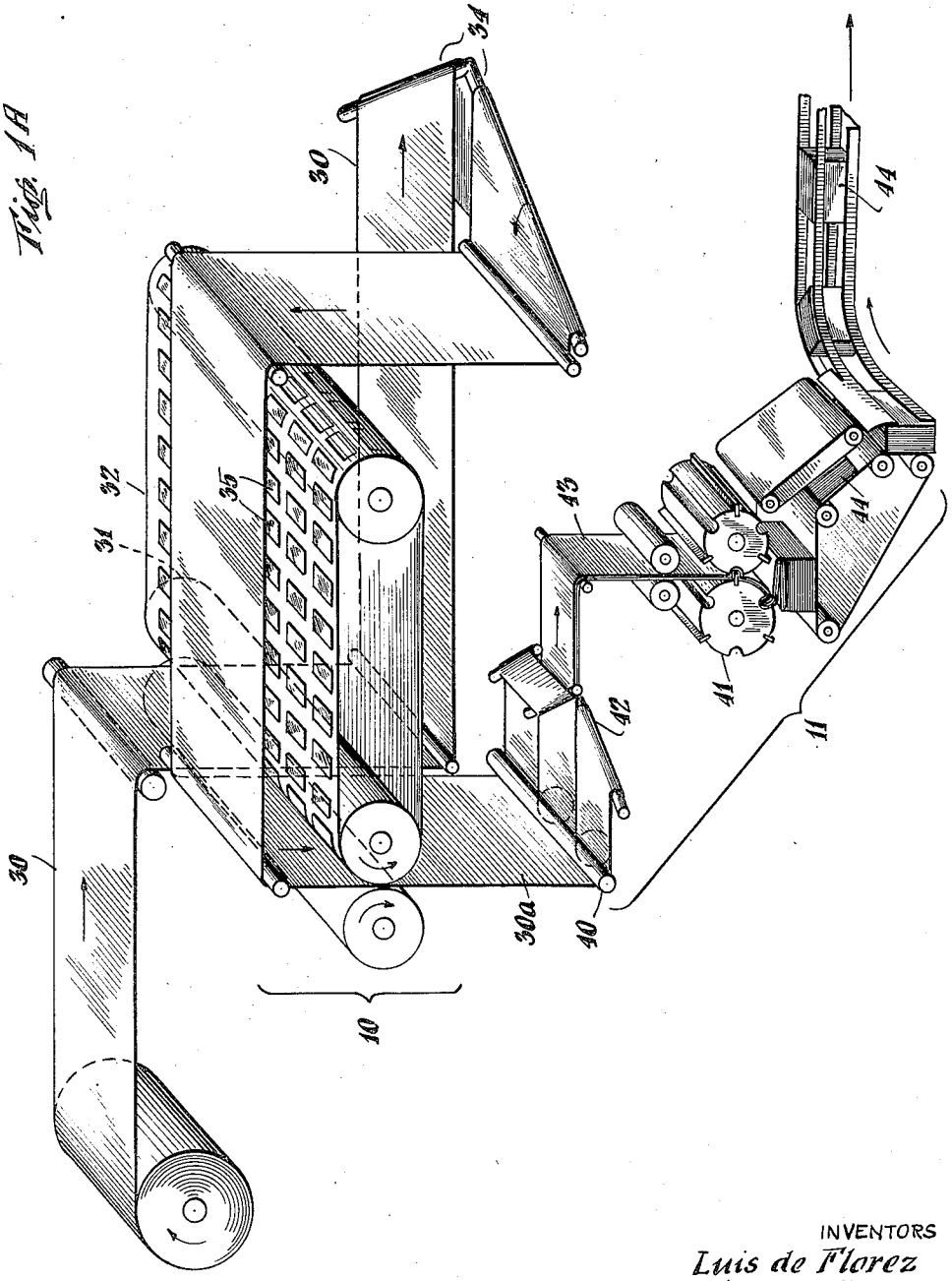
Dec. 4, 1951 L. DE FLOREZ ET AL 2,577,568

PLASTIC BINDING OF HARD CASED BOOKS

Filed May 1, 1948 3 Sheets-Sheet 1

Fig. 1A



INVENTORS
Luis de Florez
Peter de Florez
Owen L. Gore
BY
Richard J. Dearborn
ATTORNEY

Dec. 4, 1951 L. DE FLOREZ ET AL 2,577,568

PLASTIC BINDING OF HARD CASED BOOKS

Filed May 1, 1948 3 Sheets-Sheet 2

Fig. 1B

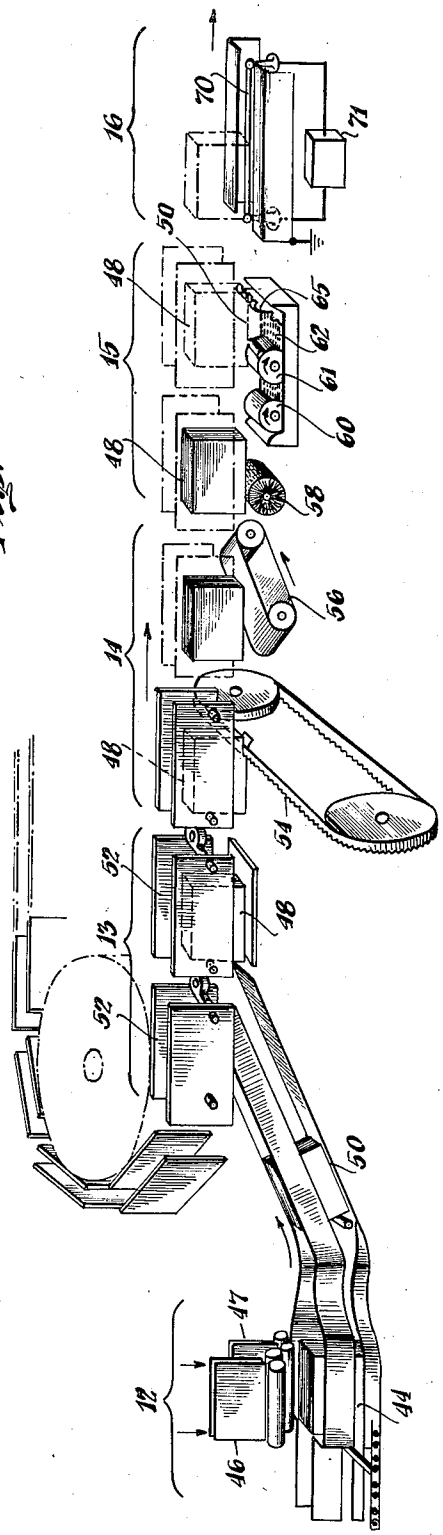


Fig. 3

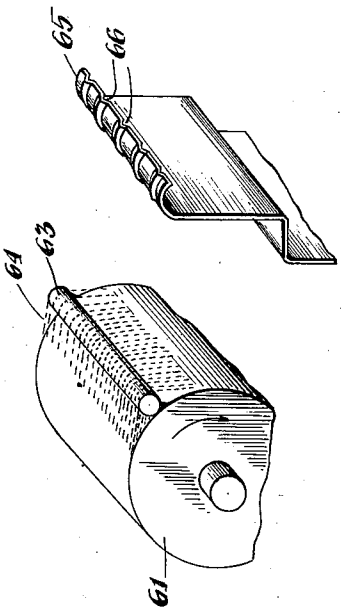
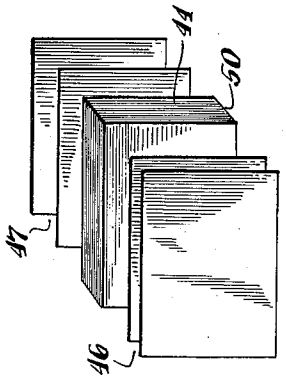


