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BOOK BINDING PROCESS

Filed Sept. 22, 1970

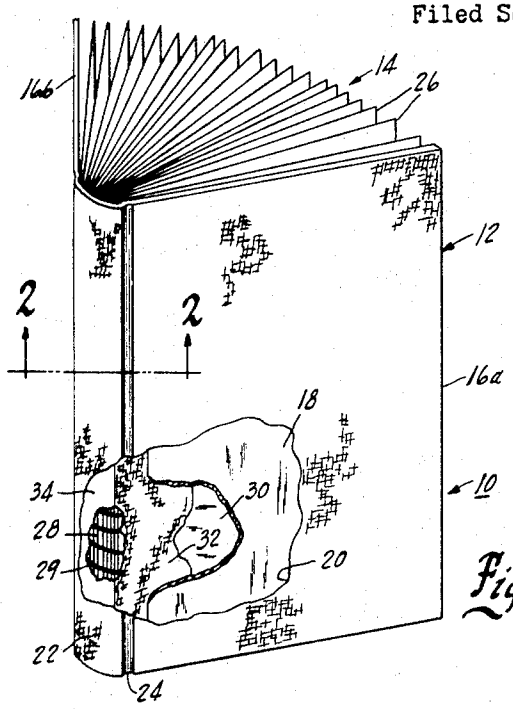

Fig. 1

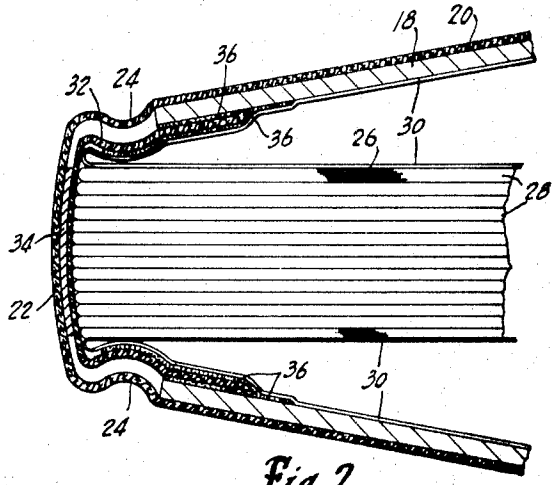

Fig. 2

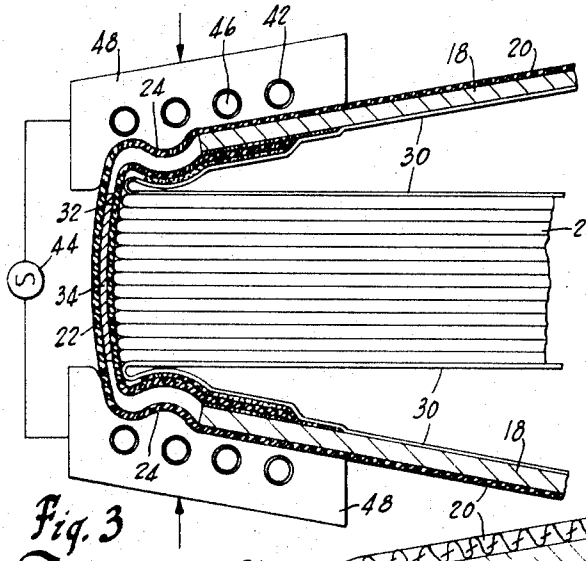

Fig. 3

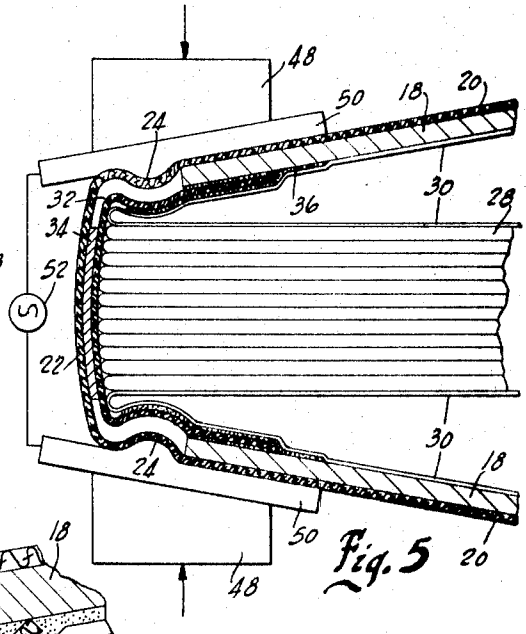

Fig. 5

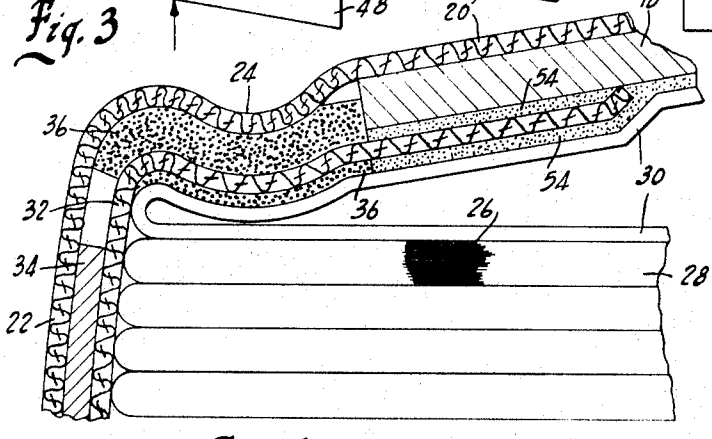

Fig. 4

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BOOK BINDING PROCESS

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ABSTRACT OF THE DISCLOSURE

An improved process of attaching a book body to a case at the hinge to form a hard bound book. A bonding agent having a short period of adhesiveness following exposure to indirectly applied energy is applied to the body or case adjacent the hinge area and the body is inserted into the case so that the portion to which the agent has been applied is located at the hinge of the completed book. The treated portion is then exposed to a selected form of indirectly applied energy to cement the body to the case at the hinge while pressure is applied to the hinge area. An improved hinge joint is thus formed.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention is directed to the book binding process, and more particularly to that step of the book binding process termed in the art "casing-in."

Description of the prior art

The ordinary hard bound book consists of two main parts, the case and the body. The case comprises the front and the back covers connected by the spin. The covers are hinged along either edge of the spine. An indentation or groove in the case at the spin edges allows the cover to be opened and closed easily.

The body of the book is comprised of a plurality of paper sheets termed leaves. The leaves are sewn together along their center folds in groups of sixteen or more to form the sections or signatures of the book. The signatures are assembled by additional sewing, binding to tapes or cords, or the like, to form the body of the book. At the front and back of the body are affixed heavy folded pages, termed the end papers, which facilitate the attachment of the body to the case.

