Title: CONVEYOR SYSTEM WITH ITEM RECEIVING UNITS AND USES OF THE CONVEYOR SYSTEM

Abstract: A conveyor system having a number of receiving units. At a discharge position the items are unloaded from the conveyor to a trolley or a box. The trolley is used for transporting the items to a third location. Is well suited for use in a library for transporting books and other library items being returned by patrons from a receiving unit to shelfs of the library. May also be used for delivering reserved material to patrons. Decreases the heavy workload on the staff and shortens the time elapsed from an item is returned until it is available on the shelf again. Furthermore, use of the conveyor system for transporting library items, postal items, or transporting freight items at airports or train stations.
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
CONVEYOR SYSTEM WITH ITEM RECEIVING UNITS AND USES OF THE CONVEYOR SYSTEM

FIELD OF THE INVENTION

The invention relates to a conveyor system for transporting items. The invention further relates to different uses of the conveyor system of the invention.

The present invention is primarily intended for being used when handling library items such as books, magazines, recorded tapes, recorded discs etc. Today, the dominant way of having library items returned from the patrons and having the library items placed on the shelves again involves a lot of manual handling by the library staff. This handling is time-consuming and the physical impact on the library staff is rather heavy. Thus, the time elapsed between the items being returned to the library and the items being present again on the shelves may be several days during which period of time the items are not directly available to the patrons. Also, the increased focus on increased physical work-loads may result in a further delay because the library staff may be prevented by physical health regulations from shelving too many items during a working day in order to obviate Repetitive Strain Injuries (RSI).

Attempts have been made to automate the working routines between the return of the items borrowed and the shelving of the items. However, either these prior attempts have led to other physical stresses to the library staff, or these prior attempts have led to automatic solutions being damaging to the items and/or not being capable of proper identification, orientation and aligning of the items to be easily and correctly shelved. Also, such prior solutions are only capable of handling a minor part of the items being returned.

Other uses of the present invention may be at other sites where handling of items take place between two persons, such as luggage and other items at an airport or at a railway station, or such as letters and parcels at a postal office. The invention is especially advantageous, where the items are to be returned by unauthorised staff such as private persons not working at the site and to authorised, however perhaps untrained, personnel working at the site and handling the items further at the site.

SUMMARY OF THE INVENTION

One object of the present invention may be to reduce the time period between the return of the items borrowed by one patron and the shelving of the items enabling another patron to borrow the item, thus improving service for the patrons.
Another object of the present invention may be to reduce the time for returning the items, where said returning involves handling the items for checking whether returned too late, and if, how late returned, thus reducing or even eliminating queues.

A still other object of the present invention may be to reduce the harmful physical workload to the library staff during return, transporting, sorting and shelving of the items, thus reducing the risk of physical damage to the library staff.

An even still other object of the present invention may be to increase the mental satisfaction of the library staff by reducing the amount of monotonous work, such as laborious and repetitive handling of returned library items until shelving of the items.

An even still other object of the present invention may be also to make it easier for the patrons returning books at a library by enabling a greater number of patrons to return books within a certain period of time and/or to provide a greater number of return terminals than if the items borrowed had to be returned to one of only a few number of library staff.

An object of the invention may be also to enable books and other items to be delivered to the patrons in case patrons have reserved items during a prior visit to the library, where the item reserved was not at the library, or during a prior on-line reservation of the item. It is the object that such delivery may take place without involving library staff.

These and other objects may be obtained by a conveyor system for transporting items, said conveyor system comprising
- a number of item receiving units each having an inlet for passing items to the conveyor system and each having an outlet leading towards conveyor units,
- a plurality of conveyor units for carrying the items from a number of loading locations, where the items are loaded onto the conveyor units, to a number of discharge locations,
- a main track along which the conveyor units are moving in a transport direction, along which transport direction the conveyor units are in a carrying state carrying the items,
- each of said conveyor unit having discharge means for discharging the items from the conveyor units at the number of discharge locations,
- a number of intermediate transporting means placed at the discharge location, said intermediate transporting means intended for transporting the items to trolleys, alternatively to boxes, after the items have been unloaded from the conveyor units, and
- a number of said trolleys, alternatively a number of said boxes, being provided for transporting, alternatively being provided for accommodating, the items to third locations.
By providing a complete conveyor system extending from item receiving units to be operated primarily by the patrons themselves or alternatively by library staff to trolleys to be operated by the library staff when shelving the items, a large amount of the prior time-consuming, laborious and repetitive handling by the library staff will not only be reduced but will be completely eliminated. The library staff formerly being employed with handling these working operations may be released to further improve service to library users having questions or needing guidance for using the library.

The object of the invention may also be obtained by an item receiving unit constituting an initial transporting means and for receiving items to be passed on to a conveyor system, said item receiving unit having
- a front face being fixedly arranged and having an opening defined therein for allowing items to pass the front face into the item receiving unit, thus allowing the items to pass between an exterior and an interior of a conveyor system,
- an item receiving surface defining an exterior inlet of the item receiving unit, the surface constituting a means for placing the items at the loading location before the items are passed to the interior of the conveyor system,
- the items, when having been placed on the surface, intended for being subjected to an automatic control for determining a transporting to the interior of the conveyor system.

By providing an item receiving unit capable of receiving and automatically controlling the items for thereby determining the transport of the item to an interior of a conveyor system, much of the laborious human work is eliminated. The laborious work may e.g. be related to the scanning of the items in order to control any possibly lately returned books at a library, to control if the items returned are reserved by others, to control any weight and thus postage of a parcel at a post office, to control any too heavy luggage per flight traveller at an airport, to control any forbidden objects of luggage for an aeroplane, or for determining any destination of luggage from an airport or from a train station.

The object of the invention is especially well obtained by providing a first intermediate transporting means having an item receiving unit and being placed at a loading location,
- said intermediate transporting means being intended for transporting the items to the conveyor units, after the items have been passed from the inlet to the outlet of the item receiving unit, and
- said intermediate transporting means leading from the outlet of the item receiving unit to the conveyor units, and at least part of said intermediate transporting means being displaceable from a normal operating position to an interrupted operating position.
The possible failure of an interior of the conveyor system leading to a stop of the conveyor system, may result in backlogs or bottleneck situations in the entire conveyor system. A first intermediate transporting means according to the above and being placed between an item receiving unit and the remainder of a conveyor system will provide the possibility of still being capable of delivering items to the item receiving unit although the conveyor units, being intended for carrying the items along the interior of the conveyor system, are stopped and thus are not capable of transporting the items.

The object of the invention may also be obtained by a trolley constituting a final transporting means for transporting to a third location, where items are being loaded onto the trolley at any of the following locations: a location of receiving the items, a discharge location of a conveyor system for conveying the items, and a location for storing the items, and said items being loaded onto the trolley at said discharge location of the conveyor system, said trolley having
- a chassis being provided with wheels for allowing transportation of the trolley to the third location from the location, where the items are loaded onto the trolley,
- an item supporting shelf capable of collecting the items directly at the loading location and for supporting and storing the items, when transporting the trolley to the third location, at said third location the items are unloaded from the trolley, and
- said item supporting shelf having an inclined position, where the items by means of gravity are loaded onto the shelf, and said trolley having a first stop for avoiding items to fall off the shelf, when the shelf is in the inclined position.

The possibility of inclining the item supporting shelf allows the items to be placed on the shelf in a manner where the items are placed from the first stop and upwards from the first stop, i.e. the first piece of item being placed on the first stop by means of gravity and the subsequent items being placed on top of the previously placed items.

The object of the invention may also be obtained by a second intermediate transporting means comprising a trolley receiving unit for receiving a trolley, and said second intermediate transporting means being placed at a discharge location of a conveyor system,
- said intermediate transporting means being intended for transporting the items from conveyor units of the conveyor system, after the items have been transported by the conveyor system to the discharge location of the conveyor system, and
- said intermediate transporting means leading from the conveyor units to the trolley receiving units, and said trolley receiving units having means for identifying an orientation of the items and having means for changing the orientation of the items.
By providing an item receiving unit capable of automatically determining an orientation and automatically changing the orientation of an item for thereby orientating the item to a preferred or needed orientation on the trolley, much of the laborious human work is eliminated related to the turning and tilting of the items in order at a library to orient a book with the back and the front of the book orientated in certain directions, at a post office to orient parcels and letters in certain directions for postage at the right side, at an airport to orient any luggage in certain direction for proper marking of destination, at airports to orient any luggage for best possible position or for different positions for inspection for forbidden objects of luggage for an aeroplane, or at airports and train stations for orientating any luggage for proper and best orientation in relation to loading of the luggage onto a luggage compartment of an aeroplane or a train.

