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(57) A system (22) for manufacturing books on demand (23), with formation of a book block (36) having basic sheets (29) and pre-formation of covers (26) comprises a binding machine (37) and manufactures books of varying format, with different orientations of the basic sheets belonging to the principal formats of books. The basic sheets of each book are printed on a longitudinal section of paper strips (281, 28r) together with a book code (121), and sheet codes (122) for the basic sheets, while the cover (26) and a cover code (123) are printed

on a respective cover sheet (32). Two input and forming equipments (331, 33r) respond to the book codes and the sheet codes for separating the basic sheets from the sheet strips and a cover pre-forming equipment (39) responds to the cover code for pre-forming the covers (26) from the cover sheets. The binding machine (37) bounds the book block and the cover in dependence of agreement of data from the book code and the cover code, while finishing equipments (41) trim the book (23) according to finishing data.



Description

FIELD OF THE INVENTION

[0001] The present invention relates to a system for manufacturing books on demand and a method for the management and the printing of these books on demand.

[0002] More specifically, the invention relates to a system for manufacturing books on demand and a respective method for the management and the printing of the books on demand according to the introductory portions of the main claim.

BACKGROUND OF THE INVENTION

[0003] Typically, a book comprises a plurality of sheets with pages of text stacked one upon the other and which constitute a book block, and a cover overlaying the first sheet, the last sheet and the rib of the book block. The pages are generally printed in black and white, whereas the cover is typically printed in color and on paper which may be thicker and of higher quality. Between the sheets with the pages of text, there can be interposed, as inserts, sheets with illustrations, also with paper of different quality. In non-bound or *brossure* books, the assembling of the book blocks with the respective covers is effected by automatic binders set for the mass gluing the ribs of the book blocks with the backs of the spines of the covers.

[0004] For reasons for economy and velocity, books are generally mass produced by offset printing, but it has as a result that, for each title, the publishing industry must print a large number of copies, hundreds, but more commonly, thousands. The produced books are supplied to the distributors and from these to the bookstores. Apart the discards of processing, the printing house produces not only the required number of components, but also excess components. Consequently, at least a part of the production go to waste. Moreover, since the demand for a book is very hard to estimate, large number of books go to waste when they are not sold. It has the effects to increase the intrinsic cost of the book and makes not economically convenient the industrial production of books with limited circulation and the reprint of books of exhausted editions and limited demand.

[0005] In recent years, with progress in the techniques of laser printing or ink jet and the use of binders with flexible setting, the printing of books has been rendered possible "on demand", allowing the production, with limited costs, of books in very limited quantity. The productions "on demand" they have nevertheless limits in the typology of the printable books, are relatively slow and require a significant use of manpower. In fact,, so far book blocks and covers are produced separately and manually inserted into a binder for binding. Therefore the cost of production of the single copies results very greater with respect to the cost of copies obtained by productions of traditional type.

SUMMARY OF THE INVENTION

[0006] An object of the invention is to provide a system for manufacturing books on demand and a method of management and printing of these books which have costs similar to the one of the productions of mass either for large quantities of identical books, or for orders from clients regarding limited quantity of books having different title and format to be set up on the basis of the demand.

[0007] According to this object, the system and the method for manufacturing of books on demand manufactures books of varying format and uses one or more continuous sheet strips of standard width, such to allow the printing, with different orientations, of basic sheets belonging to the principal dimensional formats of books. The basic sheets of each book are sequentially printed on a respective longitudinal section of the strip or strips provided for the required book and according to the respective orientation and in which, in association with the longitudinal section of the strip or strips for the required book, there is printed a book code and, in association with each basic sheet is printed a respective sheet code, while, in association with each cover is printed a cover code for the control of the various component of the system, according to the characterizing portion of the main claims.

[0008] This structure allows a high productive flexibility with minimum need of manpower and using of commercial binding machines.

[0009] The characteristics of the invention will become clear from the following description given purely by way of non-limiting example, with reference to the appended drawings in which:

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Fig. 1 represents a schematic plan view of a system for manufacturing books on demand according to the invention;

Fig. 2 shows, in enlarged scale, a partial schematic view in plant of some components of the system for manufacturing books of Fig. 1;

Figs. 3a-3l schematically show different operative conditions of some details of the components of Fig. 2;

Fig. 4 shows, on an enlarged scale, a partial schematic view in plant of components of the system represented in Fig. 1;

Figs. 5a-5d show schematically different operative conditions of some details of the components of Fig. 4;

Fig. 6 represents, on an enlarged scale, a partial schematic view in plant of other components of the system represented in Fig. 1;

Figs. 7a and 7b are schematic views of covers of a

book in course of manufacturing by the system of Fig. 1;

Fig. 8 represents schematically different operative conditions of one of the components of Fig. 6;

Fig. 9 is a partial schematic front view of some components of Fig. 6;

Fig. 10 is a partial schematic lateral view of some components of Fig. 6;

Figs. 11 and 12 show diagrams representative of different formats of books manufactured by the system according to the invention;

Fig. 13 shows some details of pages for formats of books of the Figs. 11 and 12;

Figs. 14 and 15 represent diagrams of pages in course of manufacturing by the system of the invention; and

Figs. 16 and 17 represent diagrams of covers in course of manufacturing..

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] With reference to the figures 1-4, is represented with 22 a system for manufacturing books on demand. The system 22 manufactures books 23 formed with book sheets 24 stacked one upon the other and covers 26 and uses a pair of spools 27r and 27l of paper strips 28r and 28l for the book sheets and the cover sheets 31 for the respective covers. The pairs of pages which form the sheets 24 are printed on the opposite faces of the paper strips 28r and 28l and are separated as basic sheets 29r and 29l. The covers 26 are printed on cover sheets 31 or, in alternative, on respective sections of a paper cover strip unwinding from a spool not shown in the figures. The covers of the manufactured book can be provided of one or two flaps or devoid of flaps and are directly derived from basic pre-shaped covers 32, which are separated by cutting and trimming from the cover sheets 31 or the respective sections of the cover strip.

[0012] In extreme synthesis, the system 22 includes two sheet input and forming equipments 33r and 33l for separating and stacking the basic sheets 29r and 29l, a collecting device 34 for forming a book block in vertical format (portrait) 36p, or in horizontal format (landscape) 36l, a bookbinding machine or binder 37 for binding and gluing the book block 36p, 36l with the pre-shaped cover 32, an interconnecting group 38 between the collecting device 34 and the binder 37, a cover pre-forming equipment 39 for forming the pre-shaped covers 32, finishing equipments 41 and an electronic control equipment 42.

[0013] The binder 37 includes a series of pneumatic clamps, mounted on an elliptic chain, in which the book blocks 36p, 36l to be bound are inserted and which transports the book blocks for the whole sequence of binding. In sequence, a vibrating surface lines up the basic sheets, a miller, shown not, grinds ribs 43 of the book blocks, while rollers and blades smear the glue on the ribs 43. In a known manner, a cover feeder positions each pre-

shaped cover 32 in registering with the rib 43, while a cover press and a folding device cause the back of a spine 44 of the pre-shaped cover to be forced against the rib and adjacent edges of the block book, and an output mechanism provides to the output of the glued books.

[0014] In a plan view, the binder 37 is extended longitudinally according to an axis "A". The system 22 has a "T" like arrangement of the sheet input and forming equipments 33r and 33l and the interconnecting group 38, with respect to the axis "A" of the binder 37. The cover pre-forming equipment 39 has an "L" like arrangement, while the finishing equipments are arranged in correspondence of an output of the binder 37, transversally to the axis "A"

[0015] The binder 37, of commercial type, is, for instance, as described in PCT Patent Application WO 01/85466. As for the present invention, the binder 37 requires that the book block 36p, 36l is positioned at a sheet input "IB" with a pre-assembling configuration having the faces parallel to the axis "A" and the rib 43 arranged downwardly with horizontal asset. In turn, the pre-shaped covers 32 must be positioned at a cover input "IC" with a pre-assembling configuration having the face horizontal and the spine 44 parallel to the axis "A", while the book block and the cover approach each the other for the assembling parallel to the axis "A".

[0016] The cover sheets 31 define a front edge "FE", reference edge "RE" and an end edge "EE" associated, respectively, to the top edge and a lateral end edge of flapped or un-flapped pre-shaped covers. The cover pre-forming equipment 39 comprises a feeding mechanism 46 for the cover sheets 31, a trimming mechanism 47 for trimming, in the cover sheet, a reference lateral edge "LE" of the flapped or un-flapped pre-shaped covers, opposite to the end edge "EE", a marking mechanism 48 for executing on the pre-shaped cover markings for the spine 44, easy opening of the cover and possible flaps and a cutting mechanism 49 for cutting an edge "OE" associated with the bottom edge of the pre-shaped cover, opposite to the reference edge "RE". Further, the equipment 39 comprises a flap folding mechanism 51 actuable for folding, by overlapping, a possible front flap 52a, and/or a back flap 52b of the pre-shaped covers 32 and forming a flap or flaps of the cover. Specifically, the finishing equipments 41 comprise a drying group 53, a trilateral cutting equipment 54 and a flap opening and book cutting equipment 56.

[0017] The drying group 53, has a tower conveyor of spiral shape: it receives the books assembled by the binder 37 and provides to the drying of the glued areas; the trilateral cutting equipment 54 is actuable for executing the finish trimming on the upper, lower and frontal edges of the books devoid of cover flaps, or the sole finish trimming on the upper and lower edges of the books with flapped cover. Suitably, the flap opening and book cutting equipment 56 is actuable for opening the flapped covers with and executing the trimming on the side of the

book opposite to the spine. The drying group 53, the tri-lateral cutting equipment 54 and the flap opening and book cutting equipment 56 are of commercial type and the description is herein omitted. Nevertheless, some components of interface and of control are modified for being in agreement with the other components of the system 22 and the respective manufacturing method.

[0018] According to the invention, each of the input and forming equipments 33r and 33l includes, respectively: an unwinding device or unwinder 57l, 57r for the spool 27r, 27l, a longitudinal cutting and overlying device or "merger" 58l, 58r and a double cutter 59r, 59l for separating the basic sheets 29r and 29l from the strip 28r, 28l. The equipments 33r, 33l, further includes a group forming mechanism 61r, 61l having an area of stacking 62r, 62l for the basic sheets 29r and 29l and output toward the collecting device 34 and in which the areas of stacking 62r and 62l are arranged at the right and the left of the axis "A".

[0019] The unwinding device 57l, 57r unwinds the spool 27r, 27l, while the merger 58r, 58l provides to longitudinally cut in half the strip 28r and 28l and preset the overlying of the longitudinal sections of the strip 28r and 28l according to the "two-up" technique with constant mean feed velocity, servoized to information from the other equipments of the system. The merger 58r, 58l receives the strip 28r and 28l from the unwinding device 57l, 57r through a loop 63r, 63l, while the double cutter 59r, 59l receives the strip 28r and 28l from the merger 58r, 58l through a loop 64r, 64l.

[0020] The double cutter 59r, 59l executes transversal cuts on the strips 28r and 28l or the separation of the basic sheets 29r and 29l and moves the sheets along directions Fr and Fl of input for the group forming mechanisms 61r, 61l. Here, the basic sheets 29r and 29l are received and stacked on the area of stacking 62r, 62l forming a respective group of basic sheets Gr, Gl as component of the book block 36p, 36l. The collecting device 34 has a receipting area 67 for receiving the groups Gr, Gl whereby forming the book block 36p, 36l, while the interconnecting group 38 includes a conveyor belt 68.

[0021] The unwinding device 57l, 57r, the merger 58r, 58l and the double cutter 59r, 59l are of commercial type and their description is herein omitted.

[0022] Optionally, a longitudinally rotating mechanism, not shown in the figures, can be inserted between the loop 63r, 63l and the double cutter 59r, 59l, for longitudinally rotating of 180° one of the two longitudinal sections of the strip 28r and 28l. Thus, the basic sheets emerging from the cutter will have a longitudinal bending, by pairs, congruent and opposite with respect to the bending of the strip in the spool of origin 27r, 27l. It to the end of preventing that the groups Gr, Gl can have a given bending to be transferred to the manufactured book.

[0023] The sheet input and forming equipments 33r and 33l also include respective input pushers 71r, 71l actuatable for pushing the first sheet group Gr and the second sheet group Gl from the respective areas of stack-

ing 62r, 62l toward the receipting area 67 or on a sheet group Gl or Gr already stacked on the receipting area.