To effect this attachment, the center of a piece of fabric, termed crash, is glued to the centerfolds of the body signatures. The ends of the crash extend along the outside of the end papers on either side of the body. The body is then inserted in the case so that the folds in the end papers are adjacent the spine of the case. Paste is applied to both sides of the crash and to the sides of the front and back end papers adjacent the insides of the covers of the case. The end papers are pasted to the inside of the covers, enclosing the crash. The case and body are then placed in a press to form the groove at either edge of the case spine. When the attachment process, termed casing in, is complete, the body is bound to the case at the hinge so that the covers and leaves are movable with respect to each other.

From the standpoint of durability and utility of the completed book, the hinge forms a most critical portion thereof. The hinge must have sufficient flexibility to permit the covers to open and close easily and to lie flat when the book is in use. On the other hand, the hinge must have sufficient strength to retain the body in the case under conditions of normal wear and tear throughout the useful life of the book.

The creation of satisfactory book hinges having the desired qualities of flexibility and strength makes severe demands on the bonding materials and techniques employed in the book binding process and becomes particularly critical with the high processing speeds employed in modern bookbinding methods.

When assembling a book with conventional book binding paste of the starch or animal variety, continuous application of pressure to the hinge area of the bound book is desirable until the paste is dry or at least until it has set in order to form a satisfactory hinge. The application of pressure is necessary, in part, to overcome the natural springiness of the material which tends to separate the hinge. Such conditions have not been previously obtainable at the processing speeds employed in commercially and economically feasible book binding processes, with the result that pressure is prematurely removed from the book causing faulty bonding in the hinge.

