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METHOD OF BINDING SHEET MATERIAL IN PILES

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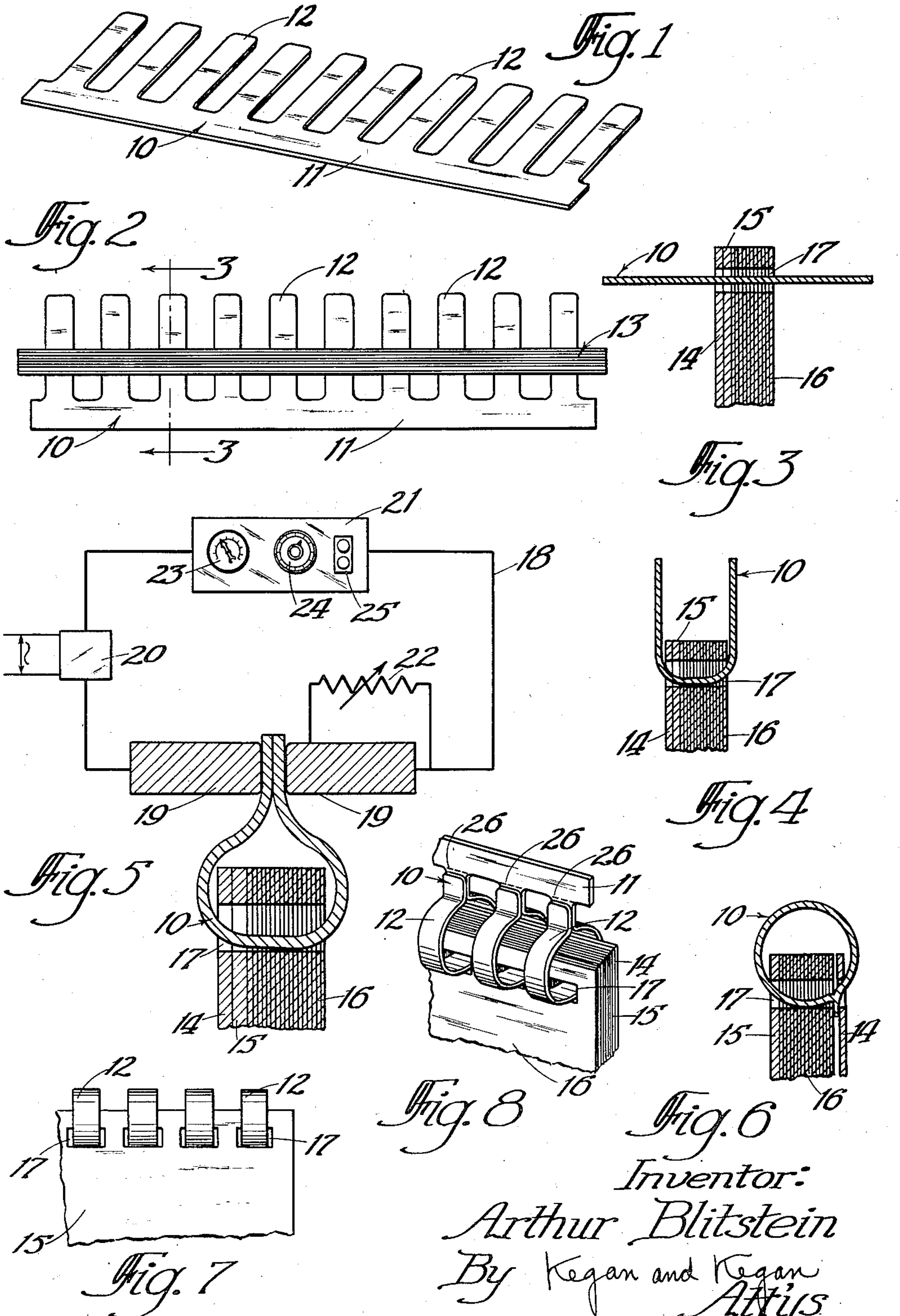

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METHOD OF BINDING SHEET MATERIAL IN PILES

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1 Claim. (Cl. 11—1)

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The instant invention pertains generally to methods for binding sheet material in piles. More specifically, the instant invention pertains to an improved method of binding magazines, notebooks or the like with plastic or other heat-sealable material to obtain a ring-like binding, as distinct from the sewn or stapled type of binding.