[0024] In particular, the conveyor belt 68 is parallel to the axis "A" of the binder, while the receipting area 67 is defined by an initial section of the conveyor belt: The collecting device 34 includes a platform 72 arranged above the receipting area 67, between the areas of stacking 62r, 62l, for receiving temporarily the sheet group Gr and the sheet group Gl. The platform 72 is quickly shiftable parallel to the axis of the conveyor belt for leaving the sheet group Gr or Gl to fall on the underlying receipting area, as represented in the sequences of the Figs. 3c, Fig. 3l, without substantial lateral shifting.

[0025] The group forming mechanism 61r, 61l comprises an arresting shovel 73r, 73l with lower edge tangent to the area of stacking 62r, 62l and having possibility of horizontal shifting along the directions Fr and Fl and of vertical shifting with respect to the area of stacking by means of corresponding, not shown, actuators. The arresting shovel 73r, 73l, in a depressed position, is adapted to hold back the sheet group Gr, Gl during the stacking on the area of stacking 62r, 62l while, in the lifted position, allows the input pushers 71r, 71l to shift the sheet group Gr, Gl from the area 62r, 62l to the platform 72. The group forming mechanism 61r, 61l also comprises a lateral vibrating leveller, shown only schematically in the drawings.

[0026] The collecting device 34 also comprises an arresting wall 74 with lower edge tangent to the platform 72, which is actuatable for being shifted along the directions Fr and Fl from a central position to a position "LP" of left margin and a position "RP" of right margin of the platform 72 (Figs. 3b and 3d) for allowing the exact positioning of the sheet group Gr, Gl on the same platform 72.

[0027] As represented in the Figs. 3a-3l, the basic sheets 29r, 29l, progressively separated from the double cutter 59r, 59l, are stacked on the area 62r, 62l, arrested by the shovel 73r, 73l in the depressed position, and form the group Gr, Gl, which is levelled. Thereafter, after lifting of the shovel 73r, 73l and shifting of the arresting wall 74 on the position "LP", "RP", the input pusher 71r, 71l shifts the group Gr, Gl on the platform 72 in a centered position. Now, the platform 72 is quickly moved, allowing the group Gr, Gl to fall on the receipting area 67 constituted by the initial portion of the conveyor belt 68.

[0028] The two sheet input and forming equipments 33r and 33l can receive and pre-form the group Gr, Gl of basic sheets as component of the book block 36p, 36l, with function of buffer and independently of one another, with "merge" or "tandem" processing. The input pushers 71r, 71l can shift, respectively, a first sheet group Gr, Gl from one of the equipments 33r, 33l and/or a second sheet group Gl, Gr from the other equipment 33l, 33r to the collecting device 34 for the formation of the book block 36p, 36l. The conveyor belt 68 can remove the book block 36p, 36l from the collecting device functionally to the transfer of the book block to the binder 37. Moreover,

while an equipment of input 33r, 33l forms a group Gr, Gl, the other equipment 33l, 33r shifts the group Gl, Gr to the collecting device 34, with possible transfer of the book block 36p, 36l to the binder 37.

[0029] In the "merge" processing, the second sheet group Gl represents an insert of the first sheet group Gr and the input pusher 71l of the equipment of input 33l shifts the second group Gl to the collecting device 34 as insert to the first sheet group Gr. After the insertion of the group Gl, the equipment of input 33r can shift another group of sheet group Gr to the collecting device 34 above the group Gl and so on, up to the complete forming of the book block 36p, 36l for the requested book 23.

[0030] In the "tandem" processing, the input pusher 71r of the equipment 33r shifts the first sheet group Gr to the collecting device 34 for forming a first book block 36p, 36l only with the first sheet group Gr for a first required book 23', while the input pusher 71l of the equipment 33l, after the removal of the first book block 36p, 36l, shifts the second sheet group Gl to the collecting device 34 for forming a second book block 36p, 36l for a second requested book 23.

[0031] Therefore, this structure of the system 22 allows the possibility of using different qualities of printing and supports for the sheets of the pages of text and for the inserts: moreover, the system 22 substantially doubles the productivity in the case in which the sheet groups Gr and Gl represent the only component of the book block 36p, 36l.

[0032] Along the conveyor belt 68 is arranged an inserting device 76 (Fig. 4), including a liftable arm 77 with a stop wall 78. This inserting device is provided for allowing the manual positioning of a book block "portrait" 79p, or "landscape" 79l on the conveyor belt upstream from the arm 77; in the case of assembling independent from the equipments 33r and 33l. The stop wall of the arm 77 is liftable on request to release the book block 79p, 79l, with the start of the conveyor belt 68 from an exact reference position, as defined by the stop wall, for a controlled transferring of the manually inserted book block to the binder 37.

[0033] Downstream from the inserting device 76, a thickness measurement device 81 of the book block 36p, 36l or 79p, 79l is provided. The measurement device 81 comprises, for instance, a probe 82, which can be depressed to bear on the book block laying on the conveyor belt 68 and a respective transducer for supplying corresponding information of thickness "TI". This information is used by the cover pre-forming equipment 39 and the binder 37 for executing with precision the pre formation of the spine 44 of the cover 32 and the assembling of the cover with the book block 36p, 36l or 79p, 79l. Conveniently a sensor, not shown, supplies a control signal to the electronic control equipment 42 for arresting the conveyor belt when the presence of the block underneath the probe 82 has been revealed.

[0034] A manipulating device or rotator 86 is mounted between the conveyor belt 68 and the binder 37. This

rotator is actuatable for arranging the book block 36p, 36l or 79p, 79l in a reference position and with a pre-defined orientation for the pre-assembling configuration. In detail, the rotator 86 (Figs. 5° and 5d) comprises a surface of support 87 for the book block 36p, 36l or 79p, 79l at the output of the conveyor belt 68, a pushing member 88 and a common support 89 for the surface of support 87 and for the pushing member 88. The conveyor belt presents a terminal portion 91, while a transferring pusher 92 (see Fig. 4) is provided, which is normally arranged above the terminal portion, and is actuatable to be lowered and pushing the book block up to the surface 87.

[0035] The pushing member 88 is provided for being shifted between an acceptance or release position for the book block 36p, 36l or 79p, 79l and a taken position in which it presses the book block against the surface of support 87. The common support 89 is provided for a transfer rotation around an axis 93 parallel to the conveyor belt 68 between a rest position and a transfer position.

[0036] In the rest position of the support 89 (see Fig. 5b), the surface of support 87 is adjacent and substantially coplanar with respect to the conveyor belt 68, while, in the transfer position of the support 89 (see. Fig. 5c), the surface of support is perpendicular to the surface of the conveyor belt 68. The support 89 is also designed for an orientation rotation around an axis 94 parallel to a transversal shaft of the conveyor belt 68. It for rotating the book block 36p, 36l or 79p, 79l, with positioning of an edge opposite to the trailing edge arranged according to the reference orientation required by the binder (see Fig. 5c). Thus, through the rotations around the axis 93 and eventually around the axis 94, the support 89 positions the rib 43 of the book block downwardly and with orientation parallel to the axis "A" of the binder 37, as requested for the perfect binding.

[0037] Moreover, jointly to the position of release of the pushing member 88, movement pliers carried by catenary, not shown, are provided for engaging the book block 36p, 36l or 79p, 79l in an area of the book block opposite to the rib 43 for transferring the book block on the input "IB" of the binder 37 in the provided pre-assembling configuration.

[0038] As above summarized, for gluing the back of the spines 44 of the pre-shaped covers 32 with the respective ribs 43 of the book blocks, the bookbinding machine or binder 37 provides the feeding of the covers 32 along a direction of assembling parallel to the spines 44, along the axis "A".

[0039] For the use of cover sheets 31, the cover pre-forming equipment 39 (Figs. 6, 9 and 10) comprises a store 95 for the cover sheets, and an equalizing device 97. The feeding mechanism 46 causes the cover sheets to singularly advance from the store 95 to the equalizing device 97. For instance, the feeding mechanism 46 includes motorized suckers "Sc", first motor rollers 96a, and further motor rollers 96b. The suckers "Sc" take sin-

gularly the cover sheets 31 from the store 95 for the engagement with the first motor rollers 96a toward the equalizing device 97. The equalizing device 97 is actuatable for aligning the reference edge (RE) and the lateral front edge (FE) of each cover sheet 31 with an alignment member 97a and the further motor rollers 96b for a given positioning of the cover sheet 31 of starting for the following operations of marking, trimming and cutting. After the alignment, the feeding mechanism 46, by means of the further motor rollers 96b, causes the cover sheets 31 to singularly advance from the device 97 along a direction of formation "FD" for the pre-shaped covers transversal to the direction of the spine to be executed for the following operations of marking, trimming and cutting.

[0040] In the case of covers 26 obtained from a paper cover strip, the respective sections for the cover sheets are separated from the strip and transferred to the further motor rollers 96b for the following processing, also along the direction of formation "FD".

[0041] The marking mechanism 48 has two sections: a section 48a for folding markings in the sense of the face of the cover sheet 31 and a section 48b for spine markings in the sense of the back of the sheet 31. The sections 48a, and 48b, respectively, execute the folding markings facilitating the folding of the cover during the turn over operations of the bound book, while the spine markings facilitate the folding of the spine 44 during the binding of the book. The section 48b also executes flap markings requested for a front flap 52a, and/or back flap 52b, when present, of the pre-shaped cover. The trimming mechanism 47 is provided for trimming, in the cover sheet, the reference lateral edge "LE" of the pre-shaped cover, perpendicular to the reference edge "RE". This reference edge "LE" will constitute one of the lateral edges of the pre-shaped covers 31 of the front flap 52a (Fig. 7a), when present, or a given lateral edges for the pre-shaped covers devoid of flaps (Fig. 7b) or having a sole flap 52b. In turn, the end edge "EE" will constitute the lateral edges of the back flap 52b for the pre-shaped covers having the back flap 52b or the other lateral edges of the pre-shaped covers devoid of flaps or having the sole flap 52a.

[0042] Suitably, the cover pre-forming equipment 39 can include a heating device, not shown in the figures, to facilitate the marking of plasticized covers.

[0043] According to the invention, the trimming mechanism 47 and the marking mechanism 48 operate on the cover sheet 31 transversally to the direction of formation "FD" and the direction of the spine 44 in agreement with the dimensions of the book block, the thickness of the book block and the dimensions of the cover flaps, when present. For example, the trimming mechanism 47 provides an actuatable knife of guillotine type, while the marking mechanism 48 provides actuatable transversal punches of suitable shape. The cutting mechanism 49 is provided for cutting the cover sheet perpendicularly to the direction of the spine so as to define the lower edge "OE" of the pre-shaped cover opposed to the reference

edge "RE". This mechanism 49 can provide conventional cutting disks and counter disks positionable perpendicularly to the direction "FD". A diverting device 98 provides to deviate the discards from the cutting mechanism and the trimming mechanism toward a, not shown, lower container.

[0044] The cover pre-forming equipment 39 comprises, upstream from the flap folding mechanism 51, an intermediate diverting station 99 and a taking and transferring mechanism 101. The station 99 arranges a marked and cut cover sheet 31 entered along the direction of formation "FD" in a starting position for the binding associated to a pre-assembling configuration, with a pre-defined position of the spine with respect to the input cover "IC" of the binder 27 and for being shifted along a direction of assembling of the binder parallel to the axis "A".

[0045] To this end, the intermediate station 99 comprises a support surface 102, a fixed front bank 103, a motorized lateral bank 104 and an alignment device 106. The alignment device is of known type with strip of transport and small alignment balls and provides to shift the cover sheet 31 so as to arrest the reference edge "RE" against the fixed bank 103 and the lateral edge "LE" against the motorized bank 104. The bank 104 is shiftable by program, along the direction of formation covers "FD", according to the thickness of the book block, for arresting the edge "LE" so as to arrange the pre-shaped cover in its starting position.

[0046] The taking and transferring mechanism 101 (Fig. 10) comprises a carriage 107 shiftable along guides 108 parallel to the axis "A" and includes three exhausting taking mouths or suckers 109, for lifting the cover sheet 31 from the support surface 102 of the station 99 and exactly positioning the cover sheet on the flap folding mechanism 51 and, in sequence and without transversal shifting with respect to the direction of assembling, toward the input cover "IC". The folding mechanism 51 is actuatable for folding by overlying the possible flaps 52a, 52b, whereby accomplishing the flaps of the pre-shaped cover 32 in association with the moving of the cover 32 along the direction of assembling.

[0047] In detail, the folding mechanism 51 comprises a central support surface 111, two contrast wings 112r and 112l and two bending wings 113r and 113l (see Fig. 8), symmetrical each the other, arranged parallel to the direction of assemblage. By program, the contrast wings and the bending wings have possibility of transversal shifting with respect to the assembling direction, up to position the contrast wings 112r and 112l in alignment with the markings regarding the flaps 52a, 52b (Fig. 8, fase1). The contrast wings 112r and 112l remain coplanar with the upper surface of the cover sheet and operate as contrast for the bending wings 113r and 113l which rotate, whereby folding the flaps 52a, 52b (Fig. 8, steps 2 and 3) around the markings for an angle of over 90°. Then, the wings 112r and 112l and the wings 113r and 113l are withdrawn from the effected folding (Fig. 8, step

4).

