ABSTRACT

A method and apparatus for making books including a book block bonded to a book cover board structure includes a continuous conveyor onto which is placed a linear array of book cover board structures. Each structure includes two leaf boards which are hinged together, and the board structure is disposed in a horizontal open position to enable the application of adhesive material to the upper surface of the board structure. The structure is then pre-bent about the hinged portion, after which additional adhesive is applied to the hinged portion of the board structure. At the next stage in the operation, a book block is placed on one leaf portion of the board structure, after which the other leaf portion is folded so as to cover the book block. The final step in the process is the bonding of the board structure to the book block.

13 Claims, 13 Drawing Figures
METHOD AND APPARATUS FOR MAKING BOOKS INCLUDING A BOOK BLOCK BONDED TO A BOOK COVER BOARD STRUCTURE

This invention relates to books, and more particularly books formed by bonding a book block to a book cover board structure.

In the manufacture of inexpensively bound hard cover books, such as children's books, recipe books, and the like, minimizing the cost of manufacturing is a paramount consideration. To this end, the book making industry has turned to a bonding technique employing adhesive materials to bind the book block, i.e., the pages of the book which are normally bound together along a common fold line, to the book cover board structure. Prior art techniques employed staples or stitching to form the binding for such books.

In order to further reduce the cost of forming books, the industry has developed book cover board structures, such as disclosed in U.S. Pat. No. 3,273,913 entitled "Book Cover Boards And Book Structures And Apparatus And Method For Making The Same," which issued on Sept. 20, 1966 to Mullen et al. and was assigned to the assignee of the present application. A book cover board structure is characterized as comprising a spine board, two leaf boards, each in spaced relation to the spine board, and a strip of hinge material joining the leaf and spine boards. As previously mentioned, the book block comprises a series of pages which are interconnected along a common fold line, such as by stapling or stitching.

It is an object of this invention to provide a method and apparatus for making books including a book block bonded to a book cover board structure.

It is a further object of this invention to provide a method and apparatus for making books of the kind described in the first-recited object in a continuous process thereby greatly reducing the cost of assembly.

It is another object of this invention to provide a method and apparatus for making a book of the kind described in the first-recited object in which the book cover board structures are conveyed in a continuous manner and covered on one side with an adhesive material by an overset glue roll apparatus.

It is another object of this invention to provide a method and apparatus for making a book of the kind described in the first-recited object in which the book block is automatically aligned and precisely positioned on the book cover board structure.

It is another object of this invention to provide a method and apparatus for forming a book of the kind described in the first-recited object in which the leaf portions of the book cover board structure are positioned about the book block, after which the composite structure is subjected to pressure in order to make the book.

It is another object of this invention to provide a book making apparatus which is adapted to be fed with a succession of book cover board structures in linear array, each board structure being in the open planar condition; to be coated with a thin layer of adhesive material on the upper surface thereof; to be fed further with a succession of book blocks, one book block for each book cover board structure, with the book blocks being placed onto one of the leaf boards of the book cover board structure; to fold the other leaf of the book cover board structure about its spine so as to cover the book block; to bond the book cover board structure to said book block so as to complete the making of the book.

It is another object of this invention to provide a book making apparatus of this kind described in the foregoing object which is further adapted to pre-bend the book cover board structure about its spine subsequent to the application of the adhesive material; and to subsequently spray a coating of adhesive material to the spine portion of the book block after the pre-bending thereof.

It is another object of this invention to provide a book making method including the steps of conveying a succession of book cover board structure in linear array, with each book cover board structure being open and in planar configuration; applying adhesive to the upper surface of the book cover board structure; conveying a succession of book blocks and placing each successive book block onto one leaf of the book cover board structure; folding the second leaf board portion about the hinged spine board portion of the book cover board structure to cover the book block; and bonding the book cover board structure to said book block to complete the assembly of the book.

It is another object of this invention to provide a book making method of the kind described in the foregoing object which further includes the step of pre-bending the book cover board structure subsequent to the application of glue to said board structure, and further selectively spraying adhesive material in the region of the spine area after pre-bending the board structure.