One expedient commonly employed to improve the quality of bound book hinges is to carefully stack the books after binding so that no strain is on the hinge area. The books are left in this condition for a period of time, typically 24 hours, before shipping. Pressure is thus applied to the books as the paste dries. While this technique is simple and feasible to some extent, it leaves much to be desired in terms of uniformity and control of pressure. The extra handling and storage of the stacked books increases the cost of the book binding process.

A second expedient has been to accelerate the drying of the paste. For this purpose, the press used to form the hinge is equipped with heated press platens so that heat, as well as pressure, is applied to the book undergoing binding. However, the heat of the platens must pass through the cover in order to reach the paste on the inside thereof. Typical cover materials include multi-layer cardboard and buckram, both of which tend to be good thermal insulators. Thus, considerable time is required for this directly applied heat to pass through the case to the paste area and the desired bonding result is not achieved without an unwanted reduction in the speed of the binding process.

While higher platen temperatures may be utilized to increase the rate at which heat passes to the paste area, the point is quickly reached at which scorching and degradation of the case and body materials becomes likely. Thus, the use of heated press platens has not achieved the desired result of increasing binding speed without undue loss of hinge quality.

Another drawback of prior art binding processes is that the paste when it reaches the point at which pressure is applied in the casing-in line, may have reached different degrees of drying. This may be due to variations in the viscosity of the paste from time to time even from the same batch, or to differences in the paste from batch to batch, or to differences in the climate conditions in the binding room, or to changes in the operating speed of the machine, or for a number of other reasons. This results in variations in the bond at the hinge joint obtained during casing-in.

It is thus characteristic of prior art casing-in processes that books so bound vary in strength at the hinge joint very widely, even though they are manufactured in one batch sequentially one after the other.

Yet another expedient which has been used is to employ hot melts, i.e. substances which are applied to the book parts in the molten form and which subsequently solidify to affix the body to the case. However, such substances are difficult to handle and apply, are low in strength, and are expensive. Further, commercially feasible hot melts have a fairly long solidification period, for example seven seconds, so that only modest increases in processing speed are obtainable.

SUMMARY OF THE PRESENT INVENTION

It is therefore, the object of the present invention to provide an improved process of casing in bound books which permits a significant increase in the processing speed while at the same time maintaining or, in many cases, enhancing the quality and uniformity of quality of the hinge formed during the casing-in operation.

It is a further object of the present invention to provide an improved process of casing-in which permits the case and body of the book to be formed in the normal manner and which permits in so far as is possible, use of conventional book binding techniques, thereby permitting the use of existing book binding equipment.

It is another object of the present invention to provide an improved process of casing in which may be used in conjunction with conventional book binding techniques to reinforce the book hinge.

It is a further object of the present invention to provide a book having an improved hinge or case joint.

In summary, the present invention provides an improved process of casing-in including the step of applying a bonding agent having a thermally induced short period of adhesiveness to the body or case adjacent the hinge area. The short adhesive period of the bonding agent is induced by exposure of the agent to a selected form of indirectly applied energy. A suitable bonding agent is typically formed by dispersing in a thermoplastic carrier a susceptor material heatable by indirectly applied energy. The bonding agent may be applied directly to the end papers, crash, and covers of the book in the conventional manner or may be applied as a separate material film interposed between the above identified elements. The bonding agent may be used in conjunction with conventional pastes to reinforce the hinges of the book.

The body of the book is inserted into the case so that the portion having the bonding agent applied thereto is located at the hinge. The portion is then exposed to the indirectly applied energy to induce the adhesive period as by heating the agent, thereby to cement the body to the case at the hinge to form the completed book. Pressure is applied to the hinge area during and/or after the exposure of the portion having the bonding agent applied thereto to complete formation of a hinge having the desired properties of flexibility and strength in a minimum of time.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a typical hard bound book, a portion of the hinge area of the book being broken away to reveal the construction thereof;

FIG. 2 is a cross sectional view taken generally along the line 2—2 of FIG. 1, showing in detail, a hinge of a book and showing the initial step of the casing-in process of the present invention;

FIG. 3 is a cross sectional view, similar to FIG. 2, showing subsequent steps in the process of the present invention;

FIG. 4 is a cross sectional view, similar to FIG. 2, showing a modification of the casing-in process of the present invention; and

FIG. 5 is a cross sectional view, similar to FIG. 3, showing the use of a different type of indirectly applied energy in the process of the present invention.

