, 9, 10, 11, 12.

The partial sequence T(22) for the postal consignment 22 consists of the postal consignments 19, 20, 21, 22, 23, 24, 25. The postal consignment 22 is preceded in the second sorting pass not by the postal consignment 21, but by the postal consignment 9. The postal consignments 19, 20, 21 are therefore deleted from the partial sequence 19, 20, 21, 22, 23, 24, 25.

After the reduction, the data records for the postal consignments 3, 4, … , 9, 22, … , 25 remain as search space.

The search space is further restricted by those postal consignments which precede the postal consignment 8 and whose identifications have already been clearly recognized, if the postal consignment 8 is to be identified. In the example from Fig. 5 and Fig. 6, these are the postal consignments 5, 6, 7.

The method will now be explained, taking the postal consignment 27 as an example. No identification can be read clearly in the second sorting pass for this postal consignment 27 either. The postal consignment 27 is located at the end of the sequence A3.

In the second sorting pass, the postal consignment 27 is preceded by the two postal consignments 25 and then 26 and followed by the two postal consignments 16 and 17. These four postal consignments were also identified clearly in the second sorting pass on the basis of their identifications. Therefore, four partial sequences are again determined, namely the partial sequences T(16), T(17), T(25) and T(26). These four determined partial sequences are shown in Fig. 7. The partial sequence T(26) consists of only 6 postal consignments, because the postal consignment 29 is the last in the item sequence. The search space for the postal consignment 27 consists of the data records for the postal consignments 13, … , 20, 23, … , 29.

Fig. 8 shows the reduced partial sequences from Fig. 7. This results in a reduced search space which consists only of the data records for the postal consignments 15, …, 20, 23, 27.

List of reference characters

Reference character	*Meaning*
1,2,…,29	Postal consignments which pass through the sorting installation Anl-1 twice
A	Discharge sequence, and simultaneously the item sequence
A1, A2, …	Sequences of postal consignments which are transferred consecutively into the container Beh-1
AF-A, Af-B, Af-E	Output compartments of the sorting installation Anl-1
Af-3.1, Af-3.2, …	Output compartments of the sorting installation Anl-3
Anl-1, Anl-3, Anl-4	Sorting installations
Beh-1	Container, in which postal consignments from Af-A are transported to ZE-3
Beh-2	Container in which postal consignments from Af-B are transported to ZE-4
Beh-3	Container in which postal consignments from Af-E are transported to ZE-1
DB	Central database
I	Transport information
M	Measurement sequence in which the postal consignments 1, 2, … 29 pass through the sorting installation Anl-3.
n_1a	Number of succeeding postal consignments, in the flow of postal consignments, the identifications of which an attempt is made to read in advance
n_1b	Number of preceding postal consignments, in the flow of postal consignments, the identifications

	of which are taken into account
n_nf	Number of succeeding postal consignments in the item sequence which occur in the partial sequence
n_vl	Number of preceding postal consignments in the item sequence which occur in the partial sequence
T(7)	Partial sequence determined for the postal consignment 7
T(9)	Partial sequence determined for the postal consignment 9
ZE-1	Feeding device of the sorting installation An1-1
ZE-3	Feeding device of the sorting installation An1-3
ZE-4	Feeding device of the sorting installation An1-4

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CLAIMS:

1. A method for processing multiple items, wherein

at least one measurable processing attribute and at least two measurable features are predefined and a processing installation is used and

for each item, the steps are executed whereby

- a measurement is made of the value which the processing attribute assumes for the item,

- a measurement is made of the value which each predefined feature respectively assumes for the item,

- a data record for the item is generated which comprises the measured feature values and the measured processing attribute value,

- the item is transferred into an intermediate store, then transferred from the intermediate store into a transport means and transported in the transport means to the processing installation,

- after the item has reached the processing installation, a fresh measurement is made of the value which each predefined feature respectively assumes for this item,

- the data record generated for this item is determined using the feature values obtained when measured afresh,

- the processing installation processes the item using the processing attribute value of the data record determined,

wherein

- for each intermediate store used, an item sequence in which the items are transferred into the intermediate store is measured respectively,

- the transporting of the items to the processing installation comprises multiple loading processes,

- in each loading process, multiple items are transferred from an intermediate store into a transport means such that the item sequence measured for this intermediate store is retained among these items, and

- the fresh measurement is executed in a measurement sequence among the items,

wherein

one of the predefined features is an identification

with which the item can be furnished and which distinguished an actually identified item from all other processed items,

when, upon making a fresh measurement in respect of an item, its identification has been read, the data record for this item is determined by means of the read identification and

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when it is established upon making a fresh measurement that the item has no identification or no clearly readable identification, the steps are executed whereby

- at least one preceding item in the measurement sequence with a clearly readable identification and at least one succeeding item, in the measurement sequence, with a clearly readable identification are determined,

- for each item determined in this fashion, a partial sequence of a measured item sequence is determined respectively such that the partial sequence comprises the determined item and at least one item which precedes and one which succeeds the determined identified item in the item sequence respectively,

- the data record for the item with no readable identification is sought among the data records of those items which are contained in at least one determined partial sequence,

- wherein at least one further feature value of the item, which feature value has been measured during the fresh measurement, is used for the search for the data record.

2. The method as claimed in claim 1,

wherein

for at least one partial sequence, which was determined for a determined item with a clearly read identification,

a check is made by the processing installation as to whether the measurement sequence deviates from the sequence set by the partial sequence,

for which purpose item identifications which were clearly read during the fresh measurement are used, and

in the event of a deviation, those items with identifications which occur at a different position in the measurement sequence than in the item sequence are deleted from the determined partial sequence.