The object of delivering items to patrons without involving library staff may be obtained by a conveyor system for transporting items, said conveyor system comprising

- a number of item delivering units each having an outlet for passing items from the conveyor system and each having an inlet leading from storing parts,
- a plurality of storing parts for storing the items at a number of loading locations, where the items are loaded onto the storing parts, to a number of discharge locations, where the items are unloaded,
- a track along which the storing parts are intended for moving in a transport direction, along which transport direction the storing parts are in a carrying state carrying the items,
- each of said storing parts having discharge means for discharging the items from the storing parts at the number of discharge locations,
- a number of transporting means placed at the discharge location, said transporting means intended for transporting the items from a rear end to a front end of the item delivering unit, after the items have been unloaded from the storing parts.

The conveyor system may alternatively or additionally comprise a storage arrangement having a plurality of storing parts for storing the items, said storage arrangement being positioned in such a way that, if desired, an item being conveyed by the conveyor system may be conveyed to the storage arrangement and intermediated stored in one of the storing parts. The storage arrangement may, thus, be positioned immediately adjacent to the conveyor system, or it may even form part of it. Alternatively, the storage arrangement may be connected to the conveyor system by means of a conveying path.

The storage arrangement may comprise at least one rack, and at least some of the storing parts may be formed by shelves accommodated in said rack. In case the storage arrangement comprises at least two racks, these may be arranged on a carrousel, so that items being stored in the storage arrangement may be moved by means of said carrousel.
In this case there may be only one position in which items can be positioned in or removed from the storage arrangement, and the carousel must be turned in order to allow the rack with a specific shelf to be in this position in order to allow items to be positioned on or removed from that shelf.

Alternatively or additionally, the storage arrangement may be provided by a sorter apparatus of the conveyor system, and at least some of the storing parts may be formed by at least some of the conveyor units. In this embodiment a sorter apparatus provides a storage facility. The sorter apparatus may be or form part of the actual conveyor system.

Alternatively, it may be additional to the conveyor system, in which case only items needing to be stored will be accommodated by the sorter apparatus. Using a sorter apparatus to provide a storage facility may be an advantage in case a discharge of the conveyor system is full or unavailable for other reasons. In this case an item destined for that discharge may advantageously be stored in the sorter apparatus until the discharge is again available.

The object of delivering items to patrons without involving library staff may further be obtained by an item delivering unit constituting an initial transporting means and for delivering items to be passed from a conveyor system, said item delivering unit having
- a front face being fixedly arranged and having an opening defined therein for allowing items to pass the front face from the item delivering unit, thus allowing the items to pass between an interior and an exterior of a conveyor system,
- an item delivering surface defining an exterior outlet of the item delivering unit, the surface constituting a means for placing the items at an un-loading location before the items are taken from the item delivering unit,

By providing a conveyor system incorporating a storing apparatus, it is possible during return of items by patrons formerly having borrowed the item to check whether the item is reserved by other patrons. If so, instead of transporting the items to a trolley or a box for further handling and for transporting the item to the proper shelf or other location within the library, it is possible to transport the item to the storing apparatus for storage until the patron having reserved the item has been notified and has collected the item reserved.

By further utilising an item delivering unit, it will be possible to deliver the item directly to the patron having reserved the item the next time the patron identifies himself at the item delivering unit. Such identification may for example be by means of a library card. Once the item delivering unit has identified the patron, the item reserved and having been stored in the storing means of the conveyor system will be transported to the item delivering unit for the patron to get the item. In a preferred embodiment, the item
delivering unit is the same as the item receiving unit. Thus, the one and same unit is capable of both receiving items to be returned and delivering items having been reserved. The present invention also relates to a method of receiving items in a conveyor system, the method comprising the steps of:

- a patron entering an item in an item receiving unit, said item comprising identification means,
- identifying the item by means of said identification means,
- determining whether the item has been reserved by another patron, based on said identifying step,
- automatically or semi-automatically processing the item in accordance with the determining step.

Thus, when an item is being returned it is immediately determined whether or not it has been reserved by another patron. If this is not the case the item is processed by the conveyor system in the normal manner, i.e. in such a way that the item is eventually returned to the correct shelf. If, on the other hand, the item has been reserved, it should not be returned to the shelf, but should instead be processed in a way which ensures that the item reaches the patron having reserved the item. This process may be either automatic, i.e. completely controlled by the conveyor system, or semi-automatic, e.g. the conveyor system conveys the item to a member of staff who will subsequently take the necessary steps to ensure that the item reaches the patron having reserved it.

The method may further comprise the step of:
- conveying the item to a specific destination in case it is determined that the item has been reserved by another patron.

The specific destination may comprise a storage arrangement having a plurality of storing parts for storing items, and the method may further comprise the steps of:
- allocating a storing part to the item in case it is determined that the item has been reserved by another patron, and
- conveying the item to the allocated storing part.

Alternatively, the specific destination may be a position where one or more members of staff is/are located.

The method may further comprise the steps of:
- alerting the patron who has reserved the item,
- delivering the item to said patron when he or she approaches the conveyor system.
The alerting step may also be performed automatically, e.g. the conveyor system may automatically generate an e-mail message, an SMS message, a letter, etc. when it has been determined that a reserved item has been returned. Alternatively, this step may be performed manually by a member of staff.

The method may further comprise the steps of, in case it is determined that the item has been reserved by another patron:
- printing a label comprising information relating to the reservation,
- attaching said label to the item.

These steps may e.g. be performed by a printing device positioned immediately adjacent to (such as above) the conveyor system, e.g. immediately adjacent to a sorter apparatus conveying the item. Once the label has been printed and attached to the item, information relating to the reservation will be visually apparent on the item. It may thus be apparent to a member of staff (and/or to the patron having reserved the item) that the item has been reserved and to whom.

Apart from the initially described item receiving unit being provided with identification means being optically and/or radio frequency based, also item controlling units may be provided at the exits of the library. Such exits often comprise a gate through which the patrons have to pass, when leaving the library through any of the exits. Such gates are adapted to control a small strip of magnetic tape or the like, such as an RFID, and being placed underneath the barcode being attached to a visually identifiable part of the item when the item is closed. However, such control of the items being brought along with the patron when leaving the library cannot be used for controlling items consisting of more parts, and where only the part containing the other parts is provided with the barcode.

Thus, according to the invention, an item controlling unit may be placed at exits of the site, at which site items are handed out to patrons for the patrons to bring the items along out of the site, said item controlling unit being provided with
- first identification means capable of identifying magnetic marking attached to the item, and said item controlling unit also being provided with
- second identification means capable of identifying radio frequency identification marking attached to the item.

By providing gates at the exits of the library, and said gates being capable of not only reading any magnetic strip or RFID placed underneath the barcode, but also being capable of reading any radio frequency signal of RFIDs placed inside the item at any other part of the item, and said RFIDs being attached to parts of the item not being visible, when the
Item is closed, then it will be possible to further control that no other items and parts of items than the ones, which the patron has lawfully borrowed, are brought along with the patron, when leaving the library.

Apart from the initially described item receiving unit being provided with identification means being optically and/or radio frequency based, and apart from item controlling units being provided at the exits of the library, also item controlling units may be provided at the entrances of the library. Such entrances may also comprise a gate through which the patrons have to pass, when entering the library through any of the entrances. Such gates may be adapted to control a small strip of magnetic tape or the like, such as an RFID, and being carried by the patron, e.g. in connection with a personal identification card. Thereby, it will be possible to inform the patron when entering the library that any books and/or other items, which the patron may have reserved, are now available for delivery. Thus, the patron does not have to ask the library staff, and the patron need neither address an item delivering unit in order to be informed of any items now being available. The informing of the patron may either be visually, acoustically or perhaps by wireless signals to a mobile phone carried along by the patron. However, in order to actually collect the items reserved, the patron must go to an item delivering unit or go to the library staff being responsible for delivery of books and other items.

