Feb. 21, 1956 C. R. FORDYCE ET AL 2,735,771

COMBINED LIGHT SENSITIVE FILM AND DRAW TAB FOR FILM PACKS AND METHOD OF MAKING SAME

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Fig. 1

PRIOR ART

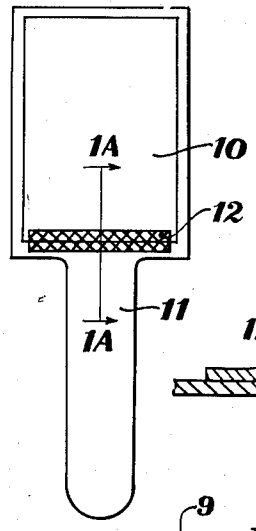


Fig. 2

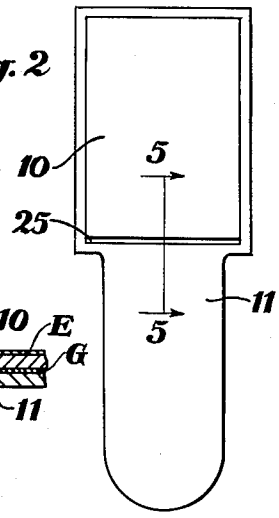


Fig. 1A

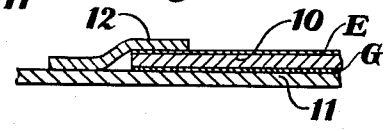


Fig. 3

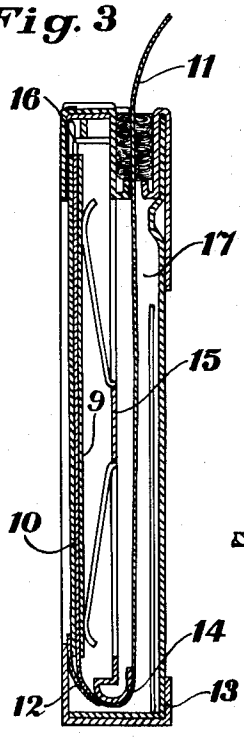


Fig. 4

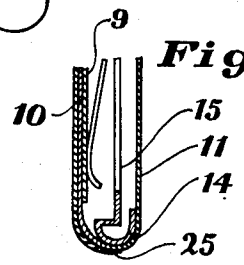


Fig 5

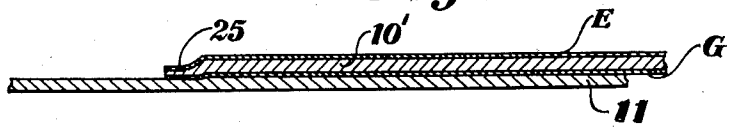


Fig 6

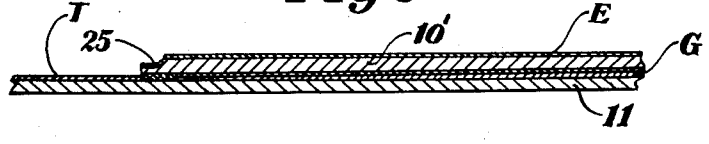
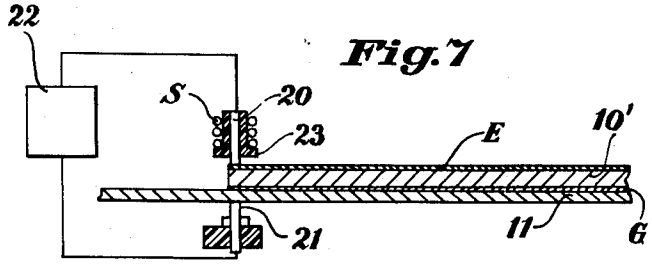


Fig. 7



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COMBINED LIGHT SENSITIVE FILM AND DRAW TAB FOR FILM PACKS AND METHOD OF MAKING SAME

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Application January 10, 1952, Serial No. 265,876

10 Claims. (Cl. 95—9)

This invention relates to an improvement in photographic film packs and particularly to the method of attaching each sheet of film to its respective draw tab.