Fig. 2



INVENTORS

Luis de Florez

Peter de Florez

Owen L. Gore

BY

Richard J. Dearborn

ATTORNEY

Dec. 4, 1951 L. DE FLOREZ ET AL 2,577,568

PLASTIC BINDING OF HARD CASED BOOKS

Filed May 1, 1948 3 Sheets-Sheet 3

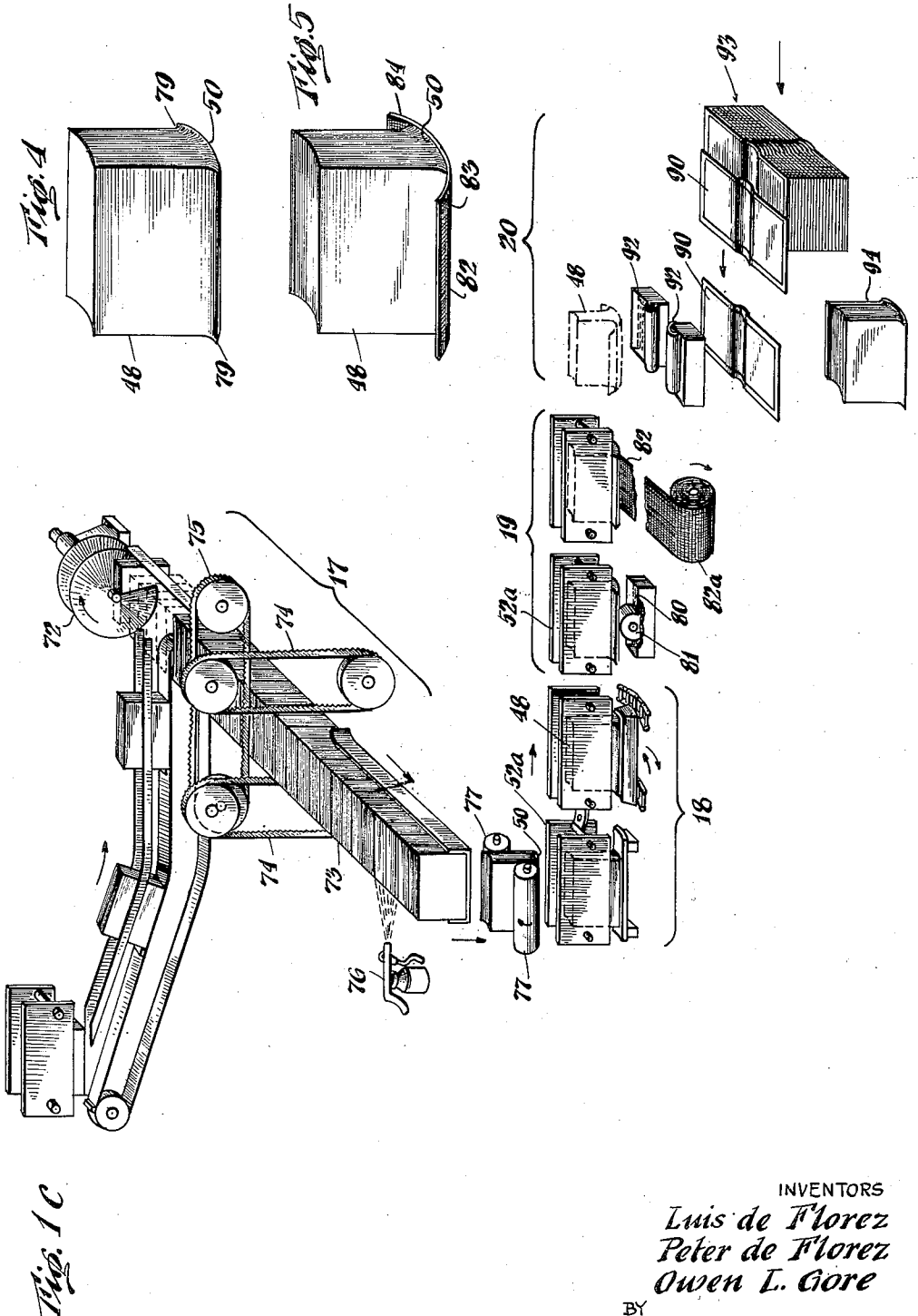


Fig. 1 C

INVENTORS
Luis de Florez
Peter de Florez
Owen L. Gore

BY
Richard J. Dearborn
ATTORNEY

Patented Dec. 4, 1951 2,577,568

UNITED STATES PATENT OFFICE

2,577,568

PLASTIC BINDING OF HARD CASED BOOKS

Luis de Florez and Peter de Florez, Pomfret, Conn., and Owen L. Gore, Great Neck, N. Y., assignors, by mesne assignments, to The de Florez Company, Inc., a corporation of Delaware

Application May 1, 1948, Serial No. 24,494

9 Claims. (Cl. 11—1)

1

This invention relates to the manufacture of books, and in a particularly important aspect, to the making of hard cased books, which are generally characterized by having an attached cover of a relatively stiff or heavy nature. Such cover or casing usually consists of cloth faced boards or the like, with the cloth or other covering material extending across the back edge or spine of the book, the structure being further characterized by a grooved or creased hinge at the joint of each side element with the back edge covering.

Books of this nature ordinarily require the inclusion of certain elements and manipulative operations in the early stages of their manufacture for proper application and permanency of the ultimately attached casing or cover. Thus, for instance, the stages of assembling and binding the book prior to the rounding and other steps that precede the ultimate casing operation per se, have customarily provided for the inclusion of the so-called end papers, which are relatively heavy, single folded sheets that have to be pasted in by hand at each end or face of the book body and that have the outer leaf of each ultimately adhered to the inner face of the corresponding cover board.

Furthermore after binding the signatures and rounding and backing their back edge, the lining-up operation has involved the attachment of a piece of fabric, usually crash, over the back edge and with sidewise protruding flaps, all arranged for adhesive attachment to the casing so as to cooperate in holding the latter in place and so as to strengthen the hinges. As mentioned above it is customary, before the crash is applied, to round and back the rear edge of the book body, especially to bend the rear portions of the outermost signatures into a flaring or flange-like projection along each side of the back edge so that the cover boards may fit close to the assembled body of leaves and so that the hinge portions of the cover fabric (whether cloth, paper or other material) will have ample freedom of motion without any tendency to become torn or pulled out of place.

In these and other respects the manufacture of hard cased books involves special features of construction and operation which may not be required in other methods of book binding and casing, for example as followed in making books (such as telephone books and many others) that are simply cased with paper or like wrappers.

Although procedural combinations of the sort contemplated by this invention may find application elsewhere, they are primarily designed for the production of hard cased books, and are intended to serve, in a novel and efficient manner, the particular requirements of book structures to which such a casing can be finally applied. It will be understood that although the term "binding" is sometimes loosely employed to denote the entire operation of securing the leaves of a book together and applying a casing or the like to it, or is indeed sometimes identified only with the casing operation, a more specific significance of the term (generally followed herein) is in reference to the particular set of operations whereby an unsecured assembly of leaves, such as a collection of unsewn signatures, is firmly and effectively fastened together so as to constitute an integral book assembly with all of the leaves held against removal from each other, the binding operation per se being thus distinct from the subsequent steps that are more directly preliminary to or involved in the application of the casing.

2

Heretofore in the manufacture of books, notably of the type described, the complete procedure has been in many respects discontinuous, involving tedious and time-consuming hand operations, requiring accumulation of printed sheets, or signature bundles or book assemblies at one or another stages of partial completion and thus representing, in many respects, a disproportionately expensive process. Thus not only is the book printed in a multiplicity of separate, so-called signatures which must be individually folded, and then, for each book, collected, but the end papers are commonly pasted by hand to the outer leaves of the first and last signatures. Thereupon the books are individually transferred to sewing machines, where the signatures of each assembly are sewn individually (in succession) and to each other. The assembled and sewn books are subjected to the so-called smashing operation. Further steps include applying some adhesive to the sewn back edge (to complete the binding per se), then trimming other edges of the book body, and finally rounding and backing it, the last mentioned step being followed by lining-up, which involves the application of hot glue to the rounded surface and the attachment of the crash and backing paper thereon. The books are then ready for the actual casing-in operation.