Thus, according to the invention, an item controlling unit is placed at entrances of the site, at which site patrons are entering for the patrons to borrow and bring items along out of the site, said item controlling unit being provided with either
- an identification means being capable of identifying radio frequency identification marking, said identification marking being carried by the patron in connection with personal identification means such as personal identification cards, or being provided with
- identification means being capable of identifying magnetic marking, said identification marking being carried by the patron in connection with personal identification means such as personal identification cards,

Additionally to either one or both of the above-mentioned identification means, the item controlling unit is furthermore provided with
- first means for identifying data of the patron entering by means of a personal identifying numbers (PIN), a personal identification card, or bodily personal identification means or a combination of any of these personal identification means,
- second means for checking any possible reservations of items in relation to any of the personal identification means, said second means for checking utilising a database correlating the data of the patron and data of items, and
- third means for checking, if any item having been reserved by the patron is available for
delivery to the patron, said third means for checking utilising a database correlating the
possible items being reserved with items present in the conveyor system,
- and, if items having been reserved by the patron are present in the conveyor system,

fourth means for informing the patron entering the site that items having been reserved by
the patron is available for delivery at any of a number of item delivering units.

BRIEF DESCRIPTION OF THE DRAWINGS

Different embodiments according to the present invention are for illustration purposes of
the invention described below with reference to the accompanying drawings of which

Fig. 1 is a drawing of a possible embodiment of an item receiving unit according to the
invention, intended to be placed at a loading location of a conveyor system at an exterior
of a conveyor system before further transport by means of the conveyor system,

Figs. 2A-2B are drawings of an embodiment of a first intermediate transporting means for
transporting items from an outlet of an item receiving unit either to conveyor units of a
conveyor system or to intermediate storing means,

Fig. 3 is a drawing of a main track with conveyor units of a sorter apparatus constituting
an interior of the conveyor system according to the invention, intended for transporting
items between a loading location and a discharge location of the conveyor system,

Figs. 4A-4B are drawings of a first embodiment of a second intermediate transporting
means intended for transporting items from conveyor units of a conveyor system to trolley
receiving units for further transport of the items after transport by the conveyor system,

Figs. 5A-5B are drawings of a second embodiment of a second intermediate transporting
means intended for transporting items from conveyor units of a conveyor system to trolley
receiving units for further transport of the items after transport by the conveyor system,

Fig 6A-6B are perspective views of a preferred embodiment of a second intermediate
transporting means consisting of a single chute between a sorter apparatus and a trolley,

Fig. 7 is a drawing of a possible embodiment of a trolley receiving unit according to the
invention for receiving trolleys for final transport of items from a location of a conveyor
system, where items are loaded onto the trolleys, to a third location not constituting part
of the conveyor system,
Figs. 8A-8C are drawings of a possible and preferred embodiment of a trolley according to the invention, said trolley being intended for further transport of the items,

Fig. 9A-9B are perspective views of a possible storing means for intermediate storing of items having been returned to the conveyor system according to the invention, and

Fig. 10A-10B are perspective views of a possible further intermediate storing means for intermediate storing of items to be delivered through an item delivering unit.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 is a perspective view showing an embodiment of an item receiving unit according to the invention. The unit has a front face 1 being provided with a display 2 for assisting a user when using the item receiving unit. The unit also has an inlet 3 for passing the items (not shown) to the unit. The inlet 3 comprises an item receiving surface 4, where the items are to be placed, when passing the items into the inlet 3. The inlet 3 is further provided with means (not shown) for reading information relating to the item being placed on the item receiving surface 4. In relation to items of a library, the information to be read may relate to, whether the item is returned belated, whether the item is reserved by others, whether all parts of the item is returned, and/or whether it is the correct parts of the item, which are returned as part of the item. Additionally, or alternatively, the inlet 3 may be provided with means for measuring the dimensions of and/or for measuring the weight of the items being placed on the item receiving surface 4. A shelf 5 is provided for placing items in a waiting position, before the items are being successively led to the item receiving surface 4.

The reading of information is intended for identifying the item and for identifying any properties of the item. In relation to items being returned at a library, identification means, i.e. the means for actively identifying the item and its properties, is preferably means which is not physically in contact with the item. However, any identification marking which the identification means is intended for identifying is of course physically in contact with the items. Identification means may be optical reading means for identifying the item via a barcode attached to the item, such barcodes being the identification marking being attached to the item. Using a barcode will often necessitate correct orientation of the item in relation to the identification means for reading the barcode.

Identification means may also be means for reading tags using Radio Frequency Identification (RFID), such tags being the identification marking attached to the item. The
advantage of using RFID is that it is possible to identify the item and any properties
related to the item without the tag being visible. Thus, as example, when returning talking
books containing a number of audio tapes, audio discs and perhaps also books, it is
possible firstly to identify the talking book itself. The identification of the talking book itself
may alternatively also be accomplished by a barcode. Secondly, by using RFID, it is
possible to identify if the right number of audio tapes, audio discs and perhaps books are
contained in the possibly closed talking book, when being returned. Finally, by using RFID,
it is possible also to identify, whether it is the correct audio tapes, audio discs and books,
which are contained in the talking book having been identified during return of the item.

All identification takes place by means of tags at least being attached to any tapes, discs
or books contained in the talking book and not being visible, when the talking book is
closed. Thus, identification of the properties such as the number of tapes, discs and books
contained and such as the tapes, discs and books actually contained, may be accomplished
without opening the talking book during return of the talking book. Other items than
talking books and properties related to such other items may benefit from the advantages
of using RFID. It is also possible to combine RFID with optical identification.

After an identification and/or measuring and/or weighing of the item has been performed,
the item is passed from the inlet 3 through an interior of the item receiving unit to an
outlet (not shown) of the item receiving unit. From the outlet a first intermediate
transporting means (see fig. 2A-2B) is provided for transporting the items further on to a
plurality of conveyor units provided along a main track of a conveyor system (see fig. 3).
Thus, the outlet of the item receiving unit leads towards the conveyor units, but transport
of the items from the outlet to the conveyor units takes place along the first intermediate
transport means. In a possible specially adapted embodiment, the outlet of the item
receiving unit may lead directly to the conveyor units of the conveyor system.

Fig. 2A and Fig. 2B are perspective views showing an embodiment of a first intermediate
transporting means. In the embodiment shown, the first intermediate transporting means
comprises a number of conveyor belts 10,11,12 leading from a first end A to a second end
B of the transporting means. The conveyor belts 10,11,12 are divided into three belts, and
a turning device 13 is provided between the first belt 10 and the second belt 11.

Furthermore, the first belt 10 is provided with side walls 14 for centring the item 15 before
being transported to the more narrow dimensions between side walls 16 of the turning
device 13 compared to the width of the first conveyor belt 10. The turning device 13 is
intended for changing the orientation of the item, before the item is transported to the
second conveyor belt 11. The orientation may be changed half a turn, i.e. 180°. The
turning section 13 is tilted, thereby letting gravity transport the item 15 along the turning
device 13. Free-running rollers 17 or a free-running belt (not shown) is provided for decreasing friction in order to ease the transport of the item 15 by means of gravity. Alternatively, the rollers 17 or the belt may be driven in order to further assist in transporting the item along the turning device 13, perhaps if the turning device 13 is not tilted, tilting however being the case in the embodiment shown.

In an embodiment not shown, one or more of the conveyor belts 10,11,12 of the first intermediate transporting means may be raised by lifting an end of the conveyor belt, said end being an end orientated towards, i.e. not along, but against, the transport direction of the item. This will inevitably lead to the item dropping from one conveyor belt, alternatively dropping from the outlet of the item receiving unit, said one conveyor belt being situated just in front of the conveyor belt having the neighbouring end lifted.

However, in such an embodiment, a box or other accommodating means for collecting and/or storing will be placed underneath the position, where the item will drop from the conveyor belt, alternatively the outlet, situated in front of the neighbouring lifted end. The purpose of lifting an end of a conveyor belt and allowing the items to drop into a box or other intermediate accommodation means is to provide the possibility of an interruption of the transport of items from the outlet of the item receiving unit (see Fig. 1) to the conveyor units of the subsequent conveyor system (see Fig. 3). This may be advantageous in case of either an intended service stop or an unintended stop due to failure of the conveyor system. Also, the patrons may still return items continuously although an interruption of the intermediate transporting means is established.

Fig. 3 is a perspective view showing a possible part of a main track of a sorter apparatus for conveying items between an item receiving unit to means such as a trolley or such as boxes at least for further accommodation and for possible further transport of the items.

Conveyor units 18 are provided for carrying items being loaded onto the sorter apparatus.