[0048] Now, the taking and transferring mechanism 101 moves the cover between a pair of upper shaped plates 114r and 114l and lower plates 116r and 116l, which provide progressively to further fold the flaps 52a, 52b up to the overlying on the back of the cover. Moreover, the transferring mechanism 101 puts the cover in engagement with a moving mechanism including counter-rotating rolls 117, having the function of advancing the pre-shaped covers along the direction of assembling up to the input cover "IC" of the binder 37 and consolidating the folding of the flaps.

[0049] According to the invention, the paper strips 28l, 28r used in the system 22 have standardized format, of width such to allow the printing, side by side (two-up), with different orientations, of basic sheets of the main dimensional format of books, with minimum waste. As shown in the Figs. 11, 12 and 13, with a maximum width of $440 \div 460$ mm, there can be printed basic sheets for book blocks 36p having vertical orientation (P) of notebook or "portrait" format, and book blocks 36l having horizontal orientation (L) of album or "landscape" format. The obtainable formats are substantially the ones most generally used in the book industry, varying from 105X180 mm to 210x295mm, and with the additional areas or "abundances" necessary for the finishing trimming.

[0050] As represented in the Figs. 14 and 15, in the strip 28r, the sheet groups Gr of the books 23, are arranged in longitudinal sections "LS", while the strip 28l provides longitudinal sections "LL" for the sheet groups Gl as inserts between the sheet groups Gr, but in which the groups Gr and the groups Gl can constitute the sole components of the books 23.

[0051] The pages 24 of each book 23 are sequentially printed on the two faces of the longitudinal section "LS", "LL" of the strip 28l, 28r provided for the required book and according to the respective orientation. In association with the longitudinal section "LS", "LL" for the required book, there is printed a book code 121 and, in association with each basic sheet 29r, 29l is printed a respective sheet code 122. The book codes and the sheet codes are machine-readable. Further, in association with each cover sheet 31, is printed a cover code 123, also machine-readable and associated with the required book, while the cover sheet 31 for the cover devoid of flaps include a further service code 126 similar to the code 123.

[0052] The input and forming equipments 33r and 33l with cutting and stacking function, respond to information of the book codes 121 and the sheet codes 122 for the transversal separation from the sheet strip or strips of the basic sheets and the stacking of the basic sheets 29r, 29l with formation of the book blocks 36.

[0053] The cover pre-forming equipment 39 responds to cover data from the cover code 123 for pre-forming the pre-shaped covers 32 from the respective cover sheets 32. The finishing equipments 41 for the bonded

books include the trilateral cutting equipment 54 and the flap opening and book cutting device 56 for trimming the basic sheets of the book block and the cover according to finishing data from the code 123/126 and/or the book code 121.

[0054] The manipulating device 86 provides to orientate the book blocks 36 for a predetermined operative position of input of the book block in the binding machine 37 in dependence of orientation data from the book code 121, while the binding machine proceeds to gluing the book block 36 with the respective pre-shaped cover 32 in dependence of agreement of book identifying data from the book code 121 with book identifying data from the cover code 123.

[0055] The method for manufacturing a book 23 provides the followings steps:

- a) printing the basic sheets 29r, 29l for each book 23 in the respective longitudinal section "LS" of the paper strip 28r, 28l provided for the requested book and according to the orientation (P, L) of the book;
- b) providing the printing of a book code 121 and of sheet codes 122, in which the book code 121 is associated with the longitudinal section "LS" of the book and includes data of the required book, while the sheet codes 122 are associated with the basic sheets 29r, 29l and relate to the process of formation of the book;
- c) providing the printing of a cover code 123 (Ved. Figs. 7, 16 and 17) in association with each sheet cover 31 and including data regarding the cover;
- d) activating, on the basis of the data of the book code 121 and/or the sheet code 122, the sheet input and forming equipments 33r and 33l and, respectively, the collecting device 34 for the separation from the paper strip and the stacking of the basic sheets 29r and 29l and the formation of the book block 36p, 36l;
- e) providing the measurement of the thickness of the book blocks 36p, 36l and activating, on the basis of the cover code 123, and of information of thickness on the book block 36p, 36l, the equipment for the pre-formation of covers so as to pre-form the pre-shaped cover 32 from a respective cover sheet 31;
- f) providing the binder 37 for gluing a rib 43 of the book block 36p, 36l with the back of a spine 44 of the respective pre-shaped cover 32, in dependence on the information of thickness;
- g) orientating the book block 36p, 36l and arranging the pre-shaped cover 32 for respective predetermined operative positions of input of the binder, in dependence on the book code 121 and/or, respectively, the cover codes 123;
- h) activating the binder 37 for assembling and gluing the rib 43 of the book block 36p, 36l with the back of the spine 44 of the respective pre-shaped cover 32; and
- i) activating, on the basis of the data of the book

code 121 and/or the sheet code 122, the finishing equipments 41 for the trimming of the basic sheets and the cover according to the data from the code cover 123.

[0056] The book code 121, the sheet codes 122 and the cover code 123 are of a type known as Datamatrix: of rectangular format for the book code 121 and the sheet codes 122, and of square format for the cover codes 123. These codes are printed by program on the basic sheets and the cover sheet on a conventional upper surface and/or the conventional lower surface thereof, jointly with the printing of the sheets and the cover in the "abundances" provided to be removed upon the trimming in the finishing equipments. The codes are read by appropriate code readers of the various equipments for supplying information for the execution of the respective functions, while the electronic control equipment 42 has function of general coordination and control and supplies the sequence of activation for the same equipments.

[0057] The book code 121 is arranged at an initial portion of each longitudinal section "LS" of the paper strip 28r, 281 for the required book, which will correspond to the first page of the book block 36. This book code 121 contains data essential for the identification and the characteristics of the book. In turn, the codes sheets 122 are printed beside the basic sheets and contain data necessary for processing the formation of the book. Synchronism strokes or "marker" 124 are also printed on the longitudinal section "LS" in correspondence of the pairs of basic sheets as signals of synchronism for the double cutter 49 and as signals of definition for the transversal cutting for the same pair of sheets.

[0058] The book code 121 and the cover code 123 have the following data:

- A) - Data regarding the batch of the books and progressive, also identifying the required book and regarding the client;
- B) - Dimensional data regarding the sheet on which the printing is effected;
- C) - Data regarding the height and to the width, including the abundance, of the book;
- D) - Data regarding the presence of the front flap 56a, and/or the back flap 56b and, in positive case, the respective dimensions;
- I) - Dimensional data regarding the distance of the folding marking, the upper abundance and the lateral abundance; and
- F) - Finishing data regarding the height and the width of the finished book.

[0059] In turn, the sheet codes 122 have the following data:

- P) - Data regarding the absolute number of pages of the book, which decrements naturally sheet by sheet and keeps in count the real number of he

sheets considering the groups Gr, Gl which composes the book;

G) - The number of the current sheet of the group Gr, Gl, which decreases from the total of the pages of the current group;

H) - Data regarding the height of the page and it is repeated on each page;

L) - Data regarding the identification of the batch of books;

I) - Data regarding the beginning of the book or the group Gr, Gl;

R) - Data regarding the rotation to effected by the book block by the manipulating device; and

S) - Data of status regarding further information, for instance the thickness of the block book.

[0060] The book 23 always begins with a pair of sheets. A white sheet is left in the book block or discarded off line. For each book, the two branches of the strips 28r, 281 are equalized by managing the discards, if necessary.

[0061] As for the cover sheets 31, the cover code 123 (Figs. 7a and 7b) is printed on an code area of each cover sheet having a given relationship with respect to the reference edge (RE) and the lateral front edge (FE), for instance near to the corner between these edges. Further, a draw or marker 127 is printed adjacent to the lateral front edge (FE) of each cover sheet. The service 126 (Fig. 7b) is printed on an code area of each cover sheet devoid of flaps having a given relationship with respect to the reference edge (RE) and the lateral end edge (EE), for instance near to the corner between these edges.

[0062] Specifically, the cutters 59r, 59l have respective Datamatrix readers DRCra, DRCrb; DRCla DRClb for the sheet codes 122, while specific sheet marker sensors recognize the "marker" 124 for controlling the exact positions of the cuts for the basic sheets.

[0063] In the use, the readers DRCra, DRCrb; DRCla DRClb of the cutters 59r, 59l read the value P on the strips 28r and 28l, beginning from a cutter master. As function of the read numbers, the program sets the sheet input and forming equipment 33r, 33l for the insertion of groups if the current book has or not respective groups. For instance, if the program recognizes the equality of the value of P with the value of G, indicative of absence of groups. In the case of $G < P$, it is indicative that the book includes at least a group Gr, Gl to be inserted by the other equipment 33r, 33l in the concurrent cutter.

[0064] The cutter 59r, 59l which starts the work continues the separation of the sheets up to exhaustion of the parameter G (0-1); at this point, it leaves again the control to the other cutter 59l, 59r for a following group. When the counter P has reached value 1 and the last sheet has entered the receipting area 67, it is indicative that the book block 36p, 36l, has been completed. Now, the program causes the start of the conveyor belt 68 toward the binder with stop when the book block is in front of the thickness measurement device 81.

[0065] Thereafter, the program starts for the manufacturing of a following book. The progressive number is checked for overcoming conditions of anomaly and restoring the activities after a possible breakup of the strip 28r and 28r and the restarting. When the work restarts in front of an anomaly, the remaining book is composed up to the end but, at the arrival of the code on a start binder reader DRB the program verifies that the progressive code has been wrongly composed and alerts the operator to remove the book block and the respective cover.

[0066] Downstream from the receipting area 67, the interconnecting group 38 provides a Datamatrix reader DRB for reading the book code 121 of the book blocks 36p, 361 in transit. Further, on the feeding mechanism 46, a Datamatrix reader DRC reads the cover code 123 regarding the cover sheets 31, while a specific cover marker sensors 128 recognize the "marker" 127 for controlling the exact positions of the trimmings and markings for the cover sheets. The control equipment 42 compares the book identifying data from the book code read by the reader DRB with the book identifying data from the cover code read by the reader DRB. In the case of agreement the equipment 42 enables the binder 37 for the binding of the book block with the respective pre-shaped cover.

[0067] As for the finishing equipments, a Datamatrix reader DRT and, respectively, a Datamatrix reader DRFs are provided, upstream from the trilateral trimming mechanism 54 and the flap opening and book cutting equipment 56. In particular, for the trimming information, the reader DRT reads the book code 123 from the first page of the bound book having flapped covers, which is visible in view of the fact that the edge of the book block opposite to the spine projects from the edge of the folded flaps. On the contrary, for bound book having covers devoid of flap, the reader DRT reads the service code 126. Finally, the Datamatrix reader DRF is provided for reading the book code 123 from the first page of the bound book.

[0068] The data of beginning of the book and beginning of a group, are also used for controlling the correct proceeding of the work. At the beginning, if a white page is present and it is decided that it must be discarded it will be discarded, for going to an equalized condition of processing. The un-equalized conditions of sheets, during the manufacturing of the book are not recovered; it will be made at the end: the discard is signalled on the first page of the group which contains the discard but it will be executed at the end of the group. Conveniently, a diverter can be provided downstream of the cutter to discard such sheets.

[0069] Naturally, the principle of the invention remaining the same, the embodiments and the details of construction can broadly be varied with respect to what has been described and illustrated, by way of non-limitative example, without by this departing from the ambit of the present invention.

[0070] As alternative to the manipulator or rotator having three axes of rotation at the end of the transport belt,

it can be provided a rotating device arranged immediately downstream of the cutters 59r and 591 or on the book block 36p, 361 of the platform 72 for orientating suitably the basic sheets or the book block.

5 [0071] An additional input can be provided for one or both the group forming mechanisms 61r, 61l to the end of introducing groups of basic sheets independent of the spools strips 27r, 271. It can be accomplished by using a three channel cutter of the type described, as variant, 10 in the European Patent Specification EP 1 741 653 in the name of the co-applicant Tecna S.r.l.

[0072] In a simplified system, the formation of the book blocks can be effected through a single sheet input and forming equipment, with the possible addition of a three 15 channels cutter.

[0073] In front of a reduced velocity, the system can use strips of half width with respect to the "standard" ones, such to allow the printing of a single column of sheets and technique "one up" of cutting and gathering. 20 Further, the inserts for the book blocks can be obtained by other inputs and from equipments different from the one above described.

