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Brackett et al.

[11] **3,870,582**

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[54] **NOVEL LAMINATING SYSTEM**

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[73] Assignee: **Polaroid Corporation,** Cambridge, Mass.

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[52] **U.S. Cl.** **156/306,** 100/211, 156/583

[51] **Int. Cl.** **C09j 9/00,** B32b 31/00

[58] **Field of Search** ..... 156/383, 583, 220, 306, 156/581; 100/93 P, 295, 296, 211

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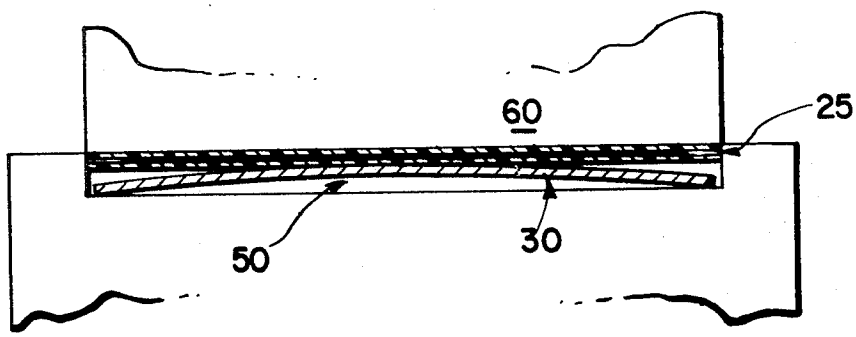
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[57] **ABSTRACT**

Novel laminating system or means especially useful for heat laminating I. D. cards and/or I. D. credit cards. Essential elements of the novel laminating system presented include an I. D. card or I. D. credit card laminar assembly and pressure distribution means arranged in combination with the assembly to distribute the pressure applied to the assembly so that intially the pressure is selectively applied to a median portion of the assembly. As further pressure is applied, the area of the assembly to which pressure is applied is progressively increased until pressure is uniformly applied to all portions of the laminar assembly.

