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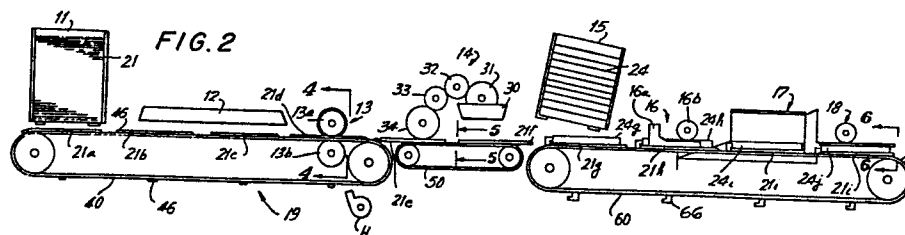
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54 **Method of casing-in books.**

57 A method for bookbinding on a continuously-moving, constant-speed conveyer belt (19) operation with the case (21) or back-strip being centrally located on the axis of motion. As the case (21) is formed between opposing rotary irons (13), glue or paste is then applied to the upper insides of both sides of the case (21). A book block (24) is next dropped on one side of the case, the book block (24) is aligned to register with the case (21); and the other side of the case (21) is folded over to fasten to the upper side of the book block (24) to form the book and prepare it for pressing and crimping of the building-in operation, without any interruption of the motion of the book along the conveyer system (19).



## METHOD OF CASING-IN BOOKS

Of the numerous discrete and separate operations entailed in the manufacture, and specifically the binding, of a hardcover book, "casing-in" is the process in which  
5 a book and its hard cover (or "case") are fastened together.

My United States Patent Number 4,091,487, issued May 30, 1978 for a "Method for Binding Books" discloses an  
10 important improvement over conventional book binding, wherein the signatures are first collated, the spines or backbones of the signatures are then cut off to provide a single backbone exposing every sheet in every signature, and whose edges can be glued together and to at least one paper  
15 cover that will ultimately be glued to the interior surfaces of a conventional hard cover, after the other three edges of the assembled and collated signatures are trimmed.

My United States Patent Number 4,106,148, issued  
20 August 15, 1978 for a "Method of Binding Papers", discloses an additional improvement over conventional book binding, wherein notches or apertures are cut into the spines at intervals to permit the flow of adhesive glue well into the backbone of all of the pages in every signature. This method  
25 avoids the waste of paper and the extra step of grinding the backbone while still eliminating the even-more-costly step of sewing the signatures.

My co-pending United States Patent Application  
30 Serial No. 145,018 discloses still another method for

binding a book wherein the backbone of printed and folded signatures receives a heat activated glue. A short reinforcing cover whose inner surface is also covered with a heat activated glue is applied to the backbone. The outer portions of the short cover are then bonded to the outer pages of the signatures, under sufficient heat and pressure to form a strong bond. A hard cover of suitable size and shape is then glued to the outside of the short cover and the signatures.

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The present invention relates to a method for casing-in books which is faster, more economical, and more accurate than conventional casing-in, and which creates a finished hardcover book that is as strong as, or stronger than, books cased-in by the usual methods.

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In effect an assembly operation, casing-in uses as raw materials (1) complete books (without hard covers, often referred to as "book blocks"), (2) completed hard covers or "cases", and (3) glue, paste, or some other adhesive to bond the book blocks and cases together. Book blocks and cases are produced in the book bindery, each in a separate and distinct series of operations, prior to casing-in. There are numerous alternative methods and materials that may be employed in both book block-and case productions.

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These in-process materials may differ in their appearance or structure. Book blocks, for example, may be bound, inter alia, with adhesives, by needle-and-thread sewing, or mechanically (such as wire-spiral bound or with plastic). Their backbones or spines may be "flat backed" or "round backed", depending upon the shape or configuration of the raw materials, and particularly that of the book blocks. The number and nature of the discrete steps in casing-in may vary in its current art.

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Regardless of the types of book blocks or cases used, presently known casing-in is slow and cumbersome, and requires considerable hand labor, requiring four basic steps, i.e.