The nature and substance of this invention as well as its objects and advantages will be more clearly recognized and fully understood by referring to the following description and claims taken in connection with the accompanying drawings in which:

FIG. 1 represents a plan view of the book making apparatus of this invention;

FIG. 2 represents a view in longitudinal sectional elevation of the book making apparatus of this invention from its loading end up to the discharge end;

FIG. 3 represents a partial sectional view taken at line 3—3 of FIG. 1 and illustrating the apparatus for pre-bending the book covers;

FIG. 4 represents a view taken at line 4—4 in FIG. 1 and illustrates the adhesive spraying apparatus;

FIG. 5 illustrates a view taken at line 5—5 in FIG. 1;

FIG. 6 illustrates a partial plan view of the book making apparatus of the subject invention taken at line 6—6 in FIG. 5;

FIG. 7 illustrates a view taken at line 7—7 in FIG. 1;

FIG. 8 illustrates a view taken at line 8—8 in FIG. 1;

FIG. 9 illustrates an exploded perspective view of the assembly of a book consisting of a book block and a cover board structure;

FIG. 10 illustrates a perspective view of a completely assembled book made according to the teachings of the invention;

FIG. 11 illustrates a partial sectional view taken at line 11—11 in FIG. 10;

FIG. 12 illustrates a view taken at line 12—12 in FIG. 1; and

FIG. 13 illustrates an alternate form of folding means of the book making apparatus of the subject invention.
Referring now to the drawings in detail, especially to FIGS. 1 and 2, the apparatus of the invention comprises two side plate assembly 10 and 11 which are maintained in spaced, and substantially parallel relation by means of a plurality of cross bars or cross ties (not shown) and which are supported above the level of the floor 12 by means of a plurality of leg members (not shown). The side plates provide bearings and retaining means for the various rolls, devices, and drive assemblies making up the apparatus of the subject invention as more fully described hereinafter.

The side plates 10 and 11 are notched to provide bearings and retaining surfaces for the belt rolls 13 of a conveyor C consisting of three parallel drive belts 17, 18, and 19 (see FIGS. 4 and 5). Each of the belts 17, 18, 19 is provided with a plurality of equally spaced upstanding pins or studs 20. The studs on the drive belts 17, 18, and 19 are aligned transverse to the longitudinal axis of the apparatus of the subject invention in order to insure the precise and uniform registration of the book covers and book blocks during operation of the apparatus, as more fully described hereinafter.

Before describing the apparatus of the subject invention, reference is made to FIGS. 9, 10 and 11 which illustrate the type of book made according to the method and apparatus of the subject invention. In the exploded perspective view of FIG. 9, a book cover board structure 30 is defined by two leaf board portions 31, a spine board portion 32, and hinge material portions 33 which join the spine portion to the leaf board portions. The book cover board structure may be completely encased with a decorative cover 34, or alternatively the decorative cover may comprise, as illustrated, the hinge portions between the spine board and the leaf boards. The book block 35 consists of a plurality of sheets which are folded about a common fold line 36. In order to form the books, the outermost sheets of the book block are bonded to the inside surfaces of the leaf boards 31, with the spine 32 of the book cover board structure being bonded to the fold line of book block 35. In order to provide a defined straight line fold joint for the cover board, and to increase the flexibility of the leaf boards, while adding additional rigidity to the bond between the book block and the book cover board structure, it is desirable to provide an accentuated crease 40 (FIGS. 10 and 11) in the vicinity of the spine and hinge portions.

Turning to FIGS. 1 and 2, disposed at the extreme left end of the subject apparatus is a feeding means for successively feeding the book cover board structures. The feeding means comprises a hopper 50 of approximately the size of the book cover board structures when in horizontal planar disposition, with the inside surfaces of the book cover board structures facing upwardly. The book cover board structures are fed from the hopper 50 by means of an actuating device in the form of piston 51 to which is attached a L-shaped plate 52 that is adapted to slide under the hopper 50 to force the lowermost book cover board structure out of the hopper and into the nip of a pair of pull rollers 53 which are supported between side plates 10 and 11. The pull rollers 53 are spaced to engage one book cover board structure at a time and convey the removed book cover board structure onto the conveyor C. At such time, three of the aligned pins 20 mounted respectively on the drive belts 17, 18, and 19 would convey the open book cover board structure along the conveyor C.