The form of film pack almost universally used at the present time comprises a casing divided by a central partition into two compartments, namely a front exposure compartment and a rear light-tight compartment for receiving and storing the exposed films after exposure. In this type of pack the individual films are transferable in turn from the front to the rear compartment of the casing around the lower end of the partition by means of draw tabs attached to the films and projecting through a slot in the rear compartment at the top of the casing. The lower end of the partition around which the films are drawn is usually beaded or otherwise rounded so as to allow free passage of the films and draw tabs, and the tabs and films in passing around the end of this partition are subjected to a rather sharp bend by virtue of the compact nature of the pack.

This sharp bending of the tab and film places a severe rupturing stress on the joint between the draw tab and film which very often results in the draw tab being detached from the film before it has been completely moved from the front to the rear compartment. When this happens the film itself will remain wholly or partly in the exposure compartment and interferes with the future use of the pack, and an unformtunate part of such an accident is found in the fact that the user may not be aware that the film has not been fully removed from the exposure compartment and will proceed to go through the motions of exposing the other films in the pack only to eventually find that they are spoiled by the failure of the joint between one film and its draw tab.

The all too frequent failure of the connection between the draw tabs and their films has plagued the photographer for years and considerbale research has been undertaken to improve this connection without too great success. While in the past, attempts have been made to cement the films directly to the draw tabs, at the present time the connection between the film and its draw tabs which most film manufacturers have adopted as most acceptable consists of a narrow strip of adhesive tape, or the like, having one longitudinal edge overlapping one transverse edge of the film and the remainder stuck to the surface of the draw tab. While different adhesive materials have been used on these tapes one of the most widely used tapes consists of a paper tape having a water wetting glue thereon and commonly referred to as a court plaster. It has been notice dthat the failure of the connection between the films and their draw tabs have been most prevalent in cold weather and particularly when the temperatures are below freezing. While no specific reason for this condition has been found it has been assumed that the flexibility of the joint between the film and draw tab decreases in cold weather with the result that a greater disrupting stress is placed thereon as the joint is bent sharply in moving around the lower end of the partition.

One object of the present invention is to provide an

improved method of attaching films to their draw tabs which not only provides a stronger attachment between the two but an attachment which is of such a nature as to facilitate the manufacture of such combined films and draw tabs.

Another object is to provide a method of attaching a film to its pull tab which provides a joint having a tensile strength greater than the draw tab itself.

And another object is to attach the film directly to the draw tab by a dielectric seal so that the need of a separate adhesive strip is unnecessary and as the result of which the flexibility of the joint or sealed area is enhanced by the reduction in overall thickness of the joined area. To further reduce the overall thickness of the sealed area, and thus increase its flexibility, the surface of the film and/or draw tab adjacent the sealed area is embossed, skived, or otherwise indented, to cut down the overall thickness of the sealed area.

And yet another object is to dielectrically seal a film to a paper draw tab using a gelatin coating which is found on the rear surface of the film for another reason, or as purposely placed thereon for this purpose, as the thermoplastic dielectric material which is melted and bonds the film and draw tab together on again setting when allowed to cool. A still stronger seal or joint can be made by placing a thermoplastic coating on the adjacent faces of both the film and draw tab which upon melting due to dielectric sealing become, in effect, welded together.

And another object is to provide an improved combined film and paper draw tab for film packs wherein the film and draw tab are sealed along a narrow elongated area extending transversely of the tab by an intimate bond formed by a thermoplastic coating constituting a part of one or both of the adjoining faces of the film and paper tab.

And another object is to provide a combined film and paper draw tab for film packs of the type mentioned wherein the external surface of the film adjacent the seal is embossed, skived, or otherwise indented to reduce the overall thickness of the sealed area and thereby increase the flexibility of the seal.

The novel features that we consider characteristic of our invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and the methods of carrying it out, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a plan view of a combined film and draw tab of the usual type.

Fig. 1A is an enlarged sectional view taken substantially on line 1A—1A of Fig. 1.

Fig. 2 is a plan view of a combined film and draw tab of a similiar type but showing the film and tab secured together according to the present invention.

Fig. 3 is a sectional view diagramatically showing a film pack including a combined film and draw tab of the usual type.

Fig. 4 is an enlarged sectional detail showing how a seal between the film and draw tab made according to the present invention is narrow relative to the circumference of the end of the partition and is flexible enough to readily bend around the bottom of the film pack partition without suffering a transverse rupturing stress sufficient to break the joint.

Fig. 5 is an enlarged sectional view taken substantially on line 5—5 of Fig. 2 and showing the improved seal between the film and draw tab made according to one embodiment of the present invention.