(1) Glue, paste, or some other adhesive is evenly applied to the outside of both the first and last pages ("endpapers") of the book block. In conventional casing-in equipment, the book block is positioned either manually or mechanically astride a flat, metal, vertical plate called a "wing". The wing then mechanically lifts the book block, drawing it between a pair of rollers that applies the adhesive to the outer endpapers. If the books to be cased-in have a rounded back, a second pair of rollers applies adhesive at the "joints" where the backbone flares out. Finally, if the books are to be "tight backed" (also glued along the spine), still a third application of adhesive is required.

(2) The hard cover, or case, is subjected to heat and pressure at its spine between a male-female set or pair of metal "forming irons" which rounds or curves the cases' spine into conformity with the shape of the book block's spine. In conventional methods, cases are dispensed from a hopper and remain stationary during forming.

(3) The adhesive-coated book block is inserted into the now-formed case in the position in which the two are to be adhered. In prior art equipment, the adhesive application operation and case forming operation are synchronized so the book and cover meet at their respective spines as the book is lifted through the adhesive-dispensing rollers. As the wing continues to rise, the front and back sides of the cover drape around the book block.

(4) The book block and case are pressed together so the glue or paste will bond both together. In some conventional equipment, this step is performed mechanically before the cased-in book is ejected. With other equipment, however,

this step must be performed manually by removing and clasping the book block-and-case unit from its wing.

5        If the now-complete books were permitted to dry as is, they would warp badly. Accordingly, casing-in is immediately followed by a separate and distinct bindery operation called "building-in", in which heat and pressure are applied to the book so it will dry flat.

10        A number of problems and shortcomings are inherent to the aforedescribed conventional methods for casing-in. In general, conventional casing-in methods are mechanized versions of manual operations, and the equipment used to perform the various steps of casing-in is complex and cumbersome. Book blocks and cases, while being processed, are  
15        subject to continuous stopping and starting, and abrupt and awkward movements. This invites questionable and uneven performance, considerable maintenance, slow operation, and recurrent breakdowns, all contributing to high production  
20        costs.

      Especially in the situation in which adhesive-bound book blocks are to be cased-in, a drying period before casing-in is required to permit the adhesive binding to set.  
25        A direct transition from binding to casing-in before the requisite drying period elapses would place undue stress on the adhesive binding, occasioning distortion, mangling, or misalignment of the book and hence considerable spoilage.

30        Consequently, book blocks are often piled on skids until dry prior to casing-in, thereby causing delays and requiring additional labor. This process, moreover, brings about another problem. The book blocks towards the bottom of the pile tend to become compressed under the natural  
35        weight of the book blocks above. The rollers that apply the glue or paste in the casing-in machine, however, must be adjusted and spaced within close tolerances. Accordingly,

the casing-in machine's operator must continually stop the equipment to readjust the rollers. Failure to do so accurately results in excessive adhesive application on the thicker book units (called "creepage"), whereby the overabundant adhesive creeps over the edges of the book block and bonds together several outer pages , or insufficient adhesive application on the thinner book blocks towards the bottom of the pile. Depending upon the shape of the book blocks to be cased-in, as many as three sets of rollers must therefore be continually readjusted. The use of multiple pairs of rollers, moreover, requires the waste of larger quantities of adhesive when the "glue pots" are cleaned at the completion of an operating schedule.

In prior art casing-in, it is often necessary for an operator to realign manually the book block within its case after the two have been pressed together. Misalignment occurs frequently because of the abrupt, starting-and-stopping movements inherent in the equipment. In addition to the extra labor required, in some cases the misalignment is so severe that the book block and case must be separated by hand and reprocessed. Before recycling, however, the book block must be allowed to dry to prevent adhesive from fouling the equipment's mechanisms.

In casing-in very thin "juvenile" books (under 1/4-inch thick), automatic book block feeding equipment cannot be used. Book blocks must accordingly be manually and individually positioned on the wing by one operator, and a second operator removes the book block-with-case from the wing after processing. Operating speed is therefore limited by both operators' dexterity.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an in-line method for casing-in books that results in a continuous flow, at a constant rate throughout the actual casing-in of the book with no stop-and-start steps as in the prior art.

It is a further object of the present invention to provide a method for casing-in books that is simpler and considerably faster than existing methods and machines can provide.

