Sept. 28, 1954 J. F. LANGAN 2,690,021

FILM RECORD CARD AND METHOD AND APPARATUS FOR ITS PRODUCTION

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FIG. 1

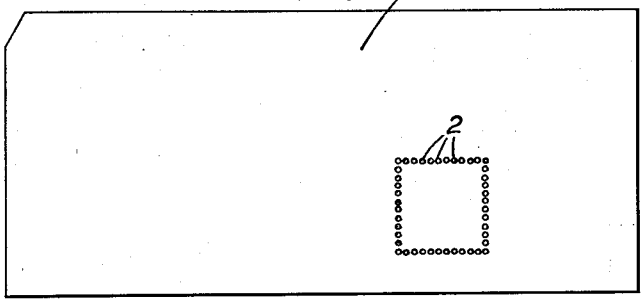


FIG. 2

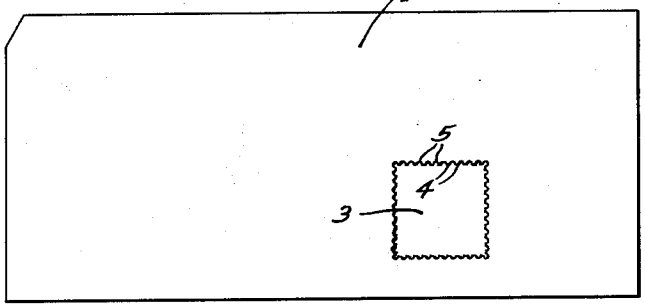


FIG. 3

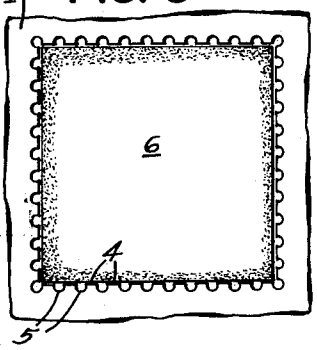


FIG. 4

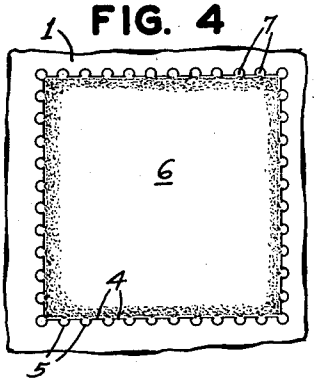


FIG. 5

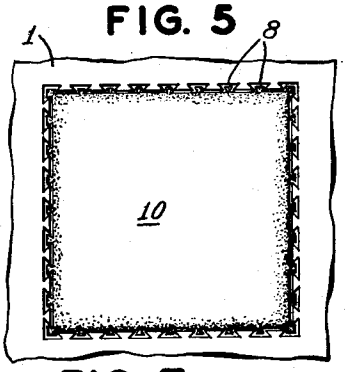


FIG. 6

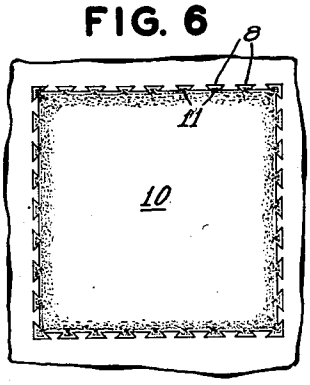


FIG. 7

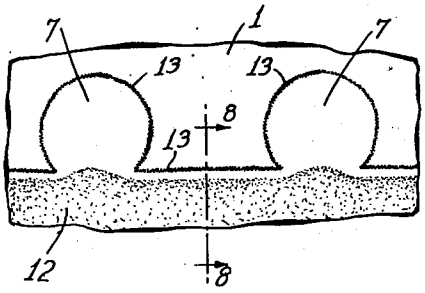


FIG. 8



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FIG. 9

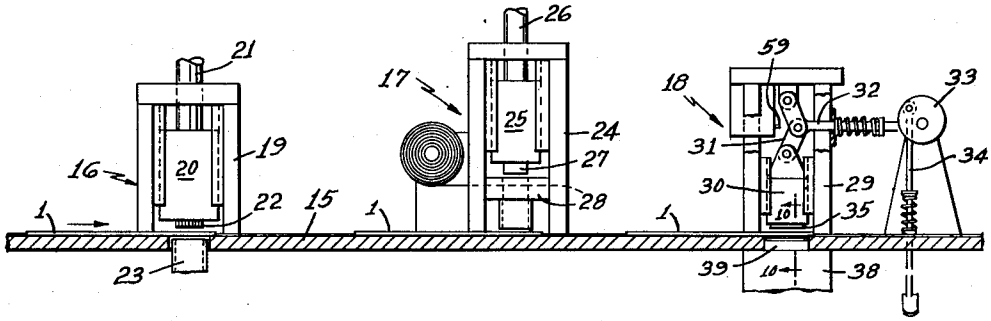


FIG. 11

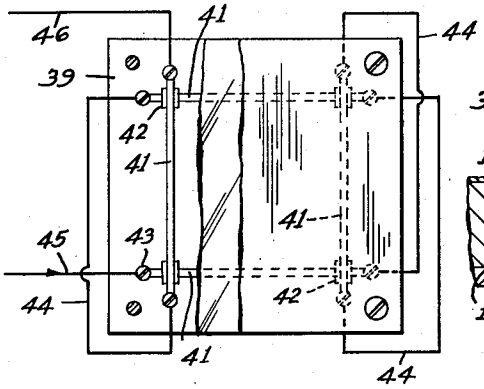


FIG. 10

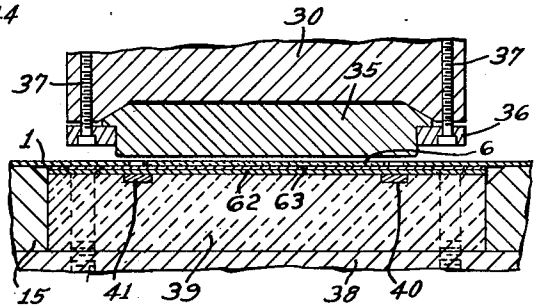
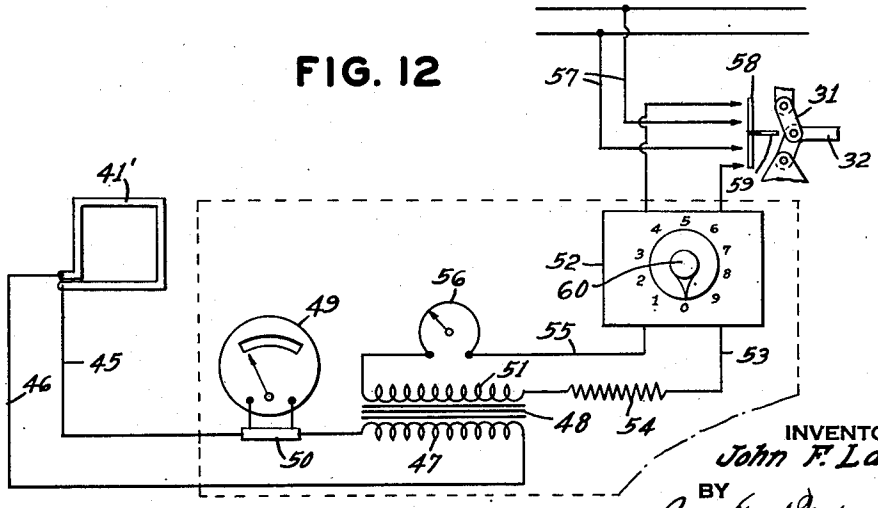


FIG. 12



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UNITED STATES PATENT OFFICE

2,690,021

FILM RECORD CARD AND METHOD AND APPARATUS FOR ITS PRODUCTION

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Application August 17, 1949, Serial No. 110,692

16 Claims. (Cl. 40—158)

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This invention relates to improvements in record cards and their production, and includes record cards having openings for the mounting of microfilms or the like therein, record cards having microfilms or the like mounted in openings therein, an improved method for mounting microfilms and the like in such cards, and an improved apparatus for carrying out the process and for producing the finished cards with the films mounted therein.

The new record cards, prior to the mounting of the microfilm or the like therein, have one or more openings of a size adapted to receive the film section to be mounted therein, with the edges of said openings recessed or undercut to provide an interlocking union with the film when mounted therein.

The new record cards with the film sections mounted therein have one or more openings with recessed or undercut edges, and with the edges of the film extending into the undercut edges of the opening, being forced under high pressure therein in a molten state and cooled under pressure to give an interlocking unit between the edge of the film and the edge of the opening.

The improved process of mounting the film sections in the openings in the cards involves heating the edge of the film under a high pressure for a short time to fuse the film and force it into intimate union with the undercut edge of the card while under pressure, followed by cooling under pressure. The process requires a high pressure and a melting temperature for a very short time, followed immediately by cooling while still under pressure.