3. The method as claimed in claim 1 or claim 2,

wherein

each item to be processed is furnished with an identification of a destination address to which the item is to be transported,

the destination address with which the item is furnished is used as a processing attribute value, and

the processing of the item by the processing installation comprises the step whereby the processing installation triggers transportation of the item to the particular destination address which the data record determined comprises.

4. A device for processing multiple items,

wherein the device comprises

- a first processing installation,

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- a second processing installation,

- a database connected to both processing installations,

- at least one transport means and

- at least one intermediate store,

at least one measurable processing attribute and at least two measurable features are predefined,

the first processing installation is configured, in respect of each item,

- to measure the value which the processing attribute assumes for the item,

- to measure the value which each predefined feature assumes for the item,

- to generate and to store in the database a data record for the item which comprises the measured feature values and the measured processing attribute value,

- to transfer the item into an intermediate store,

the device is configured such that the item is transferred from the intermediate store into a transport means and is transported in the transport means to the processing installation,

the second processing installation is configured, in respect of each item,

- to measure afresh, after the item has reached the processing installation, the value which each predefined feature assumes for this item respectively,

- to determine the data record generated and stored for this item using the feature values obtained in the fresh measurement,

- to process the item using the processing attribute value of the data record determined,

wherein

- the first processing installation is configured furthermore to measure for each intermediate store used, a respective item sequence in which it transfers the items into the intermediate store,

- the transporting of the items to the processing installation comprises multiple loading processes,

- in each loading process, multiple items are transferred from an intermediate store into a transport means such that the item sequence measured for this intermediate store is retained among these items, and

- the second processing installation is configured furthermore to execute the fresh measurement in a measurement sequence among the items,

wherein

one of the predefined features is an identification

with which the item can be furnished and which distinguishes an actually identified item from all other processed items,

the second processing installation is configured to determine, when during the new measurement in respect of an item its identification is read, the data record for this item by means of the read identification and

the second processing installation is configured so as, if during the fresh measurement it is established that the item has no identification or no clearly readable identification,

- to determine at least one preceding item in the measurement sequence with a clearly readable identification and at least one succeeding item in the measurement sequence with a clearly readable identification,

- to determine for each item determined in this fashion respectively a partial sequence of a measured item sequence such that the partial sequence comprises the determined item and at least one item which precedes and one which succeeds the determined identified item in the item sequence respectively,

- to search for the data record for the item with no readable identification among the data records of those items which are contained in at least one determined partial sequence,

- wherein the second processing installation uses for the search for the data record at least one further feature value of the item, which feature value has been measured during the fresh measurement.

5. The device as claimed in claim 4,

wherein

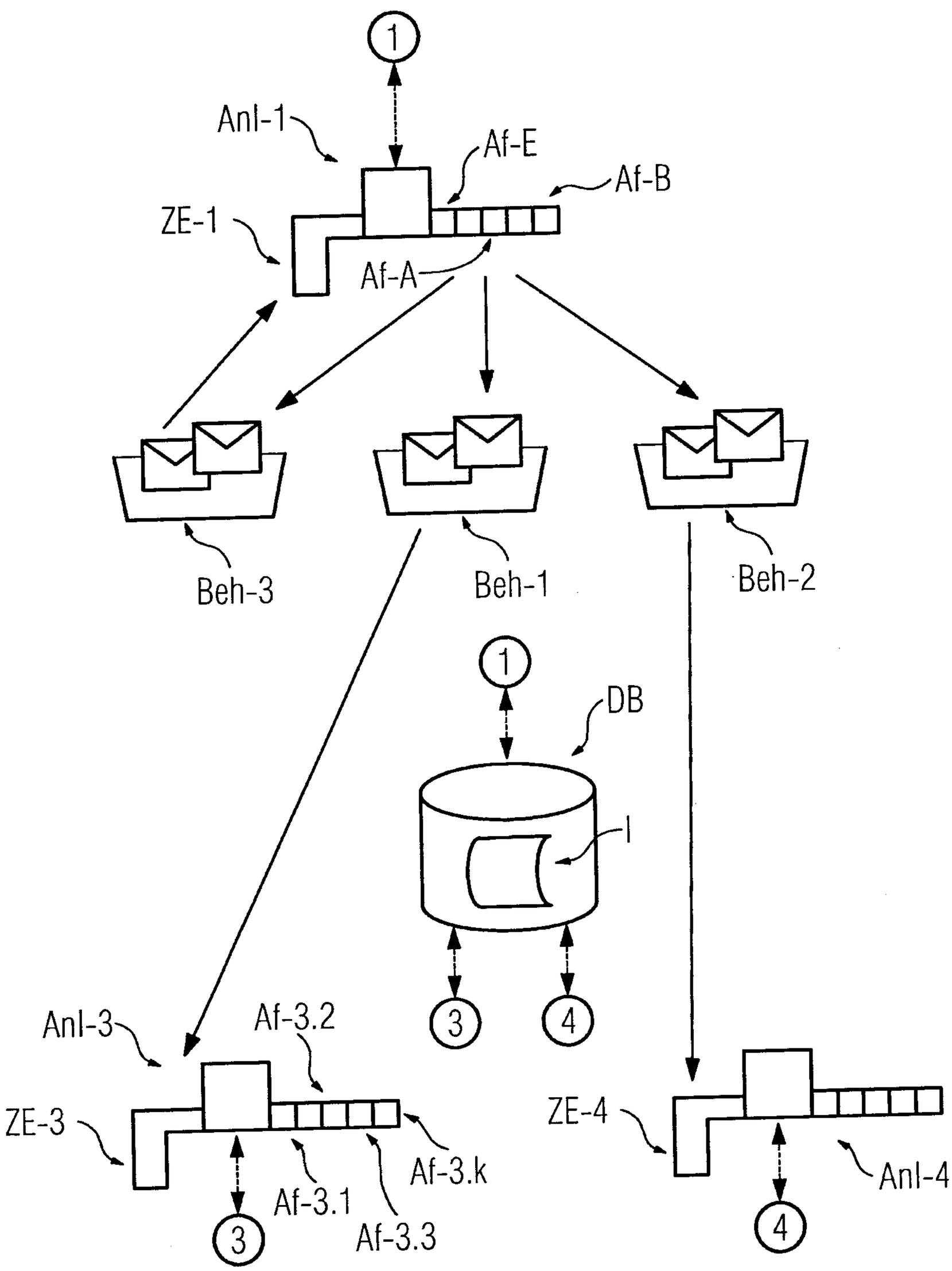
the second processing installation is configured to check, in respect of at least one partial sequence, which was determined for a determined item with a clearly read identification,