It is a further object of the present invention to provide a method for casing-in books that does not require that the adhesive on the spines of adhesive-bound book blocks dry or set before casing-in, and in which the book block may be cased-in as an in-line process from the adhesivebinder, without intermediate drying, stacking, storing, or associated time delays.

It is yet a further object of this invention to provide a method for casing-in books that does not involve creepage due to excess of paste, or rejects due to insufficient paste because of variations in the thickness of book blocks in a given batch.

Another object of the present invention is to provide a method for casing-in books wherein the cased-in books do not have to be realigned by hand after casing-in.

It is a further object of this invention to provide a method for casing-in books that requires fewer and simpler steps or mechanical functions and parts and that provides improved precision.

It is yet another object of the present invention to provide a method for casing-in books that permits utilization of machinery that is simpler, less complex, easier to maintain, more durable, and very much less expensive than that required by existing methods and machinery.

It is a further object of this invention to provide a method for casing-in books that requires fewer transfer functions, less supervision, and much less manpower, so as to reduce both time and cost.

It is yet a further object of the present invention to provide a method for casing-in books that can be joined directly in-line to the succeeding building-in operation.

It is another object of this invention to provide a casing-in method that produces hardbound books that are as strong as, or stronger than, hardbound books cased-in by existing methods.

The method of the present invention involves a continuous, linear-flow process for casing-in books, requiring no start-and-stop motions. Hard book covers or cases are first formed by a circular forming iron while the cases remain in motion. Glue or paste is then applied to the entire inside surface of the moving cases. Book blocks are then dispensed horizontally, as unopened units, in proper axial alignment on passing cases. Next, the covers are folded over and the books are closed. Finally, the completed books, while still in motion, are subjected to pressure to adhere the book blocks and cases together.

The glue or adhesive used in the present invention is of a nature such that wherever two surfaces do not come into direct contact, the glue or adhesive dries quickly in both colorless and non-sticky form, thereby preventing  
5 adhesive build-up on the inside borders of the hard covers around the book blocks' outer edges.

BRIEF DESCRIPTION OF THE DRAWINGS

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FIG. 1 is a block diagram showing the steps followed in a preferred method embodying the present invention;

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FIG. 2 shows a side view of an apparatus which may be utilized to accomplish said method;

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FIG. 3 is a top view of the apparatus of FIG. 2;

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FIG. 4 is a horizontal sectional view taken in enlarged scale along line 4-4 of FIG. 2;

FIG. 5 is a horizontal sectional view taken in enlarged scale along line 5-5 of FIG. 2; and

30

FIG. 6 is a horizontal sectional view taken in enlarged scale along line 6-6 of FIG. 2.

# DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

The general arrangement of an apparatus which may be utilized to carry out the method of the present invention is disclosed in FIGS. 1, 2 and 3. In FIG. 1 the block diagram shows a case feeder 11 that puts cases with their outside face downward on a constant speed conveyer system, generally designated 19, the cases situated with their inside faces upward. The conveyer then passes the middle, or central, backbone portions of the cases under heater 12 to prepare them for a rotary forming iron or former 13. The conveyer next passes the cases under a case gluer 14, and next under a book block feeder 15. The book blocks are next drawn into register with the cases by an aligner 16 before the other side of the case is turned over by a case closer or folder 17.

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FIG. 2 is a side view of a suitable apparatus for carrying out a preferred method embodying the present invention. The case feeder 11 is seen loaded with cases 21a, 21b, etc., that are fed onto a first conveyer belt 40 of conveyer system 19 in timed sequence under the control of a conventional mechanism (not shown). The reference numbers 21a, 21b, etc. indicate not only a plurality of cases in different phases of casing-in and building-in, but also their locations on the conveyer belt system. A heat lamp heater 12 warms the center portion of the backs of the cases before they are passed between the upper and lower

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rolls 13a and 13b of a rotary forming iron 13; case 21d is seen between these rolls in FIGS. 2 and 4. As shown in FIGS. 2 and 5, the formed case 21e is then disposed under a gluing roller 34, which is fed by a series of rollers 5 33, 32, and 31, the latter of which turns in a glue or pastepot 30. This gluing sequence may be motivated by a second shorter conveyer belt 50. A third conveyer belt 60 receives the glued case 21g and passes it under a book block feeder 15, which contains a stack of book blocks 24, 10 which fall on the formed, glued cases. Each book block is brought into register along both axes by each aligner 16 with a first outer side of the block against a first side part of the case, before a case closer 17 folds the other side of the case toward the upper or second outer 15 side of the book block to fit on said second side of the book block which is then ready for the final building-in processing.