Economic studies have revealed the fact that whereas a high percentage of the total cost of book making has resided in the handling, assembling, sewing and binding operations as usually conducted to produce hard cased books there is no easy way of effectively reducing the cost with-

out introducing additional steps or affecting various other steps in the procedure. We have now discovered, however, a complete and integrated procedure the elements of which are so correlated and interdependent as to constitute a continuous process which can best be illustrated by a flow diagram, as of the sort embodied herein. In accordance with our discovery, the book sheets, the book blocks and the book assemblies enter into the procedure and are gradually progressed in a continuous manner, the aim being to start with a web of paper and end with a finished, cased and complete book.

A similarly important object of the invention is to provide a new and improved procedure for book manufacture, whereby the successive operations are simplified and rendered entirely or at least in much greater part continuous and whereby stronger and more durable characteristics in the binding and casing are afforded. A further object is to enhance the efficiency and decrease the cost of book manufacture, particularly in the binding, rounding, backing and lining-up operations, and other objects are more specifically to provide methods minimizing the number of separate steps, preferably eliminating certain operations altogether and affording a more ruggedly bound book which is better adapted for casing and for long service after it is ultimately cased and completed.

Still further objects are the provision of new procedural combinations and sub-combinations for expediting various operations and sets of operations in the art of book making, and in an important, complete sense, a chief aim of the invention is to provide an essentially continuous process for making hard cased books or the like, throughout all operations from the actual printing step or steps to the ultimate casing-in.

To these and other ends, a specific procedure, including a number of variations thereof is described hereinbelow by way of example and thus for illustrative disclosure of the principles and features of improvement; but it will be understood that one or more of various steps in the process may be carried out in other ways, and that various sub-combinations of the method may be employed under other circumstances or in other environments.

In the annexed drawings:

Fig. 1 (consisting of Figs. 1–A, 1–B and 1–C) is a view of the nature of a flow diagram illustrating one embodiment of the preferred process, of which the continuously successive portions are represented by illustration of correspondingly progressive operations on the paper or on the book assembly, all in a generally schematic manner;

Fig. 2 is an enlarged schematic view of one stage in the assembly of the book block;

Fig. 3 is an enlarged view of certain devices past which the book block is carried in Fig. 1; and

Figs. 4 and 5 are enlarged views of the book as it leaves the successive backing and lining-up operations respectively, of Fig. 1.

Although limitations of space compel Fig. 1 to be divided into a plurality of views, they represent in fact a single, continuous process and can be conveniently identified simply as Fig. 1.

The complete procedure shown is intended to cover the entire sequence of operations from printing to ultimate casing-in, except for the omission of certain minor steps which have no outstanding relation to the invention and which will be fully understood by persons skilled in the art. It will be appreciated that elements of apparatus appearing in the drawing are purely schematic in that for the most part they are intended to afford a recognizable indication of the type of operation at various stages, rather than to restrict the system to any particular device which might be employed to perform such operation.

By way of general introduction, the complete and preferably more or less continuous procedure, may include the original step of printing indicated at **10**, the assembling of the printed leaves or other sections into a collection that may be conveniently designated as a book block, i. e. at **11**, the co-assembly of the end papers at **12**, and the step of engaging and holding the block in its assembled condition, i. e. as at **13**, for further successive operations. The latter include an edge trimming or smoothing step **14**, adhesive application **15**, drying **16**, outer-edge trimming **17**, rounding and backing **18**, lining-up **19** and ultimate casing-in at **20**. Notably important aspects of the present invention reside in the discovery that improvement and simplification of the entire procedure may be realized by taking advantage of certain inter-relationships among the several steps, such as shown and such as are more fully described below. For at least the most part, these inter-relationships represent special features of cooperation beyond and in addition to the desirably continuous character achieved by the process more or less throughout its course, such continuous character being nevertheless one to which an important, and indeed for many purposes essential, contribution is made by the correspondingly continuous nature of the several individual steps.

For instance, although the original printing operation may be performed in the customary manner with flat bed presses and to provide separate signatures, a particularly convenient step is to print the entire book continuously on a constantly traveling web of paper (withdrawn from a supply **29**), which is appropriately sectioned and folded for collection into an assembled book block. One apparatus suitable for the printing step involves features and combinations described and claimed in the copending applications of Edwin K. Smith, Serial No. 24,210, filed April 30, 1948, now abandoned, and Luis de Florez and Edwin K. Smith, Serial No. 24,174, filed April 30, 1948, and involves passing the web **30** first in engagement with a set of flexible printing plates **31** on a wide, endless, steel belt **32** such that all of the pages for one side of the sheet are printed by a single cycle of the belt **32** as the web passes one section of the long impression cylinder **33**. The web moves over the turning and reversing bars **34** and then travels past another set of printing plates **35** mounted along side of the first set on the belt **32** to imprint the opposite side of the web so that the latter, on leaving the press at **30***a* may have all of the pages for the complete book printed on it by a continuous operation. The pages, for economy of space and paper may be aligned in rows lengthwise of the web and thus can be severed into corresponding strips side-by-side as shown at **40** (in the first step of the collecting operation **11**), and the separate pages in the strips may then be physically defined by an accordion folding operation as shown at **41**. Although the several strips can be separately folded and the resulting page groups then assembled in proper order, another procedure, as

illustrated, is to combine the moving strips by means of turning bars 42 so that a plural-layer web 43 is provided for the accordion folding operation 41. In either case the web is appropriately severed in correspondence with the printing cycles, and the resulting assemblies constitute complete book blocks 44. Where the strips are separately folded each block consists of successive single folds, while with the specific process shown the blocks 44 are made up of a like accordion arrangement having several layers (e. g. three, in the drawing) at the folds. It will be understood that in any given case the printing plates 31, 35 are arranged to suit the ultimate folding and assembling operation so that the actual succession of individual leaves in the block provides the printed pages in desired order.

The book blocks 44 are moved along in continuous series, and as shown at 12, suitable end papers, 46, 47 may be associated with each passing block, the relation of the end papers being also shown in the exploded view, Fig. 2. The end papers are thus incorporated directly against and as part of each block, but without any adhesive attachment thereto. It will be understood that in the case of larger books more than one press operation may be necessary, but in any event the primary stages just described comprise the assembly of a complete set of printed leaves together with the end papers in the proper order to form a completely assembled but entirely unfastened book block 48 as shown at the next stage 13.

Although stage 12 might employ the conventional structure of end papers as double sheets disposed with their folded edges at the back edge 50 of the book block, it is equally feasible in most cases to use simply one or two single sheets (as shown) at each end or even to employ double sheets folded the other way, i. e. with their folded edges at the outer or forward edge of the book block (uppermost in the drawing), in complete contradistinction to the present, invariable practice of book manufacture. In other words, in most instances of the invention the folds of the end papers are unnecessary and indeed undesirable in the finished book; such folds are preferably cut off during manufacture, i. e., if at the outside, they are removed when the outside edge is trimmed. It may be noted that the convenience of assembling the end papers with the book block and without pasting them to the end leaves of the latter is made possible by the cooperation of further procedure in the complete sequence, particularly the edge finishing and adhesive binding steps which provide a peculiarly secure attachment of the end papers as well as of all the other leaves, without the customary pasting operation.