whether the measurement sequence deviates from the sequence set by the partial sequence,

for which purpose the second processing installation uses item identifications which were read clearly during the fresh measurement, and

in the event of a deviation, to delete from the determined partial sequence those items with identifications which occur at a different position in the measurement sequence than in the item sequence.

FIG 1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Af-E
Af-B
ZE-1
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Beh-3
Beh-1
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FIG 2

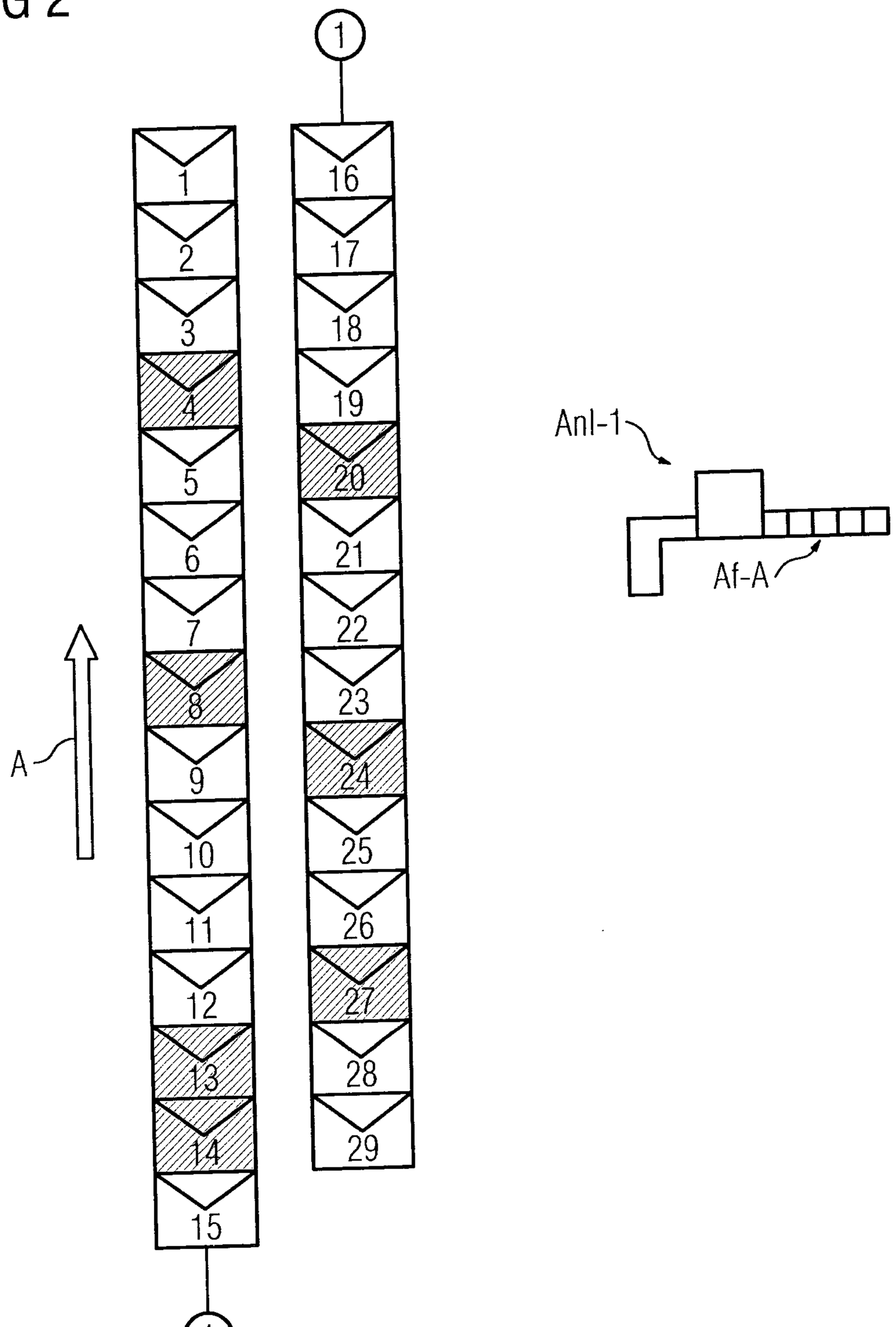
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FIG 3