More particularly, first conveyer belt 40 may have 20 lugs such as 46 for abutting the downstream edge of the cases 21. The second conveyer belt 50 may omit lugs that might interfere with the gluing roller 34. The third conveyer belt 60 may have lugs, such as 66, for moving the cases and cased-in books. FIG. 3 is a top plan view of 25 the apparatus of FIGS. 1 and 2, with similar elements similarly numbered. In this figure cases 21b and 21c are shown with their center portions or backbones 22 passing under the heater 12 before case 21d passes between the rotary forming irons 13a and 13b. Such irons form back- 30 bone 22 (FIG. 4). Case 21e passes under the gluing roller 34, which is seen being fed by the intermediary rollers 31, 32 and 33 from the glue pot 30. The case 21g now passes under the book block feeder 15 to receive a book block 24g which is aligned with one side of case 21h by the 35 conventional aligner 16 as shown in FIG. 3. Aligner 16 includes a pair of centering fingers 16a and a roller 16b to control the book block 24g. The case closer or folder 17 next lifts the other side of the case at 21i to cover

the book block 24i. This may be accomplished by an inclined plane such as 17a, or a succession of such inclined planes, or other types of conventional folding mechanisms. The casing-in of case 21j and its book block  
5 24j into book B is now complete, as seen also in FIG. 6.

While a typical, relatively-simple series of mechanisms is shown for performing a preferred method of the present invention other variations of mechanisms could be  
10 employed. Also, the sizes and functions of the mechanisms may be varied to accommodate any size and type of book. Almost all types of books from flat to rounded backs and hard to soft covers, and even spiral bound books, could be bound by this method with only slight variations in  
15 the mechanisms. By way of example, additional drive belts or wheels (not shown) can also be added above or below the moving cases or book blocks to insure consistent and positive motion of the elements. Flexible strips may be positioned where desirable to hold the elements in close  
20 contact with the conveyers, or align the book blocks to the cases. After alignment, a slight pressure may be applied to the book block, and after the other side of the case is folded over, slight pressure may again be applied to the upper case to bond the case to the book block just  
25 enough for handling, if necessary, and passing on to the final pressing and crimping stage of the building-in processor.

The conveyer system 19 is shown as having three  
30 different stages to provide the preferred means for moving the cases and book blocks through the different steps of the process. However, a single, continuous, conveyer belt could be used to provide positive and steady movement of the elements throughout the casing-in process. Driving  
35 lugs are desirable in the first and last stages, particularly for the alignment, but they could be lowered within the belts during the gluing stage. Alternately, the conveyer system may consist of a series of parallel,

synchronized chains or belts.

5       The first stage on the belt 40 for forming the  
backs of the cases 24, although preferred, is actually  
optional, since the case backs could be preformed in one  
of several conventional manners before being fed onto  
conveyer belt 50. Also many flat-backed, softcover, and  
certain other books, do not require forming. However,  
where forming is required, the rotary forming iron is  
10       probably faster and more efficient than the older methods.  
Actually, the heating of the cases 21 before they are  
passed through the rotary forming iron may be accomplished  
by heating the rotary iron itself. This arrangement  
could control the amount of heat and direct it to the  
15       exact portion of the backbone that is being formed. This  
could be accomplished by heating the forming irons in-  
ternally (not shown) or through an external hot-air  
blower as shown in FIG. 2 at H. Obviously, if a heater is  
used, the conveyer would have to be open (such as chains)  
20       to permit the heat to pass through to the forming irons.  
This arrangement would also reduce the length of the con-  
veyer, which would obviously be advantageous. In the  
other stages, too, it could prove advantageous to reduce  
the space or distance along the conveyer to complete a  
25       given step, as well as the spacing between steps. The  
case folder, for example could be a simple flipping arm, or  
air gun, activated by the presence of a case, instead of  
a gradual inclined plane using the motion of the con-  
veyer, and a considerable length of the conveyer, to  
30       function.