Each of the open book cover board structures being conveyed on the conveyor C passes beneath an arrangement of glue rolls 60, 61, and 62. Glue roll 60 is partially immersed in a body of liquid glue 65 of any suitable kind contained in a trough 66 which is supported between the side plates 10 and 11 by a suitable bracket means (not shown). As the glue rolls are rotated, the first roll 60 picks up a layer of liquid adhesive material from the body of glue within trough 66. The glue rolls have at least a slight separation which is desirable subject to some adjustment through vertically shiftable mountings of the rolls in the side plates 10 and 11. At least some of the layer of glue on the first roll 60 is transferred onto the second roll 61 and thence to the main glue roll 62 in the course of the rolls' rotation. The greater the separation of the glue rolls, up to a point, the greater is the amount of glue transferred from the first to the last roll. As the open book cover board structure passes under the roll 62, there is a further transfer of glue from this roll onto the upper surface of the book cover board structure, and in particular, onto the upper surface of the leaf boards 31 and the spine board 32.

The glue-coated book cover board structure is then conveyed in a continuous manner to a device 70 for pre-bending the book cover board structure about the hinge portions 33. As illustrated in FIGS. 1, 2, and 3, the device 70 for pre-bending the book cover board structure includes an elongated bar 71 mounted below the conveyor C and of a width generally corresponding to the width of the spine 32 of the cover board. The bar 71 is inclined upwardly in the direction of movement of the cover board. Mounted above the conveyor between the side plates 10 and 11, and on opposite sides of the bar 71 are downwardly inclined bars 72, 73. The latter are spaced and inclined to gradually engage the hinge portions 33, 33 of the cover board structures being conveyed on conveyor C. As a cover board passes between the pre-bending device, the spine portion of the cover board is gradually and temporarily bent. If desired, the lower bar 71 may be heated to further aid in flexing and bending of the spine portion. The primary purpose of the pre-bending device 70 as embodied in the subject apparatus is to facilitate the folding of the leaf boards, as more fully described hereinafter, and also in the formation of the crease 40 in the resulting book. It is noted that the pre-bending device may not be essential for the formation of a book according to the method and apparatus of the subject invention when very flexible material is used for forming the hinge portions of the cover structure.

After leaving the pre-bending device 70, the open, glued cover board structure passes beneath a joint adhesive gun or sprayer 80 for selectively spraying adhesive material in the vicinity of the spine and the hinge portions of the cover board structure. The sprayer 80 is mounted in overset relationship with respect to the conveyor C and is supported by a suitable bracket means (not shown) extending between the side plates 10 and 11.

Actuation of the spray apparatus 80 is coordinated with the operation of the conveyor belt assembly
whereby adhesive material is sprayed only when a book cover passes below the sprayer. It is readily apparent that, through the use of suitable microswitches and conventional electrical actuating equipment, well known to those skilled in the art, the apparatus of the subject invention may include inter-related and co-ordinated electrical and air controlled means to ensure that the spray apparatus 80 is not actuated unless a book cover board structure is present. This is illustrated in FIGS. 1, 2 and 4 wherein the subject apparatus includes a pair of microswitches 81, 81 which are connected via electrical leads 82 to the spraying apparatus 80. The latter is of a commercially available nature, and generally includes air operated means for spraying the adhesive material, with the operation of the air operating means being controlled by the output signals from the microswitches 81, 81 in such manner that the spraying apparatus 80 is only actuated when a book cover is disposed below said apparatus.