8 Claims, 6 Drawing Figures



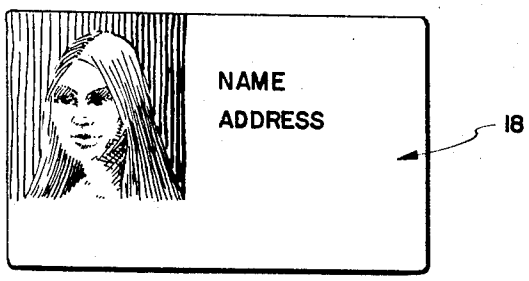


FIG. 1

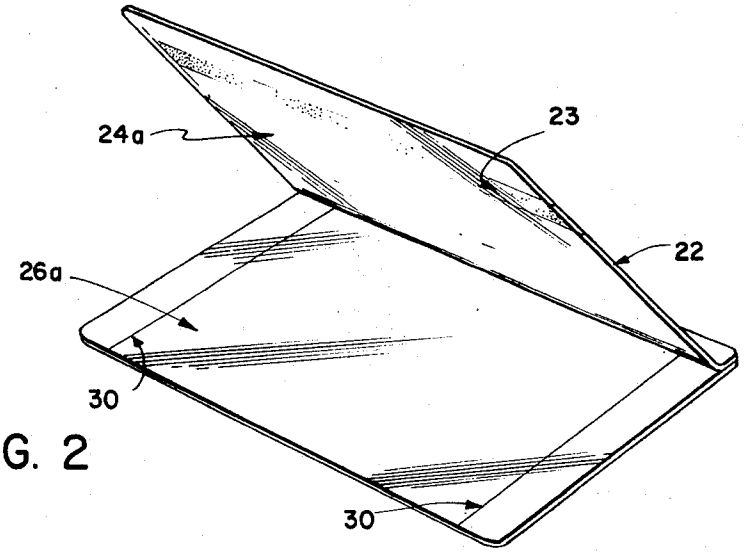


FIG. 2

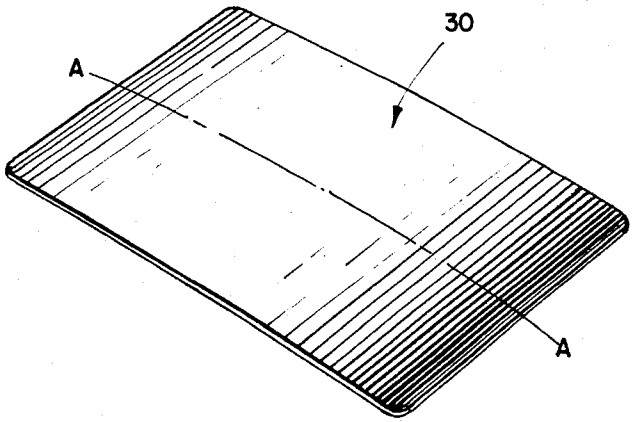


FIG. 3

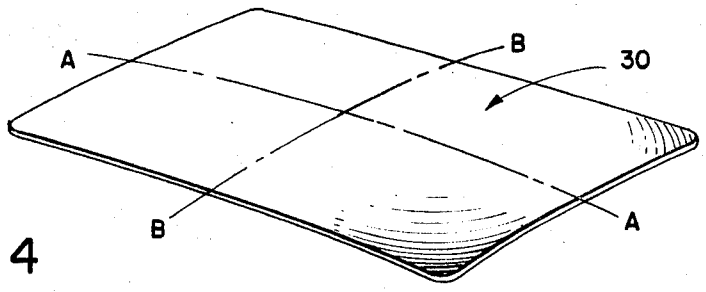


FIG. 4

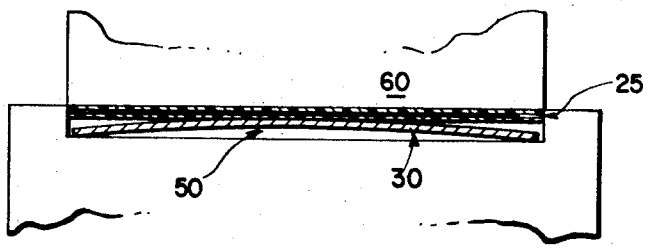


FIG. 5

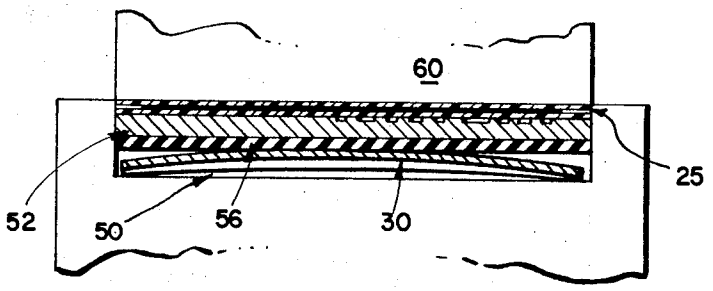


FIG. 6

NOVEL LAMINATING SYSTEM

BACKGROUND OF THE INVENTION

1. The Field of the Invention

This invention relates to laminating means. More precisely, the invention disclosed herein relates to laminating means especially useful in the lamination of I.D. cards and/or I.D. credit cards.

2. Description of the Prior Art

I.D. cards including I.D. credit cards are known products of commerce and their desired performance characteristics are well defined. In addition to being durable under conditions of handling as well as compact, such cards must also contain relevant information pertaining to the bearer and issuer and oftentimes additional indicia for recording any transactions conducted with the card all integrated in a secure fashion so as to discourage tampering or alteration.

The fabrication of I.D. cards or I.D. credit cards usually involves the lamination of a laminar assembly which generally includes as essential elements or components thereof, an information-bearing medium interposed between two layers at least one of which is transparent so that the information can be viewed therethrough. Lamination of the elements or components of such assemblies is oftentimes effected by the use of adhesives which are activated when heat and pressure are applied to the elements of the assembly. Also, in the usual practice of the prior art, the elements of the assembly can move laterally as heat and pressure are applied thereto.

As those in the art know, lamination operations of conventional I.D. cards and I.D. credit cards usually employ pressures in the order of 300 psi or higher and temperatures in the order of 250° F. or somewhat higher. Essentially, such high pressures are required in order to provide a high quality laminated product essentially free of bubbles which are inherently generated in such lamination operations because of the entrapment of air or because of the application of heat to the elements and/or the adhesive system of the assembly. The lamination means presented in accordance with the practice of the present invention provides high quality I.D. cards and/or I.D. credit cards and permits the lamination operation involved in preparing such cards to be conducted at pressures which are markedly lower than those heretofore employed.