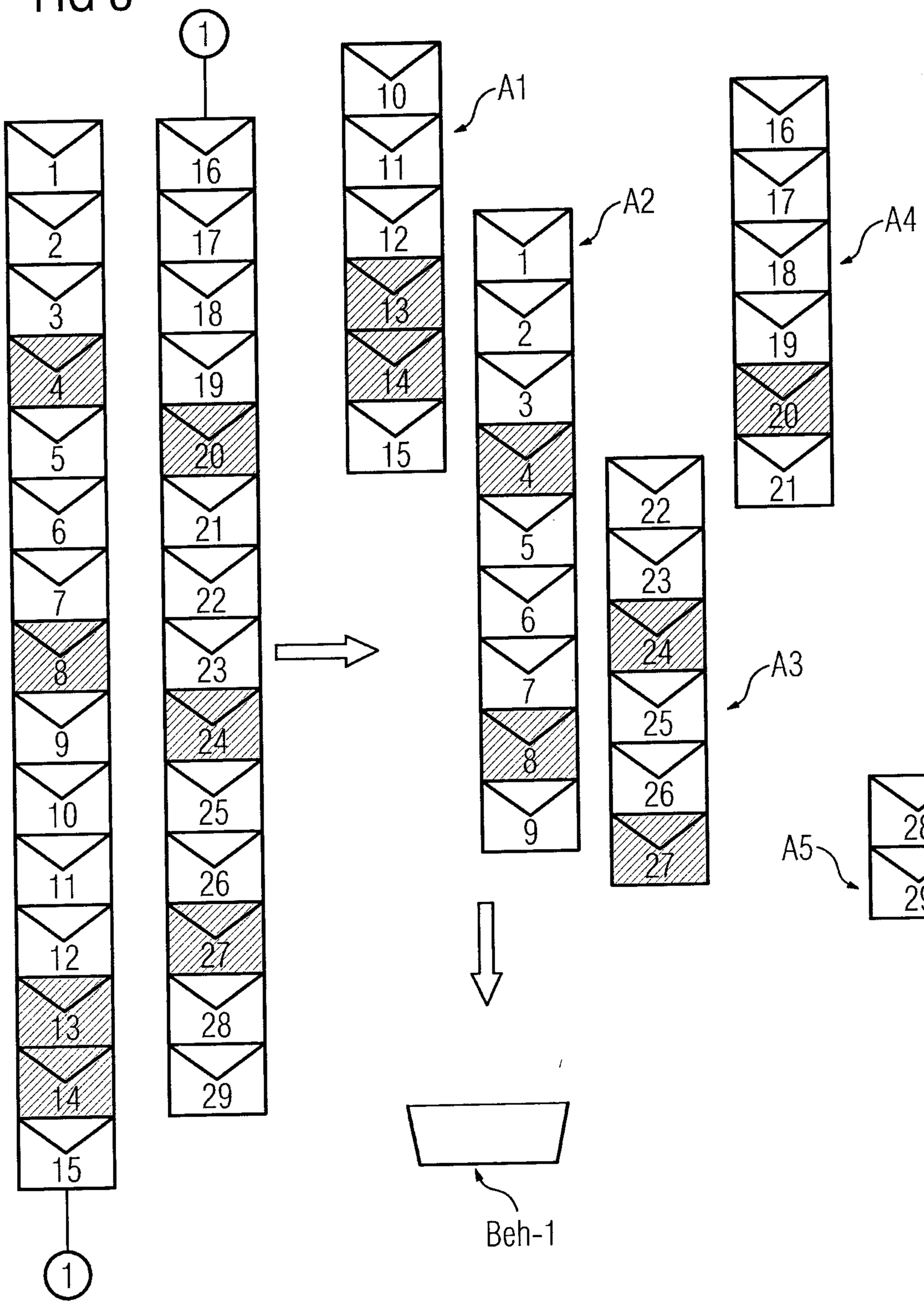
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FIG 4