Fig. 6 is a view similar to Fig. 5 but showing a seal made according to a second embodiment of the present

invention and adapted to have a greater strength than the seal shown in Fig. 5.

Fig. 7 is a schematic view illustrating how the seal between the film and paper draw tab can be effected by dielectric heating.

As shown in Figs. 1 and 1A, the usual method of attaching the film 10 to the paper draw tab 11 is by a strip of adhesive tape 12 having a wettable or pressure sensitive adhesive thereon, which overlaps and is secured to the lower edge of the film (assuming the latter to be in exposure position in the film pack) and overlaps the wide portion of the draw tab. Referring to Fig. 3, it will be seen that when the film is in the exposure position in the casing 13 of the film pack, and held in position by a pressure plate 9, the lower edge of the adhesive strip 12 lies above the lower rounded end 14 of the partition 15 which divides the casing into a front exposure compartment 16 and a rear light-tight storage compartment 17.

As is well known, after exposure the film 10 is pulled around the lower end 14 of the partition 15 and into the rear compartment 17 by pulling upwardly on draw tab 11. In addition to this act placing considerable tension on the joint between the tab and film, the joint is subjected to a considerable transverse rupturing stress by virtue of its being drawn around the sharp bend formed by the lower end 14 of the partition 15. By reason of the compactness of these film packs the radius of the rounded end on the lower end of the partition is rarely as large as ⅛ inch and is generally smaller.

Looking at Fig. 1A, it will be observed that an adhesive tape joint between the film and draw tab produces a relatively thick joint and one whose width is greater than the length of curved supporting surface provided by the rounded lower end of the partition. This combination of characteristics results in a joint which is susceptible to rupture because of severe transverse rupturing stresses, in addition to considerable tensile stress, because of the excessive width of the joint relative to the sharp bend it must make and the lack of flexibility in the joint which aggravates this condition. In an attempt to overcome this last-mentioned defect in the joint, thin paper adhesive tapes or court plasters have been used, but it is impossible to get a tape flexible enough to closely follow the right angle formed by the sharp end of the film and provide a taped joint having a complete connection with the film and tab. Another objection to strips of adhesive tape for attaching the film to the draw tab is that the square end of the tape extending transversely of the draw tab and directed toward the direction of pull of the tab constitutes a stop which can frictionally engage the wall of the casing of the film pack or some obstruction thereon to retard or even positively limit forward movement of the film and draw tab.

According to the present invention, the use of adhesive tapes and wettable adhesives is eliminated in combined films and draw tabs and the film is directly attached to the draw tab by a heat sensitive coating which normally constitutes a part of films as made, or which may be a coating applied to the unsensitized surface of the film for this specific purpose. As is obvious from Fig. 2, wherein a combined film and draw tab sealed together according to the present invention is shown, the seal between film and draw tab is located right at the one transverse end of the film and is so narrow and neat that it is hardly conspicuous. Despite the narrowness of this seal we have found that it has several times the strength of conventional adhesive tape seals and is unaffected by subzero temperatures while adhesive tape seals fail repeatedly under below freezing conditions.

According to one embodiment of the present invention, a conventional light-sensitive film, which normally has a thin coating of gelatin on its unsensitized surface to overcome the curling tendencies set up by the light-sensitive emulsion, is placed in face-to-face contact with the surface of the paper draw tab. While holding the film and draw tab in this relation sufficient heat is applied to the sandwich to melt the gelatin coating whereupon the fluid gelatin becomes impregnated into the surface of the paper. Then the gelatin is allowed to cool and set up so that an intimate and extremely strong bond is formed between the two. For reasons to be more fully discussed below the heat should be applied to the combination in such a way that a very narrow seal is obtained, and the useful area of the light sensitive surface of the film is not adversely effected. A very efficient way of accomplishing this is by using a dielectric sealing technique since gelatin is a thermoplastic dielectric material. If as indicated in Fig. 7 the sandwich is placed between two electrodes 20 and 21 which are connected to a well known type of high frequency generator 22 then the film and draw tab will be subjected to a high voltage, high frequency field which will cause the gelatin coating to be heated to a melting temperature by the dielectric loss set up in the mass thereof. While the film base, which is generally cellulose acetate, and the paper are also dielectric materials and will have heat generated therein, they will not be overheated because the exposed surfaces thereof can radiate heat and some will be conducted away therefrom by the electrodes. As a result the heat will be concentrated in the gelatin layer where it is wanted.