By way of alternative, the conventional printing and signature gathering operations can be substituted for the steps indicated in sections 10 and 11 of the drawing. In such case the several signature sheets, for example, are printed in the usual manner and are then folded to provide the separate signatures (i. e., each having 4, 8, 16, 32 or other usual number of leaves), which are thereupon collected into assemblies corresponding to individual books, as in a gathering machine of the sort commonly used. Preferably, in accordance with the present invention, these operations would be modified to include the end papers in the gathering-machine step, i. e., so that as the signatures are gathered for each book the end papers would be included, respectively in the first and last places of each completed assembly. As stated above, in the preferred practice of the process it is unnecessary and usually undesirable to paste either end paper to the adjoining signature; the papers are simply assembled in proper relation, without attachment, as indicated at stage 12 of the drawing.

It is at present greatly preferred, however, to employ a more effectively continuous printing and assembling operation than is involved in the separate printing and subsequent collecting of signatures. Not only is the entire process greatly expedited by the continuous nature of steps of the sort illustrated at 10 and 11 in the drawing, but further operations in the course of binding are peculiarly facilitated by avoiding folds of more than two or three layers at the back edge, e. g. by avoiding the multiple-layer folds which necessarily occur at the back edges of signatures. Indeed a further and especially useful alternative to the indicated arrangement of printing and assembling is to provide for actual severing of the individual pages or leaves as single sheets so that the entire book block has no folds at any edge at all. In this, and likewise, in other cases, the end papers can consist of merely a pair of separate sheets at each face of the block, or indeed a single sheet alone may be used, it being thus understood that the term "end papers" is intended herein to include generically the use of a single end sheet (i. e. to such extent, if any, as the end papers need be identified separately from the other leaves of the book), which is the sheet that is ultimately adhered to the inside of the front or rear cover of the final casing. Furthermore although in some cases it is preferred to make the end papers of heavier stock than the ordinary leaves of the book, the entire procedure is often expedited by simply providing an extra leaf or leaves at suitable localities in the sheet or web used in the printing operation, to constitute the end papers.

Although other means of holding and transporting the book block 48 for further operations may be employed, a convenient arrangement is to engage it in a clamp 52 which acts compressively on opposite faces of the block so as to leave the edges, particularly the back edge 50, accessible for further operations. Preferably, too, the same clamp can be employed to hold the block through at least many, and indeed practically all of the succeeding steps, and the clamp thus also serves to transmit motive power to the block where efficiency is enhanced by performing one or another of the operations on the moving book.

With the book block 48 held in the clamp 52 (detailed illustration of the latter being omitted for simplicity in the succeeding portions of the drawing, although it will be understood that in practice this or another clamp is preferably there used), the block is then advanced and carried through the edge finishing station 14, where the back edge is constituted as a smooth, usually plane surface in which the edge of each constituent leaf is fully and squarely exposed, i. e. at the level of such surface. Although heretofore cutters of the guillotine type have been extensively used for trimming other edges of assembled books than the back edge, it is greatly preferred that in the present process the operation on the back edge of the block be carried out with rapidly moving cutting elements which repeatedly traverse the block and advance across it. As will be further apparent hereinbelow, max-

imum effectiveness of the present binding method appears to be attainable only where the adhesive, as applied, can both reach and penetrate the cut edge of each individual leaf. In the use of knives of the guillotine type, the block is held stationary under direct pressure and the cutting blade is forced through the block in a single powerful motion. Not only is this operation poorly adapted for inclusion in a continuous or other desirably rapid process, but the resulting transverse surface is excessively smooth and indeed of a glazed or glossy character, which it has now been found to be relatively unsatisfactory for adhesive binding. Although a moderately smooth surface is desirable in many cases, there should be opportunity for edgewise penetration of the adhesive, and preferably some provision for control of the smoothness of cut, e. g. to accord with the character of the paper as explained below. Generally speaking, guillotine trimmers are incapable of adjustment or change to provide anything less than an extremely smooth cut.

In consequence the operation designated **14** is preferably accomplished with rapidly and repeatedly moved cutting elements. In some cases the elements may constitute a rotary knife (successively presented portions of the knife periphery being conveniently considered as successive elements), but evidence indicates that at least in some cases a rotary knife may have the disadvantages, though in a less degree of a guillotine cutter, giving an excessively smooth cut across the leaves or otherwise preventing the attainment of a uniform, square exposure of each leaf edge, suitable for the adhesive.

Accordingly one preferred operation is first to slice off a thin layer of the back edge **50** of the continuously moving block **48** with a band saw **54** (i. e. as the block moves by) and then to advance the book across a rapidly moving and conveniently diagonally disposed abrasive surface such as the sanding band **56**, whereby the saw-cut edge is converted to a surface of relatively high smoothness which now seems preferable for optimum results. It has been found that in this manner the desired constitution of the back edge is achieved, with the individual leaf edges adequately exposed in the common plane of such surface.

Although it might superficially appear desirable to proceed with the relatively rough surface left by the band saw, i. e. as furnishing more "tooth" for the subsequently applied adhesive, experience indicates that the roughness is occasioned by relatively loose fibers which may become embedded in the adhesive but have no holding strength relative to the leaves of the block. With a smooth edge, there is little looseness of the fibers and much better opportunity for penetration of the adhesive edgewise into the individual leaves, for maximum holding effect. The optimum degree of smoothness depends on the character of the paper, as more fully explained below, and an advantage of the abrasive treatment resides in the accurate control which it permits for reaching any desired smoothness.

In the edge finishing operation, all folds at the back edge are effectively cut away or removed. Where the block consists of signatures of the older sort each having a multiplicity of superimposed folds of paper, the cut made by the saw should be relatively remote from the back edge of the assembled signatures, in order to be sure that all folds are removed. In some cases, even with the existence of folds at the back edge of the block and particularly where there are only single folds as derived by separately subjecting each page strip of a printed web to the accordion folding step, the finishing operation can be perfected with a simple sanding or grinding process, i. e. without any actual saw or knife cut; for simplicity of definition herein, the term "cutting operation" is employed broadly to designate any removal of paper, whether by saw or knife or merely by abrasive treatment alone. Indeed it is conceivable that in some instances with a block of separate sheets having no folds at the back edge, the assembly may be so jogged or otherwise treated as to afford a sufficiently smooth back edge surface with all leaf edges fully exposed at the level of the surface, so that the cutting operation (which might involve abrasive treatment alone, or both sawing and abrasive treatment) can be dispensed with. Ordinarily, however, it appears more efficient to rely on some positive surfacing step as assuring the desired condition and shape of the edge surface.

After passing a rotating brush **58** which removes loose particles of fiber and abrasive grit from the surface **50**, the clamped block **48** is further advanced for application of adhesive to the surface **50**, preferably in such manner that the applied adhesive penetrates edge-wise into each leaf and at the same time comprises an integral film or coating over the entire back surface, integrally connecting the adhesive portions that have penetrated (e. g. to a desired extent, which need be relatively slight in most cases) within the several leaves. For some limited purposes a variety of glues or other adhesives may be used, e. g., such as heretofore employed for securing tablets or blocks of sheets that do not receive a hard casing; but an important and peculiarly cooperative element of our preferred, complete process, i. e. to yield durable results and indeed to afford a way of realizing certain subsequent operations which lead to the ultimate production of a hard-cased book and which cannot be effectively performed with glue-type adhesives, involves the application of an adhesive having specific characteristics such as described immediately below. This type of composition, which is now greatly preferred in carrying out the continuous operations shown, comprises a thermoplastic adhesive material, advantageously dispersed as an aqueous emulsion, i. e. an emulsion of the material in water. More particularly the plastic substance constituting the body of the adhesive is preferably water-insoluble and should also be of a somewhat resilient nature, i. e. should have some small degree of elasticity or resilience (when it is finally dry, set and entirely cold) for maximum wearing qualities in the ultimate book. Unless otherwise stated, references herein to insolubility of the adhesive substance mean insolubility in water.

