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PRESSURE RESPONSIVE MATERIAL

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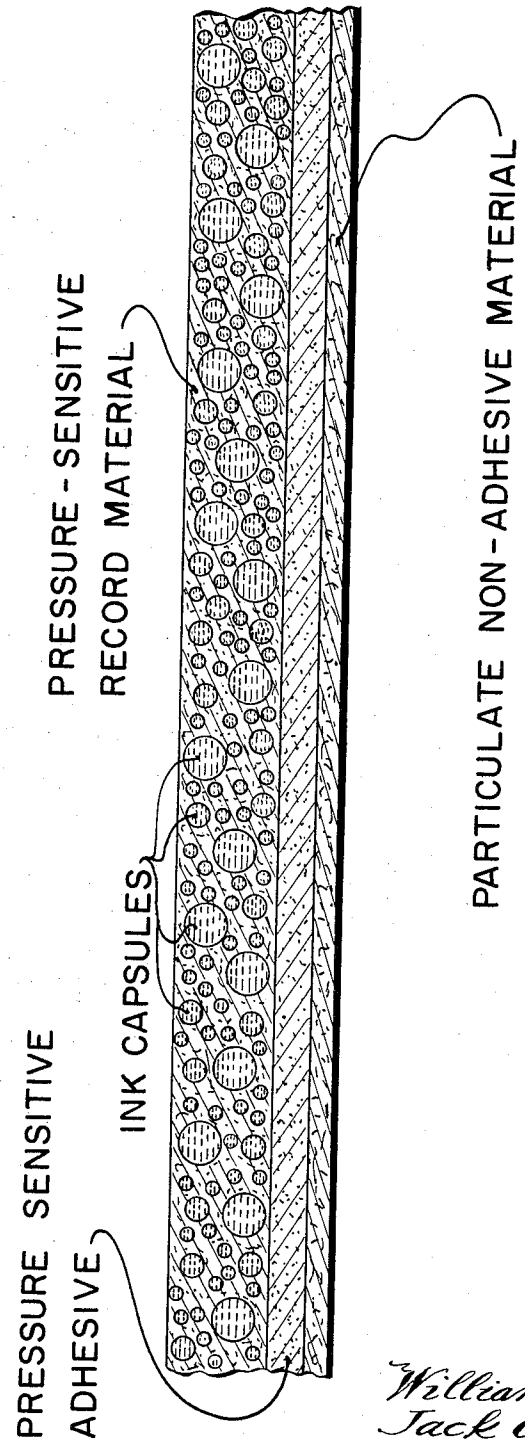


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# PRESSURE RESPONSIVE MATERIAL

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This invention relates to pressure responsive materials and more particularly relates to articles employing a combination of pressure responsive materials for concurrently producing a marking on a pressure sensitive surface and a relatively temporary marking on a surface of a light transmitting platen.

It is often desirable to make a relatively permanent record while projecting the record relatively temporarily on a screen or the like. For example, in keeping score in the game of bowling, and especially in league or tournament bowling, it is desirable to produce a legible, relatively permanent record on a printable surface such as paper or the like, while projecting a relatively temporary image thereof to be more conveniently viewed during the game. A recently developed system makes use of temporary images or impressions produced on a surface of a light transmitting platen and projects the images as legible markings on a screen or the like. The present invention finds utility in such applications and particularly in bowling score keeping, using such a projection system.

It is a general object of this invention to provide a new and useful pressure responsive record material.

It is a further object of this invention to provide a new and useful material capable of producing a legible relatively permanent record on one surface thereof and concurrently producing a temporary image of the record on a surface of a light transmitting platen.

It is another object of this invention to provide a new and useful combination including a printable surface, means producing a legible mark on the printable surface responsive to pressure and means for concurrently producing an impression of the mark on a surface of a light transmitting platen.

Yet another object of this invention is to provide a score sheet material which includes a layer of pressure sensitive record material capable of producing a legible mark on its own surface responsive to pressure thereon, an adhesive capable of releasably or removably adhering to a platen surface and a layer isolating the adhesive from the platen surface in the absence of pressure and penetrable under pressure to permit impression on a platen surface upon application of pressure to the pressure sensitive record material.

Other objects of the present invention may be apparent to those in the art from the detailed description to follow.

The objects of this invention have been attained by an embodiment thereof described in detail in the following specification. However, it is to be understood that this invention is susceptible of embodiment in many different forms and that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment described.