FIGS. 2 through 5 show the book hinge in a somewhat exaggerated form to facilitate an understanding of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to FIG. 1, there is shown therein an assembled hard bound book **10** comprised of case **12** and body **14**. Case **12** includes front cover **16***a* and back cover **16***b*, each of which is formed of board **18** covered with buckram cloth **20**. Buckram cloth **20** connects the boards at spine **22**. A groove **24** formed in the buckram

at either edge of the spine permits the covers to hinge on the spine.

The body **14** of book **10** is formed of a plurality of leaves **26** folded on a center fold and sewn together to form signatures **28** which are sewn on cords **29** to form body **14**. End papers **30** are affixed to the front and back of the body so as to abut the inner surfaces of front and back cover boards **18**.

The crash **32** is cemented to the center folds of the assembled signatures across cords **29** and extends along the exterior surface of the end papers between the cover boards and the end papers. If desired, the portion of crash **32** adjacent the spine of the book may be covered with kraft paper **34**.

In the conventional, prior art casing-in process, the crash is pasted to the end papers and to the insides of the cover boards at the hinge in the presence of such pressure and/or heat as is obtainable to attach the body to the case and form the assembled hard bound book.

To overcome the shortcomings of the prior art, as noted above, the present invention contemplates the use of a bonding agent having a short period of adhesiveness or viscidness responsive to exposure to a high frequency magnetic field. The exposure typically results in a temperature increase and the bonding agent may be thermoplastic in nature. In the alternative, the bonding agent may be thermosetting, such as an epoxy compound having a cure rate proportional to temperature. A bonding agent having a short period of adhesiveness is often said to have a short "open time."

A bonding agent having the necessary properties for successful practice of the present invention may be formed by selecting a thermoplastic or thermosetting carrier and dispersing therein a material susceptible to heating by the indirectly applied energy. The material is preferably in particulate form and is incorporated in the carrier in quantities sufficient to produce the desired heating action. This is typically 10 to 50% by weight with respect to the carrier. Such material termed herein a susceptor, may be responsive to the indirect application of energy in the form of an alternating magnetic field, in which case the susceptor could consist of material heatable by induction heating, such as fine particles of iron oxide, preferably γFe_2O_3. Metal particles or ferrite particles may also be used.

The carrier may, under normal conditions, be a fluid substance, typically a liquid, having the susceptor suspended therein, or the carrier may be solid substance, such as a film or layer, having the susceptor dispersed therein. In the case of a liquid carrier, the carrier should be dryable at a rate commensurate with the speed of the casing-in process. A typical carrier of the thermoplastic type which has been found useful in the process of the present invention is the water emulsion of ethylene vinyl acetate sold under the trade designation Aircoflex 400 by Air Reduction Co., New York, New York. The period of adhesiveness or open time of such a carrier upon termination of the application of heat is on the order of one second.

The bonding agent, formed as described above, is applied to the book portions to commence the casing operation. As shown in FIG. 2, the bonding agent, identified by numeral **36**, may contact both sides of crash **34** adjacent hinge **24** as well as the inside of boards **18** of covers **16***a* and **16***b* and the outsides of end papers **30**. In cases in which bonding agent **36** is in fluid form, it may be applied to a desired combination of the above mentioned surfaces. It has been found preferable, from the standpoint of reducing unwanted smearing, adhesion, and the like, to allow bonding agent **36** to assume the dry state before further processing of book **10**.

When bonding agent **36** is in solid form, it may be applied to the hinge area, either before or after assembly of the case and body, as hereinafter described.