The improved apparatus of the invention, for carrying out the proces, and mounting the film sections in the cards, includes a device for heating the film at its edges only to a high temperature for a very short time while under heavy pressure to fuse the edge of the film and force it into the undercut edge of the card and to cool the fused edge while still under heavy pressure.

The new record cards of the present invention are intended for use in card record systems, such as indexing, cataloging and classification systems where it is desired to provide a film library or large number of cards with sections of microfilm or the like mounted therein. The new record cards are particularly advantageous for use in film libraries and the like with classification cards having one or more openings therein and film sections mounted in said openings and which are punched or perforated for classification purposes and to permit them to be handled in punched-card classification and sorting systems.

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The cards used and which are provided with the openings with recessed or undercut edges are single ply cards of a thickness somewhat greater than that of the film to be mounted therein. The usual film thickness is around 0.0055'' and the single ply cards having the recessed or undercut edges may have a thickness, for example, around 0.0067'' or 0.0070'' or 0.0075''. The cards used for classification purposes have portions around the edges or on other portions of the card than those at which the film section or sections are located which are punched for classification purposes and enable the cards to be sorted much as ordinary punched cards are sorted in classification devices and machines.

Record cards have heretofore been made with film sections mounted in openings therein and secured to the card by a thin transparent adhesive sheet overlapping the marginal edge of the film and the adjacent marginal edge of the card. This method of mounting the film sections in the cards is entirely satisfactory but requires somewhat expensive and elaborate machinery for applying the adhesive sheets to the card. And when the cards are prepared prior to the mounting of the film sections therein, they require a protective cover for the projecting marginal edge of the adhesive, and the removal of this protective cover sheet prior to the insertion of the film in the opening against the adhesive material. The present invention makes unnecessary the use of separately applied thin adhesive sheets for holding the film section in the card open.

According to the present invention, one or more openings are made in the card with recessed or undercut edges, a film section, which may have complementary recessed or undercut edges, is placed in the opening, the edge of the film is heated rapidly and for a short period of time to melt it while it is held under a heavy pressure, and the molten edge of the film is forced into the undercut or recessed edge of the card, after which the cooling of the film while still under high pressure gives an integral interlocking union of the edge of the film with the undercut edge of the card.

The punching of the card to form one or more openings therein with recessed or undercut edges may be carried out in the same machine in which the film section is subsequently inserted

in the opening and fastened in place therein by the fusing operation; or the cards may be previously punched by a separate machine and supplied to the mounting machine with the openings already formed therein ready for receiving the film sections. The film sections may be sections of microfilm or of motion picture film or other film sections which are punched or cut to a size corresponding to the size of the openings in the cards in which the films are to be mounted. These film sections may have straight edges, but advantageously have undercut or recessed edges, complementary to the edges of the opening.

The apparatus for uniting the edges of the film with the adjacent undercut edges of the cards includes special heating means for heating the film sections only at their edges and for a short period of time, together with pressing means for applying heavy pressure to the marginal edges of the film while being so heated and subsequently cooled and to the adjacent undercut edges of the cards. The heating is advantageously effected by electrical heating means with the use of low voltage and high amperage and with controlled timing of the heating to effect almost instantaneous melting of the edge of the film. If insufficient heat is applied, the edge of the film is not sufficiently softened or melted to permit it to flow freely into the undercut edge of the card while if too much heat is applied at too high a temperature, there is danger of burning.

The presses used for pressing the marginal edge of the film and the adjacent undercut edge of the card have special surfaces to which the molten film will not adhere. The surface through which the heat is applied is advantageously made of stainless steel, which will rapidly dissipate the heat and cool the marginal edge of the film after the edge has been fused and forced into the undercut edge of the card.

The invention will be further described in connection with the accompanying drawings, which illustrate in a somewhat conventional and diagrammatic manner the new cards and their method of production and the apparatus which is advantageously used in their production; but it will be understood that the invention is illustrated thereby but is not limited thereto.

