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PRESSURE SENSITIVE TRANSFER ELEMENTS AND
METHOD FOR PREPARING SAME
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Fig. 1

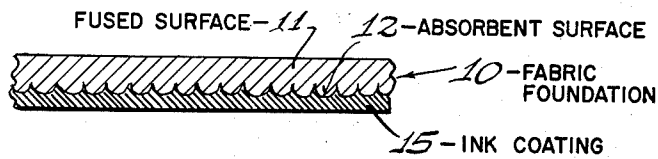
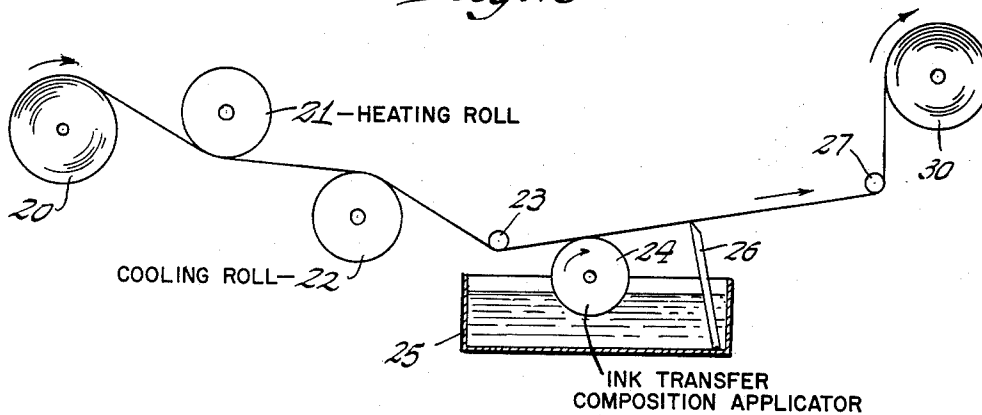


Fig. 2



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PRESSURE SENSITIVE TRANSFER ELEMENTS AND METHOD FOR PREPARING SAME

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This invention relates to novel pressure-sensitive transfer sheets and ribbons and to the method for preparing the same.

It is known to prepare pressure-sensitive transfer ribbons by impregnating a suitable woven or non-woven fabric strip with a pressure-transferable ink composition. Such ribbons are the most common type presently used in typewriters, although it is recognized that they have several disadvantages. Possibly the greatest disadvantage is due to the fact that such ribbons are uniformly porous and allow the transferable ink composition to transfer to the type bars during the typing operation. Such back-transfer gradually decreases the sharpness of the individual indicia on the type bars as the ink dries and cakes thereon and necessitates frequent cleaning.

Another disadvantage of such fabric ribbons is their tendency to result in typed images which are not completely uniform in color and which carry the impressed print of the fabric with which they were typed. This effect is most clearly evidenced when typing with a woven fabric ribbon, although non-woven dispersed-fiber fabrics also produce similar results.

In an attempt to overcome these problems, ribbons and sheets have been produced by applying a pressure-transferable ink composition over a continuous film foundation such as cellophane, cellulose acetate or Mylar (polyethylene terephthalate polyester). Although such attempts have been successful in overcoming the problems of back-transfer of the ink to the type bars and fabric prints in the typed images, they have resulted in several additional problems not encountered with the use of fabric ribbons.

These problems are due to the smooth continuous surface of the film foundation which provides very little grip or tooth for the applied ink composition. Unless a binder layer is applied between the foundation and the ink coating, the ink coating tends to peel from the foundation and transfer to the uncoated side of the foundation when the ribbon is rolled up. Such binder layers can be relatively expensive and can also reduce the imaging quality of the ribbon or sheet since the foundation thickness is increased and thus its ability to conform to the shape of the indicia on the type bar is reduced.

It is therefore an object of the present invention to prepare transfer elements such as typewriter ribbons which have a foundation which prevents back-transfer of ink and fabric impressions on the typed images and which nevertheless has excellent affinity for ink transfer compositions.

It is another object to prepare plastic foundation transfer elements on which the transfer material has no tendency to crack or peel from the foundation and which provide uniformly sharp and clear images under pressure.

These and other objects and advantages are accomplished as more fully disclosed herein.

In the drawing:

FIGURE 1 represents a diagrammatic cross-section, to an enlarged scale, of a transfer element prepared according to the present invention.