By choosing the proper size and shape of electrodes the heating zone, and hence the shape and size of the sealed area, can be controlled. We have found that a seal of this type as narrow as $\frac{1}{25}$ inch and located at the extreme end of the film will result in a joint which is stronger in all respects than the customary adhesive tape joint. To provide such a seal, bar type electrodes approximately as wide as the desired seal should be used.

Satisfactory seals were obtained between the gelatin layer of the film and the draw tab over a range of frequencies from 200 megacycles to 27.4 megacycles in the electronic generator, thereby indicating that there is apparently no limit to the range of frequencies which would produce a satisfactory seal. A good seal was made at a frequency of 200 megacycles with 350 milliamperes flowing for less than a half second. While seals can be obtained if the film and draw tab are held in contact with almost no pressure at all, a decided advantage has been found in a seal made with pressure between the electrodes. In Fig. 7 we have indicated such pressure as being obtained through the use of a spring S insulated from electrode 20 by a flanged insulating collar 23 fixed to the electrode. A pressure in the order of 40 pounds for a 2¼" by 3¼" film and tab combination results in the sealed area of the film becoming embossed, as indicated at 25 in Figs. 5 and 6, during the sealing operation. This embossing serves to further reduce the overall thickness of the seal and hence increase its flexibility over the present adhesive tape mounted tabs. There appears to be no maximum limit to the pressure which can be used since an increase in pressure merely serves to increase the embossing effect. A combined film and draw tab attached according to this technique is shown in Fig. 5 where E represents the light-sensitive emulsion on one surface of the film support 10' and G represents the gelatin coating on the other surface of the film and 11 represents the paper draw tab.

The fact that this increased flexibility of the sealed area produces a superior combined film and draw tab combination is evidenced by the results of the following rather drastic test. Both types of mounted tabs were pulled around a rod at −10° F. which produced approximately the same degree of bending in the sealed area as is produced in normal pack operation but at a rather abnormal temperature. The tabs mounted according to the conventional technique of adhesive tapes all broke on the first pass around the rod, while the dielectrically sealed tabs showed no defects after being pulled ten times. The greater flexibility of the dielectric mounted tabs can be attributed to two main reasons. First, by eliminating the adhesive tape or court plaster, the over-

all thickness of the laminated film and draw tab is considerably reduced while at the same time the area or width of the seal has been greatly reduced. The advantage of reducing the width of the seal will be evident from an inspection of Fig. 4. By making the width of the seal a fraction of the length of arc around the lower end of the partition of the pack the tendency for the seal to be subjected to transverse sresses as it moves around the bend, and, which would tend to rupture the seal, is eliminated or greatly minimized. Secondly, by embossing the leading edge of the film over the seal the thickness of the lamination is still further reduced which adds to the flexibility of the joint. It is pointed out that the reduction in thickness of the seal to increase its flexbility can be accomplished by ways other than embossing if such technique is not available by virtue of the sealing equipment used. For example, the surface of the film can be skived, or mechanically removed in other ways at this point for the purpose of achieving the desirable feature of increased flexibility.

Testing these dielectrically sealed tabs under straight longitudinal tension resulted in the tab paper breaking some distance from the seal which indicates that the strength of the seal is greater than that of paper. Coating the tab paper with a thin layer of properly plastized zein before making the seal raised the force required to tear the film from the tab paper by a transverse stress from 1.5 pounds, with no coating on the paper tab, to 4.6 pounds. This transverse stress test consisted of gripping the free end of the film and the free end of the tab under the film and pulling them apart in opposite directions to rupture the seal by a force acting substantially transversely of the sealed surfaces. Such a stress is deemed to be more significant in testing the virtues of a seal of this type than a straight longitudinal pull since it approximates the sort of stress to which the seal is subjected in passing around the sharp bend of the film pack partition, and which stress is believed to be the primary cause of failure in present sealing techniques. The conventional adhesive tape seal when subjected to this same type of stress ruptured with a pull of less than 1 pound. A combined film and draw tab constructed according to this last mentioned embodiment is illustrated in Fig. 6 wherein the zein coating on the surface of the draw tab 11 is represented by T.