A carrier means 19, to which the conveyor units are connected, moves in an endless main track that may have sections 21 curving in the vertical plane, thus forming vertical half-turns. Alternatively or additionally, the main track may have sections curving in a horizontal plane (not shown). An endless belt 22 extending to one side from the vertical plane of the carrier means constitutes the item carrying surface of each conveyor unit 18.

The endless belt 22 or cross-belt may be moved in a direction perpendicular to a transport direction T, and items may be discharged to either side of the conveyor unit. The item carrying surface 22 may also be constituted by other devices such as a tray, which may be tiltable in one or in both directions.
A control system of the sorter apparatus is adapted to control the loading of items onto the sorter apparatus and the discharging of items from the sorter apparatus. The conveyor units may be uniquely identifiable with an automatically readable identification mark, such as a bar code label in order to identify the individual conveyor units. The sorter apparatus may thus further comprise reading means for reading the identification marks at least at one location along the track of the sorter apparatus, preferably at loading locations and at discharge locations. A main control terminal has means for communicating with control members of each individual conveyor unit, which controls a driving element on each conveyor unit for driving the endless belt in a given direction to discharge items from the item carrying surface at a predetermined discharge location.

The sorter apparatus further comprises means (not shown) for driving the conveyor units such as a linear motor, which is driving at least some of the conveyor units, one or more electro-motors driving the carrier means etc. The sorter apparatus also comprises one or more loading locations for loading items onto the item carrying surfaces. A low radius of curvature of the curved main track sections makes the sorter apparatus very flexible and allows for a very high spatial exploitation. The main track sections that form half-turns in the vertical plane allow for discharge locations to be placed in the vertical direction. However, special arrangements must be made at the vertical half-turns of the main track to prevent the item carrying surfaces of the conveyor units from tilting so as to prevent the items transported by the conveyor units from being unintentionally discharged.

Fig. 4A and Fig. 4B are perspective views showing a first embodiment of a second intermediate transporting means. In the embodiment shown, the second intermediate transporting means comprises a number of chutes 23, 24 leading from a lead end C to a final end D of the transporting means. The chutes 23, 24 are divided into a leading chute 23 and a finalising chute 24, and a turning device 25 is provided between the leading chute 23 and the finalising chute 24. Furthermore, both the leading chute 23 and the finalising chute 24 are provided with side walls 26, 27 along one side only, and both chutes 23, 24 are tilted sideways towards the side wall side for directing the item 15 to one side of the chutes, before the items are transported to and from the turning device 25.

The turning device is intended for changing the orientation of the item 15, after the item 15 is discharged from a conveyor unit of a sorter apparatus (see fig. 3) and before being transported to the further means such as a trolley or a box for at least accommodating and perhaps also for further transporting of the items. The orientation may be changed half a turn, i.e. 180°. The leading chute 23 and the finalising chute 24 as well as the turning section 25 is tilted, thereby letting gravity transport the item 15 from the lead end C along the leading chute 23 to the turning device 25, from the turning device 25 to the finalising
chute 24 and along the finalising chute 24 to the final end D. Alternatively, the embodiment shown in Figs. 4A-B may be used as part of a first intermediate transporting means instead of the turning device 13 shown in fig. 2A-2B.

Fig. 5A and Fig. 5B are perspective views showing a second embodiment of a second intermediate transporting means. In the embodiment shown, the second intermediate transporting means comprises a number of chutes 23, 24 leading from a lead end C to a final end D of the transporting means. The chutes are divided into a leading chute 23 and a finalising chute 24, and a turning device 28 is provided between the leading chute 23 and the finalising chute 24. Furthermore, the leading chute 23 is provided with side walls 29 for centring the items before being transported to the turning device 28, and the finalising chute 24 is also provided with side walls 30 for preventing the items 15 from falling from the chute 24 after the items have been transported from the turning device 28.

The turning device 28 is intended for changing the orientation of the item 15 after the item 15 has been discharged from a conveyor unit of a sorter apparatus (see fig. 3) and before the items 15 are transported to the further means such as a trolley or a box for at least accommodating and perhaps also for further transporting of the items. The orientation may be changed half a turn, i.e. 180°. Alternatively, the orientation may be changed by any other suitable angle, such as a quarter of a turn (90°), an eighth of a turn (45°), etc. The leading chute 23 and the finalising chute 24 as well as the turning section 28 is tilted, thereby letting gravity transport the items from the lead end C along the leading chute 23 to the turning device 28, from the turning device 28 to the finalising chute 24 and along the finalising chute 24 to the final end D. Alternatively, the embodiment shown in Figs. 5A-B may be used as part of a first intermediate transporting means instead of the turning device 13 shown in Fig. 2A-2B.

Fig. 6A-6B show a possible alternative embodiment of a chute according to the invention. In the embodiment shown, the chute is constituted only by a single chute leading from a lead end, where the items are discharged from conveyor units of a sorter apparatus, to a final end, where the items are loaded onto a trolley as shown, or into a box for at least accommodating and perhaps for further transporting of the items. Such a single chute is a preferred embodiment of a second intermediate transporting means. The single chute is preferably also tilted downwards from the lead end to the final end, thereby letting gravity transport the item along the chute from the lead end to the final end along the chute. Furthermore, such a single chute is preferably also provided with side walls. Either, side walls are provided along one side only, and the chute also tilted sideways for directing the items to the side wall side of the chutes, when the items are being transported along the chute. Or side walls are provided along both sides of the chute for centring the items,
when being transported along the chute. In the embodiment shown, side walls are provided along both sides.

The single chute shown is being bent in a curvature having the appearance of a rain gutter, however, the curvature being shaped according to constructional studies and tests made with books and other library items being passed from the sorter apparatus to the trolleys. At the lead end C of the chute and at a distant side wall 29D, a projecting pin 62 is provided. The projecting pin 62 is intended for catching any items, which are either being relatively large, or which are not being directed properly down the chute. Thus, the projecting pin 62 will assist in directing large items and/or out-of-track items down into the chute. Furthermore, at the lead end C of the chute, a slope 63 is provided. The slope 63 is intended for directing items, which are relatively large, or which are not being directed properly down the chute. Thus, the slope 63 will further assist in directing large items and/or out-of-track items down into the chute. At the final end D of the chute and at a proximate side wall 29P, the side wall is extended past the final end of the chute and into the trolley receiving unit. The extension 64 of the side wall 29P assists all items being passed along the chute and into the trolley in arriving in the trolley in the right direction, i.e. without accidentally being turned round, when leaving the final end D of the chute and before landing on the elevated first stop (see fig. 8A-8C), or before landing on top of items already collected on the trolley.

Fig. 7 is a perspective view showing a possible alternative embodiment of a chute, a possible and preferred embodiment of trolley receiving units and a possible and preferred embodiment of a trolley for further transporting of the items.

The trolley receiving units 31 are placed at the final end of single chutes (see description above) leading from a lead end of the chutes, said lead ends being positioned at conveyor units 18 along a main track of a sorter apparatus (see fig. 3). Each of the trolley receiving units 31 has side walls 32,33 defining an inlet for a trolley and for centring a trolley being received in the units. In the embodiment shown, each of the trolley receiving units 31 also has rods 34 extending from a base 35 of the units and extending outwards from the base towards the inlet, said rods 34 being provided with means for sensing the presence or non-presentation of a trolley. A plug 36 is provided in the base 35 inside each of the trolley receiving units 31, said plug being intended as an electrical plug between a mains electrical charging means (not shown) and a battery (not shown), said battery being provided on each of the trolleys, and said battery being intended for powering an actuator of the trolley (see also Fig. 8A-8C).
Each of the trolley receiving units 31 also has one or more sensing devices 37, preferably a photoelectric cell, provided in at least one of the side walls 32,33. The photoelectric cell 37 is intended for sensing the presence or non-presence at a certain position of a stop provided at one end of an item supporting shelf of the trolleys (see also Fig. 8A-8C). Each of the trolleys has foremost ends of the chassis, which may have the shape of a ball catch, where the foremost ends of the chassis of the trolley constitute ball-like shapes and corresponding holes (not shown) in the base 35 of the trolley receiving units 31 constitutes the catch for the ball-like shape of the foremost end of the chassis of the trolley. Thereby, the trolley is positioned in the trolley receiving unit, and the positioning is secured by the ball catch between the chassis of the trolley and the trolley receiving unit.

