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INK TRANSFER ELEMENT

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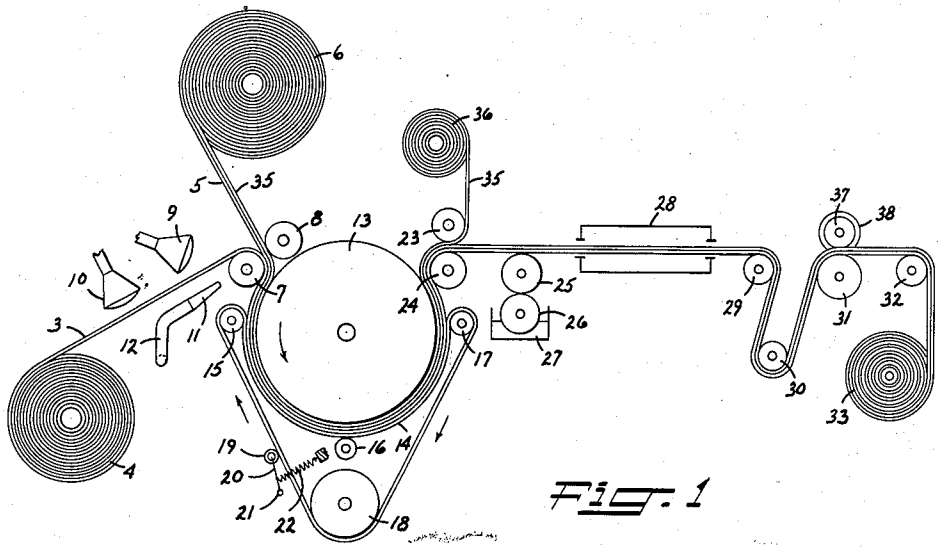


Fig. 1

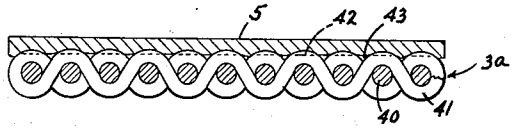


Fig. 2

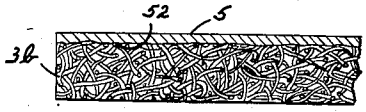


Fig. 3

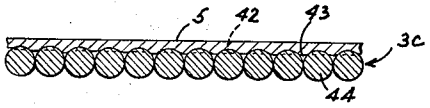


Fig. 4

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INK TRANSFER ELEMENT

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6 Claims. (Cl. 154—46.8)

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This invention relates to typewriter transfer elements and in particular to a transfer element of this type provided with an impervious backing film.

Various expedients have been tried in an attempt to provide typewriter ribbons which when struck by the type face would not liberate ink, dust, or fiber particles which become lodged in the recesses of the type face and by accumulation build up so as to fill the recesses and blur the typed impressions. The coating procedures heretofore practiced have, however, the disadvantages that the impregnation of the ribbon cannot be adequately controlled, and a smooth plane in the rear of the coating cannot be obtained for several reasons. When a thin coating medium is employed, the impregnation is excessive and the ribbon is virtually completely impregnated by the entire substance of the film so that the back face of the film is for practical purposes the same as the back face of the ribbon and has the same irregularities. When a higher viscosity of coating is employed, the fine fibers projecting from the yarns in the back face of the ribbon tend to prevent impregnation to any extent whatsoever so that the coating has an irregular contour as determined by the roughness of the back face of the ribbon and yet has inadequate adherence. If pressure is employed to increase impregnation, the result is the same as if a thin low viscosity impregnating medium had been used. These faults of coating procedures result in several faults in the product. In the first place, the ribbon is so deeply impregnated by the low viscosity coating that its capacity for ink or other printing medium is seriously impaired. On the other hand, where a high viscosity is applied, the adherence is inadequate. In all cases, the back face of the coating has roughly the same irregularities as the back face of the ribbon. This results in severe indentation of the coating by the type face wherever the hight points of the coating occur, thereby decreasing the durability of the product.