The thermoplastic nature of the adhesive is not only of advantage in application and in insuring the desired integrity and bonding of the adhesive material during the drying operation, but cooperates peculiarly in the subsequent mechanical deformation of rounding and bending the back edge structure to the shape commonly needed for a hard cased book. Thus by operating at an appropriate temperature, the thermoplastic adhesive yields satisfactorily without losing its integral character or its bonding to individual leaves during the mechanical deformation, and yet at ordinary temperatures it has sufficient rigidity (although some elasticty as mentioned

above) to keep the block, and thus the book, in essentially its desired shape and inter-relation of leaves at all times.

Finally the use of water as a suspending agent for the adhesive seems of special advantage, too. While in some cases other media for suspension or solution may be employed, and can be satisfactorily removed in the drying operation, water is believed to be peculiarly appropriate (as a vehicle for dispersion or suspension of the insoluble adhesive substance) for optimum penetration of the adhesive into the fibers. Extensive investigation tends to confirm this characteristic of water-carried adhesives of the type herein contemplated, and while the precise reason for the effect is not positively known and the present invention is therefore not to be bound by any theory, it is thought that the nature of paper as derived from a water suspension of pulp fibers renders it peculiarly susceptible to softening and capillary penetration, e. g. temporary separation of the constituent fibers, by water.

That is to say, water is more or less readily absorbed by any kind of paper, and in the corresponding absorption of a water-carried adhesive, the particles or drops or other elemental portions of the adhesive substance itself appear to be physically carried by the water into and among the fibers. To some extent, in the case of an emulsion, the paper may have a filtering action, in that the water tends to penetrate further than the suspended adhesive substance; nevertheless the adhesive penetration seems to be greatly facilitated by the water, and the result is a satisfactory structure which is understood to provide a somewhat decreasing adhesive density in the paper, from a maximum at the extreme outer edge to a lower (though useful) value somewhat short of the extreme limit of water penetration. In any event a full and effective bond is obtained between each leaf and the overlying film (across the back surface), and thus among all of the individual sheets or leaves.

Very preferably in most cases effort should be made, as by tight clamping of the book block and if necessary by regulating the fluidity of the adhesive material, to keep the latter from becoming very far inter-leaved, so to speak, between the adjacent sheets of the block, since investigations indicate that a maximum holding power is afforded by edgewise bond of the adhesive film to each sheet, or at least that the holding power is fully as effective and there is less interference with the opening of the book in use and indeed less tendency of the sheets to tear (i. e. by actual breakage of the paper) under unusual stresses, than when reliance is placed on any substantial extent of flatwise adherence between the leaves near the back edge. The extent to which the adhesive should penetrate the individual leaves may vary somewhat with different circumstances, such as grades and thicknesses of paper, size of the book, the type of ultimate casing and the character of the intended use of the book. Ordinarily and at least for economy in the use of the adhesive, the distance of such penetration need only be very small, for example so that a substantial density of the insoluble plastic is established to a distance of 0.001 inch or so from the back edge in each leaf, with the water carrier penetrating somewhat further. In any case the optimum penetration can be ascertained, if adjustment appears necessary, by very simple tests with sample book blocks in any particular course of operations. It has found that with adhesives of the sort specified by way of example below and with a proper smoothness and leaf-edge exposure at the back edge surface 50 as determined by the surfacing operation 14, a relatively substantial layer or coating may be applied to the back edge surface, without capillary penetration in the leaves beyond a useful distance, and without excessive flow of adhesive between sheets (e. g. further than 0.010 inch or so from the back edge) where the block is held moderately tightly as by the clamp 52.

An important correlation between the adhesive application 15 and the surfacing operation 14 resides in the variation of adhesive penetration with the character of the paper and the smoothness of the back edge surface of the block. For instance, with relatively non-absorptive papers a back edge surface of only moderate smoothness is satisfactory and may often be most desirable to secure the optimum endwise bond of each leaf. With many papers of high or considerable absorptiveness, however, an extremely smooth surface is preferred, to insure that a satisfactorily retentive film is formed and remains across the back of the block; a roughly cut, absorbent paper is apt to soak up so much adhesive that only a very thin film can remain across the edges. With such a cut, the juxtaposed edges of the leaves provide a minutely uneven contour which tends to aggravate the weakness of any film so thin that its outer face (as well as its under side) follows such contour. It will now be readily understood that the smoothness of cut in operation 14 can be regulated according to the absorptiveness of the paper, for instance by employing finer or coarser grit in the abrasive element 56, so as to provide precisely the desired extent of absorption of the liquid adhesive composition in any given case.

Uniformity of adhesive penetration and bonding is desirable and indeed under ordinary circumstances an adequate control of these factors and of the extent of penetration now appears to be attainable with proper control of the thickness of the applied adhesive layer and of the character of the edge surface as provided by the cutting operation 14. Furthermore for proper disposition and adherence of the subsequent crash and for proper attachment of the ultimate casing, uniformity in the adhesive film is very advantageous, as well as reasonably careful control of the thickness of such film. As will now be readily appreciated by persons skilled in the art, a film that is too thin may provide only a weak binding of the pages together, while a film of excessive thickness may afford only a poor or otherwise improper sort of bond between the block and the subsequently attached structure, i. e. the crash and the casing, especially in that the operation of drying an overly thick coating may produce imperfections in it.

Thus a particularly important feature of the invention, cooperating in various significant ways with other steps as indicated above and elsewhere herein, involves the regulated application of the described adhesive coating to the back surface of the book block. Various mechanical arrangements may be employed for such application of adhesive, for instance so as to apply a relatively substantial coating of controlled thickness. By way of illustration the drawing shows schematically an arrangement such as described and claimed in the patent application of Peter deFlorez, Serial No. 770,726, filed August 26, 1947. A pair of spaced rollers

60, 61 are disposed to rotate half submerged in a bath 62 of the liquid adhesive, so that each book block 48 passes across them in succession, their upper surfaces moving in the same direction and at the same rate as the blocks. The first roller 60 effectively forces liquid adhesive against and throughout the back edge of the block for insurance of the desired penetration. A relatively thin, stationary rod 63 is disposed adjacent the second roller 61 at the further side of its uppermost point so that a pool of adhesive 64 is maintained back of the rod and overflowing the latter; this arrangement (see also Fig. 3) completes the application of a relatively heavy coating of the liquid adhesive on the back surface 50 of each block while providing a sharp break of the material as the trailing end of the block leaves the rod 63.

While various arrangements as indicated hereinabove, may be employed to regulate the thickness of the coating, peculiarly satisfactory results are achieved with a further device described and claimed in the aforesaid application of Peter deFlorez, Serial No. 770,726, involving a wiper or doctor element 65 having spaced, upstanding ridges 66 extending in the direction of book travel (as also shown in the detail view, Fig. 3). The element 65 is of thin flexible material or is otherwise resiliently constructed so that as the book travels by, the upper edges of the ridges 66 are pressed with moderate firmness against the actual back surface 50 of the block 48. The height of the ridges 66 above the plane upper surface of the doctor element 65 is equal to the thickness desired for the adhesive coating on the surface 50.

Since with the applicator 60 an excess of adhesive is preferably applied, the doctor element 65 thus wipes off the excess and leaves only a coating of the precise thickness desired, which is automatically gauged to the edge of the book itself, by virtue of the ridges 66. There is no dependence on an exact positioning of the book relative to any stationary element, and the fluid nature of the adhesive coating in effect obliterates the paths of the ridges once the book has left the element 65, whereby a smooth coating of the desired thickness is obtained. As indicated hereinabove, it is essential for proper penetration and for proper constitution of an integral bonding layer across the surface that the coating be relatively substantial in thickness as distinguished from the thin sort of film that would be left if a full scraping or wiping operation were used. At the same time, for effective binding of the pages and for smooth and secure attachment of the crash later applied, the coating should be uniform and should not exceed a practical limit, a convenient criterion being to make the wet coating as thick as is possible without giving rise to bubbles or other physical disturbance in it during the drying step that follows. For instance, for books of average dimensions (8 vo. size), a coating 0.006 to 0.010 inch thick, when wet, has been found suitable; such coating dries and sets to a thickness of 0.004 to 0.006 inch.