[0074] The employable codes for the control of the various components of the system can be different from the 25 ones of Datamatrix type above described.

[0075] Further, the device of measure of the thickness of the basic stack of sheets for the control of the binder can be applied to an automatic system for manufacturing of book blocks different from the ones specific for "book 30 on demand."

Claims

- 35 1. A system for manufacturing books on demand, with formation of a book block having basic sheets for the required books and pre-formation of covers and comprising a binding machine for binding a book block with a respective pre-shaped cover, the said system being **characterized in that** it manufactures 40 books of varying format and uses one or more continuous sheet strips of standard width, such to allow the printing, with different orientations, of basic sheets belonging to the principal dimensional formats of books; 45 in which the basic sheets of each book are sequentially printed on a respective longitudinal section of the strip or strips provided for the required book and according to the respective orientation; 50 in which, in association with the said longitudinal, there is printed a book code and, in association with each basic sheet is printed a respective sheet code, in which the book codes and the sheet codes are machine-readable while, in association with each cover is printed a cover code, also machine-readable 55 and associated with the required book; said system further comprising:

one or more input and forming equipments with cutting and stacking function, responsive to information of the book codes and the sheet codes for the transversal separation from the sheet strip or strips of the basic sheets and the stacking of the basic sheets with formation of book blocks;

a cover pre-forming equipment responsive to cover data from the cover code for pre-forming covers from respective cover sheets; and finishing equipments for the bonded books including a trimming mechanism for trimming the basic sheets of the book block and the cover according to finishing data from the cover code and/or the book code;

in which, a manipulating device provides to orientate the book blocks, for a predetermined operative position of input of the book block in the binding machine in dependence of orientation data from the book code; and

in which the binding machine proceeds to gluing the book block with the respective pre-shaped cover in dependence of agreement of book identifying data from the book code with book identifying data from the cover code.

2. System for manufacturing books on demand according to claim 1, **characterized in that** it comprises two input and forming equipments and a collecting device for receiving and stacking the basic sheets forming a book block, the two equipments being arranged by opposite sides with respect to the collecting device and each one of the two equipments being provided for receiving and pre-forming a respective group of basic sheets as component of the book block, with function of buffer and independently one another, while the binding machine has a single book block input; the system further comprising a mechanism of output for each of the two equipments for shifting, respectively, a first group of basic sheets from one of the input and forming equipments and/or a second group of basic sheets from the other equipment to the collecting device for the formation of the book block; and an extraction mechanism for removing the book block from the collecting device, functional to the transfer of the book block to the book block input of the binding machine and in which the mechanism of output of the other equipment moves the second group of basic sheets on the collecting device as insert of the first group of sheets for the manufacturing of the book block for the required book, or in alternative, the mechanism of output of the one equipment moves the first group of basic sheets on the collecting device for forming a first book block only with the first group of sheets for a first required book, while the mechanism of output of the other equipment, after the removal of the first book block, moves the second group of basic sheets

on the collecting device.

3. System for manufacturing books on demand according to claim 2 **characterized in that** it includes a transfer mechanism for transferring the book block from the collecting device toward the binding machine; in which the collecting device includes a receipting area for receiving the groups of basic sheets forming the book block; and in which the areas of stacking of the input and forming equipments are arranged side by side with respect to the receipting area of the collecting device; the said equipments including respective input pushers actuatable for pushing the first sheet group and the second sheet group from the respective areas of stacking toward the receipting area or on a sheet group stacked on the receipting area; and the transfer mechanism being actuatable for transferring the book block from the collecting device toward the binding machine, the transfer mechanism including a conveyor belt having an initial section in which the receipting area is defined and in which the collecting device includes a platform arranged above the receipting area, between the areas of stacking, for receiving temporarily the first sheet group or the second group sheets, said platform being shiftable for leaving to fall the first sheet group or the second group sheets on the underlying receipting area.
4. System for manufacturing books on demand according to one of the preceding claims **characterized in that** a synchronism draw or marker is associated to each basic sheet and in which the input and forming equipments or each of the input and forming equipments, is synchronized by the synchronism draw or marker for the transversal separation from the sheet strip or strips of the basic sheets.
5. System for manufacturing books according to claim 1 **characterized in that** the book code is printed on a given section of the first page of the book block and in which said system comprises, a belt conveyor or other conveyor member of support and shifting for the book block with final section adjacent to the binding machine and a code reader device arranged upstream from said final section in order to read the book code from the first page of the book block and extract the orientation data for the actuation of the manipulating device.
6. System for manufacturing books according to claim 1 **characterized in that** it comprises, a belt conveyor or other conveyor member of support and shifting for the basic stack of sheets with final section adjacent to the binding machine and a measuring device arranged upstream from the final section for measuring the thickness of the book block supported by the belt conveyor or other conveyor member, in

which said measuring device is functional to the cover pre-formation equipment and the binding machine and in which a station of manual insertion is provided upstream of the measuring device for enabling the insertion of book blocks independently of the input and forming equipments.

7. System for manufacturing books on demand, according to claim 1 **characterized in that** it comprises, a belt conveyor or other conveyor member of support and shifting for the basic stack of sheets with final section adjacent to the binding machine and in which said manipulating device comprises a surface of support for the book block, at the output of the conveyor belt, a pressing member and a common support for the surface of support and for the pressing member, and in which a transferring pusher is actuatable for pushing the book block from the final section of the conveyor belt to the surface of support; in which the pressing member is provided for shifting from a position of reception or release for the book block and a holding position in which the pressing member presses the book block against the surface of support; in which the common support is provided for a transfer rotation around an axis parallel to the conveyor belt between a position of rest in which the surface of support is adjacent and substantially coplanar with respect to the conveyor belt and a position of transfer in which the surface of support is perpendicular to the surface of the conveyor belt; and in which the common support is also provided for an orientation rotation around an axis parallel to a transversal shaft of the conveyor belt for rotating the book block, with arrangement of an edge opposite to the edge of output according to said pre-defined orientation; movement pliers being provided for engaging, respectively, a pre-defined edge of the book block or an edge of the book block, adjacent to the pre-defined edge, jointly to the position of release of the pressing member for transferring the book block to the input of the binding machine.
8. System for manufacturing books according to one of the preceding claims **characterized in that** the basic sheets are obtained, side by side, from a continuous strip wound in spool or from a pair of continuous strips wound in respective spools and further comprising: a single merger equipment or, respectively, a pair of merger equipments for longitudinal cutting and overpositioning the basic sheets from the strip or the strips and in which, downstream from the merger equipment or equipment, there is provided a longitudinal rotation of 180° of one of the longitudinal sections for avoiding a prevailing bending of the basic sheets in the book block or blocks.

9. System for manufacturing books according to one of the preceding claims, in which the binding machine operates for gluing the spines of the pre-shaped covers with ribs of the book blocks, the said system being **characterized in that** the cover pre-forming equipment derives the covers from respective cover sheets or from respective sections of a strip, in which the cover data also include dimensional data and typology data of the cover, and in which the cover pre-forming equipment comprises a marking mechanism for executing markings for the spine and flaps of the pre-shaped cover and a trimming mechanism for the cover sheets, the marking mechanism and the trimming mechanism operating according to the dimensional data and typology data of the cover and the flaps, if present, and the thickness of the book block.
10. System for manufacturing books on demand, according to one of the preceding claims, **characterized in that** it further comprises a flap folding mechanism, arranged upstream of the binding machine, actuatable for folding, by overpositioning, a possible flap or flaps of the cover and formation of a pre-shaped flapped cover in response to the cover data and in which the trimming mechanism is trilateral for executing finishing cuttings on three edges of a bonded book devoid of flaps or finishing cuttings on two edges of a bonded book with a flap or flaps, the finishing equipments further comprising a flap opening and book cutting equipment, actuatable for opening the covers with a flap or flaps and executing a cutting on the side of the book opposite to the spine of the cover; the trilateral and the flap opening and book cutting equipment responding to the finishing data from the cover code or the book code.
11. System for manufacturing books on demand, according to one of the preceding claims, **characterized in that** the book codes, the sheet codes and the cover codes are of Datamatrix type.
12. Method of management and printing of books on demand, also different one another, for a system according to one of the preceding claims, the said method comprising the followings steps:

using standardized paper strips, of width such to allow the printing of a single sheet (one-up) or two sheets, side by side (two up), with different orientations, of basic sheets belonging to the principal dimensional typologies of books; and printing the sheets of each book in a longitudinal section of the strip, provided for the required book and according to the orientation of the respective book and printing the book code in association with the longitudinal section of the strip or strips for the

required book and the sheet codes in association with each basic sheet and in areas of abundance of the book to be eliminated by the finishing equipments.

13. Method of management and printing of books on demand, also different one another, for a system according to one of the preceding claims, the said method using cover sheets or a continuous cover strip for the covers, the said method providing the printing of the cover code in association with each cover sheet or with a section of the strip cover used for the cover of the required book, functional to the control of the cover pre-forming equipment.

14. Method of management and printing of books on demand, for a system according to one of the preceding claims, the said method being **characterized in that** it manages orders of clients of different typologies and different locations, the said method comprising the followings steps:

providing, in the book code data by a respective customer order, data of the book to be printed and data of the sheets and, on the cover support, codes of identification cover with data of the customer order, data of the book to be printed and data of the cover in a given sequence and grouping on the basis of the customer order;
arranging the basic sheets of the strip or strips and the cover sheets in the sequence attaining to the respective books and grouping on the basis of the respective customer orders;
actuating, on the basis of the book codes and the sheet codes, the input and forming equipments or equipments, with formation of book blocks according to the positions in the given sequence;
actuating, on the basis of the book codes and the cover codes, the cover pre-forming, with formation of the said covers;
actuating, in association with the formation of a book block, the binding machine for the binding of the book block with the respective cover; and
actuating the finishing equipments of the bound books for the finishing and the grouping in the given sequence of the customer order regarding the respective location.

15. System for manufacturing books on demand comprising a collecting device for receiving and stack basic sheets forming a book block for the required book and a binding machine for binding the book block with a respective cover; said system being **characterized in that** manufactures books of varying format and comprises a interconnecting group between the collecting device and the binding machine; in which the binding machine defines a taking

of input for the book block with pre-defined orientation for the rib of the required book; said interconnecting group comprising a conveyor member of support and shifting for the book block and a manipulating device for the book block; in which the conveyor member extends between the collecting device and the manipulating device, while the manipulating device is actuatable for positioning the book block in a predetermined operative position of input of the binding machine; said manipulating device comprising

a surface of support for the book block at the output of the conveyor member, a pushing member and a common support for the surface of support and for the pushing member, and in which a transferring pusher is actuatable for pushing the book block from the conveyor member to the surface of support; in which the pushing member is provided for shifting between a position of acceptance or release for the book block and a position nipping in which the pushing member presses the book block against the support surface;

in which the common support is provided for rotation of transfer around a first axis between a position of rest in which the support surface is adjacent and substantially coplanar with respect to the conveyor member and a position of transfer in which the support surface is perpendicular to the surface of the conveyor belt; and

in which said support is also provided for rotation of orientation around an axis parallel to a second axis for rotating the book block, with arrangement of an opposite edge to the trailing edge according to said pre-defined orientation;

movement pliers being provided for engaging, respectively, a pre-defined edge of the book block or an edge of the book block adjacent to the pre-defined edge, jointly to the position of release of the pushing member for transferring the book block to the taking of input of the binding machine.