Each of the trolley receiving units 31 is also provided with a lifting fork 38. The lifting fork 38 is intended for lifting and lowering the stop of the trolley. Lifting and lowering of the stop of the trolley is established in order to position the stop in relation to a vertical level of the final end of the chutes and in relation to the amount of items already having been loaded onto the trolley. The lifting fork 38 is guided along a groove 39 provided in a front 40 of the trolley receiving units 31. A positioning by means of the lifting fork 38 is effected of the lastly loaded item just beneath the vertical level of the final end of the chutes, thus enabling loading of further items onto the trolley on top of the already loaded items, previously having been loaded onto the trolley. For allowing the stop to be lifted and lowered in relation to the item supporting shelf, the stop is supported along a linear bearing (see also Figs. 8A-8C) running along the length of the item supporting shelf. Thereby the stop may be positioned along the item supporting shelf in any position between one end and another end of the shelf. The stop may be provided with means such as a bead-like member placed in the middle of the surface of the stop. This bead-like member will tilt the items towards one side end of the stop, preferably tilt the items in the same inclined direction as the tilting of the chute, when the items land on the stop. Thereby, when items are passed along the chute, in the embodiment shown inclined towards the left, and the items land on the stop of the trolley, the items will be inclined by the bead-like member, when landing on the stop, because the bead-like member will constitute a sort of raised middle part of the stop. This inclination of the items will also be directed towards the left, thus tilting the items towards the one side end of the stop, and thereby assuring a proper, correct and consistent positioning of the items on the stop of the trolley.

Fig. 8A, Fig. 8B and Fig. 8C are plane views showing a possible and preferred embodiment of a trolley according to the Invention. The embodiment shown is intended for books, magazines, recorded discs, recorded tapes etc. to be shelved at a library. The trolley comprises a chassis 41 having front wheels 42 and rear wheels 43 for manually rolling of
the trolley between locations. For handling the trolley, a handlebar 44 is formed as part of an upper and rear part of the chassis 41. An item supporting shelf 45 is provided. The item supporting shelf 45 is attached to the chassis 41 of the trolley by means of a hinged connection 46 at an upper part and rear part of the chassis 41. The item supporting shelf 45 is capable of resting in two positions, a lowered position, where the shelf 45 has an inclination α in relation to a horizontal plane, and a raised position, where the shelf 45 is substantially horizontal.

A stop 47 is provided at one end E of the shelf, and the one stop 47 is being tipped together with the item supporting shelf 45, when the item supporting shelf 45 is being tipped upwards from the lowered inclined position to the raised position, or vice versa. The stop 47 is intended as a stop preventing the books etc. from dropping off the shelf 45 at least in the lowered inclined position of the shelf 45, and the stop 47 is intended also as a supporting means in the inclined position. In the raised substantially horizontal position, the stop 47 supports the books etc. in a sideways direction, thus preventing the books etc. from falling down the one end of the shelf 45, if the books etc. tilt on the shelf 45. As mentioned with reference to Fig. 6, the stop 47 is capable of being displaced along a bearing 48 running along the length of the item supporting shelf 45. The purpose of displacing the stop 47 is mentioned in the description of Fig. 6, and the capability of displacement of the stop 47 is not utilised, when the trolley is not situated in the trolley receiving units shown in Fig. 7.

Another stop 49 is provided at another end F of the shelf 45, however, said second stop 49 only constituting a stop, when the shelf 45 is in the raised substantially horizontal position. The second stop 49 is attached to the item supporting shelf 45, thus the second stop 49 is tipped, when the item supporting shelf 45 is tipped. However, in a preferred embodiment, the second stop may be tilted backwards, at least when the item supporting shelf is in the inclined position. Thereby, the second stop will not risk obstructing the stacking of books and other items onto the inclined shelf. The second stop 49 also supports the books etc. in a sideways direction, thus preventing the books etc. from falling down from the other end of the shelf, if the books etc. tilt on the shelf. The second stop 49 may be displaced manually along the length of the item supporting shelf 45. When displacing the second stop 49, the stop 49 is released from a wedge-like locking to the shelf 45. When the second stop 49 has been displaced to the desired location along the length of the item supporting shelf 45, i.e. to a location where a stack of books and other items (not shown) end, the second stop 49 is locked in a wedge-like locking of the second stop to the item supporting shelf. Thereby, the stack of books and other items cannot tilt towards the second end. In the embodiment shown, the stop 47 at the one end of the shelf 45 is a planar plate, and the second stop 49 at the other end of the shelf 45 is a bar crossing the
shelf 45 from one side of the item supporting shelf 45 to another side of the shelf. However, the one stop 47 could also be a bar instead of a plate.

An actuator 50 is provided at an underside of the item supporting shelf 45. The actuator 50 is preferably an electrically driven actuator, preferably driven by a number of batteries (not shown). In the embodiment shown, the actuator 50 is a linear actuator with an actuating arm 51 being telescopically extendable. The actuator 50 is operated by a control box (not shown) situated on the underside of the item supporting shelf 45 at the other end, near the handlebar 44. One end 52 of the actuator 50 is attached to the chassis 41 by a hinged connection 53, and another end 54 of the actuator is attached to the underside of the shelf 45 also by a hinged connection 55. The other end 54 of the actuator is attached to the underside of the shelf 45 at a location being nearer to the one end E of the shelf 45 than to the other end F of the item supporting shelf. Thereby, a larger momentum may be obtained, when tipping the shelf 45 from the lowered inclined position to the raised substantially horizontal position, than if the other end 54 of the actuator 50 was attached nearer the other end F of the item supporting shelf.

In the embodiment shown of the trolley, the item supporting shelf 45 has, in the inclined position, an inclination α of 55°. However, the inclination may be different, depending on the design of the trolley, depending on the design and function of the trolley receiving units (see Fig. 7), and depending on the type of, the size of and the number of items intended to be supported by the item supporting shelf 45. Thus, the inclination may be between 30° and 70°, such as between 45° and 60°. Also, the tipping of the shelf 45 from the inclined position to the substantially horizontal position may be effected along other inclined positions in-between the one inclined position and the substantially horizontal position.

In the embodiment shown of the trolley, the item supporting shelf 45 is, in the substantially horizontal position, at a level h of approximately 800 mm. However, the level may be different, depending on the design of the trolley, depending on the design and function of the trolley receiving units (shown in Fig. 7), and depending on the type of, the size of and the number of items intended to be supported by the item supporting shelf 45. Thus, the level may be between 200 mm and 1000 mm, such as between 500 mm and 1000 mm. Also, the substantially horizontal position may be altered by means of a mechanism allowing raising and lowering of the shelf 45, when the shelf 45 is in the substantially horizontal position for allowing the shelf 45 to be positioned in other substantially horizontally positions above or below a certain substantially horizontal position.
The chassis 41 is specially designed in relation to the inclined position and the substantially horizontal position of the item supporting shelf 45. At the bottom and the front of the chassis 41, just behind the front wheels 42, the chassis 41 is provided with a curvature 56 sloping downwards in a vertical plane, i.e. a plane parallel to the plane of the figure (see Fig. 7 for a perspective view). Thereby, the one end E of the item supporting shelf 45, in the inclined position, is accessible also from the sides of the trolley, i.e. also in directions being perpendicular, and not only parallel, to the plane of the figure.

At the middle of the chassis 41, above the rear wheels 43, the chassis 41 is provided with a curvature 57 sloping rearwards in a horizontal plane, or at least in a plane being leading from the one side of the trolley to the other side of the trolley, i.e. a plane being non-parallel with the plane of the figure (see Fig. 7 for a perspective view). Thereby, the actuator 50 may be attached to the chassis 41 without the actuator 50, in the lowered inclined position, obstructing the accessibility from the sides of the trolley, i.e. the accessibility in directions being perpendicular, and not only parallel, to the plane of the figure.

At the top and rear of the chassis 41, the chassis 41 is provided with a curvature 58 sloping rearwards in a vertical plane, i.e. a plane parallel to the plane of the figure, and said curvature leading to the handlebar 44 (see Fig. 7 for a perspective view). Thereby, in the raised position, the part of the chassis 41 leading to the handlebar 44 is not obstructing the accessibility from the sides of the trolley, i.e. the accessibility in directions being perpendicular, and not only parallel, to the plane of the figure.