The binding art has long been beset by the problem of achieving a ring-type binding which is permanent, yet easy to produce, soft and pliant, yet possessed of a tear strength which is greater than that of the bound sheets. By ring-type binding is meant that class of binding wherein a binding member is inserted through edge perforations adjacent an edge of the stack of sheets to be bound. In lieu of a binding possessing the foregoing desirable characteristics, however, the art has come to use either coarse fabric material or else rigid plastic materials which rely upon their inherent rigidity to hold the bound sheets together. As a binding material, rigid plastics have the drawbacks of lacking flexibility and of having a tendency to crack or split apart under hard usage. Also, they lack pliability. Because of their hardness, such materials are unpleasant to the touch, and tend to tear and abrade the paper through which they are threaded. Fabric, on the other hand, being very flaccid, does not yield a binding having a uniform appearance unless stiffened by a filler. Fabric also is characterized by a tendency to fray apart when used to bind heavy or rough sheets. In addition, the fabric binding member is ordinarily secured together by gluing, so that the binding operation requires clamping the portions together until the adhesive is set. Thus, binding with this type of material is slow and inefficient.

The instant invention, on the other hand, eliminates the foregoing disadvantages inherent to the prior art binding processes. Stated briefly, my novel process consists of binding a stack of sheets together by thermal welding of a binding blank formed from a flexible, tough synthetic plastic material. A preferred sequence of steps is as follows: (1) the binding blank is chilled to impart sufficient rigidity to facilitate insertion; (2) the binding fingers are inserted through perforations formed adjacent one edge of the stack of sheets; (3) the binding fingers are butted against the backing portion of the blank and (4) seam welded thereto.

My new method of binding may be practiced with relatively simple tools; however, if desired, it may be adapted to a semi or fully automatic

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binding process. By using it, bindings for books and the like may be obtained which are attractive in appearance, capable of withstanding harsh treatment without any diminution of their utility, and inexpensive.

It is the principal object of my invention, therefore, to provide a binding method whereby a large number of sheets may be bound together permanently into a book or the like.

Another object of my invention is to provide a method for manufacturing books or the like having a pliable, tough binding which is capable of withstanding harsh treatment.

Another object of my invention is to provide a method of binding notebooks, magazines or the like which is inexpensive and which may be reduced to automatically performed steps.

Another object of my invention is to provide a method of manufacturing books wherein the binding appears to be a plurality of separate sealed ring-like members.

The foregoing and such other objects, principles, advantages and capabilities as are disclosed as this description proceeds, or which are inherent in the present invention, are illustrated in the accompanying drawing, in which:

Figure 1 is a perspective view of a preferred form of blank for practicing the instant invention;

Figures 2–4 illustrate successive steps in the preferred practice of my new method; Figure 2 being a plan view; and Figures 3 and 4 being side elevational views taken in section along the line 3—3 of Figure 2;

Figure 5 illustrates schematically one form of apparatus which may be used to fuse the blank together permanently;

Figure 6 is a plan view taken in vertical section through the bound volume;

Figure 7 is a fragmentary front elevational view of the binding shown in Figure 6; and

Figure 8 is a perspective view illustrating an intermediate step in an alternate binding method conforming to my invention.

Like reference characters designate like parts in the drawing and in the description thereof which follows.

Referring now to the drawings, and more particularly to Figure 1 thereof, the binding blank 10 is shown as having a comb-shaped configuration and comprising a rib 11 and a plurality of outwardly extending binding fingers 12. While the blank 10 is shown as having closely spaced fingers 12 of a more or less rectangular cross section, other configurations, as for example a blank having binding fingers of circular cross-section, are within the contemplated scope of my invention. Regardless of the particular form which it may take, the binding blank 10 is made of flexible, tough, heat-sealable material, such as thermoplastic synthetic resins derived from rubber hydrochloride, polyvinyl chloride, polyvinylidene chloride, polyethylene, or the like. Such materials are particularly advantageous as a binding medium since they are tough, coriaceous, possess some elasticity and pliability, and in addition may be obtained in myriad colors and surface patterns. Thus, binding formed with my method add to, rather than detract from, the attractive appearance of the bound volume.