Body **14** is inserted in case **12** with that portion of crash **34** located across the centerfolds of signatures **28** abutting

spine **22**. This locates the portions of crash **32**, or end papers **30**, to which bonding agent **36** has been applied at hinge **24**. In the case where bonding agent **36** has been applied to case **12** this places crash **32** and end papers **30** adjacent the treated portions of case **12**.

The bonding agent is then exposed to the indirectly applied energy as by inserting hinge **24** into a radiant field. In the instance in which the susceptor is inductively heatable, an alternating magnetic field may be established by coils **42**, shown in cross section in FIG. 3 energized by the current of alternating source **44**. Coils **42** may be cooled by coolant circulated in passages **46**, to prevent scorching or degradation of buckram **20** of boards **18**.

Upon insertion in the field of coils **42**, the susceptor of the bonding agent increases in temperature causing the agent carrier to enter the adhesive state and commence the bonding process.

During the time bonding agent **36** is in the adhesive state, i.e. during the open time of the bonding agent, pressure is applied to book **10** in the area of hinge **24**. While separate pressure applying means may be used, it is advantageous to utilize the pressure applying means, platen **48**, as the support for coils **42**, as shown in FIG. 3. Pressure is applied in the direction of the arrows in FIG. 3.

The pressure applied by platen **48** continues until the termination of the period of adhesiveness of bonding agent **36** or until bonding agent **36** is set, and boards **18**, crash **32**, and end papers **30** are firmly bonded at hinge **24**. Removal of book **10** from the field of coils **42**, or the turn off of alternating current source **44** initiates the termination of the period of adhesiveness in a thermoplastic carrier. Pressure may be applied prior to the termination of the heating of the susceptor, as described. When bonding agent **36** has set, the pressure may be removed and the casing-in of book **10** is complete. Because pressure is applied during the entire time bonding agent **36** is setting, a highly satisfactory hinge joint is obtained through the firm adhesion and its continuity throughout the hinge area. There is also considerably less variation in the quality of the hinge joint than has heretofore been experienced.

In the case in which bonding agent is subjected to dielectric heating, case **12** and body **14** may be placed in an electric field created by electrodes **50** energized by alternating current voltage source **52**. Platens **48** may be incorporated in electrodes **50** as shown in FIG. 5. The remaining steps of the process proceed as described in connection with FIGS. 2 and 3.

The process of the present invention may also be used to reinforce the hinges of books cased-in in the normal manner. Bonding agent **36** is placed in hinge **24** at the points of joinder or at points of excessive stress and wear, as shown in FIG. 4, adjacent the conventional paste **54**. Bonding agent **36** is treated in the manner described above to insure that adequate bonding occurs at the aforesaid points, thereby to improve the strength and durability of hinges **24**. With the critical points of the hinge joint bonded by bonding agent **36**, the conventional paste may dry in the ordinary manner and without pressure without affecting the quality of the hinge.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

We claim:

1. An improved process of attaching a body of leaves to a case to form a bound book of conventional construction, said body and case having abuttable portions, suitable for joinder at a hinge area of the book, said process employing a bonding agent assuming a viscid state of short duration responsive to exposure to a high frequency magnetic field, said process comprising the steps of:

applying the bonding agent to an abuttable portion of at least one of the body and case;

inserting the body into the case to form the common bonding interface from the abuttable portions of the case and body at the hinge area of the book;

exposing the portion having the bonding agent applied thereto to a high frequency magnetic field to create a short period of viscidness in the bonding agent; and

applying pressure to the hinge area at least during the terminal part of the period of viscidness of the bonding agent to bring the abutting interfacial portions of the case and body into bonding contact to effect the attachment.

2. The improved process of claim **1** wherein the bonding agent is a dryable liquid and wherein the step of applying the bonding agent is further defined as applying the bonding agent in liquid form.

3. The improved process according to claim **1** wherein the bonding agent is heatable upon exposure to a high frequency magnetic field and assumes a viscid state by thermoplasticity and wherein the step of exposing the bonding agent is further defined as placing the bonding agent in the thermoplastic state by exposure to a high frequency magnetic field to induce the short period of viscidness.

4. The improved process according to claim **3** wherein the step of exposing the bonding agent is further defined as melting the bonding agent by exposure to a high frequency magnetic fluid to induce the short period of viscidness.