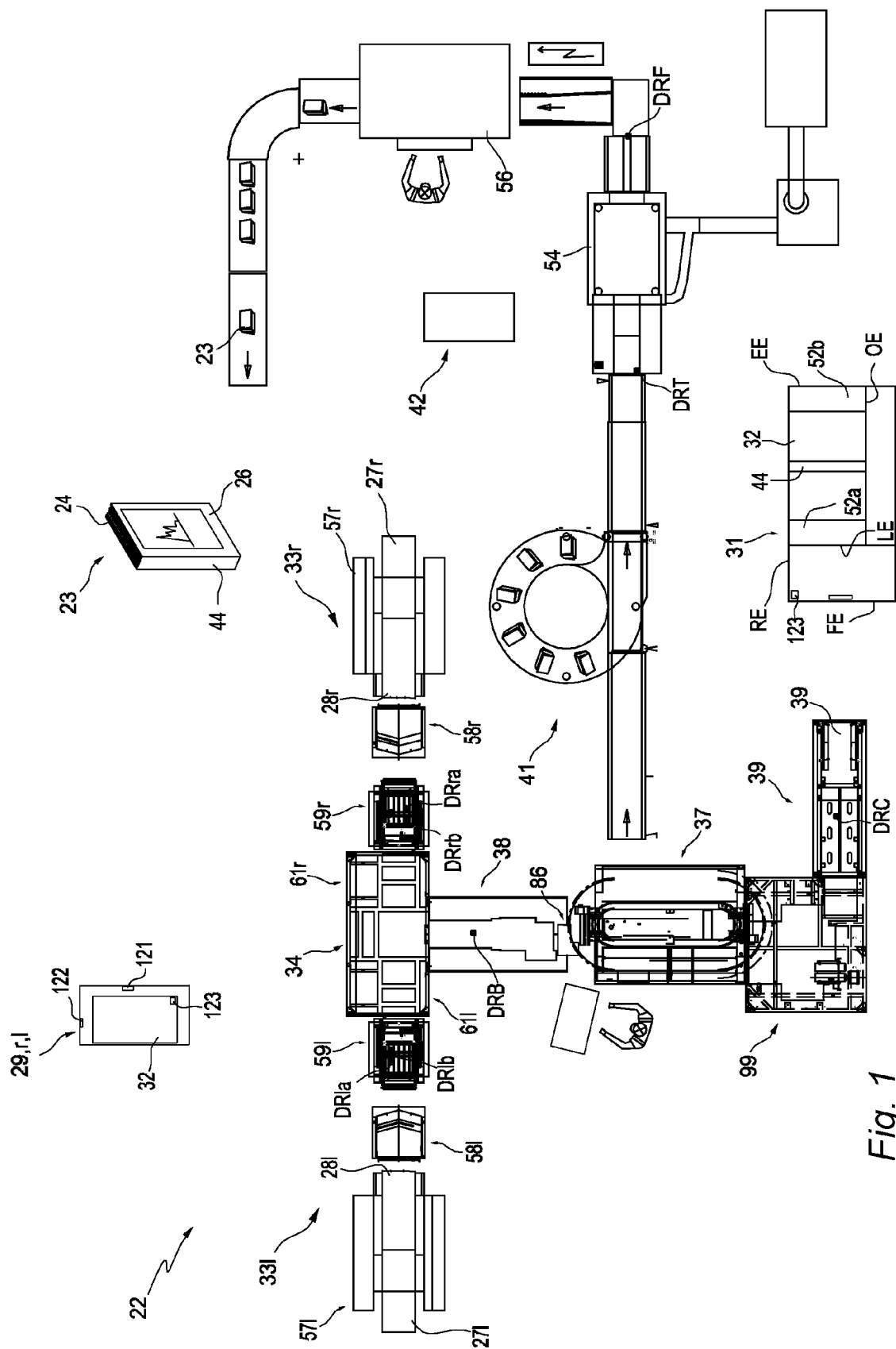


Fig. 1

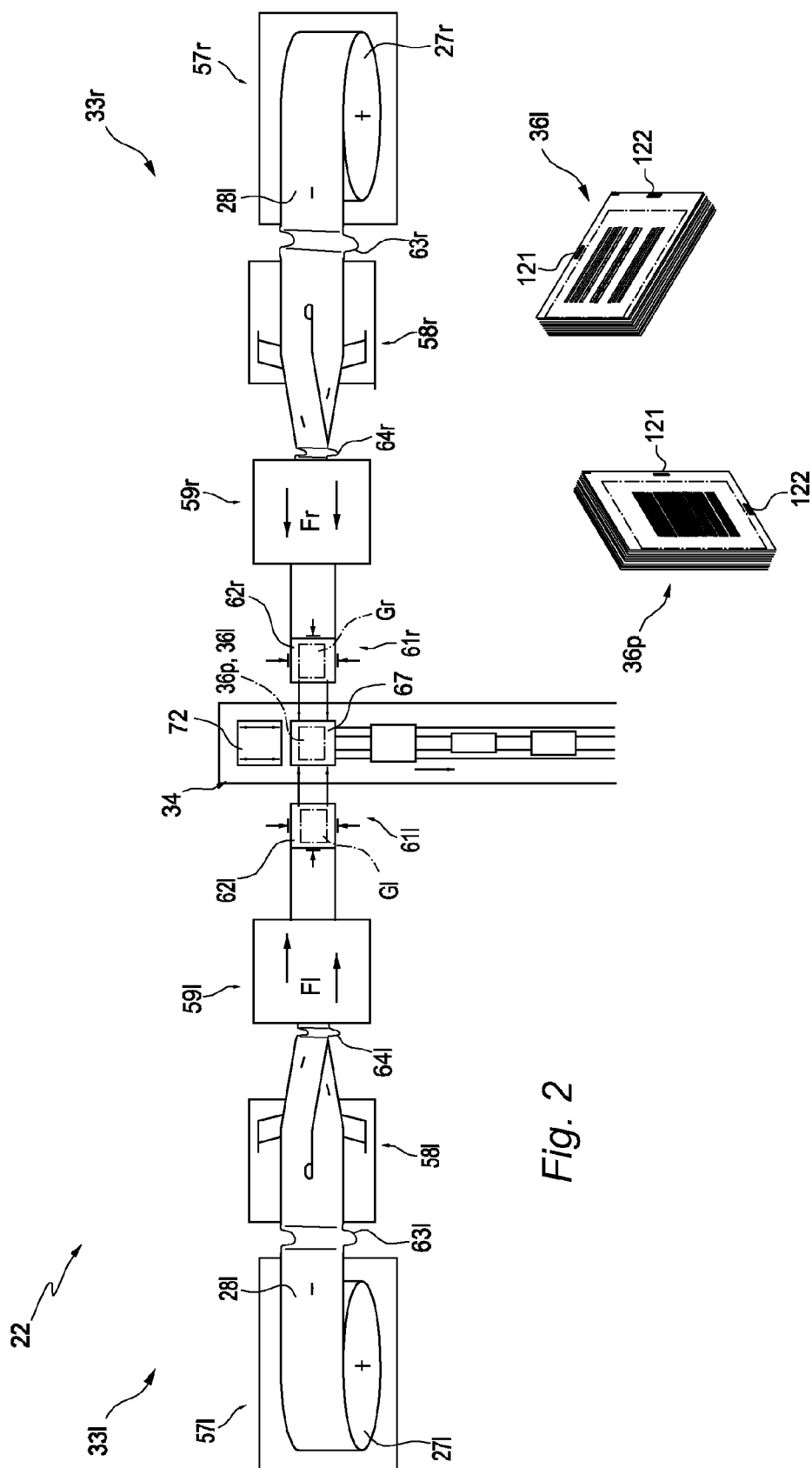


Fig. 2

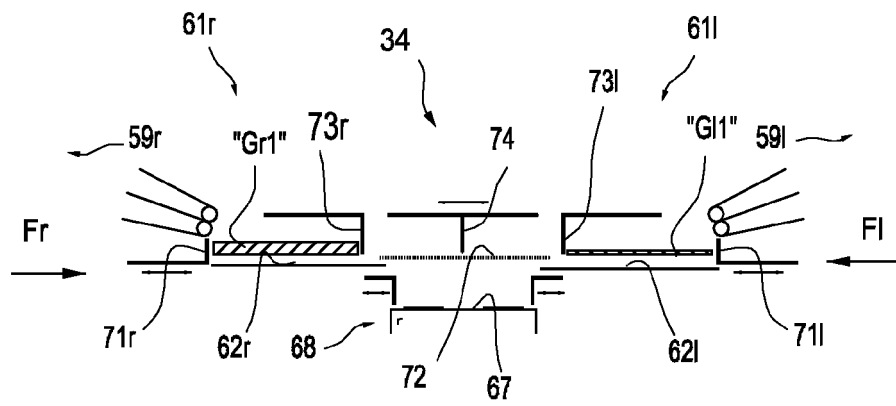


Fig. 3a

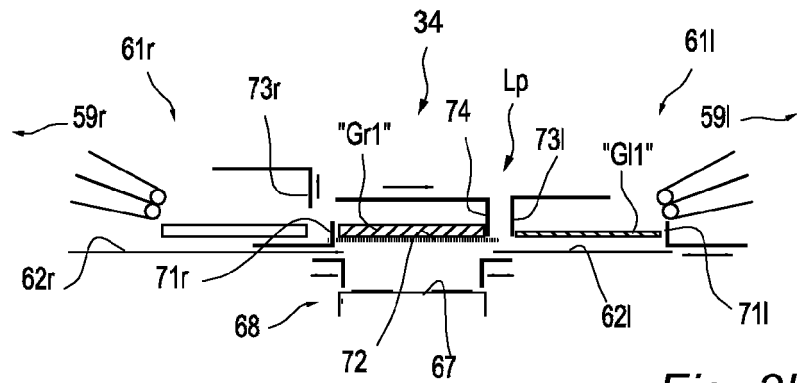


Fig. 3b

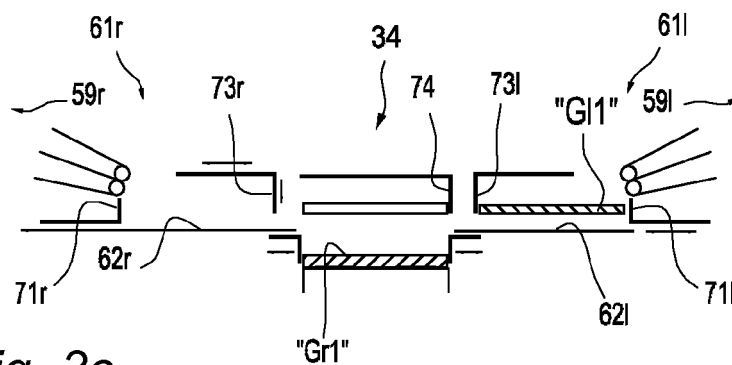


Fig. 3c

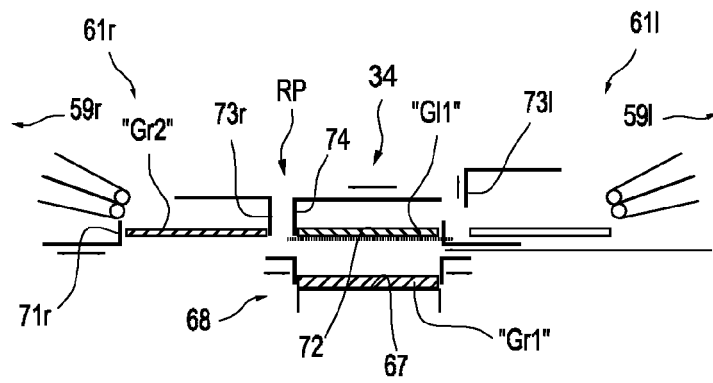


Fig. 3d

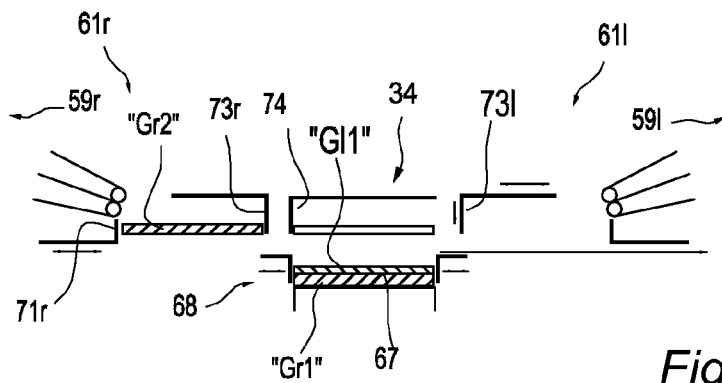


Fig. 3e

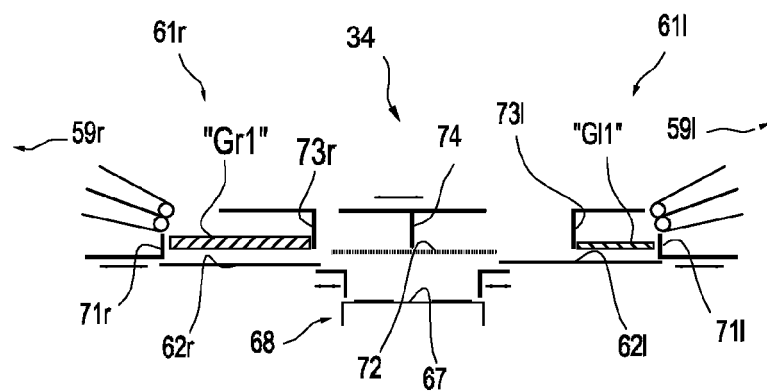


Fig. 3f

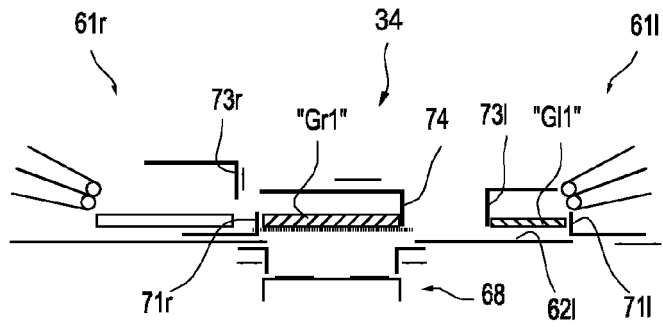