The essential object of the present invention therefore is to provide a novel laminating system or means which can provide high quality I.D. or I.D. credit cards substantially free of bubbles and this accomplishment can be obtained by employing pressures markedly lower than those heretofore employed in such lamination operations. Accordingly, the lamination system of the present invention can be advantageously employed to prepare diverse I.D. and/or I.D. credit cards including conventional I.D. or I.D. credit cards as well as such cards having distinctive capabilities including, for example, the capability for recording transactions and/or a magnetic encoding capability.

SUMMARY OF THE INVENTION

The novel laminating system of the present invention comprise two essential elements; a heat activatable laminar assembly and pressure distribution means arranged in combination with the assembly to distribute the pressure applied to the assembly so that initially the pressure is applied to a median portion of the assembly. As further pressure is applied, the area of the assembly to which pressure is applied is progressively increased until pressure is substantially uniformly applied to all portions of the laminar assembly. The essence of the present invention resides in the discovery that the bubbles which are inherent in pressure lamination operations involved in the production of I.D. cards or I.D. credit cards can be effectively eliminated by selectively applying pressure initially to a median portion of a pressure laminar assembly and thereafter progressively increasing the area to which pressure is applied. Moreover, in accordance with the practice of the present invention the inherent problem of bubbles can be eliminated by employing pressures markedly lower than those heretofore employed.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is an illustration of an information bearing medium employed in the practice of the present invention.

FIG. 2 is a perspective view of a protective envelope employed in the practice of the present invention.

FIG. 3 is a perspective view of an illustrative pressure distribution means employed in the practice of the present invention.

FIG. 4 is a perspective view of an especially preferred pressure distribution means employed in the practice of the present invention.

FIG. 5 is a cross sectional view of an arrangement of essential elements of the laminating system of the present invention.

FIG. 6 is a cross sectional view of another arrangement of elements of a preferred laminating system of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A typical information-bearing medium **18** useful in the preparation of identification cards and/or I.D. credit cards of the present invention is shown in FIG. **1**. Traditionally, such media include a photograph of the intended bearer and any other desired descriptive information pertaining to the bearer.

One particularly useful and especially preferred system for preparing card **18** utilizes the principles of photography known as diffusion transfer. In such photographic systems either a black-and-white or a color print may be obtained, depending upon the particular photographic procedures employed.

Black-and-white images may be obtained in accordance with the silver transfer procedures described and claimed, for example, in U.S. Pat. Nos. 2,543,181 and 2,647,056 issued to Edwin H. Land. As is described and claimed in these patents, an exposed light-sensitive silver halide emulsion containing a developable image is developed with an aqueous alkaline processing composition including a silver halide developing agent and a silver halide solvent; as a function of development an imagewise distribution of a soluble silver complex is formed in terms of unexposed areas of the emulsion; and this imagewise distribution is then transferred, at least in part, by imbibition, to a superposed silver receptive stratum where it is reduced to impart thereto a positive silver transfer image.

Color transfer images may be obtained in accordance with the procedures described and claimed, for example, in U.S. Pat. No 2,983,606, issued to Howard G.

Rogers. As is disclosed in this patent a photosensitive element including one or more light-sensitive silver halide emulsions each having associated therewith a dye developer (a dye which is also a silver halide developing agent), is exposed and developed with an aqueous alkaline processing composition; as a function of development an imagewise distribution of diffusable dye is formed; and this imagewise distribution is then transferred at least in part by imbibition to a superposed dyeable stratum to impart thereto a positive dye transfer image.

In a particularly suitable system for preparing card **18** utilizing one of the aforementioned diffusion transfer processes, a data card containing the desired descriptive information and a copy of the partial pattern of the predetermined validation pattern are integrated with the camera so that the subject and the descriptive matter pertaining to him as well as the partial pattern are all simultaneously photographed to provide a single developable image which is thereafter processed to provide a transfer print comprising a suitable support having thereon an image-bearing layer containing an image of the subject at one portion thereof and the descriptive matter and partial pattern at another portion thereof, e.g., a photographic print such as is shown in FIG. **1.** The aforementioned procedure for preparing the photograph may be accomplished most expeditiously with Polaroid ID-2 or Polaroid ID-3 Land Identification Systems.