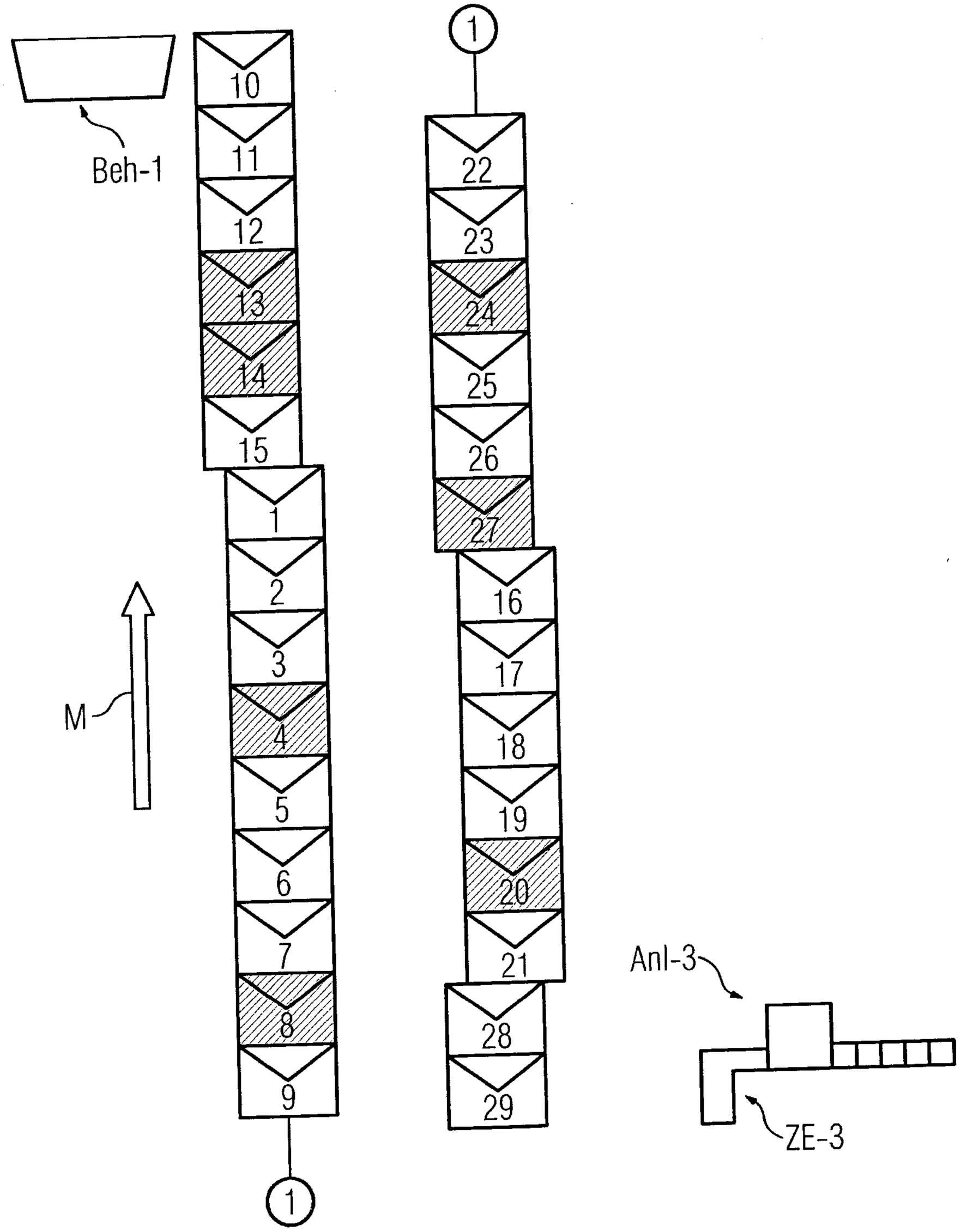
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FIG 5

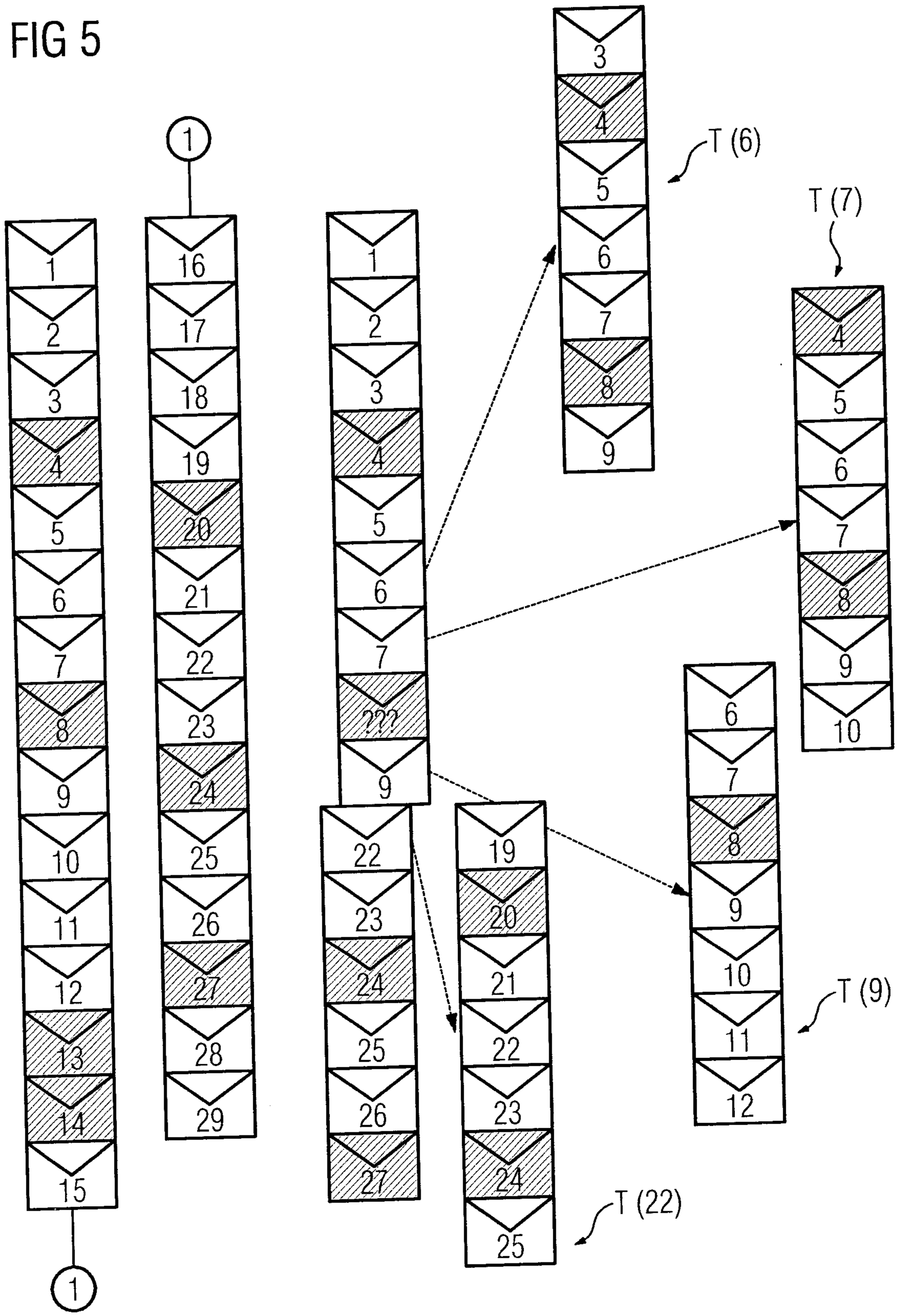
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FIG 6