In the raised position, only the second stop 49 constitutes a minor obstruction towards the accessibility from the sides of the trolley to the item supporting shelf 45. In stead of, as shown, the second stop 49 extending upwards and rearwards from the foremost angular bending 59 of the curvature 58 of the chassis 41, the second stop may extend just upwards from a more rear positioned angular bending 60 of the curvature 58 of the chassis 41. Alternatively, the second stop 49 may extend just forwards from a rearmost angular bending 61 of the curvature 58 of the chassis 41, or the second stop 49 may even extend just downwards from the handlebar 44 of the trolley. In these three latter mentioned embodiments of the second stop, the second stop will not, in the raised position of the item supporting shelf 45, obstruct the accessibility to the item supporting shelf 45 from the sides of the trolley, i.e. the accessibility in directions being perpendicular, and not only parallel, to the plane of the figure.

Figs. 9A-9B show perspective views of a conveyor system with storage means comprising a plurality of storage parts 65 arranged on a carrousel 66. The carrousel 66 comprises a
number of storage sections 67, each comprising six storage parts 65 in the form of shelves. In the shown embodiment return as well as delivery of items from/to a patron as described above (fig. 1) and below (fig. 10A-10B) is possible. Preferably, each storage part 65 has a unique ID. When an item is returned and subsequently positioned in a storage part 65, the ID of the item is linked to the ID of the storage part 65, so that the system will know where a specific item is located. Thus, in case the item is to be delivered to a patron, the system will be able to locate and deliver the correct item, when the patron turns up.

Return of items is performed as described above until the item is to be moved away from a connecting part 68. Then an empty storage part 65 is identified, and in case the identified empty storage part 65 is not in the vicinity of the connecting part 68, the carousel 66 is moved in such a way that the empty storage part 65 is in the vicinity of the connecting part 68. The connecting part 68, and optionally elevator means 69, are moved so as to connect the connecting part 68 and the chosen empty storage part 65. Finally, the item is transferred from the connecting part 68 to the chosen storage part 65. At this time at the latest the ID of the storage part 65 is linked to the ID of the item, so that the item may be located at a later time as described below (fig. 10A-10B). Based on the ID of the item the system may obtain additional information relating to the item, such as destination or other relevant information as described above. The ID of the storage part 65 may thus be linked to this additional information as well, or the system may use the information when handling the item.

The returned items may be collected for transport to locations outside the library, for example by a vehicle such as a truck or a library bus. In this case the driver may extract information from the system relating to which items have been returned for further distribution, and he may empty the storage parts 65 containing such items only. The driver may additionally deliver items, which are to be delivered to a patron from the system in question at a later time.

Return of items is performed as described above until the item is to be moved away from the connecting part 68. Then an empty storage part 65 is identified, and in case the identified empty storage part 65 is not in the vicinity of the connecting part 68, the carousel 66 is moved in such a way that the empty storage part 65 is in the vicinity of the connecting part 68. The connecting part 68, and optionally the elevator means 69, are moved so as to connect the connecting part 68 and the chosen empty storage part 65. Finally, the item is transferred from the connecting part 68 to the chosen storage part 65. At this time at the latest the ID of the storage part 65 is linked to the ID of the item, so that the item may be located at a later time as described above. Based on the ID of the
item the system may obtain additional information relating to the item, such as destination or other relevant information as described above. The ID of the storage part 65 may thus be linked to this additional information as well, or the system may use the information when handling the item.

Fig 10A-10B show a possible embodiment of a conveyor system for conveying items to the item receiving unit instead of items being conveyed from the item receiving unit. The conveyor system shown comprises a storage apparatus 70 and a unit 71 being the interface to the patron. In the embodiment shown, the item receiving unit (see fig. 1) functions as an item delivering unit. Accordingly, with reference to fig. 10A and 10B, the item receiving unit will be named item delivering unit 71. In the embodiment shown of the conveyor system, the item receiving unit is however the same unit also functioning as the item delivering unit, i.e. the same unit capable of both receiving and delivering items. In an alternative embodiment, the item receiving unit and the item delivering unit may be separate units, each one only being capable of either receiving or delivering items. The conveyor system shown in fig. 10A-10B has a functionality corresponding or similar to one or more of the functions described above with reference to fig. 9A-9B.

As described earlier on, the conveyor system according to the invention is primarily intended for conveying items from an item receiving unit along a first intermediate transporting means, further along a sorter apparatus and along a second intermediate transporting means into a trolley in a trolley receiving unit. This is also shown in fig 10A-10B. However, in stead of conveying the items to the trolleys, the items may be conveyed to storing parts 65 in an apparatus 70 for handling these storing parts 65. Depending on the items to be transported in the conveying system shown in fig. 10A-10B, the storing parts 65 may have different shapes and sizes. However, when the items are books and/or other items at a library, the storing parts 65 have a configuration of trays.

The storing parts 65 are intended for Intermediate storing of items, which are to be passed back to a patron next time the patron is at an item delivering unit 71. At a library, the items will be books and/or other items, which a patron has reserved because the item was not at the library the last time the patron was there, or because the patron has reserved the item at a remote location, perhaps via the internet, and is called, perhaps also via the internet, to get the item once the item reserved is returned to the library by a former patron. Thus, the patron may be informed of the item reserved having been returned to the library either by addressing the item delivering unit 71 next time visiting the library, or by being informed at a remote location by surface mail, e-mail, SMS, or other means of information. Subsequently to being informed at a remote location, the patron may go to the library to get the item reserved, or the item may be sent to the patron.
Once the patron having reserved the item identifies himself/herself at the item delivering unit 71, perhaps by means of a library patron card, the item delivering unit 71 will check whether any items having been reserved is present in any of the storing parts 65 of the storing apparatus 70. If this is the case, the storing apparatus 70 will transport the storing part 65, where the items being reserved are stored, to the item delivering unit 71. Thus, the items being reserved by the patron having identified himself/herself will be available at the item delivering unit 71. In the embodiment of the storing apparatus 70 shown, the storing apparatus comprises a lift 72 for transporting the storing parts 65, i.e. the trays, from a lower floor level, where the final sorting of the items is being performed, to an upper floor level, where the item delivering unit 71 is placed. However, alternative embodiments need not comprise a lift, if the storing apparatus 70 is located at the same floor level as the item delivering unit 71.

15 It is shown in fig. 10B how the item is delivered to the item delivering unit in order to further pass the item to the front surface (not shown) of the item delivering unit, where the patron is located. The lift has lifted the storing part 65, i.e. the tray, with the items reserved to the floor level of the item delivering unit 71. After the storing part 65 has been lifted to the floor level of the item delivering unit 71, the storing part 65 is in a discharge location for unloading the items onto transporting means 73 of the item delivering unit 71. In the embodiment shown, the transporting means 73 of the item delivering unit 71 is a conveyor belt. The storing part 65 is tilted a bit, whereby the items are unloaded by sliding to the conveyor belt 73 at the rear end of the item receiving unit 71. The conveyor belt 73 is turned oppositely to the direction, when patrons return items, thus transporting the items from the storing part 65 and from the rear end of the item receiving unit 71 to the front end (not shown) of the item delivering unit 71.
CLAIMS

1. A conveyor system for transporting items, said conveyor system comprising
   - a number of item-receiving units each having an inlet for passing items to the conveyor
   system and each having an outlet leading towards conveyor units,
   - a plurality of conveyor units for carrying the items from a number of loading locations,
     where the items are loaded onto the conveyor units, to a number of discharge locations,
     where the items are unloaded,
   - a track along which the conveyor units are moving in a transport direction, along which
     transport direction the conveyor units are in a carrying state carrying the items,
   - each of said conveyor units having discharge means for discharging the items from the
     conveyor units at the number of discharge locations,
   - a number of first intermediate transporting means placed at the discharge location, said
     first intermediate transporting means intended for transporting the items to trolleys, after
     the items have been unloaded from the conveyor units, and
   - a number of said trolleys being provided for transporting the items to third locations.

2. A conveyor system according to claim 1, wherein item supporting shelves of the trolleys
   are intended for being in an inclined position, when the trolleys are placed at the discharge
   location, where the conveyor system is provided with means for sensing the position of the
   item supporting shelf being in the inclined position, and where the conveyor system is
   provided with means for alerting a user if the shelf is not in the inclined position, when the
   trolley is in the discharge location of the conveyor system.