Ordinarily, the thickness of the binding blank 10 will be less than ⅛″, so that the binding fingers 12 normally possess little rigidity, particularly in the unbound condition due to the desirable flexible or flaccid character of the material. Consequently, to assist in inserting the finger 12 through the edge perforations provided, it is desirable to either increase the rigidity of the fingers 12, or provide a suitable fixture for guiding the fingers 12 through the perforations, or preferably use a combination of both of these expedients. One way of increasing the rigidity of the fingers 12 is to reduce the amount of plasticizer used in manufacturing the plastic material until the desired rigidity is obtained, however, this method has the drawback of increasing the rigidity permanently, and thereby making the final product too stiff. Advantageously, I have discovered that the rigidity of the binding fingers 12 may be increased temporarily by chilling the blank 10 by ordinary refrigeration methods. Obviously, however, the temperature of the blank 10 should not be lowered to the point where the blank 10 becomes so brittle that there is an attendant danger of the fingers 11 splitting or cracking when flexed or stretched during subsequent operations. For example, a temperature between 25° F. and 45° F. will produce highly desirable results when using blanks formed from 0.020 inch "Vinylite No. 1" flat stock manufactured by the Bakelite Corp. of New York, New York, although obviously a somewhat different optimum temperature range will exist for different materials and for different thicknesses and applications thereof. Moreover, this effect lasts for a sufficiently long period of time to permit reasonable delays in inserting the fingers 12 after chilling the blank 10, since heat sealable materials in general possess insulating characteristics, and thus exchange heat at a comparatively slow rate.

The initial step whereby the binding blank 10 is processed into a completed binding after being chilled is illustrated in Figures 2 and 3. The stack of sheets 13 which is to be bound into a book is shown as comprising two covers 14 and 15 and a plurality of interior sheets 16. A plurality of regularly spaced perforations 17 extend through the stack of sheets 13 adjacent one edge thereof, the spacing of the perforations 17 corresponding to that of the binding fingers 12. In practice it has been found advantageous to align the sheets 13 within a press or the like with the perforated edge section accessible for binding. Further advantages are realized by providing a flat surface which supports and guides the blank 10 as it is being inserted through the perforations 17. By this latter expediency, in combination with the foregoing chilling operation, the insertion of the blank 10 is greatly simplified.

After the binding material 10 has been inserted through the perforations 17, the rib 11 and the binding fingers 12 are bent upward so that the blank 10 in cross-section assumes a U-shaped configuration, as shown in Figure 4. Following this step, the outer free ends of the fingers 12 are butted against corresponding portions of the rib 11. The cross-sectional appearance of the binding blank 10 at this state of the process is illustrated in Figure 5.

After the binding fingers 12 are butted against the rib 11, they are permanently fused thereto. One exemplary method of fusing the fingers 12 to the rib 11 is to use high frequency heat sealing apparatus such as that shown diagrammatically in Figure 5. Specifically, this apparatus includes an electric circuit 18 connected across two metallic plates 19, 19, which plates press against the abutted portions of the blank 10. The electric circuit 18 in turn includes a source of high frequency current, as exemplified by the frequency converter unit 20, a control unit 21, and a variable resistance 22 shunted across one of the plates 19. The unit 20 draws its energy from an electrical energy supply source (not shown). By experience, it has been found practical to include in the control unit 21 an ammeter 23, an adjustable timer element 24, and a switch 25 operatively connected through the timer element 24. Thus, upon closing the switch 25, a controlled high frequency current flows from the converter unit 20 to the metallic plates 19, 19 for a predetermined interval.