Fig. 3g

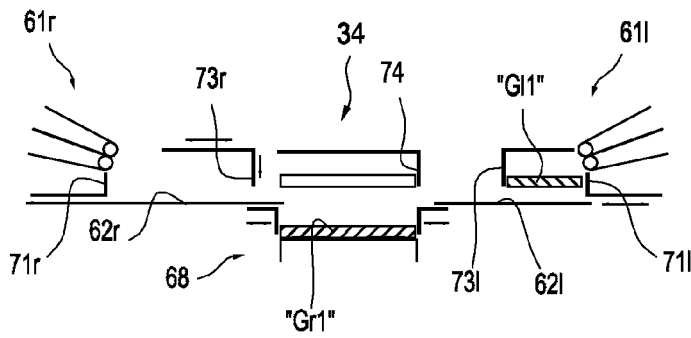


Fig. 3h

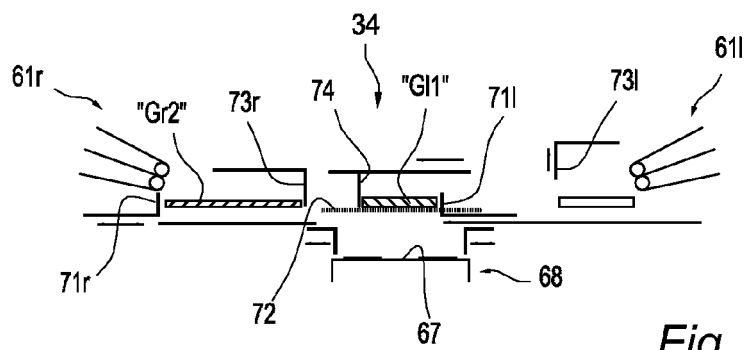


Fig. 3i

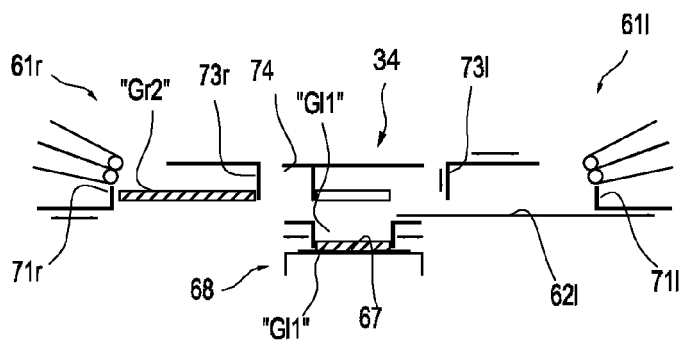


Fig. 3l

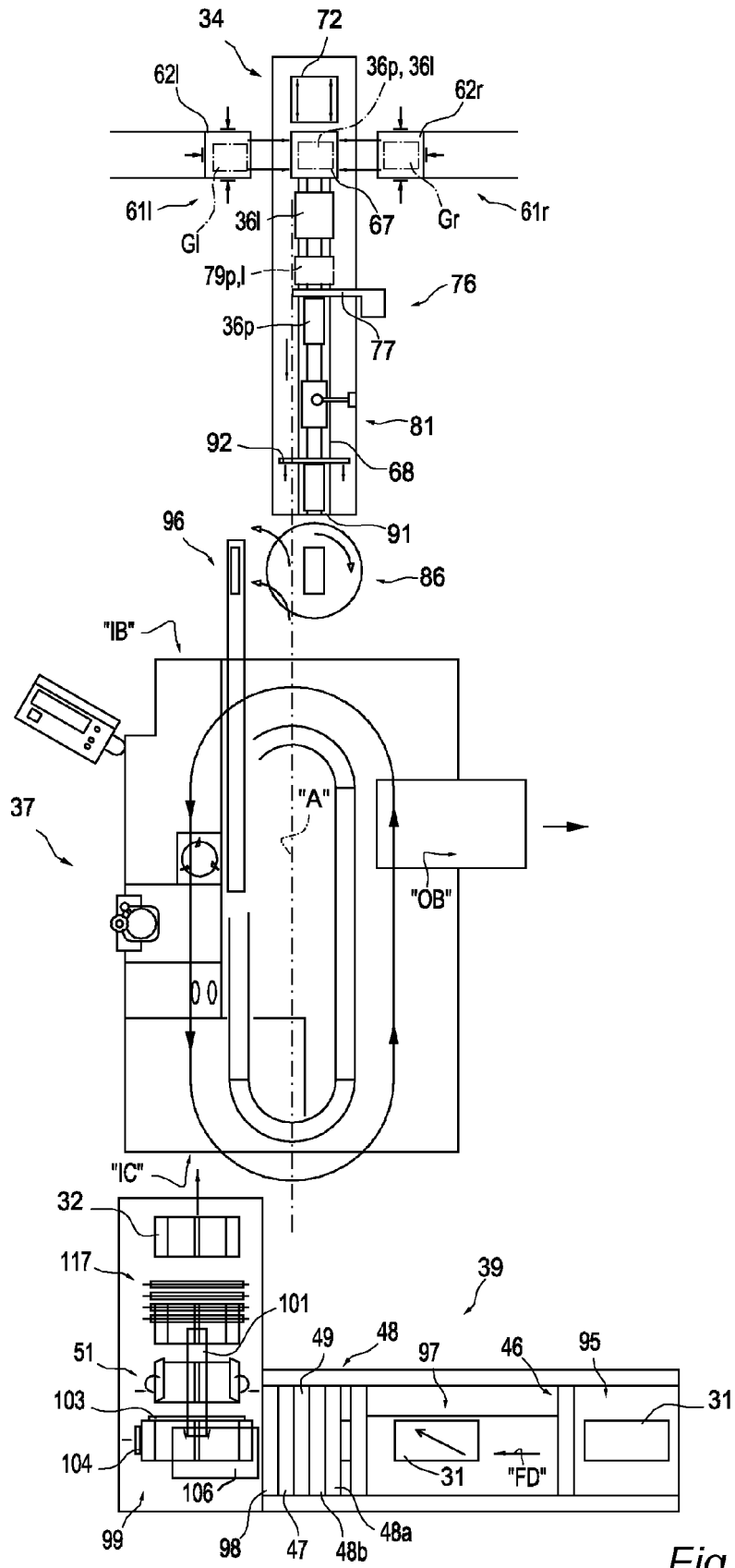


Fig. 4

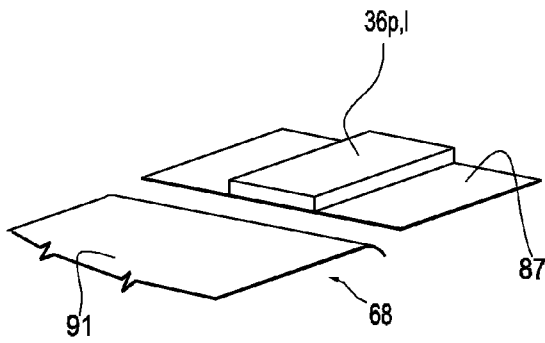


Fig. 5a

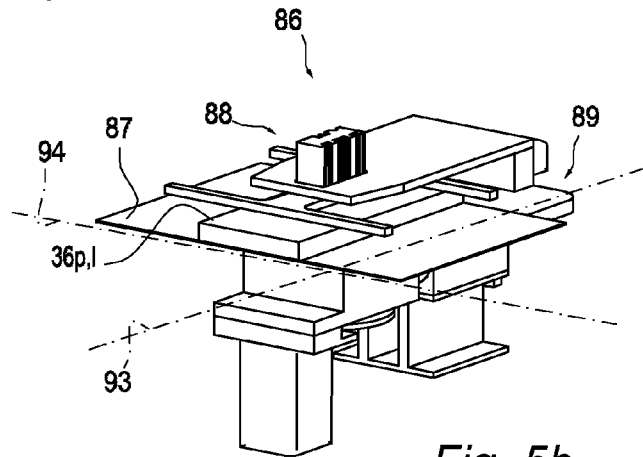


Fig. 5b

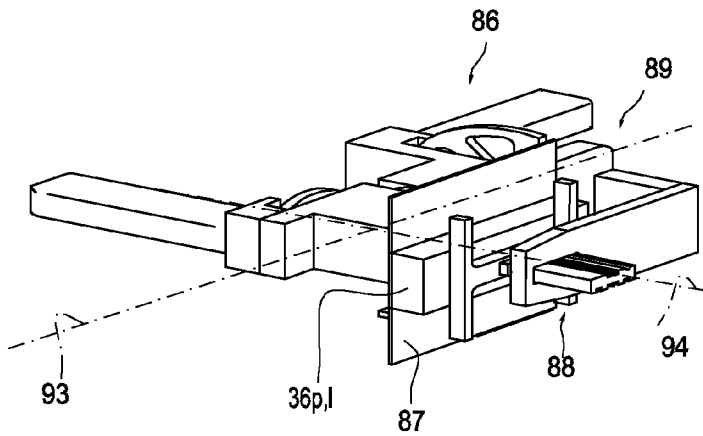


Fig. 5c

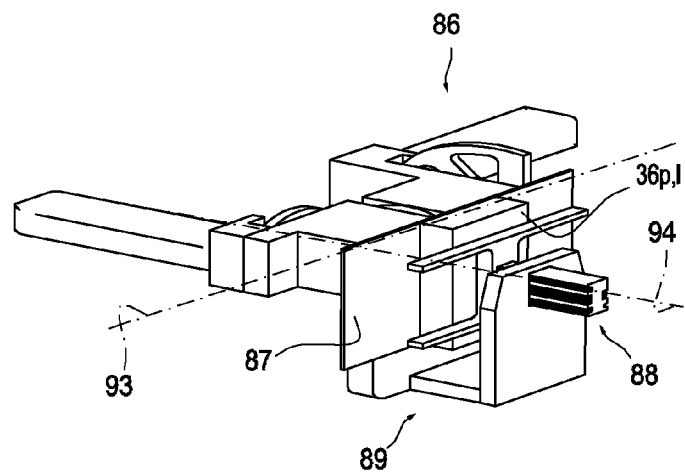


Fig. 5d