FIG. 2 is a diagrammatic illustration of a suitable treating and coating apparatus for carrying out the process of this invention.

According to the present invention, ribbons and sheets which are based upon fibers of thermoplastic resin woven,

matted, felted or otherwise compacted into a fabric, are heated on only one surface thereof for a period of time and at a temperature sufficient to melt and fuse the fibers at the heated surface and reduce them to a continuous ink-impervious surface film while leaving the unheated fiber surface substantially unaffected and ink-receptive. The fused foundation is then coated on the unheated ink-receptive surface with a suitable ink composition to produce a transfer element as illustrated by FIG. 1 of the drawing.

The present process may be carried out using an apparatus of the type illustrated by FIG. 2 of the drawing. For instance a conventional woven nylon fabric ribbon carried on roll 20 is passed over heated roller 21 which has a temperature equal to or exceeding the melting point of nylon, about 235° C. Thereafter the unheated side of the ribbon is preferably passed over a cooling roller 22 having a temperature of from about 30° C. to about 50° C. to chill the unfused fibers and stop the fusion process. The ribbon then passes under tension roller 23 and the unfused side makes contact with an ink applicator roll 24 which is mounted in trough 25 so as to dip into the ink composition therein and cause it to adhere to the roll surface during rotation. As the ribbon is inked, it passes against blade or scraper 26 which uniformly distributes the ink and picks off any excess which then returns to the trough. The inked ribbon then passes over another tension roller 27 and is wound on roll 30 ready for processing.

Although the above process has been defined with respect to the processing of ribbons, it should be understood that wide synthetic thermoplastic fabric webs may be similarly treated and thereafter cut into ribbon strips or carbon sheets as desired. It should also be understood that there is no criticality with respect to the particular inking devices or methods employed, the essence of the present invention residing in the feature of heat-fusing only one surface of a unitary thermoplastic fabric foundation prior to the application of an ink composition to the unfused surface.

The desired fusion may be brought about by passing the fabric foundation over any suitable heating surface such as a heated roller 21 illustrated by FIG. 2, a hot plate, an infrared heating device or the like. The temperature of the heating surface varies depending upon the softening or melting point of the particular synthetic material comprising the fabric foundation, and the fabric makes contact with the heating surface for only a sufficient length of time to melt the fibers, filaments or linters of thermoplastic material at the heated surface and fuse or glaze them into a continuous ink-impervious surface film while maintaining the fibers, filaments or linters relatively unaffected on the unheated surface. The time of heating generally ranges anywhere from instantaneous up to about ten seconds depending upon the fabric composition, thickness and density.

FIG. 1 of the drawing illustrates the fused fabric foundation 10 having a continuous, ink-impervious, fused surface 11 and an ink-receptive or absorbent unfused surface 12 which is either impregnated with a conventional ribbon ink composition or preferably has adhered thereto a wax- or resin-based transfer composition of the carbon paper type as illustrated by coating 15 of FIG. 1.

A suitable conventional liquid ribbon ink composition may be formulated as follows.

Ingredients:	Parts by weight
Carbon black	6
Tri-cresyl phosphate	15
Nigrosine black	9
Diglycol laurate	15

A suitable wax-base ink transfer composition may be formulated as follows.

Ingredients:	Parts by weight
Carnauba wax -----	40
Raw montan wax -----	10
Beeswax -----	10
Mineral oil -----	20
Pigment (carbon black or crystal violet dyestuff) -----	20

Wax-base inks of this type are applied to the fused fabric using conventional hot melt methods whereby the ink is heated to a fluid condition, applied to the foundation as a liquid and allowed to cool and solidify.

A suitable resin-base ink transfer composition may be formulated as follows.

Ingredients:	Parts by weight
Vynlite VYHH (vinyl chloridevinyl acetate copolymer) -----	10.0
Mineral oil -----	27.5
Carbon black -----	7.5
Volatile solvents—	
Ethyl acetate -----	45.0
Toluol -----	15.0

Resin-base inks of this type are applied to the fused fabric using conventional solvent coating methods whereby the ink solution is applied to the foundation and the volatile solvents are evaporated to form the set transfer layer.

In addition to nylon heretofore discussed, the present invention applies to any fabric, whether it be woven, matted, felted or otherwise compacted, formed from fibers, filaments, linters or other segments of any synthetic thermoplastic resinous material.