3. A conveyor system according to claim 1 or 2, wherein at least one of the trolleys
   comprises:
   - a chassis being provided with wheels for allowing transportation of the trolley to the third
     location from the location, where the items are loaded onto the trolley,
   - an item supporting shelf capable of collecting the items directly at the loading location
     and for supporting and storing the items, when transporting the trolley to the third
     location, at said third location the items are unloaded from the trolley, and
   - said item supporting shelf having an inclined position, where the items by means of
     gravity are loaded onto the shelf, and said trolley having a first stop for avoiding items to
     fall off the shelf, when the shelf is in the inclined position.

4. A conveyor system according to claim 3, wherein at least one of the trolleys is provided
   with a handlebar for manual pushing, pulling and steering of the trolley by a person.
5. A conveyor system according to claim 3, wherein at least one of the trolleys is provided with means for pushing, pulling and steering of the trolley by means of a powered apparatus.

6. A conveyor system according to any of claims 3-5, wherein said item supporting shelf also has a substantially horizontal position, and where the shelf is capable of being displaced along an angular rotation from the inclined position to the substantially horizontal position with the items being supported by the shelf during displacement.

7. A conveyor system according to claim 6, wherein the displacement of the item supporting shelf at least from the inclined position to the substantially horizontal position is established by means of an actuator.

8. A conveyor system according to claim 7, wherein the actuator is an electrical actuator, where the electrical power is provided by a battery, and where the battery is capable of being charged, when the trolley is located in a trolley receiving unit.

9. A conveyor system according to claim 7 or 8, wherein
- the actuator is a linear actuator having one end of the actuator being attached by means of a hinged connection to the chassis, and another end of the actuator being attached by means of a hinged connection to the shelf,
- where the item supporting shelf is attached by means of a hinged connection to the chassis, and where the shelf is capable of being displaced from the inclined position to the substantially horizontal position by a linear extension of the actuator.

10. A conveyor according to claim 9, wherein the other end of the actuator is attached to the shelf at a position nearer to the one end of the shelf than to the other end of the shelf, and where the shelf is attached to the chassis nearer the other end of the shelf than to the one end of the shelf.

11. A conveyor according to any of claims 3-10, wherein the first stop at the one end of the item supporting shelf is displaceable along the shelf from the one end of the shelf towards the other end of the shelf, and vice versa, thus acting as a stop both in the one end of the shelf and at a plurality of other positions towards or from the other end of the shelf.

12. A conveyor according to any of claims 3-11, wherein a second stop at the other end of the shelf is placed at the chassis of the trolley, and said second stop not being displaceable along the shelf, and said second stop not being displaceable together with the shelf from
the inclined position to the substantially horizontal position, and said second stop being intended for acting as a stop only in the substantially horizontal position of the shelf.

13. A conveyor system according to any of claims 3-12, wherein said item supporting shelf has a plurality of other positions being inclined positions, and where the shelf is capable of being displaced by tipping around a hinged connection from one inclined position to the other inclined positions with the items being supported by the shelf during displacement.

14. A conveyor system according to any of claims 3-13, wherein said item supporting shelf has a plurality of other positions being substantially horizontal positions, and where the shelf is capable of being displaced by being raised or lowered vertically from the one substantially horizontal position to the other substantially horizontal positions with the items being supported by the shelf during displacement.

15. A conveyor system according to any of claims 3-14, where the item supporting shelf when being in the one, alternatively when being in one of the other, inclined position has an inclination of between 30° and 70° compared to horizontal, preferably between 45° and 60°, most preferably approximately 55°.

16. A conveyor system according to any of claims 3-15, where the item supporting shelf when being in the one, alternatively when being in one of the other, substantially horizontal level is at a level of between 200 mm and 1000 mm, preferably between 500 mm and 1000 mm, most preferably approximately 800 mm.

17. A conveyor system according to any of claims 3-16, where at least one of the trolleys is provided with means for sensing the position of the item supporting shelf being in the inclined position, and where the trolley is provided with means for alerting a user if the shelf is not in the inclined position, when the trolley is in any of the following locations: a location of receiving the items, a discharge location of a sorter apparatus for conveying the items and a location for storing the items.

18. A conveyor system according to any of claims 1-17, further comprising:
   - a number of second intermediate transporting means placed at the discharge location, said second intermediate transporting means being intended for transporting the items to boxes, after the items have been unloaded from the conveyor units, and
   - a number of said boxes being provided for accommodating the items for third locations.
19. A conveyor system according to claim 18, the system being adapted to convey various types of items, wherein one or more types of items are transported to trolleys and one or more other types of items are transported to boxes.

20. A conveyor system according to claim 18 or 19, wherein the boxes are placed at the outlet of the item receiving units,
   - where the outlet of the item receiving units in one situation not only is leading towards the conveyor units, but also actually is leading the items to the conveyor units,
   - where the outlet of the item receiving units in a second situation still is leading towards the conveyor units, but however actually is leading the items to the boxes, and
   - where the first situation is a normal operating situation of the conveyor system, and where the second situation is an interrupted situation of the conveyor system.

21. A conveyor system according to any of claims 1-20, wherein the conveyor system comprises a sorter apparatus.

22. A conveyor system according to any of claims 1-21, wherein at least one of the item receiving units constitutes an initial transporting means and is suitable for receiving items to be passed on to the conveyor system, said item receiving unit having
   - a front face being fixedly arranged and having an opening defined therein for allowing items to pass the front face into the item receiving unit, thus allowing the items to pass between an exterior and an interior of the conveyor system,
   - an item receiving surface defining an exterior inlet of the item receiving unit, the surface constituting a means for placing the items at the loading location before the items are passed to the interior of the conveyor system,
   - the items, when having been placed on the surface, intended for being subjected to an automatic control for determining a transporting to the interior of the conveyor system.

23. A conveyor system according to claim 22, wherein the item receiving unit is provided with means for identifying the item and possible for identifying any properties of the item, said identification taking place by means not physically in contact with the item.

24. A conveyor system according to claim 23, wherein the identification means comprises optical identification means intended for optical identification of an identification marking attached to the item at an optically visible location, when the item is received by the item receiving unit.

25. A conveyor system according to claim 23 or 24, wherein the identification means comprises radio frequency identification means intended for radio frequency identification
of an identification marking attached to the item, optionally at an optically non-visible location, when the item is received by the item receiving unit.

26. A conveyor system according to any of claims 23-25, wherein the identification means comprises magnetic identification means intended for magnetic identification of an identification marking attached to the item, optionally at an optically non-visible location, when the item is received by the item receiving unit.

27. A conveyor system according to any of claims 22-26, wherein the item receiving surface is provided with means for raising and lowering the surface, thus enabling a user passing items into the item receiving unit to adjust the height of the item receiving surface.

28. A conveyor system according to any of claims 1-27, further comprising an item delivering unit for delivering items to be passed from the conveyor system, said item delivering unit having:
   - a front face being fixedly arranged and having an opening defined therein for allowing items to pass the front face of the item delivering unit, thus allowing the items to pass between an interior and an exterior of a conveyor system,
   - an item delivering surface defining an exterior outlet of the item delivering unit, the surface constituting a means for placing the items at a collecting location before the items are taken by a patron from the item delivering unit.

29. A conveyor system according to claim 28, where said item delivering unit is provided with means for identifying a patron addressing the unit, and where the item delivering unit comprises,
   - first means for identifying data of the patron by means of a personal identifying numbers (PIN), a personal identification card, or bodily personal identification means or a combination of any of these personal identification means,
   - second means for checking any possible reservations of items in relation to any of the personal identification means, said second means for checking being performed via a database correlating the data of the patron and data of items, and
   - third means for checking, if any items having been reserved by the patron is available for delivery to the patron, said third means for checking being performed via a database correlating the possible items being reserved with items present in the conveyor system.

30. A conveyor system according to claim 28 or 29, wherein the item delivering unit is also adapted to function as an item receiving unit.
31. A conveyor system according to any of claims 1-30, further comprising at least one third intermediate transporting means being positioned in connection to at least one of the item receiving units at a loading location,
- said third intermediate transporting means being intended for transporting the items to the conveyor units, after the items have been passed from the inlet of the item receiving unit to the outlet of the item receiving unit, and
- said third intermediate transporting means leading from the outlet of the item receiving unit to the conveyor units, and at least part of said intermediate transporting means being displaceable from a normal operating position to an interrupted operating position.

32. A conveyor system according to claim 31, wherein the third intermediate transporting means comprises a conveyor belt.

33. A conveyor system according to claim 31 or 32, wherein the third intermediate transporting means is provided with means for intermediate storing of items, said intermediate storing means preferably being boxes for accommodating the items, and said intermediate storing means being positioned between the item receiving unit and the conveyor units.