Inasmuch as thermoplastics in general possess good dielectric properties, the passage of a high frequency current therethrough quickly fuses the contacted surfaces of the blank 10 together. Because the dielectric characteristics of the binding are dependent principally on the type of material being fused and the thickness thereof, it becomes necessary, when different materials and different thicknesses are to be processed with one set of apparatus, to provide means for adjusting both the magnitude of the current and the time interval during which said current flows. This is accomplished by means of the variable resistance 22 and the timer element 24. By varying the variable resistance 22, the intensity of current flowing across the binding may be altered, while the timer element 24 may be adjusted to give the desired time interval during which this current is to flow.

Advantageously, the foregoing sealing operation in no way affects the surface of the blank 10 adjacent to the plates 19, 19, all fusion of the material occurring at the interface. This apparently stems from the fact that in electronic heat sealing the heat flow is from the inside of the material to the outer surfaces thereof. In addition, the plates 19, 19 rapidly conduct heat away from the adjoining surfaces of the blank 10, as a consequence of which the sealed binding blank 10 is cold to the touch when removed from between the plates 19, 19.

Obviously, other types of apparatus for sealing the binding material together may also be used to advantage. Thus, for example, it may prove advantageous to dispense with the electronic heating apparatus shown in Figure 5 and employ low frequency seam welding in its place. Again, in some instances, it is desirable to merely heat the plates 19, 19 to a temperature which is sufficient to melt or make sticky the binding material used, the welding temperature ordinarily being between 150° F. and 300° F., depending upon the particular material selected. This mode of sealing proves particularly useful where the melting point of the binding material being used falls within the lower portion of this temperature range.

The appearance of the completed binding is shown in Figure 6. It will be noted that subsequent to the sealing operation, the cover 14 is rotated through a full revolution. Hence, the portions of the binding blank 10 which are fused together are contained entirely within the cover sheets 14 and 15 of the bound volume. In Figure 6, the sealed portion of the blank 10 appears to be of prominent size, because the proportions have been exaggerated somewhat for purposes of clarity. Actually, the thickness of the sealed portion in no way interferes with the closing of the cover sheet 14. The appearance of the completed one-piece binding taken in front elevation is shown in Figure 7, wherein the ring-like effect of the completed binding is apparent.

Besides acting as a common support for the tabs 12, the rib 11 also serves to reinforce the flexure strength of the bound volume. In the event that it becomes desirable to provide a binding consisting of separate ring-like bindings, however, this form of binding may also be achieved through the use of my novel method. In that case, the outer free ends of the binding fingers 12 are butted against the inner end portions thereof, as shown in Figure 8, rather than against the rib 11, after which the abutted surfaces are welded together. Individual ring bindings are then obtained by cutting each binding finger 12 along the dotted line 26.

By means of my invention, then, it becomes possible to obtain bindings of novel and varied characteristics. For example, the strength, flexibility and elasticity of the binding may be controlled by varying the thickness of the blank 10. Again, as emphasized above, heat-sealable materials are available in many different surface textures and colors. By way of example, bindings may be obtained which closely simulate leather or fabric.

Thus, it will be seen that the objects of my invention have been fully achieved. While I have shown and described a preferred method of

practicing my invention, it is strictly to be understood that this method has been given by way of example only, and that various changes and variations in the steps shown and described herein may be made without departing from the spirit of the invention, the scope of which is defined in the appended claim.

What I claim and desire to protect is:

The method of manufacturing books from a comb-shaped, permanent binding member of flaccid thermoplastic material, front and back cover sheets, and sheets therebetween, all of said sheets having aligned perforations therethrough adjacent an edge thereof, which method consists of arranging said front cover sheet and said interior sheets in regular sequence, positioning the normally exterior surface of said back cover sheet next to the normally exterior surface of said front cover sheet, chilling said binding member until substantially rigid, guiding the fingers of said binding member through said perforations, respectively, curling said member about said edge so that the free ends of said fingers and the back portion of said member both extend away from said edge, butting said backing portion and the free ends of said fingers together, impressing a high frequency voltage across the contacting surfaces of said member to fuse the same together permanently, and rotating said back cover sheet into its normal position.

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