In accordance with the present invention, these disadvantages are overcome by the application of a thin pre-formed film to one face of the transfer element in such a manner as to preserve the smoothness of the rear face of the film and to obtain adequate adhesion by the substance of the film itself without excessive impregnation of the fibrous ink-receiving web. These and other objects and advantages of the present invention will be apparent from the drawing and description thereof hereinafter.

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In the drawing, illustrative of the invention:

Figure 1 is a diagrammatic side elevation of one system adapted to produce the transfer elements of the invention,

Figure 2 is a transverse section through a transfer element of the invention,

Figure 3 is a transverse section through a modification, and

Figure 4 is a transverse section through another modification.

In general, a thin, tough, flexible, pre-formed thermoplastic film is placed in contact with the face of a fibrous web and the film is subjected to heat and pressure sufficient to render the film tacky and to adhere the film to the fibrous web. If desired, the film may be preheated and immediately after such preheating, the film is placed in contact with the web and the two are pressed together to cause the bonding by impregnation of the substance of the film at its surface into the adjoining surface fibers of the web. The pressure upon the assembled structure is exerted by a smooth-surfaced element, such as a heated roll against which the assembled structure is pressed by a belt so as to preserve the plane surface at the back of the pre-formed film. The assembly is then cooled after which the porous web is impregnated with ink and dried. In some cases the web may be inked before the adhesion of film to the web.

The preformed film may be made of any thermoplastic film-forming material such as synthetic resins, for example, polyvinyl resins such as polyvinyl chloride, polyvinyl acetate and the like; polystyrene, polymerized hydrocarbons such as polyiso-butylene; copolymers, such as copolymers of vinyl halides and vinyl esters, vinyl derivatives and acrylonitriles, vinyl derivatives and styrene derivatives, acrylic acid esters of aliphatic and aryl alcohols. Thermoplastic cellulose derivatives may also be employed as the film-forming material such, for example, as cellulose esters of the higher fatty acids, such as cellulose stearate, cellulose palmitate, cellulose acetobutyrate; alkyl and aryl cellulose ethers of high degree of substitution, such as ethyl cellulose and the like. The following may also be used: sulfonamide-aldehyde resins; rubber hydrohalides; sulfur-olefin resins; cumarone resin; indene resin; condensation polymers such as the condensation products formed from di-basic acids and di-amines (nylon type), and polyhydric alcohols and polybasic acids; chlorinated biphenyls, as well as natural and synthetic gums, and mixtures of any two or more of the aforemen-

tioned materials. Materials which are not inherently thermoplastic such, for example, as cellulose acetate, cellulose nitrate and the like, may be mixed in such proportions with inherently thermoplastic materials that the resulting mixture will be inherently thermoplastic and used in the practice of the present invention.

The fibrous webs which may be used in making the transfer element may be in the form of a woven fabric, such as the fine silk ribbons commonly employed or they may be formed of thin non-woven fabrics of felt-like or paper-like character. Besides woven and felt-like or paper-like webs, the fibrous web may comprise a simple warp sheet of twisted yarns. The woven or non-woven fabric may comprise fibers of paper making length or textile making length and a small proportion thereof may be inherently thermoplastic to provide autogenous bonds between the thermoplastic film and the fibrous web. When the non-woven web contains potentially adhesive fibers of this character, they may be formed of any of the materials listed above from which the preformed film may be formed, and the thermoplastic fibers in the web may be made from the same or different material as that of the preformed film.

The fibrous web may have any thickness from about 0.002 to 0.02 inch thickness, a common thickness for a woven ribbon being 0.015 to 0.020 inch. The preformed film is very thin and may have any dimension from 0.0005 to 0.002 inch.

The preformed film may be applied directly to the fibrous web if it is of sufficient thickness to be handled without distortion. However, with the thinner films, the films are first formed upon a temporary backing with which they may be transferred or applied to the fibrous web after which the temporary backing is stripped from them. This is also preferable with films of greater thickness within the range desired for the present invention.