The presence of some sort of suitable thermoplastic coating on the unsensitized surface of the film appears necessary for a satisfactory joint if the seal is to be made to a plan paper tab or to a zein-coated tab even though the film support itself may be a thermoplastic material, i. e. cellulose acetate or some other known cellulose derivative material. This fact was verified when attempts were made to seal plain film support to plain paper tabs and paper tabs with various coatings. The only success was obtained when the paper tab was coated with a coating or dope having a formula similar to that of the film support itself but even then the bond obtained was not too satisfactory. From this it follows that in order to obtain a satisfactory dielectric seal the unsensitized surface of the film support must have a coating thereon which is a thermoplastic material having dielectric ceharacteristics and capable of being put in solution for coating it on the support. Gelatin is only one of many materials which would be suitable for this purpose and is particularly desirable because a coating of such material is generally applied to all film designed for still camera use for other purposes, i. e. to correct the curling tendency of gelatin light-sensitive emulsion applied to the other surface of the film, anti-halation backings, etc. By way of example, a coating of zein could be applied to the film and serve as well as the gelatin coating so far as obtaining a good dielectric seal is concerned.

Where a stronger seal is desired and the paper tab is to be coated with a thermoplastic material as well as the film it is not necessary that the coating on the film be gelatin and that on the paper tab a zein of any particular formula. It is only necessary that the two coatings be thermoplastic materials and have a certain chemical compatibility in their liquid form to permit them to physically mix so as to form a good welded bond when they become set on cooling. The following zein formula has been found very suitable as a coating on the paper when the coating on the film is a gelatin.

	Per cent
Zein	54.5
Santizer #8 (a mixture of ortho and para-toluene sulfonethylamide)	31.8
Cyclohexyl acid phthalate	13.7

This mixture of solids was dissolved in alcohol to give a 10% solid solution before coating on the paper tab. There is no reason to believe that there are not numerous variations in this formula which could be used with conventional gelatin coatings used on films. The apparent reason why gelatin and sein coatings work so well in making this seal is that they are both basically protein materials and, therefore, are sufficiently chemically and/or physically compatible to mix together in their liquid forms and remain bonded together upon solidifying. Accordingly, it can logically be assumed that any proteinacious material which is thermoplastic, can be used as coatings on the film and/or paper draw tabs. It is also though that the following thermoplastic materials might offer possibilities of use as coating on the paper tab if not on the film:

1. The polyamid resins which are esterified dimerized soybean oil that have been cross-linked with ethylene diamine. Materials of this nature could be coated using either an alcohol solution or an emulsion.

2. Any protein type resin or derivative.

The increased strength of a seal obtained by coating the paper tab with a thermoplastic material as well as the unsensitized surface of the film seems to come from the fact that when such a coating is applied to the paper in a liquid form prior to sealing it becomes impregnated into the surface of the paper to a greater degree than when a coating on only the film is melted, or only softened, and is allowed to impregnate the paper for only the short time involved in the sealing operation. In order to obtain the most satisfactory dielectric seal in the shortest time, and with the least tuning difficulty so far as the high frequency generator is concerned, it is desirable that the thermoplastic materials used as coatings on the film and paper draw tab have similar dielectric characteristics and reasonably close melting or softening points. It will be appreciated that the application of the sealing coating to the draw tab can be limited only to the area to be sealed rather than coating the entire surface of the tab as shown in the drawings should such a practice be deemed desirable for the most economical and/or practical fabrication procedure.

It will be obvious that the dimensions of the sheet of film and the paper tab in no way restrict the present technique of joining a film to its paper tab. For instance, the sheet of film and the sheet of paper could be long and narrow or in strip form as are the film strip and strip of backing paper in roll film packages. Likewise, the terminology used is not restrictive since the backing paper of a roll film cartridge is fastened only at one end to the strip of backing paper and the backing paper is in fact a pull tab for the film strip as the film is advanced across the focal plane of a camera by rolling it up on a take-up spool. Accordingly, we point out that this invention is applicable to the manufacture of roll films, as well as film packs, wherein one end of the film is fastened to the backing paper by a narrow seal extending transversely of the film and made in accordance with the present invention.

Combined films and draw tabs having dielectric seals

show less distortion in the film along the sealed area upon keeping than the present court plaster seals because the court plaster has been eliminated and no water is required in the mounting operation. This method of sealing films and their draw tabs permits a much simpler mounting machine to be designed. In addition, a warning system to indicate when the machine is not operating properly can be installed with the necessary electronic equipment. With the present mounting machines there is no means of detecting unsatisfactory machine operation without extensive testing of the sealed joints which at times amounts to 100% of production.