In the accompanying drawings,

Fig. 1 shows one form of classification card in a preliminary stage of manufacture with a series of holes punched therein prior to cutting out the opening therein;

Fig. 2 is a view of the card of Fig. 1 after the opening has been punched and before the film is inserted;

Fig. 3 is an enlarged view of part of the card of Fig. 2, with the film inserted in the opening but before the film is secured therein;

Fig. 4 is a similar view of the card, with the film section secured to the adjacent undercut edge of the opening in the card;

Fig. 5 shows part of a card with a somewhat modified form of undercut edge of the opening in the card, and with a film having a complementary undercut edge inserted in the opening but before the film is secured therein;

Fig. 6 shows the card of Fig. 5, with the film mounted and secured in place therein;

Fig. 7 is an enlarged detail view of a portion of the undercut edge of the card of Fig. 4, showing the edge of the film as it appears in the finished card;

Fig. 8 is an enlarged section on the line 8—8 of Fig. 7, illustrating the intimate contact of the roughened edge of the card interlocking with the edge of the film;

Fig. 9 is a somewhat conventional and diagrammatic arrangement of apparatus for punching the openings in the card, mounting the film sections therein and securing the film sections in place;

Fig. 10 is an enlarged sectional view showing the pressing and heating elements of Fig. 9;

Fig. 11 shows the details of one form of heating element for heating the marginal edges of the film; and

Fig. 12 shows one form of electrical connections for regulating the time and temperature of heating of the heating elements.

The card 1 of Fig. 1 is a standard single ply classification card with a thickness of about 0.0067" made of heavily pressed paper, such as commonly used in mechanical classifying and sorting systems where the cards are punched for classification and sorting. This card has a series of small holes 2 therein, such that when the opening 3 is punched in the card, as shown in Fig. 2, the greater portions of the holes will be left to form undercut or recessed portions 5 extending outwardly from the edge 4. The size of the opening is such that when the film 6 is inserted in the opening, as shown in Fig. 3, and the marginal edge of the film is heated under pressure, the edge of the film will be forced in the recesses 5, as indicated at 7 in Fig. 4.

Fig. 5 shows a modified form of undercut edge of the opening formed in the card in the form of undercut recesses 8 around the opening 9, and with a film having a complementary undercut edge therein, prior to being secured to the cards; and Fig. 6 shows the film secured in place, with the undercut film edge forced against the complementary undercut edge of the card, as indicated at 11 in Fig. 6.

The fusing of the marginal edge of the film and the forcing of the molten film into the undercut recesses are shown on a somewhat enlarged scale in Figs. 7 and 8. The emulsion layer 12 on the film is not forced into the recesses to any extent, but the molten film, when the edge does not have complementary recessed edges, is forced into the recesses and against the rough fibrous edge of the card to form an intimate interlocking union therewith, as indicated at 13 in Fig. 8. When the card opening and film section have complementary interlocking undercut edges, the edges of the molten film will be forced against the edges of the card to give a similar interlocking union. Both the marginal edge of the card and the marginal edge of the film are held under heavy pressure while the film is melted and cooled, with the result that an intimate interlocking union is obtained between the edge of the film and the undercut edge of the card.

In the apparatus illustrated conventionally in Fig. 9, a common plate or table 15 is provided on which are located three successive stations, the station 16 being the station for punching the openings in the card, the station 17 for cutting out the film and inserting the film section in the opening in the card, and the station 18 being the film sealing station. The punching station includes a punch frame 19 having a sliding member 20 with an operating rod 21 and carrying a punch die 22 which cooperates with a female punch die 23 in punching out the opening in the card. The station 17 for cutting the film sections and mounting them in the cards includes

a frame 24 for the film punch, a sliding frame 25 therein operated by the rod 26 and having a punch die carried thereby cooperating with the female die 28 for punching out a section of the film, which may have straight edges or complementary recessed or undercut edges, of suitable size to fit the opening in the card, and for depositing this film section in the card opening.

The film sealing station 18 includes a frame 29, a slide 30 mounted therein, operated by toggle arms 31 which in turn are operated by the operating rod 32, this rod being actuated by the cam 33 and its operating arm 34. The bottom of the slide 30 carries a top press member or head 35 held in place by the ring 36 and the bolts 37. This press head is advantageously made of heat resisting plastic, to which the molten film does not stick, such as polytetrafluoroethylene, sold under the trade named "Teflon." This plastic material is somewhat elastic and forms a desirable upper member for the press for pressing the film and card during the sealing operation.

The bottom press member has a support 38 carrying the member 39, which is of insulating material and extends up through an opening in the plate 15. A recess 40 in this member has the heating element 41 mounted therein. Above the heating element and the member 39 is a thin insulating layer of mica 62 and above this is a thin stainless steel plate 63. The card and film section are located between the upper press head 35 and the stainless steel plate 63, so that when the card and film section are pressed under heavy pressure and heat is applied through the heating element 41, the marginal edge of the film will be melted and forced into the undercut edge of the card by the melting of the film and the heavy pressure applied. The heat from the heating elements will pass up through the stainless steel plate 63 at the marginal edge of the film. And when the heat is turned off, after the marginal edge has been melted and forced into the undercut edge of the card, the stainless steel plate will rapidly dissipate the heat, and cool and solidify and set the film while still under heavy pressure, thus completing the union of the film and card.