Following the selective spraying of the spine and hinge portions of the cover board, the latter continues on its path along the conveyor until it reaches the next station where a book block is placed on one leaf board of the book cover board structure. More particularly, mounted in overset relation to the conveyor C is a hopper 90 for accommodating the book blocks 35. The lowermost book block in the hopper is fed from the hopper 90 by means of an actuating piston 91 to which is connected an L-shaped shuttle 92 which pushes the lowermost book block into the nip of a pair of pull rollers 95 mounted between the side plates 10 and 11. Before a book block is allowed to drop by gravity feed onto a book cover board structure, it is first passed by the pull rollers through an alignment and insert device 100 (see FIGS. 5 and 6) including a T-shaped support 101 and a U-shaped support 102 disposed in overset relation to the conveyor. Spring guide fingers 103 are fixed to support 101 and cooperate with the U-shaped support 102 to precisely locate and align the book blocks with respect to the conveyor, and more particularly, with respect to one leaf board 31 of each book cover board structure passing on the conveyor. As the pull rollers 95 cause each successive book block to drop onto the flanges of the supports 101 and 102, the studs 20 of the conveyor engage the edge of the book block thereby ensuring longitudinal alignment between the book block and the book cover board structure. Translational alignment is achieved by means of the spring fingers 103 in cooperation with support 102.

In addition to ensuring longitudinal alignment between the book block and board cover, the studs also function to precisely locate the book block at a predetermined position on the cover structure. Referring to FIG. 12, each stud 20 is generally cylindrical in configuration and includes a recessed segment 21 along the surface thereof which engages the cover structure 31. Accordingly, the book block 35 is positioned by the studs 20 a short distance, e.g. one-eighth of an inch, inside of the margin of the cover structure 31.

As is readily apparent, as the conveyor continues along its path, each successive book block drops onto a leaf board of each successive book cover board structure in a continuous operation.

The next operation in the apparatus and method of the subject invention is to cause the second leaf board structure to be folded about the spine and hinge portions so as to overlie the book block. For this purpose, the apparatus is provided with a folding means in the form of a contoured bar 110 (see FIG. 7) which is fixedly mounted as at 111 below the conveyor C between the drive belts 17 and 19 to fix the structure. The contoured bar is doubly curved upwardly and transversely in the direction of the drive belts 17 and 18, with the extreme free end of the bar 110 extended beyond an imaginary vertical plane passing through the center of the spine of the cover board. As a book cover board structure is conveyed along the conveyor C, the second leaf board, that is the leaf board which is not covered by the book block, is caused to ride along the contour of the doubly curved bar 110 and to thereby be rotated about the spine and hinge portions of the cover board structure. In that the contoured bar 110 extends beyond the imaginary vertical plane passing through the spine board, the second leaf board is caused to rotate more than 180° and to effectively flop over onto the book block thereby completing the composite structure of the book block and book cover board structure.

Other devices may also be employed for folding the second leaf board structure about the spine and hinge portions so as to overlie the book block. For instance, the folding means may take the form of a pivotally mounted finger 114 adapted for rotation about an axis 116 aligned with the center line of the apparatus of the subject invention, and having at its extreme free end a roller 118 having an axis 119 transverse to the longitudinal axis of the apparatus so as to aid in the conveying of the book cover board structure and book block as the second leaf board is being folded about the spine portions. Of primary concern is to maintain movement of the conveyor without causing misalignment of the book cover board structures during the operation of the apparatus.

At this time it is necessary to form a permanent bond between the outside sheets of the book block and the adhesively coated inside leaf board structures and spine. This is known in the industry as "casing-in."

To this end, the composite structure is conveyed by the conveyor C to a pair of pull rollers 120 mounted between side plates 10 and 11. The pull rollers convey the successive composite book structures to a pair of pressure rollers 130 which are of a width less than the width of each leaf board so as to not apply pressure to hinge portions 33. The application of pressure to the composite structure forms a permanent bond between the book block and the cover board structure, and if desired, one or both rollers 130 may be heated to further facilitate the formation of the permanent bond.