The figure of the drawing illustrates, in an enlarged section, an embodiment of pressure-responsive material of this invention in the form of a laminate structure including an uppermost layer or sheet of pressure-sensitive record material containing a multitude of fracturable ink capsules; adhering to the lower or backing surface of the pressure-sensitive record material is a layer of pressure-sensitive adhesive, and a layer of particulate non-adhesive material is shown on the exposed back surface of the adhesive layer.



The present invention provides a new and useful combination including a sheet of pressure sensitive record material, a deformable layer of adhesive backing on the sheet of pressure sensitive record material and a pressure penetrable normally continuous layer of material on the layer of adhesive backing. The adhesive backing is so termed because it is applied to the back surface of the pressure sensitive record material, i.e., the surface which opposes the marking surface where pressure is to be applied to produce a legible mark. The combination of this invention is useful to produce a legible relatively permanent record on a printed surface while concurrently producing a relatively temporary impression or image on a surface of a light transmitting platen. The combination is especially useful as a score sheet for keeping score in the game of bowling.

Also provided by the present invention is a method for making the new and useful combination, which method generally includes the steps of applying the adhesive backing to the pressure sensitive record material and applying a pressure penetrable normally continuous layer of material over the layer of adhesive backing. The pressure penetrable layer may be applied either before or after application of the adhesive material to the pressure sensitive record material.

The pressure sensitive record material may be any such material capable of producing a mark on its surface responsive to pressure applied to its surface. Such materials are well known in the art and are available commercially. The pressure sensitive material may advantageously be of the encapsulated printing fluid type having pressure rupturable capsules of printing fluid contained within the material and more usually having an adsorbent material surrounding the capsules for absorption of the printing fluid upon rupture of the capsules. The capsules are ruptured by application of pressure to the surface of the sheet of record material. The printing fluids contained within the capsules may be, for example, inks, dyes, pigment solutions or suspensions or the like which may, for example, be included within an opaque rupturable capsule or within a capsule surrounded by an opaque fibrous material precluding visual observation of the printing fluid until the capsule is ruptured and/or the printing fluid is absorbed by the absorbent material. Other printing fluids are usable, including for example, chemical reagents in separate adjacent randomly disposed caspules which react with each other or with an absorbent material, e.g., by impregnation, to produce a legible mark. Such pressure sensitive sheets may be used singly or in manifold form, e.g., with the adhesive material as a backing on the last sheet of the manifold, in the present invention. Suitable pressure sensitive record sheets are available as "NCR" such as is marketed by the National Cash Register Company.

The adhesive material is the material which, of course, adheres to the self-reproducing paper. The material is capable of releasably or removably adhering to a surface of a light transmitting platen and preferably a glass surface. Many such adhesive materials will be apparent to those in the art. Advantageously, the adhesive may be a resin-based non-hardening adhesive having a soft rubber-like consistency such as the natural and synthetic rubber base adhesives. Examples of suitable adhesives are the crude rubber resin-base adhesives as well as the synthetic polymer adhesives such as those in which the polymer predominates in polymers, including copolymers, tripolymers, etc., and graft polymers, graft copolymers, etc., and the like of such ethlenically unsaturated monomers as propylene, butylene including isobutylene, and styrene and other ethylenically unsaturated hydrocarbon monomers as well as polymers of the ethylenically unsatu-

rated non-hydrocarbon monomers as will be apparent to those in the art. Other resin base adhesives such as the polyurethane base adhesives are also usable. Such resin adhesives are often modified by plasticizers and/or prepared and marketed in carriers such as aromatic hydrocarbons. Many such adhesives are known and commercially available.

More specific examples of suitable adhesives are the Hycar type synthetic rubber base adhesives and the Permacel adhesives. The Permacel adhesives, for example, include crude rubber base liquid adhesives as well as adhesives of the synthetic rubber base type predominating in plasticized polymers of propylene, butylene and styrene. A particular acceptable adhesive may be obtained under the name Permacel EZ–4469. Adhesive products in other than liquid form may also be desired and may alternatively be used, for example, film or sheet form adhesives which are marketed on carriers such as a paper carrier having either one or both of its surfaces coated with the adhesives. Where one surface only is coated, the adhesive sheet may be applied by use of other adhesive materials as a backing on the pressure sensitive record material. Where both sides of the paper are coated with the adhesive, the sheet may be simply pressed against the back of the pressure sensitive material. An acceptable adhesive impregnated on a paper carrier may be obtained under the name Permacel EZ–4551. Such materials are normally marketed with a liner between layers such as a silicone coated liner to keep the layers from adhering. The liner supplied with the adhesive sheet may advantageously be reused if desired, as a liner between the multi-layer pressure responsive materials produced in accordance herewith.