Medium **18** of FIG. **1** is normally protected by interposing medium **18** between protective sheet materials at least one of which is transparent to provide the final identification card or I.D. credit card. An especially preferred arrangement of such protective sheet materials is shown in FIG. **2.**

FIG. **2** illustrates a protective envelope generally designated as **22** which is especially preferred in the practice of the present invention. As shown therein, envelope **22** comprises a transparent front wall member **24***a* and a rear wall member **26***a*—which may or may not be transparent —sealed along one edge **28***a*. At least one of the inner surfaces of front wall member **24***a* and/or the inner surface of rear wall member **26***a* are provided with an adherent capability. In some instances, the polymeric protective sheet materials can provide the adherent capability; in other instances, a heat activatable adhesive can be employed.

As examples of suitable heat activatable adhesives contemplated for use, mention may be made of ethylene-acrylic acid and ethylene-ethyl acrylate copolymers wherein the percent acrylic acid or ethylene-ethyl acrylate in the respective polymers is preferably from about 5 to about 20 percent. The melt index of contemplated ethylene-acrylic acid or ethylene-ethyl acrylate copolymers as measured in accordance with the procedure ASTMD 1238 can preferably range between about 5 to about 300. As mentioned, mixtures of the above copolymers can be employed and the ratio of either of the copolymers to the other can vary over a rather wide range; for example, between 1:10 or lower to 10:1 or higher. The copolymer and/or mixture thereof is normally extruded in the form of a layer or film on the surface of a plastomeric sheet material such as a polyester sheet material and usually a urethane or polyester adhesive is employed to bond the layer or film to the surface of the sheet material.

Products having the above described copolymers in the form of a layer of film bonded to the surface of a polyester sheet material are commercially available. For example, a product designated as Laminating Film **14A** and supplied by General Binding Corporation comprises a layer of an ethylene-ethyl acrylate copolymer bonded to the surface of a polyester sheet. Envelopes of the type shown in FIG. **2** may be prepared by superposing two sheets of the desired dimensions and coupling the sheets together by heat sealing along one edge of the superposed sheets.

An especially preferred envelope for preparation of I.D. cards comprises a layer of the above-mentioned heat activatable adhesives coated on the inner surfaces of **24***a* and **26***a* and an overcoat of a layer of a hydroxylated polymer on the adhesive layer of the surface of **24***a*. Preferred hydroxylated polymers include polyvinyl alcohol and copolymers thereof as well as mixtures of polyvinyl alcohol with polyvinyl pyridines especially poly-**4**-vinyl pyridine. Details relating to envelopes of this type are described in copending, commonly assigned U.S. Pat. application Ser. No. 148,768 filed by Michael E. Gordon on June 1, 1971. In such blanks, the adhesive coating on each surface of **24***a* and **26***a* is about 0.006 inch thick.

An especially preferred envelope for the preparation of I.D. credit cards involves a protective envelope such as **22** wherein front wall member **24***a* comprises a transparent overlay having an outer (topmost) side thereof a magnetic stripe **23** and a rear wall member **26***a* which comprises an opaque, embossable plastomeric sheet material.

In such envelopes, transparent front wall member **24***a* may comprise any of the known transparent materials, e.g., transparent plastics such as polyethylene terephthalate, vinyl resins such as copolymers of vinyl acetate and vinyl chloride, cellulose esters such as cellulose acetate, cellulose triacetate, cellulose butyrate, etc. It may, for example, comprise a vinyl chloride/vinyl acetate copolymer on the order of about 12 mils thick. In such an envelope a magnetic stripe **23** is usually provided which may, for example, be on the order of a quarter inch in width applied to one surface of wall member **24***a* by any of the known techniques. Stripe **23** may be provided for application in the form of a tape on the order of 2 mils thick comprising a polyvinyl chloride based ferric oxide which may then be applied with the aid of a solvent such as a ketone, an adhesive, by hot stamping, etc., to provide member **24***a* containing on one surface thereof the magnetic stripe **23.** The opposed surface of member **24***a* may be coated with a heat-activated adhesive, e.g., an acrylic, polyester or heat-activated adhesive, for lamination of the overlay to the underlying sheet material which as mentioned is medium **18.** Especially suitable heat activatable adhesives are mixtures of polyacrylonitrile and vinyl acetate vinyl chloride copolymers.