The heating element shown in Fig. 11 has four thin metal resistance heating elements 41 with thin insulation 42 between them where they overlap, and are secured to the member 39 by screws 43. These elements are connected by wires 44 and to a source of low voltage and high amperage current through connections 45 and 46, which lead to the secondary 47 of the transformer 48. The line 45 has an ammeter 49 therein and a shunt 50 e. g. of 10 amperes.

The primary 51 of the transformer 48 is connected to a mechanical timing device 52 through connection 53 having a fixed resistance 54 therein and connection 55 having the rheostat 56 therein. Current is supplied to the mechanical timing device from the current supply 57 having a switch 58 which is closed by engagement of the operating arm 59 with the toggle mechanism 31. The arrangement is such that when the toggle mechanism is actuated and heavy pressure is applied to the card and film, the switch 58 is closed and current applied through the mechanical timing device to the heating element.

The mechanical timing device is adjustable to vary the time of heating and the time may be as little as a second or less.

With a twenty volt transformer and the current to the primary regulated by the fixed resistance and the rheostat, a current of e. g. 18 amperes may be used in the heating element. And with the heating element I have used, I have found a time of about 0.7 second sufficient to heat the element to incandescence to obtain flash fusing of the marginal edge of the film which, under the heavy pressure applied by the press, forced the molten film into the undercut edge of the card. Turning off of the heating element by the mechanical timer resulted in dissipation of the heat by the stainless steel plate in contact with the film and the molten film margin was rapidly cooled and set while the pressure was still maintained.

While the heavy pressure is being applied, both the marginal edge of the card around the opening and the marginal edge of the film are subjected to the heavy pressure, the marginal edge of the card is somewhat compressed, and the marginal edge of the film is forced into the compressed undercut edge of the card.

The securing of a film section to an undercut marginal edge of the card opening in the manner above described gives a union of the film and card which holds the film section firmly in place without the use of added adhesive. The rapid and almost instantaneous heating of the marginal edge of the film does not objectionably distort the main portion of the film or interfere with its subsequent projection.

While only a single opening has been shown in the drawing, it will be evident that two or more similar openings can be made in the same card and film sections similarly secured in place therein.

In the apparatus above illustrated and described, the operating means for operating the punch, for cutting and inserting the firm, and for pressing and sealing devices, has not been shown. These can be operated simultaneously on successive cards which are fed continuously from one station to the next and a large number of cards can be handled and the film sections mounted therein. The pressing and heating elements for sealing the edge of the film in the card are operated by the same mechanism which can be readily timed so that the pressure is applied prior to, during and subsequent to the heating and fusing of the film margin, and the heating applied only for a very short time to fuse the margin of the film, followed by turning off of the heat and rapid dissipation of the heat and cooling of the film by the stainless steel plate on which it is supported. The material of the upper contact elements of the press is of plastic to which the film does not adhere, and the lower element is of stainless steel to which the fused film does not adhere, as well as a material which rapidly dissipates the heat and cools the film edge after it has been fused and forced into the undercut edge of the card under the heavy pressure applied.

The cards in which the films are mounted when punched for classification are advantageously punched prior to the forming of the openings in the card and the insertion of the film sections therein. If the apparatus above described is not operated automatically but manually, the operator can first punch the undercut opening in the card, move it to the film inserting section, check the film with the classification on the card to insure the correct film section for the card prepared therefor, and then pass the card and films to the sealing section, where pressure can be applied and the heat then applied. Where the heating element is not connected to and op-

erated by the toggle mechanism of the press, a separate push button 60 is provided to permit starting the mechanical timing device by hand, and this device will automatically shut off the current after the short period of time required for the heating and fusing operation.

I claim:

1. The method of mounting microfilms in openings in record cards of fibrous material which comprises inserting a film section in an opening in the card, which opening has an edge undercut at spaced points along the same providing notches therein, applying a high pressure to the edge of the film and the adjacent edge of the card, heating the edge of the film for a short time while under such pressure to fuse the edge of the film thus causing it to flow into direct bonding engagement with the undercut edge at all points along the same and completely fill said notches, and then rapidly dissipating the heat from the edge of the film while still under pressure.