Although we have shown and described certain specific embodiments of our invention, we are aware that many modifications thereof are possible. Our invention, therefore, is not to be limited to the precise details of construction shown and described but is intended to cover all modifications coming within the scope of the appended claims.

Having thus described our invention what we claim is new and desire to secure by Letters Patent of the United States is:

1. A combined light-sensitive film and paper draw tab for film packages comprising a sheet of film having a light-sensitive emulsion on one surface and a gelatin coating on and integral with the opposite surface, a paper draw tab, said draw tab lying in face-to-face relation with the gelatin coated surface of said film and attached thereto along one edge only extending transversely of said tab by a narrow intimate thermo-fused bond between said gelatin coating and said paper, said bond consisting solely of the gelatin comprising said coating.

2. A combined light-sensitive film and paper draw tab for film packages according to claim 1, in which one of the exposed surfaces of said joined film and draw tab coextensive with the narrow bond between the two is embossed transversely of said draw tab to reduce the combined thickness of the film and paper at their point of attachment and to provide a joint between the two which can be readily flexed transversely of said draw tab.

3. A combined light-sensitive film and paper draw tab for film packages comprising a sheet of film having a light-sensitive emulsion on one surface and a gelatin coating on and integral with the opposite surface, a paper draw tab having one surface coated with a thin layer of thermoplastic material, said film and draw tab lying in face-to-face relation with the gelatin coating of said film facing the thermoplastic coating on said draw tab and attached together along one edge extending transversely of said tab by a thermo-fused bond between said gelatin coating and said thermoplastic coating.

4. The method of making a combined light-sensitive film and paper draw tab for film packages in which the film has one sensitized surface and one unsensitized surface comprising the steps of coating the unsensitized surface of the film with a coating of gelatin, after the gelatin coating has set and dried placing the paper draw tab in face-to-face contact with this surface of the film, and while holding these two in face-to-face contact applying sufficient heat to a narrow area of the combination adjacent one edge of the film extending transversely of said draw tab to melt said gelatin, and holding said film and paper draw tab in contact until said gelatin sets.

5. The method of making a combined light-sensitive film and paper draw tab for film packages in which the film has one sensitized surface and one unsensitized surface according to claim 4, characterized by the fact that the gelatin is melted by subjecting the combined film and paper draw tab to a high frequency electrostatic field.

6. The method of making a combined light-sensitive film and paper draw tab for film packages in which the film has one sensitized surface and one unsensitized surface comprising the steps of coating the unsensitized surface of the film with a coating of gelatin, after the gelatin has set and dried placing the paper draw tab in face-to-face contact with this surface of the film, and while holding these two in face-to-face contact applying sufficient heat to a narrow elongated area of the combination along one edge of the film extending transversely of said draw tab to melt said gelatin and holding said film and paper draw tab in contact until said gelatin sets, and reducing the combined thickness of the film and draw tab in a line coextensive with the joint between the two to increase the flexibility of said joint.

7. The method of making a combined light-sensitive film and paper draw tab for film packages in which the film has one sensitized surface and one unsensitized surface according to claim 6, characterized by the fact that the localized heating of the gelatin is accomplished by subjecting the joint to a high frequency electrostatic field between two narrow electrodes and the reduction of the combined thickness of the film along the joint is accomplished by squeezing the joint between the electrodes during the heating step which results in the external surface of the film becoming embossed.

8. The method of making a combined light-sensitive film and paper draw tab for film packages in which the film has an unsensitized surface comprising the steps of coating the unsensitized surface of the film with a coating of gelatin, coating one surface of the draw tab with a thermoplastic proteinacious material, after the two coatings are set and dried placing the coated surfaces of the film and draw tab face-to-face contact, and while holding them so applying sufficient heat to a narrow elongated area extending transversely of the combination and along one edge of the film to melt the gelatin on the film and the thermoplastic coating on the draw tab, and holding said film and draw tab in contact while said coatings fuse and until they set.

9. The method of making a combined light-sensitive film and paper draw tab for film packages in which the film has an unsensitized surface according to claim 8, characterized by the fact that the coating applied to the draw tab is zein.

10. The method of making a combined light-sensitive film and paper draw tab for film packages in which the film has an unsensitized surface according to claim 8, characterized by the fact that the coating applied to the draw tab is gelatin.

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