5. The improved process according to claim **3** wherein the step of applying the bonding agent is further defined as placing the bonding agent in a solidified state before inserting the body into the case.

6. The improved process according to claim **5** wherein the bonding agent is a congealable liquid and the step of applying the bonding agent is further defined as applying the bonding agent in liquid form.

7. The improved process according to claim **5** wherein the bonding agent is a meltable solid and wherein the step of applying the bonding agent is further defined as applying a solid stratum of bonding agent to the abuttable portion.

8. The improved process according to claim **3** including an initial step of forming a bonding agent by dispersing particles of susceptor material heatable upon exposure to a high frequency magnetic field in a thermoplastic carrier to form the bonding agent.

9. The improved process according to claim **8** wherein the step of forming the bonding agent is further defined as dispersing particles of an iron oxide susceptor in the carrier.

10. The improved process according to claim **9** wherein the step of forming the bonding agent is further defined as dispersing particles of γFe_2O_3 in the carrier.

11. The improved process according to claim **1** for affixing end papers of the body inside boards of the case by interposing crash therebetween wherein the step of applying the bonding agent is further defined as applying the bonding agent to the abuttable portion of at least one of the body, case, and crash adjacent the hinge area to bond the end papers and crash to the boards of the case.

12. A process of reinforcing a hinge of a book of conventional binding construction by additional bonding of abutting portions of a body of leaves and a case at a selected area along a common interface at the hinge of the book, said process employing a bonding agent assuming a viscid state of short duration responsive to exposure to a high frequency magnetic field, and comprising the steps of:

applying the bonding agent to the selected interfacial area of the hinge;

assemblying the body and case to form the common interface;

exposing the interfacial area to a high frequency magnetic field to create a short period of viscidness in the bonding agent; and

applying pressure to the hinge, at least during the terminal part of the period of viscidness of the bonding agent, to bring the abutting interfacial portions into bonding contact at the selected area to reinforce the hinge.

13. The improved process of claim **12** wherein the bonding agent is a dryable liquid and wherein the step of applying the bonding agent is further defined as applying the bonding agent in liquid form.

14. The improved process according to claim **12** wherein the bonding agent is heatable upon exposure to a high frequency magnetic field and assumes a viscid state by thermoplasticity and wherein the step of exposing the bonding agent is further defined as placing the bonding agent in the thermoplastic state by exposure to a high frequency magnetic field to induce the short period of viscidness.

15. The improved process according to claim **14** wherein the step of exposing the bonding agent is further defined as melting the bonding agent by exposure to a high frequency magnetic field to induce the short period of viscidness.

16. The improved process according to claim **14** wherein the step of applying the bonding agent is further defined as placing the bonding agent in a solidified state before binding the body into the case.

17. The improved process according to claim **16** wherein the bonding agent is a congelable liquid and the step of applying the bonding agent is further defined as applying the bonding agent in liquid form.

18. The improved process according to claim **16** wherein the bonding agent is a meltable solid and wherein the step of applying the bonding agent is further defined as applying a solid stratum of bonding agent to the interfacial area.

19. The improved process according to claim **14** including an initial step of forming a bonding agent by dispersing particles of susceptor material heatable upon exposure to a high frequency magnetic field in a thermoplastic carrier to form the bonding agent.

20. The improved process according to claim **19** wherein the step of forming the bonding agent is further defined as dispersing particles of an iron oxide susceptor in the carrier.

21. The improved process according to claim **20** wherein the step of forming the bonding agent is further defined as dispersing particles of γFe_2O_3 in the carrier.

22. The improved process according to claim **2** wherein the bonding agent is further defined as including a thermosetting carrier capable of assuming the viscid state.

23. The improved process according to claim **13** wherein the bonding agent is further defined as including a thermosetting carrier capable of assuming the viscid state.

24. The improved process according to claim **12** for additionally bonding the crash of the body of leaves to the interior of the case at a selected interfacial area at the hinge of the book wherein the step of applying the bonding agent is further defined as applying the bonding agent to the crash at the selected interfacial area of the hinge to bond the crash to the interior of the case.

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