Rear wall member **26***a* of such I.D. card protective envelopes may comprise a suitable plastic material and is preferably pigmented. It may, for example, comprise a vinyl chloride/vinyl acetate copolymer on the order of about 9 mils thick including a suitable white pigment such as titanium dioxide for aesthetic purposes. Further, it may comprise a frame (not shown) adhered to member **26***a* to provide an opening slightly larger than medium **18** and is of at least the thickness of medium

18 so as to accommodate and provide a frame in which medium 18 is seated on member 26*a*.

Sheet member 26*a* preferably comprises a heatflowable material capable of forming the embossed indicia. It may, for example, comprise any of the known thermoplastic or thermosetting polymeric materials which, upon applying heat and pressure, will permit an embossing step to be performed. It may, for example, comprise a vinyl chloride/vinyl acetate copolymer on the order of about 10 mils thick which is pigmented to provide the desired background for the indicia. This indicia may be prepared by any of the known techniques such as silk screening, lithography, offset or other such printing techniques which are well known in the art.

In heat lamination procedures heretofore practiced in the art, medium 18 is inserted between front sheet member 24*a* and rear wall member 26*a* of protective envelope 22 to provide the laminar assembly. Registry means such as scribe marks 30 or a frame (not shown) are oftentimes included in such protective envelopes 22. The laminar assembly is then placed in the well of a platen press or the like for heat lamination in manners well known to the art.

However, in the lamination system of the present invention, a curved deformable plate is also included in the well of the platen press. The curved deformable plate of the present invention is so shaped and so arranged in combination with the laminar assembly to distribute the pressure applied to the plate so that initially the pressure is applied to a preselected portion of the assembly. As further pressure is applied, the area of the assembly to which pressure is applied is progressively increased until pressure is uniformly applied to all portions of the laminar assembly.

A curved, resiliently deformable plate suitable in the practice of the present invention is shown in FIGS. 3 and 4 and designated as 30. Preferably, curved deformable plate 30 is fabricated of sheet metal thin enough to be flattened out by the laminating pressures involved. Also the preferred peripheral dimensions and shape of plate 30 on flattening should closely correspond to those of the peripheral dimensions and shape of the laminar assembly.

As shown in FIG. 3, plate 30 is arcuate, e.g., curved or bowed along one axis A—A and this curve can be formed in the plate by conventional forming methods known to the art. The curve or bow is preferably moderate, e.g., in the order of 0.050 inch or less along the center of the sheet material. In any event, the essential function of the curve is to distribute the pressure applied to the laminar assembly in the distinctive manner described before.

As mentioned, the lamination operation inherently generates bubbles which must be eliminated or at least minimized if the appearance of the finished I.D. card or I.D. credit card is to conform to the desired predetermined criterion. In lamination procedures heretofore employed, these bubbles were eliminated or minimized by applying extremely high pressures to the laminar assembly during lamination. However, in the practice of the present invention, such high pressures are not required. Instead, the curved deformable plate apparently eliminates bubbles by providing a squeegee action which forces or sweeps any bubbles from the assembly which may be generated during the lamination operation. This squeegee action apparently operates to sweep the bubbles from the median portion of the assembly progressively toward the peripheral regions thereof where the bubbles are eliminated from the assembly. Quite surprisingly this squeegee action can be obtained even though the pressures employed are markedly lower than those heretofore conventionally employed in the heat lamination art.

FIG. 4 illustrates an especially preferred curved, deformable plate 30. As shown, plate 30 of FIG. 4 is arcuate, e.g., bowed along both the longitudinal axis A—A and the latitudinal axis B—B to provide a "dome" or bow at the median portion of plate 30. As an illustration, plate 30 of FIG. 4 can be fabricated by passing a sheet of spring steel 2 ⅛ × 3 ⅜ × 0.222 inches thick through a standard sheet metal roller having the radius of the rollers adjusted to provide a curve or bow of 0.032 inch along the center of the sheet material. After the desired bow or curve has been formed along one axis, the sheet material is passed through the roller along the other axis to obtain a sheet or plate having a spherical bow of 0.032 inch at the center of the plate or sheet.