Simply by way of example, one type of adhesive composition suitable for application as described is an aqueous emulsion or so-called latex of a copolymer of vinylidene chloride and acrylonitrile, such emulsion preferably including a suitable plasticizer such as dibutyl phthalate, dibutoxy phthalate or a mixture thereof. Compositions of this character form, upon drying, a tough, adherent, thermoplastic film across and in engagement with the edges of the leaves in the book block; the formation of such film is promoted by the heat employed in the drying operation 16. Thus one preferred material is the latex of vinylidene chloride and acrylonitrile polymerized together (in approximate proportions of 85 parts and 15 parts respectively), which is known as Saran F-122 (made by Dow Chemical Co.), such material being further modified with a plasticizer as stated above, e. g. to a total amount of about 25% based on the weight of the polymerized constituents.

Other compositions that may be used in some cases include the so-called Geons (made by B. F. Goodrich), which are emulsions of materials described as special vinyl chloride polymers, and understood to include a straight vinyl chloride polymer, but in most instances to be copolymers of vinyl chloride and vinylidene chloride. Useful adhesive properties are also exhibited, at least to a limited degree, by emulsions of polyvinyl acetate, e. g. straight polymers or inclusive of other substances. If a hot melt adhesive can be employed, there is evidence of utility for material of the nylon family; but substances capable of and used in aqueous dispersion, are at present preferred, for their special advantages mentioned above.

Following the application of the wet adhesive the book block is conveniently passed through a drying station 16, i. e. where the adhesive is converted to a relatively solid, set condition, as by suitable evaporation of its water content. Although satisfactory results have been had by employing simple heat drying means (e. g. sources of radiant heat), efficiency of the complete process is enhanced by employing high frequency energy to dry the adhesive. Thus purely for schematic illustration the drawing shows wave-emitting or radiating structure 70, delivering such energy to the adhesive-coated bottom surface 50 of the block 48, the element 70 being in turn energized by connection to an appropriate oscillator or other electromagnetic wave generator schematically shown at 71.

The general principles underlying drying of water-carried adhesives (under other circumstances) with ultra high-frequency electromagnetic radiation are known, in that the currents or other electrical effects set up by the radiation in the aqueous medium generate (presumably as a hysteresis loss) sufficient heat to evaporate the water, a result which is achieved in the present process with a maximum of rapidity and efficiency since the paper of the book is relatively non-responsive to the radiation, and the heat is localized in the very material to be evaporated. Accordingly by this or other procedure, the adhesive is effectively dried and reduced to a set condition, and to the extent that the drying operation is of a rapid character, the path of travel of the book block through the stage 16 will be relatively short and the efficiency and economy of the process (and of the apparatus for carrying it out) are greatly improved.

If one or more of the outer edges of the book block are to be trimmed, such operation may follow the drying stage 16. Although in some cases guillotine cutters, e. g. a so-called tumbler trimmer, may be used, it is generaly preferable to maintain the continuity of the process as shown at 17 in the drawing. Thus here the now bound blocks 48 may leave the clamps 52 and be advanced (for example by a screw-type pusher 72

or other suitable means) into a sidewise-moving array 73 with their successive side faces in abutment as shown, while suitable cutting means effect the desired trimming. Rotary knives or band knives or band saws or in some cases merely abrasive surfaces, or combinations of saws and sanding belts (as at stage 14) may be employed; for illustration, the drawing shows the top and bottom edges of the passing book blocks being trimmed by the vertical band saws 74 and the fore edge by the horizontal saw 75. If the trimmed edges are to be colored or otherwise decorated, this operation may also be performed on the moving column 73, by spraying the paint or ink through one or more nozzles, one such being shown at 76.

From the column 73 or directly from the drying stage 16 if there is no trimming, the book blocks are then successively passed to the rounding and backing operations generally indicated as the stage 18 in the drawing. Here the block and especially its back edge 50 are mechanically deformed, i. e. in the general manner and to the shape commonly employed for the manufacture of hard cased books. Although certain improved apparatus may be used (for example as disclosed and claimed in the copending patent application of Edward M. Getzoff, Serial No. 752,099, filed June 3, 1947), for very rapid, literally continuous travel of the book blocks through this station, experience indicates that quite satisfactory results and an effective continuity of progress of the blocks may be had with conventional rounding and backing machinery, involving first a pair of rollers 77 which engage the faces of the block and displace the inner leaves relative to the outer ones to provide a rounded contour for the back edge 50. At the station of the rounding rollers 77, the successive blocks drop on a register plate 77a where each is re-engaged by a traveling clamp 52a. The blocks in succession then advance to, and momentarily pause upon, the backing iron schematically indicated at 78, which by a sidewise rocking action mechanically deforms the back edge of the book to complete the rounded configuration with the sidewise projecting ribs or creases 79, 79 (see Fig. 4) usually deemed necessary for proper application and functioning of a hard casing, especially with respect to the hinges of the latter. In this and through subsequent operations the blocks are again held and advanced by the clamps 52a, corresponding to the clamps 52.

It is to be noted that whereas conventional apparatus may be employed at the rounding and backing stations, the procedure is not the old one of shifting and folding signature units relative to each other, but is a new operation involving displacement of individual leaves and deformation both of such leaves and of a substantial adhesive layer that covers the back surface and firmly holds the back edge of each leaf. The successful combination of this step with the preceding binding and subsequent casing operations is thus grounded on the discovery that under appropriate conditions of such other operations a bound page block of the character described may be deformed to the desired rounded shape without deranging the binding relation of the adhesive material. Where there are assembled sewn signatures, the backing iron bends over the outer signatures, i. e. adjacent their respective multiple folds, as individual units, and since each folded signature is itself of the nature of a thick booklet or the like, its folded nature would seem to be peculiarly appropriate or even requisite in affording strength to the bent-over condition achieved by the described operation. It is therefore remarkable to find not only that a block of individual leaves (securely bound by adhesive across their edges) may be rounded as by the means 77 to provide a smoothly curved edge, but especially that the backing operation, which bends over the leaves to progressively greater amounts toward the outer corners of the back edge, may be performed by the same means as used for sewn signature assemblies, and yet without breaking or otherwise disturbing the binding character of the adhesive which is now effectively set across the back surface and integrally penetrates into the edges of the leaves.

Very preferably the back edge of the book, i. e. the adhesive material itself, should be kept at a suitable elevated temperature during the rounding and backing operation, so that by virtue of the thermoplastic character of the substance it will soften and yield, without breaking, to the mechanical deformation. Experience indicates that with adhesives of the specific type set forth by way of example above, maintenance of this elevated temperature is achieved without supplemental heating means where the book comes through these stages 18 within, say, fifteen minutes of the time that it leaves the heat-drying locality 16.

If there is too much time taken intermediate these stations 16 and 18 (as by the supplemental operations 17, although the latter can ordinarily be rapid enough to avoid using too much time), infra-red lamps or other heating devices (not shown) may be used with the apparatus at 18, to insure that the adhesive will respond properly. For instance, it is found that by disposing such heating means to warm the back edge of each block as it advances to rounding operation, the adhesive coating is effectively maintained in the desired heated condition through both the rounding and backing steps. For the specific substance named above, temperatures between 120° F. and 200° F. are satisfactory, operation at the lower end of the range being preferred since at the higher temperatures the plastic is apt to become sticky, requiring lubrication of the backing iron or irons with water to keep the same from sticking during operation on the back edge of the book.