2. The process according to claim 1, in which the film prior to application of heat and pressure thereto has undercut edges complementary to and intermeshing with the undercut edges of the opening in the card.

3. The method according to claim 1, in which the film has straight edges which are forced in a flowable state into the notches of the undercut edges of the opening in the card and into direct bonding engagement with said undercut edges at all points along the same.

4. An apparatus for mounting microfilms in openings in record cards of fibrous material including an upper press member of heat resistant plastic material, a lower press member having a press surface of stainless steel, localized heating means for heating the film at its edge only to fuse the edge of the film, and timing and control mechanism for turning on and off the heating means and for applying pressure by said press elements before, during and after said heating operation.

5. An apparatus for mounting microfilms in record cards of fibrous material including a press for pressing the marginal edge of the film and the adjacent edge of the card, an electrical heating element for heating the marginal edge of the film only and the adjacent edge of the card to effect rapid melting of the film, timing mechanism for turning on and off said heating element, and means for actuating said press to press the film before, during and after the operation of said heating element.

6. A record card of single ply fibrous material having one or more openings therein of a size adapted to receive microfilms and the like, said openings having edges undercut at spaced points along the same providing notches therein, and film sections mounted in the openings in said cards, said film sections having edge portions engaged in said notches and being bonded at their edges to the undercut edges of the openings at all points along the same.

7. A card as defined in claim 6, in which the notches and the edge portions of the film engaged therein have complementary reduced throats and necks, respectively, forming an interlocking union between the card and the film.

8. An article of the character described, comprising a flat body member of a uniform thickness having an aperture therein of a predetermined size and shape, an insert member of the same shape and substantially the same size as said aperture positioned in the latter, one of said members being formed of fusible material and the other of said members being formed of a material having an affinity for said fusible material, the fusible member having the edge portions thereof adjoining the said other member directly contacting the adjoining edges of the said other member and bonded thereto.

9. An article as defined in claim 8 wherein the adjoining edge portions of one of the members has notches therein with adjoining portions of the other of the members engaged in said notches, said latter portions directly contacting the peripheral edges of said notches and being bonded thereto.

10. An article as defined in claim 8 wherein the insert member is formed of the fusible material and the peripheral edge portion thereof is in direct contact with the surrounding edge of the aperture in the body member and is bonded thereto.

11. An article as defined in claim 10 wherein the insert member is in the form of a cellulose acetate photographic film, and the body member is in the form of a card of fibrous material.

12. An article as defined in claim 10 wherein the insert member has portions thereof engaged in notches formed in the adjoining surrounding edge of the body member and opening into the aperture in said body member, said portions having direct contact with the peripheral edges of said notches and being bonded thereto.

13. The method of mounting an insert member in an apertured body member, one of said members being formed of a fusible material and the other of said members being formed of a material having an affinity for said fusible material, which comprises positioning the insert member in the aperture in the body member, softening the portions of the fusible member adjoining the said other member, applying pressure to the softened portions to spread the same into intimate adhering contact with the adjoining edges of the said other member, and then permitting said softened and spread portions to set.

14. A record card or the like comprising a thin single-ply card having an aperture therein, the peripheral wall of said aperture being constituted by an edge surface of the card transverse to the planes of the opposite faces of the card and the thickness of said card being of the order of about .007 inch, and a sheet of thermoplastic material wholly within said aperture between said planes and having the entire peripheral edge thereof bonded by a direct thermoplastic bond to said edge surface constituting the periphery of said aperture.

15. A record card or the like comprising a thin single ply card having an aperture therein, the peripheral wall of said aperture being constituted by an edge surface of the card transverse to the planes of the opposite faces of the card, and a sheet of material wholly within said aperture between said planes and having the peripheral edge thereof bonded to said edge surface constituting the periphery of said aperture, said edge surface being undercut to provide an irregular edge surface to which the edge of the sheet is bonded.

16. The method of mounting sheets of thermoplastic material, such as microfilms, in openings in record cards of fibrous material which comprises inserting a sheet of thermoplastic material in an opening in the card, applying high pressure to the marginal edge of the sheet and the

adjacent marginal edge of the card around said opening, heating the marginal edge of the sheet momentarily during said application of pressure to a temperature at which said marginal edge of the sheet will flow under said pressure, and thereafter dissipating the heat from said marginal edge of the sheet during continued application of said pressure, whereby the marginal edge of the sheet is caused to flow and become thermoplasticly bonded to the edge of the card constituting the periphery of said opening.

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