The pressure penetrable layer, including films, may be any such layer which will not in itself adhere to the surface of the light transmitting platen but which at the same time will serve to isolate the adhesive layer from the platen surface in the absence of substantial applied pressure. Under pressure, the adhesive material may be forced through the penetrable layer, i.e., by penetrating the layer, e.g., by separating particles in the layer, rupturing the layer, passing through openings in the layer, etc. Such materials include pressure separable films such as pressure rupturable films and also include, as a further example, particulate compositions such as mica, talc, starch, flour and the like. The solid particulate materials are more readily applied to the adhesive material and are therefore preferred. Other usable solid particulate materials include the offset fluids and powders such as "No-Offset Fluid" (a dextrin gum in volatile solution) and "No-Offset Powder" a dextrin starch) which are marketed in various grades by Paasche Airbrush Company. The "No-Offset liquids are applied in their usual manner, e.g., by spraying. During the spraying, and in contact with air, the offset fluid forms small globes which become deposited upon the surface sprayed. Normally the surface is then further exposed to air to permit complete drying of the globes. The offset powders may be applied by dusting.

As a particular example of a pressure responsive material in accordance with this invention, a multi-layer score sheet is prepared. In the score sheet, the pressure sensitive record material is an NCR sheet of the type employing encapsulated printing fluid and having an absorbent material adjacent the pressure rupturable capsule. The deformable layer of adhesive backing is a layer including a paper carrier between two layers of adhesive coating on the paper carrier. The adhesive is a synthetic rubber base adhesive in which the synthetic rubber predominates in plasticized polymers of propylene, butylene and styrene. The pressure separable layer of material is a layer of air hardened globes of dextrin gum. The multi-layer score sheet is prepared by applying a film-form adhesive such as Permacel EZ–4551 to the back of a sheet of NCR pressure sensitive record material and thereafter spraying No-Offset liquid on the exposed adhesive surface in an amount sufficient to form a normally continuous layer thereon. The No-Offset liquid layer is then permitted to air dry.

As another example of a form of score sheet which may be produced in accordance herewith, there is provided a multi-layer score sheet including a layer of NCR paper of the aforementioned example having a layer of crude rubber base adhesive as a backing thereon and a coating or layer of dextrin powder on the layer of adhesive. This score sheet may conveniently be prepared by coating the sheet of NCR paper with a liquid crude rubber base adhesive in suitable solvent and thereafter dusting No-Offset powder over the exposed adhesive surface.

In use of the pressure responsive multi-layer material provided by this invention, e.g., as a score sheet, the material is placed with the surface defined by the pressure separable layer of material upon a flat glass or other light transmitting material surface. A hand stylus may then be used to impress marks upon the pressure sensitive record material surface for making a relatively permanent legible mark thereon. Alternatively, a type character or other mechanically operated marking implement is pressed upon the pressure sensitive record paper. Action in the top surface of the score sheet reproduces the character on the top surface without the use of ink. The force of the printing means is simultaneously transmitted to the pressure sensitive adhesive. The characteristics of the penetrable layer are such that when the marking implement is pressed upon the top surface and transmitted to the deformable adhesive in the shape of the desired character the penetrable layer supports the adhesive away from the glass at all points except those of applied pressure. The deformable adhesive forms an intimate bond with the glass surface, where the pressure is applied to produce an impression of the character on the glass surface by adherence of the adhesive material.

We claim:

1. A multi-layer laminate material for concurrently producing a permanent marking which is legible at a pressure sensitive surface and a relatively temporary marking on a surface of a light transmitting platen, which laminate material comprises a web having a front surface for receiving printing pressure and an absorbent sheet containing a multitude of minute fracturable capsules containing printing fluid, a continuous layer of pressure sensitive adhesive strongly adhering to the back surface of said web, and a separate adhesive-permeable layer of particulate non-adhesive material adhering directly to and backing said adhesive layer in an amount sufficient to support said adhesive layer from a support surface under the weight of said web but insufficient to prevent passage of the adhesive through said permeable layer under marking force applied to said front surface, said adhesive having (1) proper tackiness to releasably adhere to the surface of the light transmitting platen under a force applied to the front surface sufficient to fracture the capsules, (2) greater adhesiveness to said paper sheet than to the prism face and (3) greater cohesiveness than the adhesiveness to the surface of the light transmitting platen.

2. The multi-layer laminate material of claim 1 wherein said layer of pressure sensitive adhesive adheres directly to the back surface of said absorbent sheet.

3. The multi-layer laminate material of claim 1 wherein said front surface is the front surface of said absorbent sheet.

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