34. A conveyor system according to claim 33, wherein the intermediate storing means is combined with the third intermediate transporting means, and where a selection between the third intermediate transporting means and the intermediate storing means is provided, thus allowing either an intermediate transporting or an intermediate storing of items being passed from the item receiving unit towards the conveyor units.

35. A conveyor system according to claim 34, wherein the intermediate storing means is selected by interrupting the third intermediate transporting means, at least at one position between the item receiving units and the conveyor units, and by providing the intermediate storing means at the at least one position of the third intermediate transporting means.

36. A conveyor system according to any of claims 31-35, wherein the third intermediate transporting means is a number of conveyor belts, where the intermediate storing means is a number of boxes, and where an interruption of the number of conveyor belts is provided at a location along the conveyor belt by displacing at least part of the conveyor belt so that a transporting track between the item receiving unit and the conveyor units is interrupted, and where the number of boxes are placed underneath the conveyor belt at the location of interruption, thus allowing the items to drop into the number of boxes.
37. A conveyor system according to any of claims 1-36, further comprising at least one fourth intermediate transporting means comprising a trolley receiving unit for receiving a trolley, and said fourth intermediate transporting means being placed at a discharge location of the conveyor system,
- said fourth intermediate transporting means being intended for transporting the items from the conveyor units, after the items have been transported by the conveyor system to the discharge location, and
- said fourth intermediate transporting means leading from the conveyor units to the trolley receiving units.

38. A conveyor system according to claim 37, wherein the trolley receiving units are provided with means for identifying an orientation of the items and means for changing the orientation of the items.

39. A conveyor system according to claim 37 or 38, where the fourth intermediate transporting means comprises at least one of the following means: a chute, a conveyor belt, a plurality of rollers, and a turning device.

40. A conveyor system according to any of claims 37-39, where guiding means for assisting items in being directed towards the lead end of the fourth intermediate transporting means are provided at a lead end of the fourth intermediate transporting means, said guiding means being located in front of the lead end of the fourth intermediate transporting means.

41. A conveyor system according to any of claims 37-40, where guiding means for assisting items in being discharged from the fourth intermediate transporting means are provided at a final end of the fourth intermediate transporting means, said guiding means being located subsequent to the final end of the fourth intermediate transporting means.

42. A conveyor system according to any of claims 1-41, further comprising at least one trolley receiving unit, said trolley receiving unit being capable of accommodation a trolley,
- said trolley receiving unit preferably being provided with means for sensing at least the presence, alternatively also the non-presence, of a trolley, and
- said trolley receiving unit comprising a lifting means for lifting a supporting surface of the trolley to a certain chosen level of the supporting means.

43. A conveyor system according to any of claims 1-42, further comprising a storage arrangement having a plurality of storing parts for storing the items, said storage arrangement being positioned in such a way that, if desired, an item being conveyed by
the conveyor system may be conveyed to the storage arrangement and intermediately stored in one of the storing parts.

44. A conveyor system according to claim 43, wherein the storage arrangement comprises at least one rack, and wherein at least some of the storing parts are formed by shelves accommodated in said rack.

45. A conveyor system according to claim 44, wherein the storage arrangement comprises at least two racks being arranged on a carrousel, so that items being stored in the storage arrangement may be moved by means of said carrousel.

46. A conveyor according to any of claims 43-45, wherein the storage arrangement is provided by a sorter apparatus of the conveyor system, and wherein at least some of the storing parts are formed by at least some of the conveyor units.

47. A conveyor system according to any of claims 1-46, further comprising an item controlling unit being placed at exits of the site, at which site items are handed out to patrons for the patrons to bring the items along out of the site, said item controlling unit being provided with

- first identification means being capable of identifying magnetic marking attached to the item, and said item controlling unit also being provided with
- second identification means being capable of identifying radio frequency identification marking attached to the item.

48. A conveyor system according to claim 47, wherein the item controlling unit is further adapted to be placed at entrances of the site, at which site patrons are entering for the patrons to borrow and bring items along out of the site, wherein the second identification means is further capable of identifying radio frequency identification marking being carried by the patron in connection with personal identification means such as personal identification cards, said item controlling unit further being provided with

- first means for identifying data of the patron entering the site by means of a personal identifying number (PIN), a personal identification card, or bodily personal identification means or a combination of any of these personal identification means,
- second means for checking any possible reservations of items in relation to any of the personal identification means, said second means for checking utilising a database correlating the data of the patron and data of items, and
- third means for checking, if any items having been reserved by the patron is available for delivery to the patron, said third means for checking utilising a database correlating the possible items being reserved with items present in the conveyor system,
- and, if items having been reserved by the patron are present in the conveyor system, fourth means for informing the patron entering the site that items having been reserved by the patron is available for delivery at any of a number of item delivering units.

5 49. A conveyor system according to claim 48, wherein the first identification means is further capable of identifying magnetic marking being carried by the patron in connection with personal identification means such as personal identification cards.

50. A conveyor system for transporting items, said conveyor system comprising
- a number of item receiving units each having an inlet for passing items to a sorter apparatus and each unit having an outlet leading towards conveyor units,
- a plurality of conveyor units for carrying the items from one location, where the items are loaded onto the conveyor units, to a discharge location, where the items are unloaded,
- a main track along which the conveyor units are moving in a transport direction, along which transport direction the conveyor units are in a carrying state carrying the items,
- each of said conveyor units having discharge means for discharging the items from the conveyor units at the number of discharge locations,
- a number of intermediate transporting means placed at the discharge location, said intermediate transporting means being intended for transporting the items to boxes, after the items have been unloaded from the conveyor units, and
- a number of said boxes being provided for accommodating the items for third locations.

51. A conveyor system according to claim 50, wherein the boxes are placed at the outlet of the item receiving units,
- where the outlet of the item receiving units in one situation not only is leading towards the conveyor units, but also actually is leading the items to the conveyor units,
- where the outlet of the item receiving units in a second situation still is leading towards the conveyor units, but however actually is leading the items to the boxes, and
- where the first situation is a normal operating situation of the conveyor system, and where the second situation is an interrupted situation of the conveyor system.

52. Use of a conveyor system according to any of claims 1-51 for transporting library items such as books, magazines, recorded tapes, recorded discs from an item receiving unit, to be operated by patrons, to trolleys, alternatively to boxes, to be handled by shelving staff at a library.

53. Use of a conveyor system according to any of claims 1-51 for transporting postal items such as parcels and letters from an item receiving unit, to be operated by patrons at a
postal office, to boxes, alternatively to trolleys, to be handled by postal staff at the postal office.

54. Use of a conveyor system according to any of claims 1-51 for transporting freight items such as trunks, suitcases, parcels, vacation accessories such as skies and other luggage from an item receiving unit, to be operated by travellers at airports, to boxes, alternatively to trolleys, to be handled by airport staff at the airport.

55. Use of a conveyor system according to any of claims 1-51 for transporting freight items such as trunks, suitcases, parcels, vacation accessories such as skies and other luggage from an item receiving unit, to be operated by travellers at train stations, to boxes, alternatively to trolleys, to be handled by railway staff at the train station.

56. Use of a conveyor system according to any of claims 1-51 for transporting library items such as books, magazines, recorded tapes, recorded discs from a storing apparatus of a conveyor system, to patrons of the library, said patrons collecting the items having been transported.

57. A method of receiving items in a conveyor system, the method comprising the steps of:
- a patron entering an item in an item receiving unit, said item comprising identification means,
- identifying the item by means of said identification means,
- determining whether the item has been reserved by another patron, based on said identifying step,
- automatically or semi-automatically processing the item in accordance with the determining step.

58. A method according to claim 57, further comprising the step of:
- conveying the item to a specific destination in case it is determined that the item has been reserved by another patron.

59. A method according to claim 58, wherein the specific destination comprises a storage arrangement having a plurality of storing parts for storing items, the method further comprising the steps of:
- allocating a storing part to the item in case it is determined that the item has been reserved by another patron, and
- conveying the item to the allocated storing part.
60. A method according to claim 58 or 59, further comprising the steps of:
- alerting the patron who has reserved the item,
- delivering the item to said patron when he or she approaches the conveyor system.

5 61. A method according to any of claims 57-60, further comprising the steps of, in case it is determined that the item has been reserved by another patron:
- printing a label comprising information relating to the reservation,
- attaching said label to the item.