      While the roller method for applying glue or paste  
is standard, very effective, and highly compatible with  
this linear system, and flat, consistently thick cases,  
35       it is anticipated that other gluing methods may be  
developed that could be effective.

      It should be noted that since the glue is applied

to the insides of the cases instead of the outsides of  
the book blocks, a peripheral rim of glue is left on the  
inside squares of the cases just beyond the edges of the  
book block. This would, in operation, dry without inter-  
5 fering with the final building-in steps of the book  
binding.

Various other modifications and changes may be  
made with respect to the foregoing detailed description  
10 without departing from the spirit of the present in-  
vention.

CLAIMS

1. A method for casing-in a book on a constant-speed conveyer, said method comprising the following steps:  
putting a book case inside-up on said conveyer  
with its central back-strip portion centrally aligned with  
5 said conveyer;  
heating and passing said central back-strip portion  
between two rotary forming irons as it moves along said  
conveyer belt;  
applying paste to the upper insides of said case  
10 as it moves along said conveyer;  
putting a book block on the glue on one side of  
said case ;  
aligning said book block with said case;  
and  
15 folding the other side of said case over onto the  
glue on the other, upper side of said book block to pre-  
pare the assembly for final building-in.
2. A method for casing-in a book on a constant-speed  
20 conveyer as set forth in Claim 1 wherein said book case  
is put on said conveyer by a feeding mechanism.
3. A method for casing-in a book on a constant-speed  
conveyer as set forth in Claim 1 wherein said central  
25 back-strip portion is heated by a source of heat posi-  
tioned above said back-strip as it moves along said  
conveyer.
4. A method for casing-in a book on a constant-speed  
30 conveyer as set forth in Claim 3 wherein said source of  
heat is a heat lamp positioned above said back strip as  
it moves along said conveyer.

5. A method for casing-in a book on a constant-speed conveyer as set forth in Claim 3 wherein said central back-strip portion of said case is heated by pre-heated rotary forming irons as it passes through said forming irons.

6. A method for casing-in a book on a constant speed conveyer as set forth in Claim 3 wherein said source of heat is a forced hot-air blower positioned so as to direct hot air onto said rotary forming irons.

7. A method for casing-in a book on a constant-speed conveyer as set forth in Claim 1 wherein said paste is applied to the upper insides of said cases by a series of rollers interacting between said case and a paste reservoir.

8. A method for casing-in a book on a constant-speed conveyer as set forth in Claim 1 wherein said book block is put on said paste on said one side of said casing by an automatic feeding mechanism.

9. A method for casing-in a book of hard covers and book blocks, said method comprising the following steps:

putting a book case inside-up on a conveyer;  
applying glue to the inside of said case as it moves along said conveyer;

putting a book block on the glued inside surface of one side of said case;

aligning said book block with said one side of said case; and

folding the glued inside surface of the other side of said case onto the endpaper of the other, upper side of said book block to prepare the assembly for final building-in before it leaves said conveyer.

10. A method for making hardcover books, said method comprising the steps of:

feeding a case onto a conveyer belt with its inside up and its central backbone along the center of said conveyer belt;

passing said backbone of said case under a heat source to raise its temperature for forming;

passing said backbone between two rotary forming irons;

passing said formed case under a glue-spreading roller;

passing said glued case under a book block feeder; dropping a book block onto one side of said case; aligning said book block with said case;

and

closing the book by folding the other side of said case onto the upper side of said book block.

11. A method for casing-in a plurality of books, each book comprising book case and book block components, using conveyer means having a central axis along its direction of movement for transporting said components, wherein a typical book case has opposite first and second side parts and a central back strip therebetween and opposite inside and outside faces of said side parts and back strip, and a typical book block has opposite first and second outer sides and a spine therebetween, comprising the steps for casing-in each book:

placing said book case with its outside face downward upon the conveyer means, its inside face upward, and its central back strip aligned generally parallel with said central axis of the conveyer means;

forming said central back strip to receive the spine of said book block by heating and passing said central back strip between a pair of forming elements;

applying glue to said inside face of said book case as it is moved by said conveyer means;

placing and aligning said book block with its first side upon said glued inside face of said first side part of said book case;

5 folding said glued inside face of said second side part of said case over and around the spine of said book block and into contact with said second side of said book block; and

applying pressure urging said glued surfaces of said book case and said book block to adhere together.