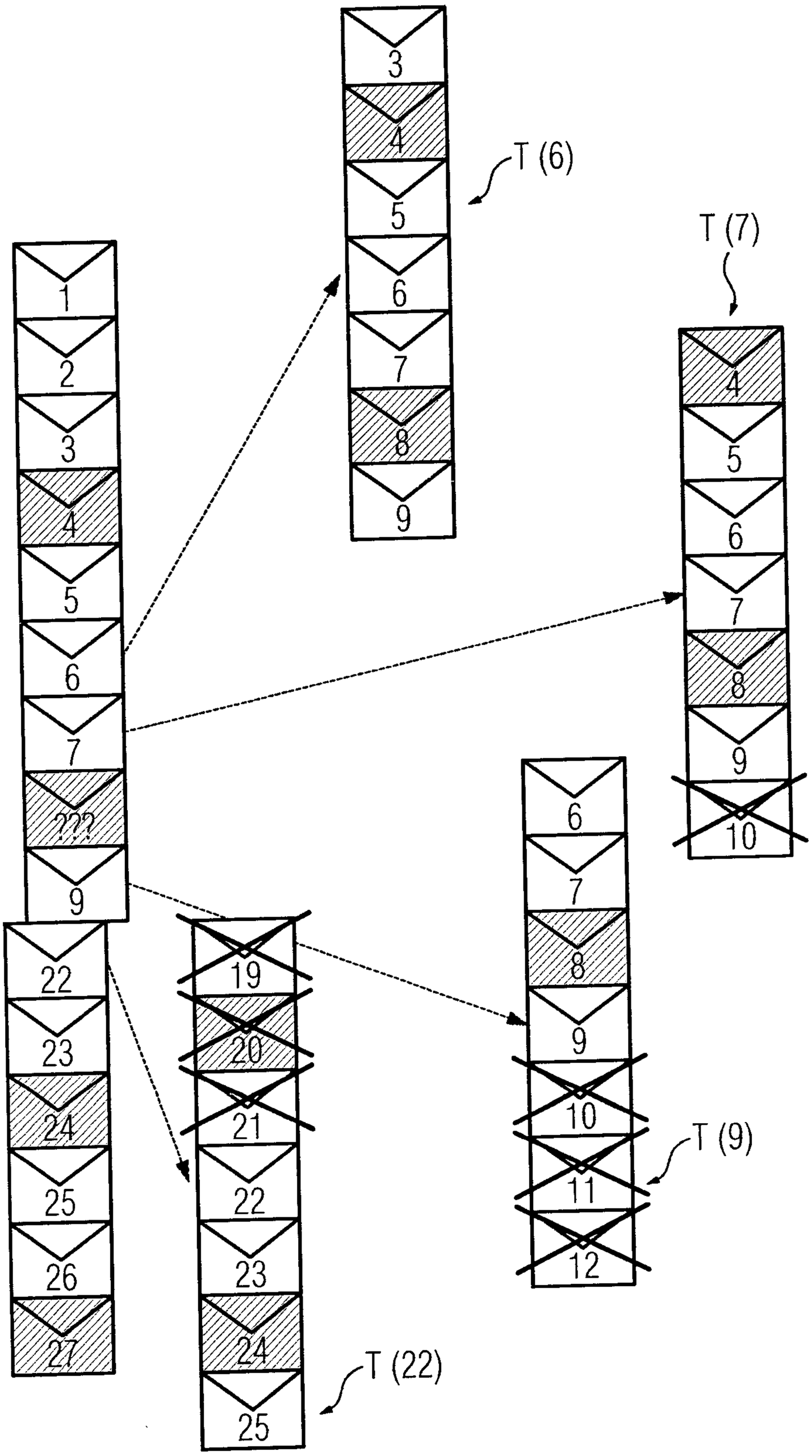
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FIG 7