Suitable materials include hydrocarbon polymers such as polyethylene and polypropylene, vinyl polymers such as polyvinylidene chloride thread (Saran) and polyacrylonitrile fibers (Orlon), polyester resins such as polyethylene terephthalate fiber (Dacron), cellulose derivatives such as rayon acetate and cellulose nitrate, and many others. Not suitable are non-thermoplastic natural materials such as cotton, silk and the like.

These materials may be woven in known manner to form conventional woven fabric ribbons or sheets, or may be compacted, for instance on a paper-making machine, to form matted or felted fabric ribbons or sheets. Suitable methods for forming non-woven ribbons are disclosed by U.S. Patents Nos. 1,533,382 and 2,590,200.

Heat fusion of the surface of fabrics composed of any of the above-named thermoplastic materials is brought about in the same manner as disclosed herein in connection with nylon. The particular heating temperature used varies depending upon the melting point of the particular thermoplastic resin constituting the fabric. For instance, Orlon melts somewhere in the area of 250° C., rayon acetate about 180° C., and Saran about 175° C. The particular melting temperature of various thermoplastic filaments, fibers, yarns and linters differs somewhat depending upon the manufacturer and production methods employed but such temperature can be easily determined by those skilled in the art.

Cooling of the fabric may occur normally after the fabric leaves the heating surface, or may be aided by the application of a cooling surface against the unfused surface of the fabric as illustrated by roller 22 of FIG. 2. Likewise, where desired, the cooling surface such as roller 22 may be placed against the heating roller 21 so that both surfaces of the fabric are simultaneously treated as the fabric passes therebetween.

Variations and modifications may be made within the scope of the claims and portions of the improvements may be used without others.

I claim:

1. The process of preparing pressure-sensitive transfer elements which comprises the steps of applying sufficient heat to one surface of a porous ink-receptive fabric foundation composed of thermoplastic resinous material to melt the fabric at said surface and fuse it into a continuous, non-porous ink-impervious surface film while retaining the ink-receptive properties of the remainder of the fabric, and applying an ink transfer composition to the opposite unheated ink-receptive surface of the fabric to form said transfer element.

2. The process of preparing pressure-sensitive transfer elements which comprises the steps of contacting one surface of a porous ink-receptive fabric foundation composed of thermoplastic resinous material with a heated surface having a temperature sufficient to melt the fabric at said surface and fuse it into a continuous, non-porous ink-impervious surface film while retaining the ink-receptive properties of the remainder of the fabric, and applying an ink transfer composition to the opposite unheated ink-receptive surface of the fabric to form said transfer element.

3. The process of preparing pressure-sensitive transfer elements which comprises the steps of contacting one surface of a porous ink-receptive fabric foundation composed of thermoplastic resinous material with a heated surface having a temperature sufficient to melt the fabric at said surface and fuse it into a continuous, non-porous ink-impervious surface film, contacting the opposite surface of the fabric with a cooling surface to prevent the melting and fusion thereof and to retain the ink-receptive properties of said opposite surface, and applying an ink transfer composition to said ink-receptive surface of said fabric to form said transfer element.

4. The process of preparing pressure-sensitive transfer elements which comprises the steps of heating one surface of a porous ink-receptive nylon fabric foundation to a temperature sufficiently high to melt the nylon at said surface and fuse it into a continuous, non-porous ink-impervious surface film while retaining the ink-receptive properties of the remainder of the nylon in the fabric, and applying an ink transfer composition to the opposite unheated ink-receptive nylon surface to form said transfer element.

5. The process of claim 1 in which the prepared transfer elements are typewriter ribbons.

6. The process of claim 1 in which the prepared transfer elements are transfer sheets.

7. A pressure-sensitive transfer element comprising a unitary ink-receptive fabric foundation consisting of thermoplastic resinous material, one surface of said foundation being heat fused into a continuous, non-porous ink-impervious surface film and the other surface being discontinuous, ink-receptive and having thereon an ink transfer composition.

8. A pressure-sensitive transfer element comprising a unitary ink-receptive nylon fabric foundation, one surface of said foundation being heat fused into a continuous, non-porous ink-impervious surface film and the other surface being discontinuous, ink-receptive and having thereon an ink transfer composition.

9. A typewriter ribbon according to claim 7.

10. A transfer sheet according to claim 7.

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