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12. A method for casing-in a plurality of books, each book comprising book case and book block components, using conveyer means for transporting said components, wherein a typical book case has first and second side parts and a central back strip therebetween and opposite inside and outside faces of said side parts and central back strip, and a typical book block has first and second outer sides and a spine therebetween, said method for casing-in comprising the steps for each book:

20 placing a book case with its outside face on the conveyer means and its inside face upward;

applying glue to said inside face of said first and second side parts and central back strip of said book case as it is transported by said conveyer means;

25 placing a book block with its first side part on and aligned with said first side part of the book case;

30 folding said book case so that its central back strip is aligned and in contact with said spine and said second side part is aligned and in contact with said second side part of the book block, and

applying pressure urging said glued surfaces of said book case and said book block to adhere together.

35 13. A method according to claim 11 further comprising the further step of moving said book case and book block at a constant speed on said conveyer means.

14. A method according to claim 13 wherein the step of forming said central back strip comprises passing said central back strip between a pair of rotary forming irons.

5 15. A method according to claim 13 wherein the step of forming said central back strip comprises positioning a source of heat above said central back strip as it is transported by said conveyer means.

10 16. A method according to claim 14 wherein heating said central back strip comprises the step of pre-heating said forming irons.

15 17. A method according to claim 16 wherein the step of pre-heating said forming irons comprises directing forced hot air onto said rotary forming irons.

18. A method according to claim 13 wherein said step of applying glue comprises positioning a series of rollers to  
20 interact between said inside face of said book case and a reservoir containing said glue.

19. A method according to claim 13 wherein said conveyer means comprises a first conveyer belt for transporting  
25 said book case while it is heated and formed, a second conveyer for transporting the book case while glue is applied, and a third conveyer where said book block is placed onto said glued book case and cased-in.

30 20. A method according to claim 11 wherein said conveyer means comprises a single conveyer belt moving at a constant speed.

21. A method according to claim 12 comprising the further  
35 step of forming each hard cover to have a pre-formed central back strip before it is placed on said conveyer means for casing-in.