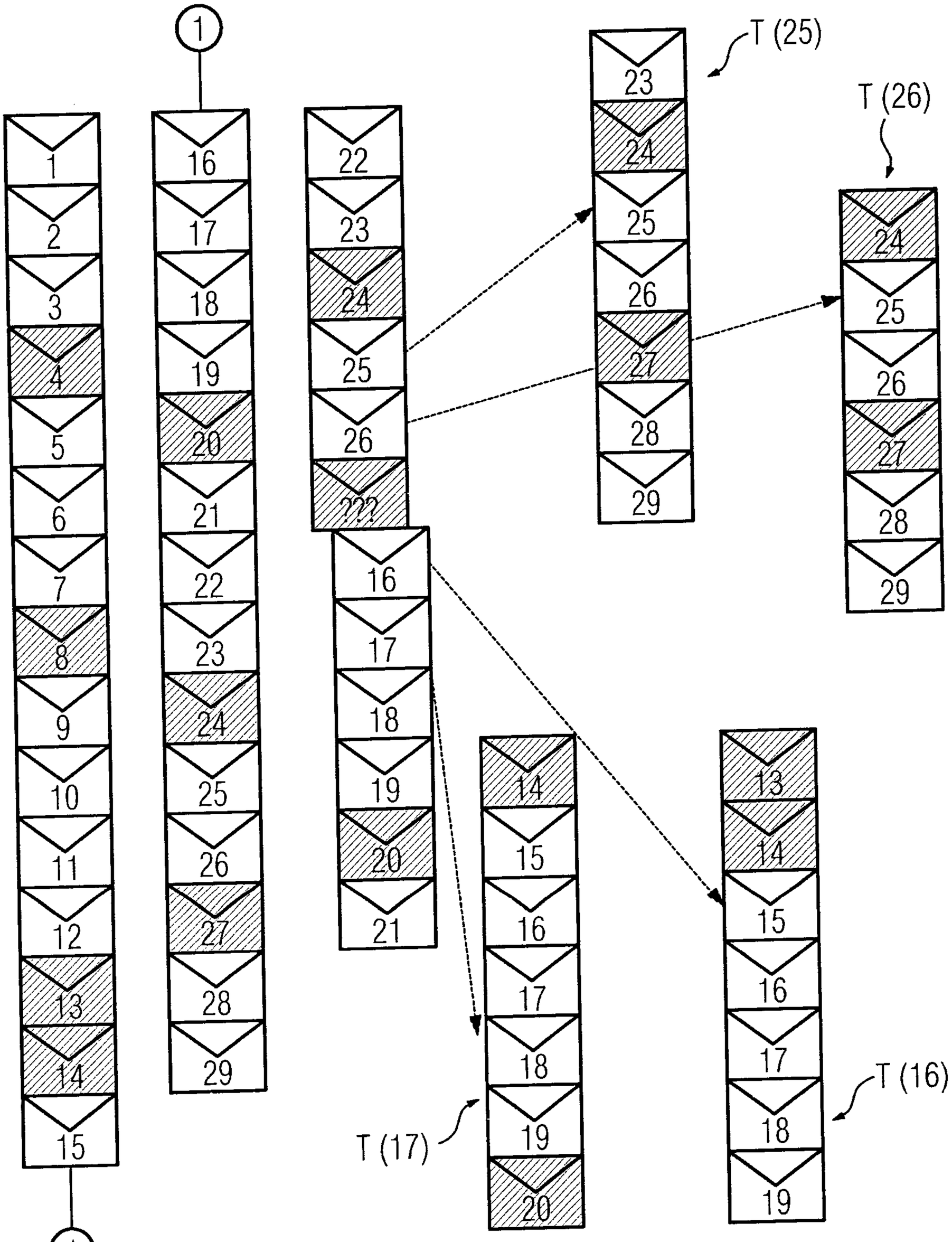
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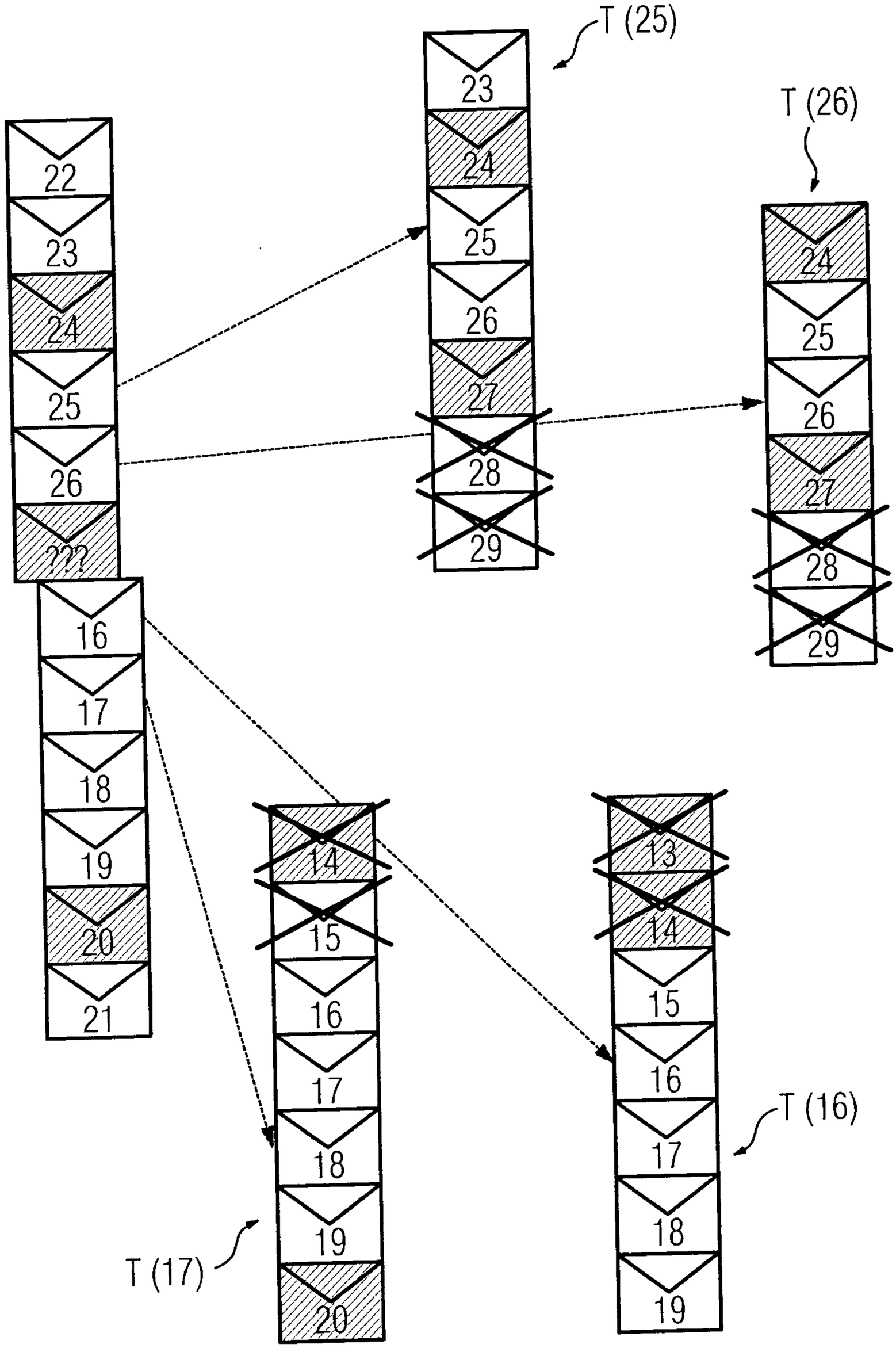
FIG 8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