The next step in the operation is the building-in step, or the step in which the accentuated crease 40 may be formed in the book block. To this end, each successive book is then conveyed to the building-in apparatus, illustrated in FIG. 8, as comprising a stationary lower die 141 having a rounded projection 142, and a movable upper die 143, also including a rounded projection 144 which is aligned with rounded projection 142. Both rounded projections 142 and 144 extend in a line and are operative to form the accentuated crease 40 in the resulting book. The operation of apparatus 140 is coo-
ominated with the operation of the conveyor C and the pressure rolls 130, and either pressure or heat and pressure are applied by the building-in apparatus to form the accentuated crease between the book block and the cover board structure. After the bonding cycle has been effected, the movable upper die 143 is retracted upwardly, and an ejection mechanism in the form of an actuator 150 including a blunt ended ram 151 is actuated to force the completed structure into a collecting bin 160, as illustrated in FIGS. 1 and 2.

The operation of the various stages forming the apparatus of the subject invention are effected in a coordinated and adjustable speed, thereby greatly reducing the cost of making books.

In summary, the method for making books according to the subject invention includes the steps of feeding a book cover board structure in open planar position, applying adhesive material to one leaf of the cover board structure, pre-bending the book cover board structure about its hinged portion, selectively applying adhesive in the vicinity of the hinged portion of the book cover board structure, precisely locating a book block onto one of the leaf boards of the cover structure, folding the other leaf board about the hinged portion to form a composite assembly of the book block and the book cover board structure, and applying heat and pressure to the composite structure to form the book. If desired, the steps of pre-bending the cover board structure and selectively applying adhesive material may be eliminated.

The apparatus and method of the subject invention provides several novel features including the hopper feeding of both the book blocks and the book cover board structures into a coordinated production line which ensures continuous and consistent production. The unique application of adhesive to the book cover board structure via a top gluer requires minimal movement of the book cover board parts prior to assembly. Also pre-forming or pre-bending of the book cover board structure permits the cover structure to be automatically turned with the minimum of effort and in the shortest distance possible.

The unique design and use of off-set studs on the conveyor chain carrying the book cover board structures to the point of registration with the book block ensures a precise and uniform registration of the book block on the adhesively coated book cover board structure. Furthermore, the inter-related and coordinated electrical and air controls provided in the subject apparatus will ensure that the adhesive sprayer 80 is not actuated unless the book cover board structure is present, and a book block is not released unless a book cover board structure is located at the precise registration point. The folding means, forming a portion of the subject apparatus, ensures consistency of operation and minimum possibility of book distortion while adhesive drying is taking place.

The unique design and use of an alignment and insert device to ensure that the book blocks are precisely registered on the book cover board structures greatly enhances the reliability and speed of making books according to the method and apparatus of the subject invention. If desired, a heating means may be provided below the conveyor in the vicinity of the alignment and insert device in order to heat the spine portion of the book cover preparatory to folding of the second leaf board. As illustrated in FIG. 2, electrical heating means 170 are provided, and suitably connected to a heating element 172 disposed below the conveyor C in order to heat the spine portion of the book covers preparatory to folding of the second leaf board. In addition, the electrical heating means 170 is suitably connected by conduit 174 to the lower bar 71 of the pre-bending device in order to heat same for aiding in the flexing and bending of the spine portion of the book. In addition, the electrical heating means is connected by line 176 to the rollers 130 to facilitate the formation of the permanent bond of the resulting book made according to the teaching of the subject invention.

It is intended to secure protection by Letters Patents to the full extent that the prior art permits of this invention in all its aspects of apparatus and method for making books as these aspects are defined in the appended claims.

What is claimed is:

1. A method for making books including a book block bonded to a book cover board structure, said method comprising the steps of:
   1. conveying a succession of book cover board structures in open condition and in linear array, each such book cover board structure comprising a first leaf board portion, a second leaf board portion, and a spine board portion disposed between said first and second leaf board portions and in hinged relation thereto;
   2. applying adhesive material to the entire surface of one side of the book cover board structures successively as they are conveyed;
   3. pre-bending the book cover board structures about the hinged portions intermediate the spine board portion and the first and second leaf board portions;
   4. selectively applying adhesive material to said spine board portion and said hinged portion;
   5. conveying a succession of book blocks and placing each successive book block onto a book cover board structure as in the preceding step hereof in parallel relation with the first leaf board thereof;
   6. folding the second leaf board portion about the hinged spine board portion to cover the book block; and
   7. bonding the first and second leaf board portions and the spine board portion of said book cover board structure to said book block.