Once rounded, the successive blocks 48 are carried through the so-called lining-up operation 19, including the application to the rounded back of a thin layer of adhesive 80, as by a suitable rotary applicator 81, and then the application of the usual portion of crash 82 or like fabric (which may in some cases be strong paper rather than woven textile) over the fresh adhesive. For customary casing operations, the piece of crash 82 severed from a supply roll 82a and applied to each block is of a size to project appreciably beyond the side edges or corners of the back surface, i. e. providing flaps as indicated at 83, 84 for appropriate reinforcement of the hinges in the casing and for secure attachment to the casing.

The adhesive material here applied should be compatible with the previously applied adhesive, and thus for example may be of a closely similar nature, for instance again embodying a water insolvent, resilient, thermoplastic substance. It is peculiarly desirable that the adhesive here applied be such as to bond firmly and preferably

integrally to the previous coating of adhesive, as by some softening or fusing of the outer surface of the previous adhesive, whereby in effect the crash **82** is firmly secured, through an intermediate, unitary adhesive layer, to the actual back edges of the book block.

Accordingly instead of a water emulsion, the liquid adhesive **80** here applied may constitute a solution or emulsion of the thermoplastic substance in a suitable organic solvent or the like which will attack or soften the plastic binding film. Indeed it will be appreciated that a further desirable property of the plastic material embodied in the binding adhesive **61** is that (after solidification) it be in effect partially soluble, i. e. subject to softening, in a preferably non-aqueous solvent fluid which can be used as the vehicle of the adhesive with which the crash is attached. To these ends, the film-forming substance of the adhesive **80** may conveniently be a plastic material which is the same as, or closely analogous to the plastic body of the adhesive **61**, i. e. so that the former is soluble or dispersible in a solvent that will soften the applied coating of the latter. In one particular instance of procedure embodying our invention, where the adhesive liquid **61** used for binding comprised an aqueous emulsion of the latices formed of a copolymer of vinylidene chloride and acrylonitrile with a suitable plasticizer such as dibutyl phthalate, an adhesive **80** consisting of a copolymer resin of vinylidene chloride and acrylonitrile in methyl ethyl ketone was notably effective for lining-up.

It will be understood that any of various means may be employed to apply the adhesive **80**, the device **81** being simply shown as a schematic representation of a suitable applicator. In some cases the book block with the crash freshly adhered may immediately pass another applicator (not shown) which spreads a very thin film of the same adhesive on the outside of the fabric, it being found that the individual threads of the crash are sometimes difficult to wet with the first adhesive film applied by the device **81**, whereas the second application insures their being surrounded by liquid adhesive and thus in effect embedded in it.

At this stage, if desired, the usual head bands may also be applied, either accompanying the crash **82** or otherwise disposed on it, and likewise, if desired, the strip of backing paper that is customarily affixed on the outer surface of the crash. For simplicity these supplemental steps are omitted from the drawing, since the purpose of the head band is largely decorative, and particularly since the use of backing paper may in most cases be dispensed with where the process of the present invention is employed. That is to say, the primary purpose of the backing paper is to prevent the usual glue with which the crash is attached and which invariably soaks through the crash, from soaking into the casing itself, especially at later times because the animal glue is hygroscopic and in moist conditions becomes fluid enough to damage or deface the back strip of the casing.

In the present process the successive blocks **48**, with the attached crash **82** are preferably progressed through a drying operation (e. g. using hot air) following the lining-up sequence **19**, and since the resulting, set adhesive is of an insoluble nature and is preferably incapable of re-dispersal as an emulsion or otherwise in the presence of any water or moisture that might later come in contact with it, there is no danger of adhesive being subsequently soaked into or through the casing from the outside of the crash **82**. In consequence the primary function of the backing paper is obviated by the present procedure. Indeed the backing paper is undesirable in many cases, since it tends to prevent rapid evaporation of the solvent from the plastic adhesive.

Finally the book blocks **48** now carrying the crash **82** and such other or alternative structure as may be desired, advance in continuous succession to the casing-in operation **20**. This step may be performed in a customary manner, for example, by applying previously prepared casings **90** to the successive book blocks, the structure of the casing and the precise steps of applying it being mechanically the same, if desired, as heretofore performed in older methods. The casing-in operations, however, are an inherently significant feature of the complete sequence embraced by the invention, e. g. in that the latter is peculiarly designed for the attainment of an effective casing-in step to provide a hard-cased book of exceptionally durable character, and in that the casing, instead of being adhered to folded end papers that transmit localized strain to the outer leaves of the outer signatures, is attached only incidentally to end leaves **46**, **47** which in the block are connected solely by the adhesive binding, whereby the actual effective connection between the casing and block is more or less restricted to the crash (which has its flaps adhered to the casing) and the adhesive layer. This last mentioned structure of crash and adhesive is peculiarly adapted to carry the stresses between casing and block, without localizing the forces in a manner to damage or derange any part of an entire book.

For example, the successive blocks are passed down between a pair of adhesive-carrying rollers **92**, which apply a suitable coating of adhesive to the crash flaps **83**, **84** and to the outer faces of the end-paper leaves **46**, **47**, using a material such as employed at **80** in stage **19**, or alternatively any other suitable adhesive such as starch paste, and then from an appropriate supply **93**, preformed casings **90** are applied. In the latter operation the casing is disposed and firmly pressed around the block, so that the crash flaps and the end papers, i. e. the outermost leaves of the book block, are firmly adhered to the casing, with each crash flap protected by the end paper pasted over it. The resulting structure **94** is a remarkably strong book, more durable and rugged than books made by conventional procedures and yet having all the characteristics of convenience and pleasing appearance heretofore deemed desirable in hard-cased book construction. The individual leaves are securely attached, and indeed considerably more resistant to removal or separation than in the case of sewn books. The attachment of the book block to the casing is also notably more firm and secure than could be obtained with prior constructions, which is attributed in substantial part to the cooperation between the adhesive binding and the crash, and to the reliance on such structure for mutual support of the parts as explained hereinabove and as distinguished from constructions (heretofore deemed necessary) involving a folded paper connection between the outer leaf of each end paper and the adjacent leaf. Finally where an insoluble adhesive of the preferred character is employed, the book is peculiarly resistant to deterioration by moisture, adverse weather conditions, damage by vermin and other circumstances tending to the deteriora-

tion of bound books, either before or after their sale.

It will be understood that whereas the entire procedure described provides a novel and especially economical continuity of operation on continuously moving book elements and book assemblies, and whereas the complete sequence is characterized by a peculiar and advantageous cooperation among all of the stages from the unprinted web of paper to the finished, hard cased books, various sub-combinations and lessor sequences of operations may be separately employed to corresponding advantage and with like realization of novel cooperative interrelationships. Thus as indicated the original printing operation may be of a conventional character, and a variety of other modifications may be effected in respect to the several stages illustrated in the drawing. Finally it is to be noted that the apparatus schematically shown in the drawing has been selected chiefly for purposes of illustration and other equipment for achieving like or corresponding results may be used at various stages.

It is to be understood that the invention is not limited to the specific procedures, arrangements and compositions herein set forth by way of example, but may be carried out in other ways without departure from its spirit.

We claim:

1. In the manufacture of books, the steps of assembling a multiplicity of printed leaves and end papers, together and without adhesive attachment among them, to form a book block, treating the back edge of the block to constitute it as a smooth transverse surface wherein the edge of each leaf, including each leaf of the end papers, is squarely exposed at the level of said surface, by rapidly and repeatedly moving cutting elements in engagement with successive portions of said edge, applying to said smooth surface a coating of an insoluble, resilient, thermoplastic adhesive dispersed in a water emulsion thereof and adapted to penetrate edgewise into each leaf, drying said adhesive to solidify the same, rounding and backing said back edge surface by mechanical deformation thereof while said adhesive is in an at least partially plastic state, and lining-up said surface by adhesively attaching thereto a portion of backing fabric, so that the book block may be cased by applying thereto a hard casing and by adhering the inner surfaces of said hard casing to portions of said end papers and backing, said rounding and backing operation including flaring the leaves of the block toward each side of the back edge surface to constitute hinge-defining ridges at the sides of said surface, which ridges are permanently maintained by the adhesive becoming fully set.