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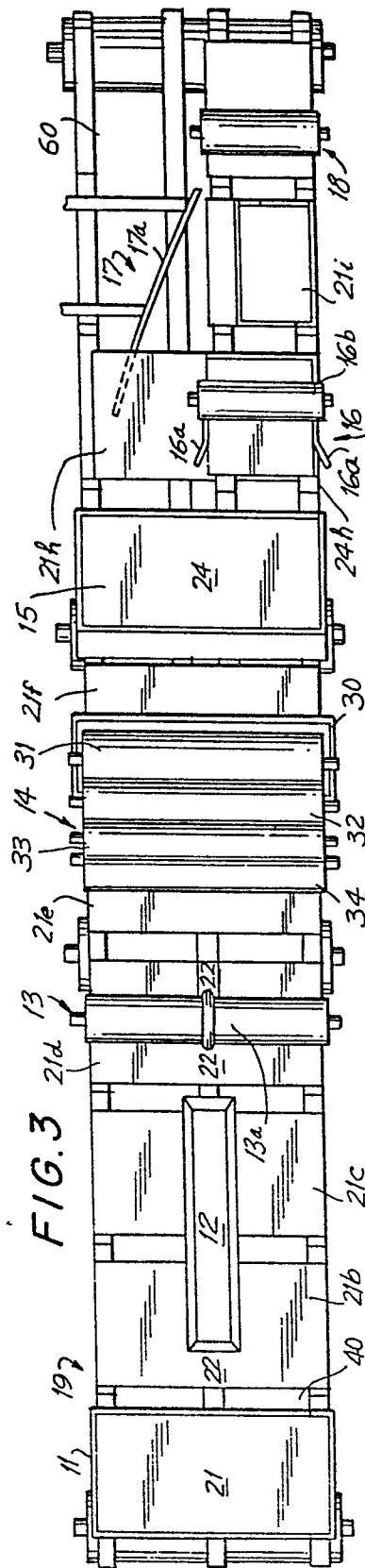
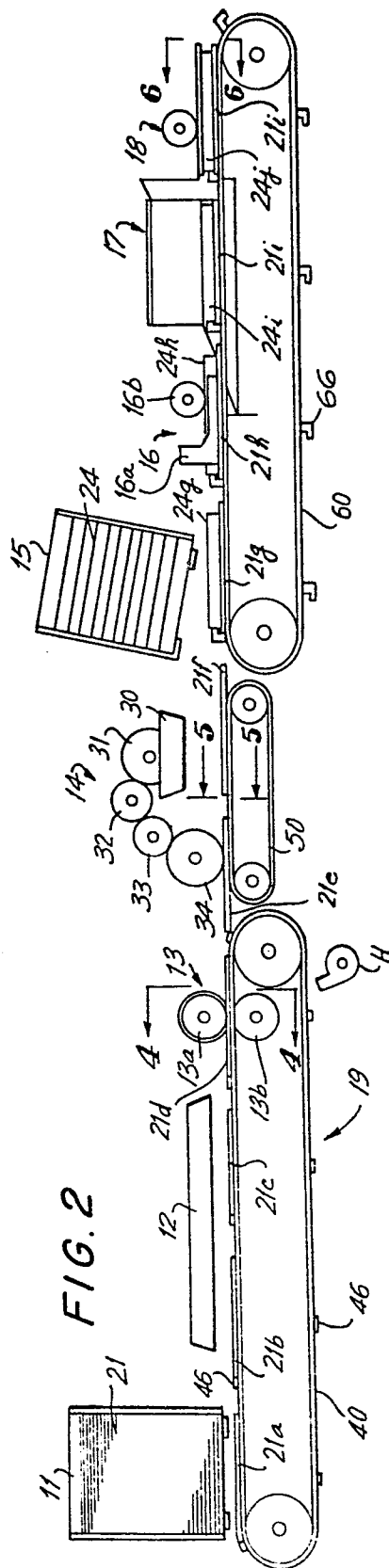
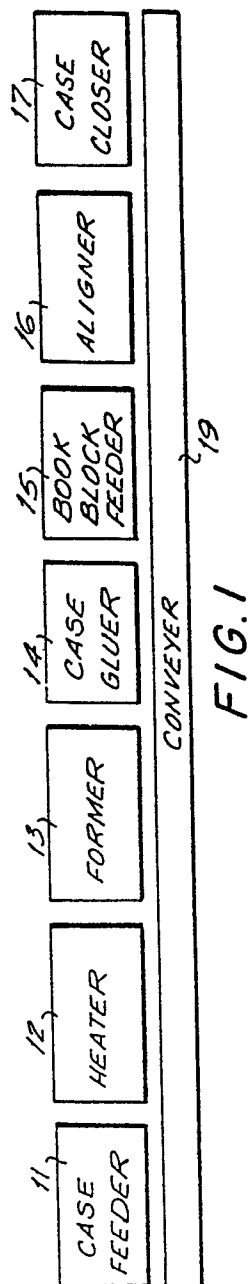


FIG. 4

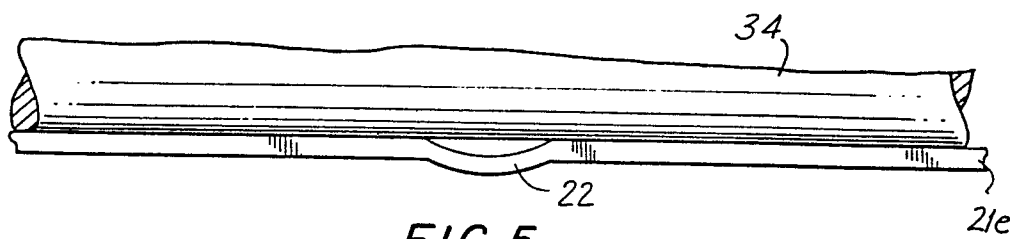
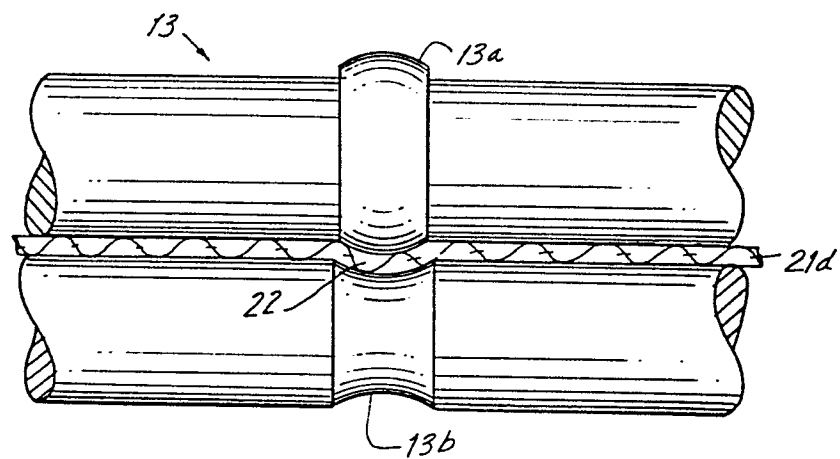