In lieu of a single plate as shown in FIG. 4, two single plates as in FIG. 3 can also be suitably employed. In such an instance, however, one plate is curved along its longitudinal axis while the other is curved along its latitudinal axis. In operation the plates are placed in superposition to thereby provide the equivalent function of the one plate shown in FIG. 4.

FIG. 5 illustrates a laminating system for the production of an I.D. card. The essential elements of the system are an I.D. card laminar assembly 25, curved deformable plate 30 and means to compress the assembly and plate together under conditions of heat and pressure to effect lamination of the assembly. As mentioned, an I.D. card laminar assembly 25 comprises a protective envelope 22 and medium 18 interposed between transparent front and rear wall members 24*a* and 26*a* with preferably both members being provided with a heat activatable adhesive. Illustrative peripheral dimensions of the laminar assembly are 2 ⅛ × 3 ⅜ × 0.031 inches and the thickness includes the combined thickness of medium 18 and wall members 24*a* and 26*a*. A curved deformable plate of the type described in FIG. 4 is the preferred pressure distribution means employed in the practice of the present invention and as mentioned, when such a plate is completely flattened out the peripheral dimensions thereof preferably very closely conform to the peripheral dimensions of I.D. card laminar assembly 25.

Details relating to platen presses or like laminating devises need not be discussed here since such devises and manners of operating same are well known to those skilled in the art. As shown in FIG. 5 the laminar assembly 25 and plate 30 are placed in the well 50 of such a press and pressure and heat are supplied by means generally designated as 60. In accordance with the practice of the prior art, heat lamination of an I.D. card assembly as described would require the application of temperatures in the order of about 250° F. to about 360° F. and pressures in the order of about 300 psi to about 350 psi. However, in accordance with the practice of the present invention, high quality heat laminated I.D. cards essentially free of bubbles can be obtained by employing temperatures in the order of about 250° F. to about 360° F. and reduced pressures in the order of about 70 psi to about 100 psi.

FIG. 6 illustrates an especially preferred laminating system of the present invention which provides special advantages in the preparation of I.D. credit cards having embossed indicia as well as a magnetic encoding capability. Essential elements of the laminating system of FIG. 6 comprise an I.D. credit card, protective envelope **22,** embossing mold **52** which can be either a male or female embossing mold but a female mold is shown, —a resilient pad **56** which is preferably employed when an embossing mold is included or involved in the laminating system and curved deformable plate **30** of the type shown in FIG. **4.**

I.D. credit card protective envelope **22** comprises transparent front wall member **24***a* and rear wall member **26***a* which preferably comprises an opaque, embossable, e.g., a heat flowable material and as mentioned it may or may not provide a border for accommodating medium **18.** In the preferred practice of the present invention, front wall member **24***a* also includes a magnetic stripe **23** and special advantages are obtained when the present invention is employed in the heat lamination of I.D. credit cards having a magnetic encoding capability.

In the practice of the invention illustrated in FIG. **6,** medium **18** along with the embossing mold **52** are first prepared. It will, of course, be appreciated that where the information to be embossed is available in advance, for convenience and speed in mass production, the mold may be prepared prior to the time when the prospective bearer presents himself to be photographed. The mold may, for example, comprise an embossable material of substantially the same shape and dimensions of the card, the embossing being provided in conventional stamping apparatus to provide the necessary relief in the form of a male or female mold into which the plastic material of rear wall member **26***a* may be compressed or flow upon application of heat and pressure to form the corresponding embossed indicia on the card. By way of illustration, the mold may comprise a 5 mil. aluminum foil adhered to a 26 mil. cardboard base.