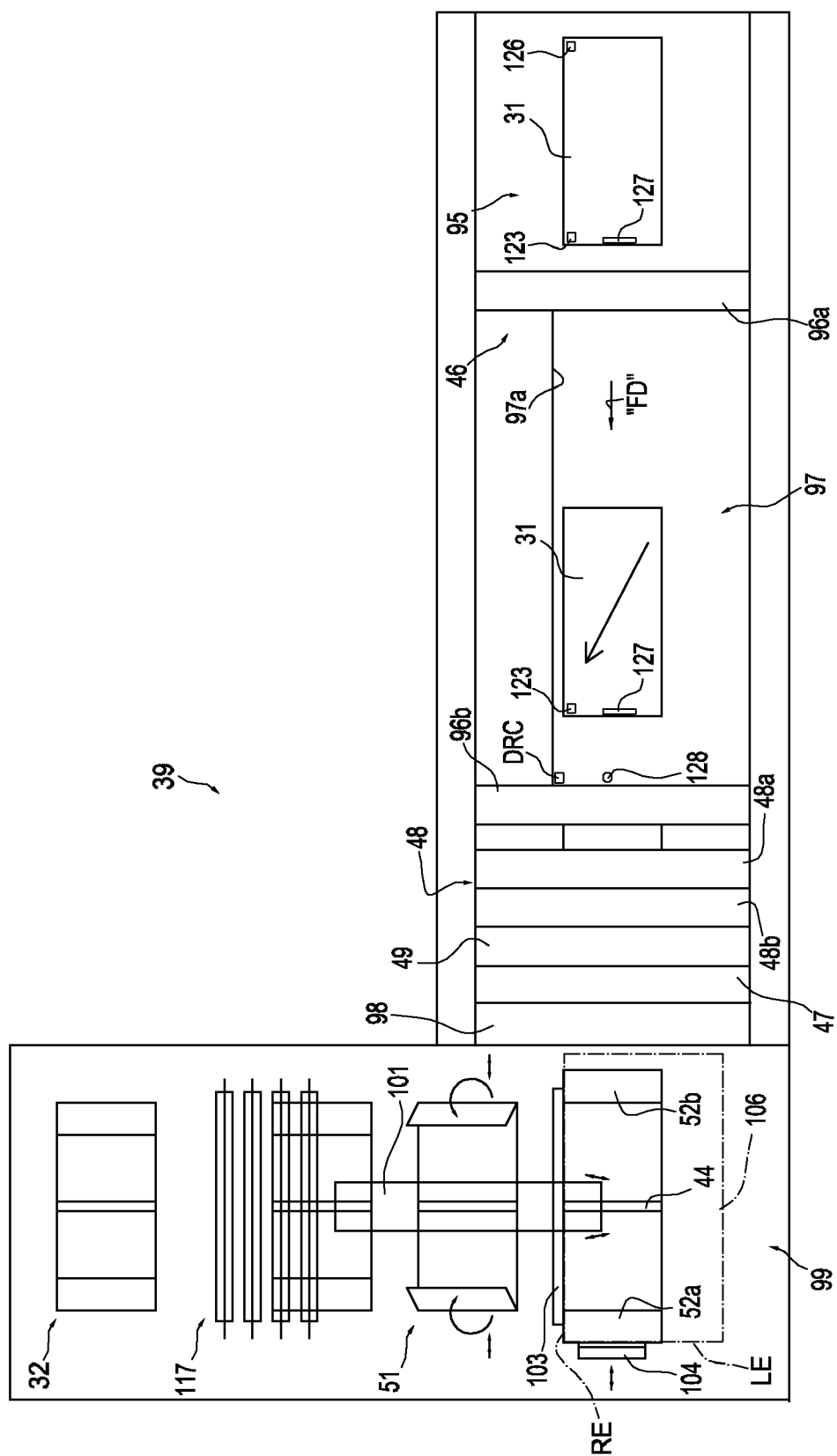


Fig. 6

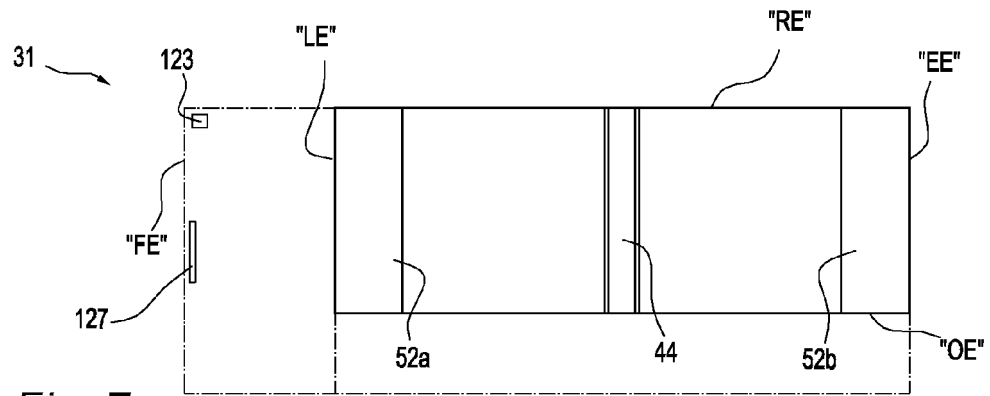


Fig. 7a

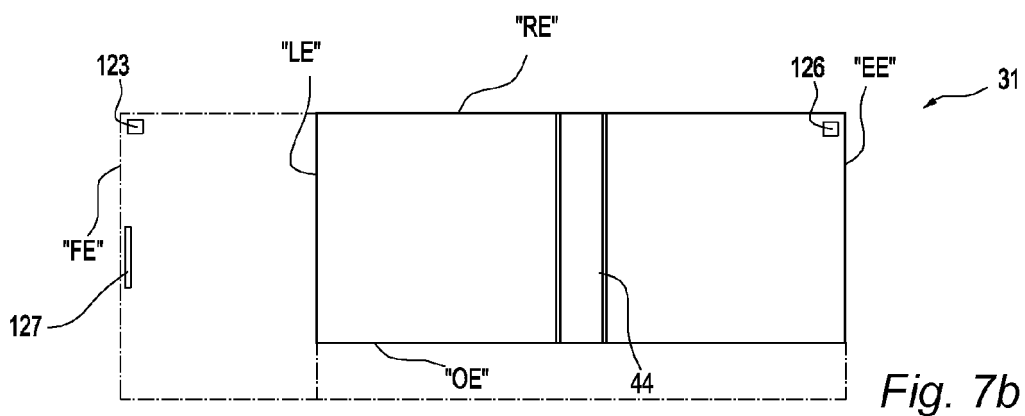


Fig. 7b

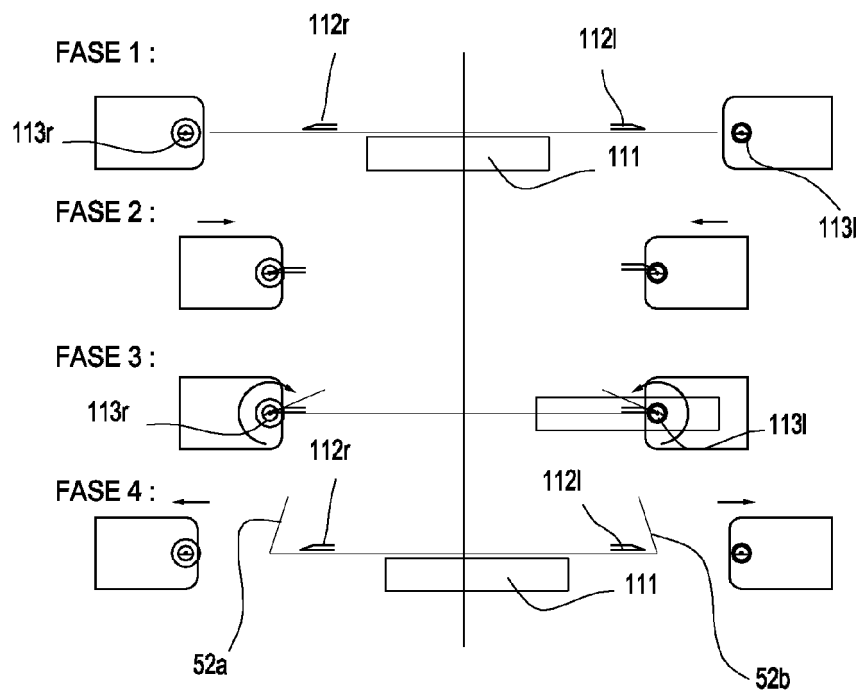


Fig. 8

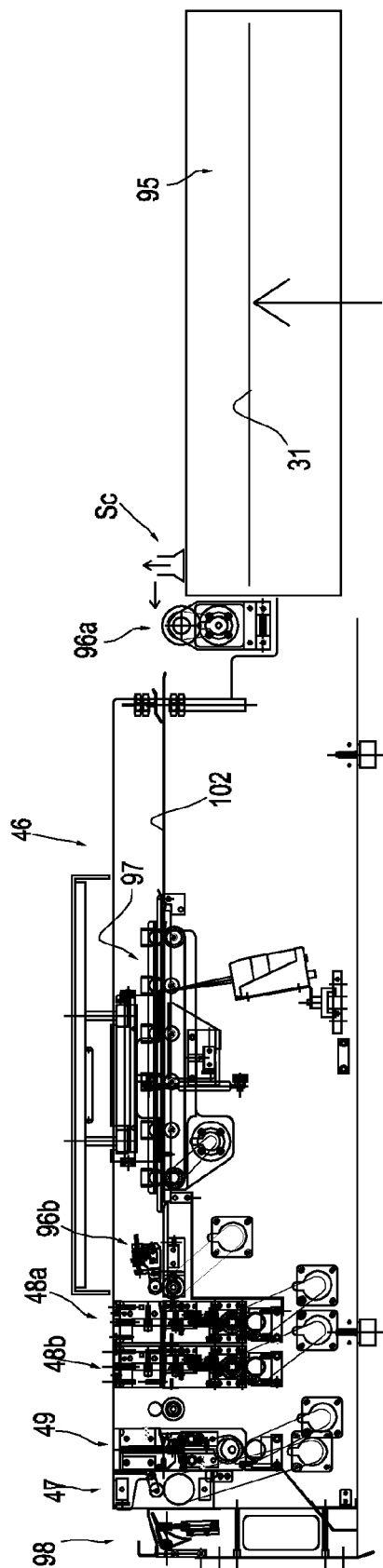


Fig. 9

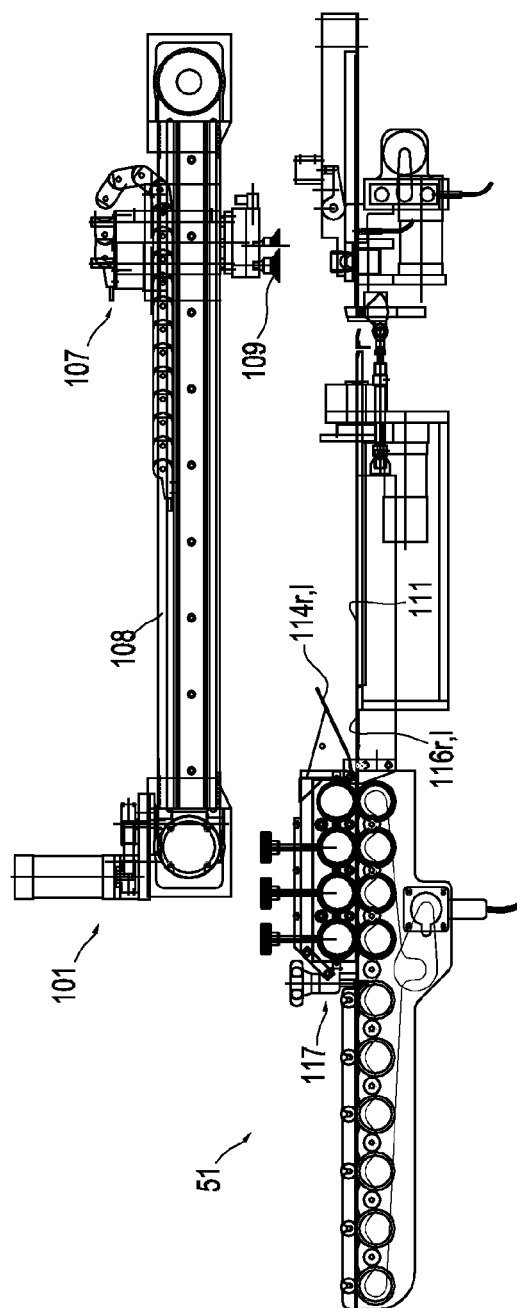


Fig. 10

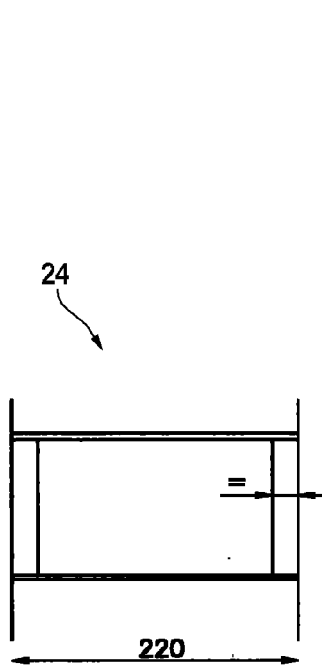


Fig. 11

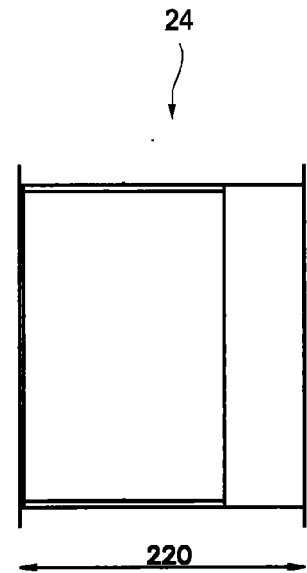
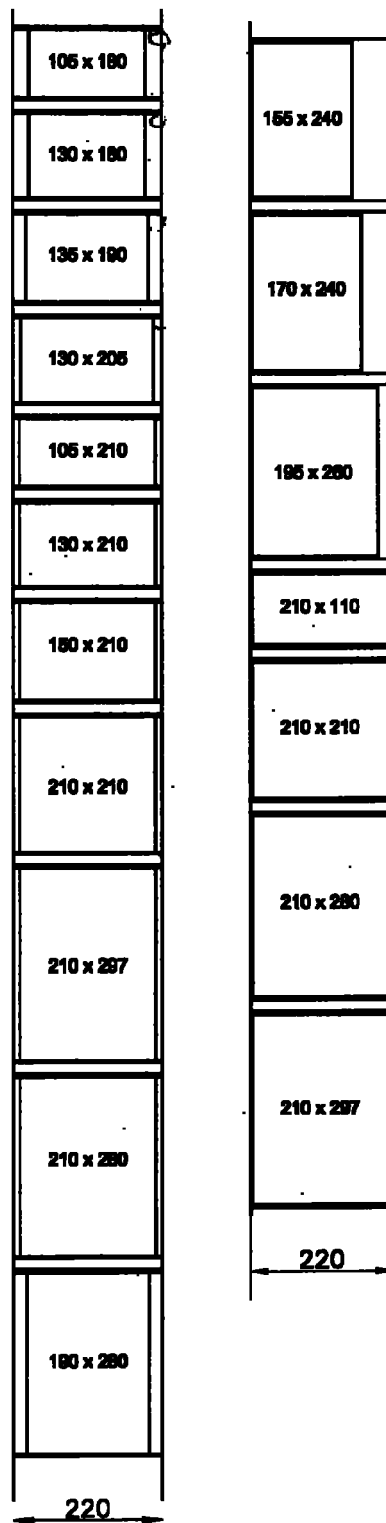