2. A method for making books according to claim 1 in which the step of applying adhesive material to one side of the book cover board structure is effected by rolling a thin layer of adhesive material onto the book cover board structure.

3. A method for making books according to claim 1 in which the step of applying adhesive material to said hinged portions is effected by spraying.

4. A method for making books according to claim 1 in which the step of bonding the book cover board structure to the book block is effected by passing the book block and cover board structure through a pair of press rolls.

5. A method for making books according to claim 1 in which the step of bonding the book cover board structure to the book block is effected by passing the

6. A method for making books including a book block bonded to a book cover board structure, said method comprising the steps of:
   1. conveying a succession of book cover board structures in open condition and in linear array, each such book cover board structure comprising a first leaf board portion, a second leaf board portion, and a spine board portion disposed between said first and second leaf board portions and connected thereto by hinged portions;
   2. applying a thin layer of adhesive material to the entire upper side of the book cover board structure successively as they are conveyed;
   3. temporarily bending each successive book cover board structure about said hinged portions;
   4. selectively applying adhesive material to said spine board portion and said hinged portions;
   5. aligning and placing a book block on the first leaf board structure of each successive book cover board structure, each book block comprising a plurality of pages folded about and connected along a common fold line, with said fold line being generally parallel to the spine portion of the associated book cover board structure;
   6. rotating the second leaf board portion approximately 180° about the hinged spine board portion to thereby cover the book block; and
   7. bonding the first and second leaf board portions and the spine board portion of said book cover board structure to said book block.

7. A method for making books according to claim 6 wherein pressure is also applied along the hinged portion of the cover board during bonding of the book cover board structure to said book block in order to accentuate a crease at the spine of the book.

8. A method for making books as in claim 6 wherein the adhesive material is applied to the hinged portions by spraying.

9. A method for making books according to claim 6 wherein the thin layer of adhesive material is applied to the upper side of the book cover board structure by rolling.

10. An apparatus for making books including a book block bonded to a book cover board structure, said apparatus comprising:
    1. conveyor means for conveying a succession of book cover board structures in open horizontal position and in linear array, each such book cover board structure comprising a first leaf board portion, a second leaf board portion, and a spine board portion disposed between said first and second leaf board portions and connected thereto by hinged portions;
    2. coating means in overset relation to said conveyor means whereunder said conveyor means carries along said book cover board structures, and which is adapted to apply a thin layer of adhesive material to the entire upwardly oriented surfaces of successive structures;
    3. pre-bending means in overset relation to said conveyor means whereunder said conveyor means carries along said book cover board structures, and which pre-bending means is disposed downstream of the coating means and is adapted to temporarily bend the book cover board structures about the hinged portions;
    4. spraying means in overset relation to said conveyor means whereunder said conveyor means carries along said book cover board structures, and which spraying means is provided to spray adhesive material to the spine and hinge portions of the book cover board structures;
    5. feeding means in overset relation to said conveyor means whereunder said conveyor means carries along said book cover board structures, each having a book block disposed thereon, and which is adapted to feed a book block onto each book cover board structure in parallel relation with the first leaf board thereof;
    6. folding means in overset relation to said conveyor means whereunder said conveyor means carries along said book cover board structures, each having a book block disposed thereon, and which is adapted to fold the second leaf board portion of each book cover board structure about the hinged spine board portion to form composite structure; and
    7. bonding means for applying pressure to said composite structure to bond the book block to the first and second leaf board portions and the spine board portion of the book cover board structure.

11. An apparatus for making books according to claim 10 in which the coating means comprises a plurality of glue rolls.

12. An apparatus for making books according to claim 10 wherein the feeding means comprises a hopper for accepting the book blocks, and a piston-actuated shuttle for removing one book block from the hopper at a time, and alignment mechanism including spring fingers for guiding the book block so removed from the hopper.

13. An apparatus for making books according to claim 10 wherein the conveyor means includes a plurality of upstanding studs, each stud having a recessed portion adjacent the stud’s connection to the conveyor means for engaging the book cover board structures.