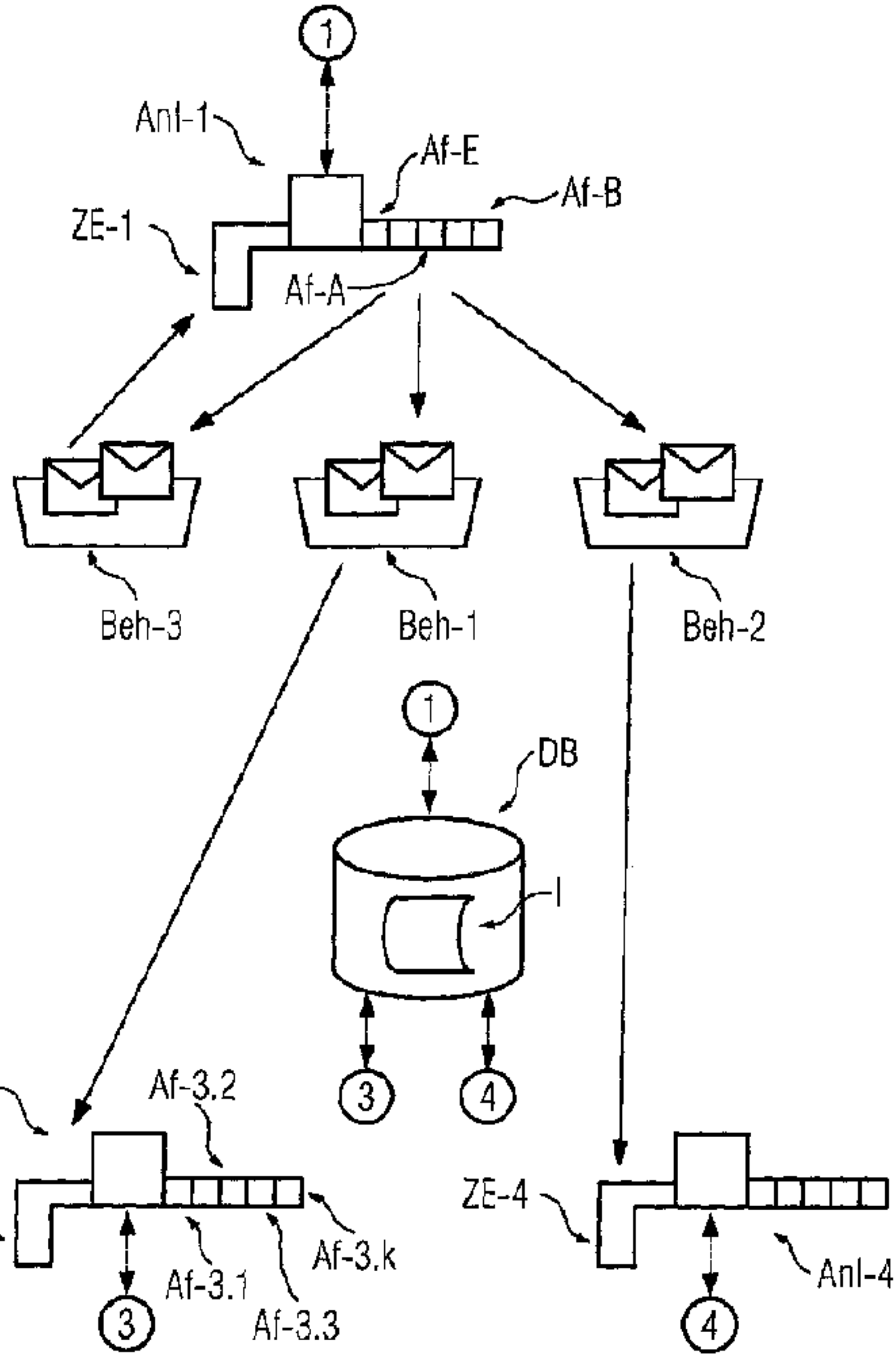
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Af-A
Beh-3
Beh-1
Beh-2
1
DB
I
3
4
Anl-3
Af-3.2
ZE-3
Af-3.k
Af-3.1
Af-3.3
3
ZE-4
Anl-4
4