FIG. 5

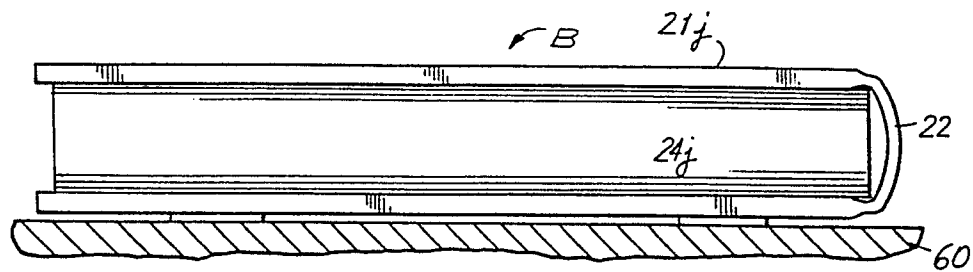


FIG. 6



European Patent  
Office

# EUROPEAN SEARCH REPORT

0079605

Application number

EP 82 11 0539

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                     |                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                  |                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Category                                                                                                                                                                                                                | Citation of document with indication, where appropriate, of relevant passages                                                                                                                                     | Relevant to claim                                                                                                                                                                                                                                                                | CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)                  |
| Y                                                                                                                                                                                                                       | ---<br>US-A-3 708 813 (CARTER et al.)<br><br>*The whole document*                                                                                                                                                 | 1-3,5,<br>7-16,<br>18-21                                                                                                                                                                                                                                                         | B 42 C 11/04<br>B 42 C 19/00                                    |
| Y                                                                                                                                                                                                                       | ---<br>GB-A-2 045 686 (SEMOTEX)<br><br>*Page 3, lines 8-39; figure 5*                                                                                                                                             | 1-3,5,<br>7-16,<br>18-21                                                                                                                                                                                                                                                         |                                                                 |
| A                                                                                                                                                                                                                       | ---<br>TETE TECHNISCH TIJDSCHRIFT VOOR<br>DE GRAFISCHE INDUSTRIE, vol. 17,<br>no. 2, March/April 1962, page<br>19, Amsterdam (NL);<br>J.C.BLANKENSTEIN: "Nieuwe methode<br>voor in de band zetten van<br>boeken". | 1,2,7-<br>13,18-<br>21                                                                                                                                                                                                                                                           |                                                                 |
| A                                                                                                                                                                                                                       | ---<br>US-A-4 156 538 (ROBERTS)<br><br>*Column 5, lines 23-51; column 6,<br>lines 58-59,64-66; figures 7-9*                                                                                                       | 1,3,5,<br>10-12,<br>14-16,<br>19,21                                                                                                                                                                                                                                              | TECHNICAL FIELDS<br>SEARCHED (Int Cl 3)<br><br>B 42 C<br>B 42 D |
| The present search report has been drawn up for all claims                                                                                                                                                              |                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                  |                                                                 |
| Place of search<br>THE HAGUE                                                                                                                                                                                            |                                                                                                                                                                                                                   | Date of completion of the search<br>01-02-1983                                                                                                                                                                                                                                   | Examiner<br>RECHLER W.                                          |
| <b>CATEGORY OF CITED DOCUMENTS</b>                                                                                                                                                                                      |                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                  |                                                                 |
| X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                                                                                                                                                                   | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br><br>& : member of the same patent family, corresponding document |                                                                 |