2. In the manufacture of books, the steps of establishing a book block consisting of a multiplicity of leaves and having a smooth back edge surface wherein the edge of each leaf is fully exposed at the level of said surface, applying to said smooth surface a coating of an insoluble, resilient, thermoplastic adhesive dispersed in a water emulsion thereof and adapted to penetrate edgewise into each leaf, while controlling said application to maintain a predetermined, uniform thickness of the coating relative to and throughout said surface, the thickness of the applied coating being controlled as aforesaid so that the coating when dried has a thickness throughout within the range of about 0.004 to 0.006 inch, evaporating the water from the coating, and thereafter and while said adhesive coating is at least partially plastic, rounding and backing the adhesively bound block by mechanical deformation of its back edge surface, said rounding and backing operation including flaring the leaves of the block toward each side of the back edge surface to constitute hinge-defining ridges at the sides of said surface, which ridges are permanently maintained by the adhesive becoming fully set.

3. In the manufacture of books, procedure for converting an unbound assembly of leaves into a rounded-back bound assembly adapted for hard casing, comprising establishing said unbound assembly in block form, treating the back edge of the block to constitute it as a smooth transverse surface wherein the edge of each leaf is squarely exposed at the level of said surface, by cutting procedure including moving an abrasive surface across and into engagement with successive portions of said back edge, applying to the said smooth surface a coating of an insoluble, thermoplastic adhesive dispersed in a water emulsion thereof and adapted to penetrate edgewise into each leaf, said adhesive being applied while clamping the book block to prevent penetration of said adhesive between the leaves further than about 0.01 inch from said smooth back edge surface, drying the adhesive to solidify the same to provide an adhesively bound block having a layer of said adhesive across said surface bonded integrally with portions of the adhesive in each leaf, and rounding and backing said back edge surface by mechanical deformation with the adhesive at an elevated temperature which renders the adhesive yieldable to prevent rupture of the adhesive bond, said rounding and backing operation including flaring the leaves of the block toward each side of the back edge surface to constitute hinge-defining ridges at the sides of said surface, which ridges are permanently maintained by the adhesive becoming fully set.

4. In the manufacture of books, the steps of establishing a book block consisting essentially of a multiplicity of separate leaves and having a smooth back edge surface wherein the edge of each leaf is squarely exposed at the level of said surface, applying to said back edge surface and in edgewise adhesive engagement with each said leaf a water-insoluble adhesive in flowable form to constitute an adhesive layer extending across said back edge surface, and thereafter and while said adhesive is in an at least partially plastic state, rounding and backing the book block by mechanical deformation of its back edge surface to provide said block with a rounded, hinge-defining configuration which is adapted for application of a hard casing to the block, said rounding and backing operation including flaring the leaves of the block toward each side of the back edge surface to constitute ridges at the sides of said surface for providing said hinge-defining configuration, and said adhesive thereafter setting to maintain the said configuration with the leaves bound together by the said adhesive at their back edges.

5. The procedure of claim 4 which includes the step of adhering a portion of backing fabric to the rounded and backed back edge surface of the book block, by applying intermediate said backing fabric and said surface an insoluble adhesive which is carried in an organic solvent for said first mentioned adhesive and which is adapted to bond integrally with said first mentioned coating of adhesive.

6. In the manufacture of books, the steps of establishing a book block consisting essentially of

a multiplicity of separate leaves and having a smooth back edge surface wherein the edge of each leaf is squarely exposed at the level of said surface, applying to said back edge surface a thermoplastic, water-insoluble adhesive layer extending across said surface in adhesive engagement with each of the leaves edgewise thereof, and thereafter and while maintaining said adhesive sufficiently plastic to permit its yielding without rupture of said layer, displacing the leaves relative to each other to constitute a rounded back edge surface and flaring the leaves toward each side of the back edge surface to constitute hinge-defining ridges at the sides of said surface, to provide a rounded and backed block adapted for application of a hard casing thereto, said adhesive layer thereafter setting to hold said back edges of the leaves in the rounded and flared configuration.

7. In the manufacture of books, the steps of establishing a book block consisting essentially of a multiplicity of separate leaves and having a smooth back edge surface wherein the edge of each leaf is squarely exposed at the level of said surface, applying to said back edge surface and in edgewise adhesive engagement with each said leaf a water-insoluble adhesive in flowable form to constitute an adhesive layer extending across said back edge surface, and thereafter and while said adhesive is in an at least partially plastic state, rounding and backing the book block by mechanical deformation of its back edge surface to provide said block with a rounded, hinge-defining configuration which is adapted for application of a hard casing to the block, said adhesive thereafter setting to maintain the said configuration with the leaves bound together by the said adhesive at their back edges, said adhesive-applying step comprising clamping the book block during the adhesive application to substantially prevent adhesive penetration between the pages, while controlling application of said adhesive to provide said layer thereof having a substantial thickness adapted to maintain the back edges of the leaves in securely bound relation.

8. In the manufacture of books, the steps of establishing a book block consisting essentially of a multiplicity of separate leaves and having a smooth back edge surface wherein the edge of each leaf is squarely exposed at the level of said surface, applying to said back edge surface a thermoplastic, water-insoluble adhesive layer extending across said surface in adhesive engagement with each of the leaves edgewise thereof, and thereafter and while maintaining said adhesive sufficiently plastic to permit its yielding without rupture of said layer, displacing the leaves relative to each other to constitute a rounded back edge surface and flaring the leaves toward each side of the back edge surface to constitute

hinge-defining ridges at the sides of said surface, to provide a rounded and backed block adapted for application of a hard casing thereto, said adhesive layer thereafter setting to hold said back edges of the leaves in the rounded and flared configuration, said adhesive-applying step comprising clamping the book block to prevent penetration of said adhesive between the leaves further than about 0.01 inch from said smooth back edge surface.

9. In the manufacture of books, the steps of establishing a book block consisting of a multiplicity of separate leaves having a smooth back edge surface in which the edge of each component leaf is squarely exposed, applying to said back edge surface an insoluble thermoplastic adhesive dispersed in a water emulsion thereof and adapted to penetrate edgewise into each leaf, drying the adhesive to solidify the same, rounding and backing said back edge surface by mechanical deformation with the adhesive at an elevated temperature which renders it yieldable against rupture of its adhesive bond, said rounding and backing operation providing the book block with a rounded, hinge-defining configuration which is permanently maintained when the adhesive is fully cooled and set and which is adapted for application of a hard casing to the block, and said rounding and backing operation including flaring the leaves of the block toward each side of the back edge surface to constitute ridges at the sides of said surface for providing said hinge-defining configuration which is maintained as aforesaid when the adhesive is set.

LUIS DE FLOREZ.
PETER DE FLOREZ.
OWEN L. GORE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
703,933	Joyce	July 1, 1902
931,679	Chivers	Aug. 17, 1909
1,554,436	Kint	Sept. 22, 1925
1,804,392	Alger	May 12, 1931
1,867,803	Bredenberg	July 19, 1932
1,973,375	Frazier	Sept. 11, 1934
1,988,208	Martin	Jan. 15, 1935
2,010,810	Bredenberg	Aug. 13, 1935
2,069,211	Brown	Feb. 2, 1937
2,090,796	Kitcat	Aug. 24, 1937
2,151,991	Schramm	Mar. 28, 1939
2,463,769	Higgins	Mar. 8, 1949
2,471,482	French	May 31, 1949

FOREIGN PATENTS

Number	Country	Date
890,794	France	Nov. 19, 1943