Following preparation of medium **18** and mold **52,** medium **18** is inserted between front and rear wall members of envelope **22.** Curved deformable plate **30** is then placed in the well of a platen press or the like. The well preferably is of substantially the same shape and dimension of the periphery of envelope **22** so as to prevent any lateral movement of the assembly during lamination. Also the well should be at least as thick as the combined thickness of each element of the laminating assembly placed therein. Preferably a resilient sheet material **56** having substantially the same peripheral shape and dimensions as envelope **22** is positioned on top of plate **30.** Resilient sheet material **56** can be fabricated of natural or synthetic elastomeric materials and preferably is at least as thick as the embossed indicia on mold **52** which is positioned in the well between resilient sheet **56** and rear wall member **26***a* of laminar assembly **22.** Pressure is then applied to the elements of the laminating system and as can be seen, plate **30** distributes the applied pressure so that initially pressure is applied to the median portion of assembly **22.** Thereafter as pressure is continually applied, causing plate **30** to flatten, the area of the assembly to which pressure is applied is progressively increased until pressure is uniformly applied to all portions of the assembly.

In the lamination system of FIG. **6** effective lamination and embossing can be obtained by applying conditions of temperature and pressure in the order of about 300° F. to about 340° F. and about 70 psi to about 100 psi to the assembly. Without the use of plate **30,** the conditions temperature would remain substantially the same but pressures in the order of about 300 psi to about 350 psi would be required to provide a high quality I.D. credit card free of bubbles.

The ability to obtain high quality I.D. or I.D. credit cards at reduced pressures is an important contribution to the art especially, for example, when the cards have a magnetic encoding capability. As those skilled in the art know a magnetic encoding capability usually takes the form of a magnetic stripe, e.g., **23** which may be applied to a surface of the protective envelope. The stripe may be provided for application in the form of a tape on the order of about 1 to 2 mils thick comprising a polyvinyl chloride based ferric oxide which may then be applied to the desired surface with the aid of a solvent such as a ketone, an adhesive or by hot stamping, etc. Normally, the magnetic capability is integrated with the desired surface after heat lamination in order to avoid disfiguration or "mud cracking" of the magnetic material. Such disfiguration or "mud cracking" is considered to be caused in part by the lateral flow caused by the extreme pressures heretofore employed in heat lamination operations. The lateral flow apparently causes disruption and distortion of the matrix material and/or the magnetic material thereby adversely affecting the performance characteristics of the magnetic encoding capability. In the practice of the present invention, however, laminar assemblies comprising protective envelopes having a magnetic encoding capability can be heat laminated and simultaneously embossed under conditions which do not affect the desired performance of this preinstalled capability.

Accordingly, it will be seen that the present invention provides an improved, rapid and efficient laminating system adopted for mass production of I.D. cards and/or I.D. credit cards which are uniformly of excellent quality and function, as well as being aesthetically pleasing.

Since certain changes may be made in the above system without departing from the spirit and scope of the invention involved, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In a system for the heat lamination of I.D. cards or I.D. credit cards including means to restrain a laminar assembly during heat lamination thereof and wherein said laminar assembly comprises an information storage medium interposed between protective sheet materials at least one of which provides means for viewing said information and wherein at least one of said sheet materials has an adherent capability integrated therewith and wherein said system includes means for applying sufficient heat and pressure to laminate said assembly, the improvement wherein pressure distribution means which comprises a deformable element which is arcute along both the longitudinal and latitudinal axis are arranged in relation with said laminar assembly to distribute pressure applied to said assembly as said assembly is heated so that initially said pressure is applied to a preselected portion of the assembly and as further pressure is applied, the area of the assembly to which

pressure is applied is progressively increased until pressure is applied substantially uniformly to all portions of said assembly.

2. A system of claim **1** wherein said laminar assembly comprises a transparent plastomeric sheet material coupled together along one edge thereof to another plastomeric sheet material.

3. A system of claim **1** wherein said laminar assembly comprises a transparent sheet material coupled together along one edge thereof to an opaque plastomeric sheet material.

4. A system of claim **1** wherein said laminar assembly comprises a transparent sheet material and an embossable plastomeric sheet material and said system includes means for embossing said embossable plastomeric sheet material.

5. A system of claim **1** wherein said laminar assembly comprises a transparent sheet material coupled together along one edge thereof to an opaque, embossable plastomeric sheet material and said system includes means for embossing said embossable, plastomeric sheet material.

6. A system of claim **1** wherein said laminar assembly has a magnetic encoding capability integrated therewith.

7. A system of claim **1** wherein said laminar assembly comprises a transparent sheet material having a magnetic stripe.

8. A system of claim **6** wherein said embossing means is a female embossing mold.

* * * * *