Fig. 12

180x105	
180x130	
190x135	
205x130	
210x105	
210x130	
210x150	
210x210	
210x297	
210x280	
190x280	
	230 230 460 MAX

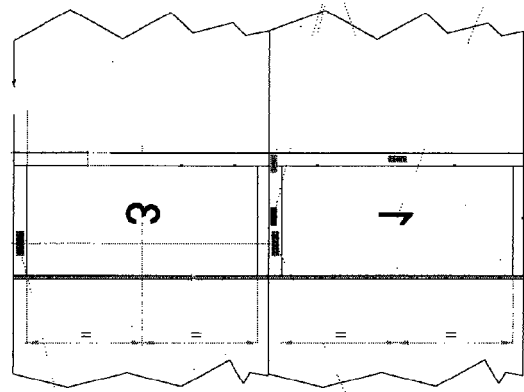
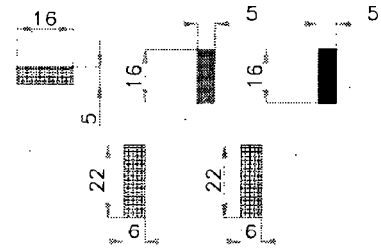
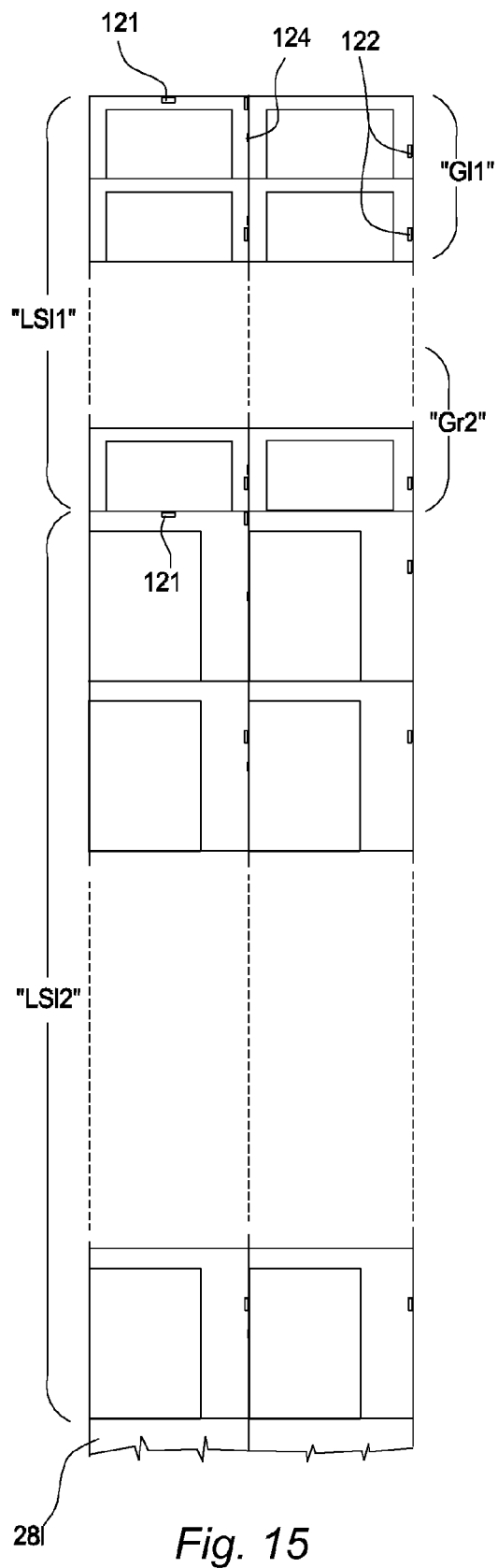
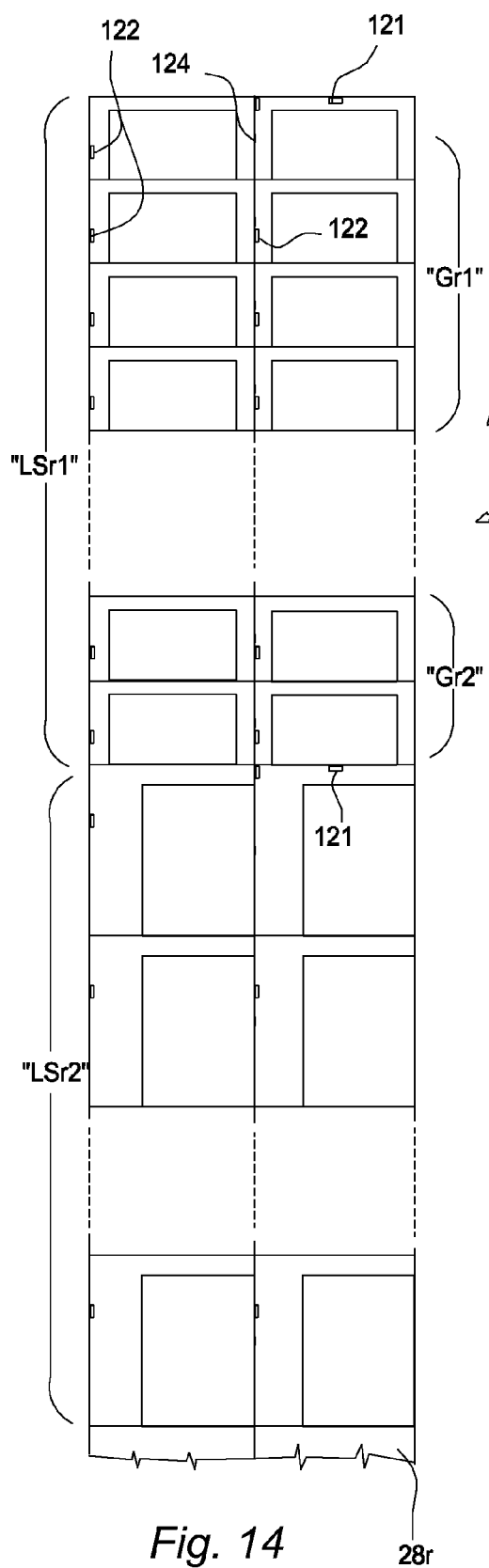


Fig. 13



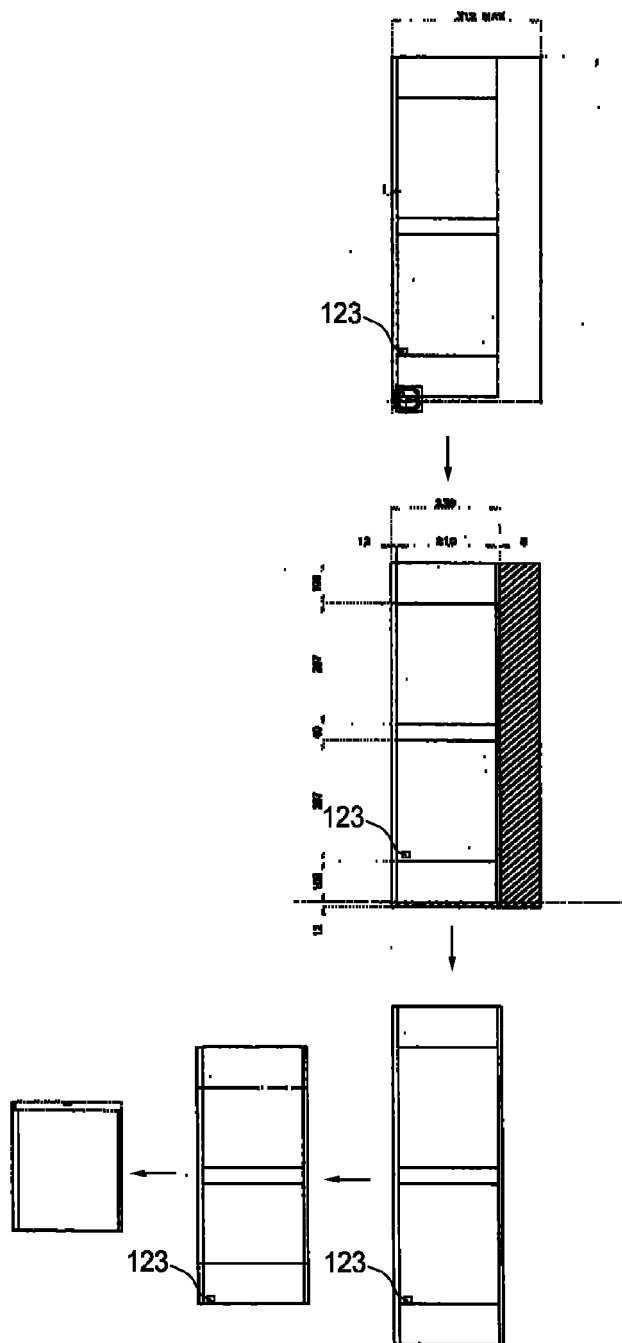


Fig. 16

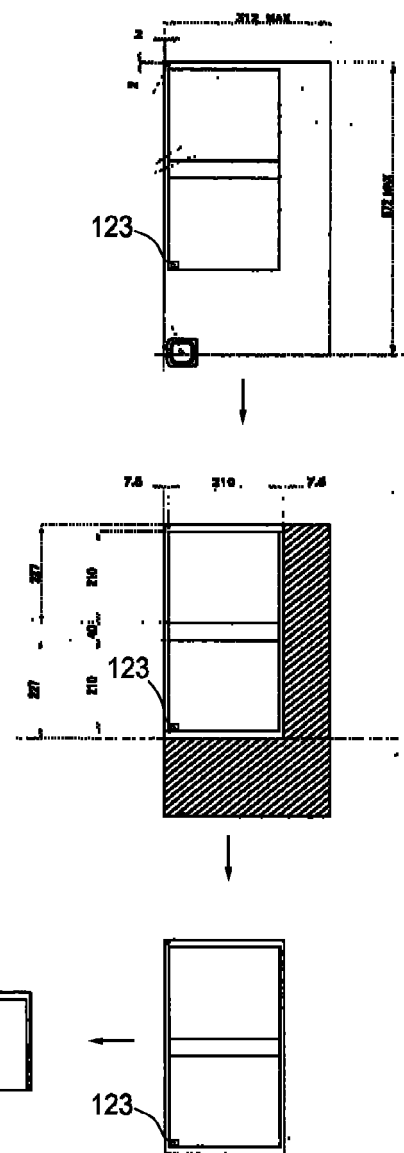


Fig. 17

**PARTIAL EUROPEAN SEARCH REPORT**

Application Number

under Rule 62a and/or 63 of the European Patent Convention.
This report shall be considered, for the purposes of
subsequent proceedings, as the European search report

EP 10 16 7096

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2002/061238 A1 (MARSH JEFFREY D [US]) 23 May 2002 (2002-05-23) * paragraphs [0002], [0053] - [0112], [0169]; figures 1-25 *	1-12	INV. B41F17/02 B42C1/10 B42C19/00 B42C19/08
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			TECHNICAL FIELDS SEARCHED (IPC)
			B41F B42C
INCOMPLETE SEARCH			
The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out. Claims searched completely : Claims searched incompletely : Claims not searched : Reason for the limitation of the search: see sheet C			
Place of search		Date of completion of the search	Examiner
The Hague		1 December 2010	Dewaele, Karl
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04E07)



**INCOMPLETE SEARCH
SHEET C**

Application Number
EP 10 16 7096

Claim(s) completely searchable:
1-12

Claim(s) not searched:
13-15

Reason for the limitation of the search:

The requirements of Rule 62a(1) EPC are not met.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 16 7096

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01-12-2010

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