Accordingly, the preferred procedure is to form the films upon a temporary backing which has little or no affinity for the thermoplastic material used in making the film. Such backing should not be affected by such solvents or plasticizers as are used in the casting of the film upon its surface. Examples of suitable materials are regenerated cellulose, metal foil, and thin sheets of infusible resins. Besides these materials of general applicability, cellulose esters, such as cellulose acetate and cellulose nitrate sheets may be employed for certain of the resins provided the solvents and plasticizers used for the resins do not affect the esters.

The preformed thermoplastic film may contain a pigment, dyestuff, or other filler to impart any degree of coloring or opacity desired since the striking action of the type characters cannot liberate such particulate material from the body of the film. For the maximum strength and toughness, however, it is preferred to omit any pigment, filler, or particulate material having a character such that it is not fused into the body of the film-forming material.

In Figure 1, a system is shown for producing transfer elements in which the fibrous web 3, such as a woven or non-woven web, in this case un-inked, proceeds from a supply roll 4 and a preformed film 5 proceeds from a supply roll 6 into the nip between a pair of rolls 7 and 8 where they are pressed together in the desired registry after their opposed faces have been preheated as by infra-red ray lamps 9 and 10. These lamps are suitably disposed to preheat the surface of the film 5 to the desired temperature in the vicinity of its tacky point, just before the web contacts it in the nip between rolls 7 and 8. The lamps are also arranged to heat the opposed surface of the fibrous web 3 at least to the tacky temperature and within a few degrees above it. To prevent the roll 7 from becoming too hot, it may be cooled as by a blast of air extending axially of the roll across its entire width by means of nozzle 11 discharging from a cold air supply duct 12. The laminar structure immediately passes about a roll 13 which is internally heated, and pressure is exerted against the laminar structure by a continuous belt 14 carried about the structure on drum 13 under the guidance of rolls 15, 16, and 17. The heat and pressure on the laminar structure are sufficient to render the film tacky and to adhere the film to the fibrous web. The belt may be driven by means of roll 18 and tensioned by roll 19 rotatably mounted in arms 20 pivotally mounted at 21 and urged against the belt by means of spring 22. As the laminar structure leaves the drum 13, it passes between rolls 23 and 24 and over the ink-applying rolls 25 and 26. The fibrous web receives the layer of ink carried by roll 25 from roll 26 which runs in the supply bath 27. After inking, the laminar structure passes through a dryer housing 28 to remove volatile solvent. From the dryer, it passes over roll 29, tension roll 30, and over rolls 31 and 32 to a take-up at 33.

When the preformed film is carried on a temporary backing or support 35, the roll 6 delivers such backed film which proceeds through the normal course until roll 23 which may be internally cooled is reached. Instead of a cooling roller, a blast of cold air may be applied to the structure. At this point, after the structure is cooled, the backing 35 is stripped and rewound on a take-up device 36.

The system may be applied to fibrous webs and preformed films of any width. These widths may correspond to the final width of the transfer element or they may be much wider such as anywhere from 2 to 6 feet depending on the width of the fabric produced in the loom or the web-forming device used to produce the woven or non-woven fabric employed. When the web 3 and film 5 are wider than the final desired width of the transfer element, a slitting device comprising a roll 37 having outwardly extending circumferential slitting knives 38 is provided to cooperate with the roll 31. The knives 38 are spaced apart axially distances corresponding to the desired width or widths of the transfer element. If desired, slitting may be performed before the ink is applied to the fibrous web or after the wide transfer element is collected on take-up 33. In any event, the final element or elements collected on 33 may be subsequently unwound and cut to any length desired.

As an illustrative specific procedure, a coating of a copolymer of vinyl acetate and vinyl chloride containing 10% of a plasticizer and having a thickness of 0.001 inch was formed on a temporary backing sheet of smooth surfaced cellophane and passed through the system shown in Figure 1 in opposition to a woven fabric ribbon having a thickness of 0.015 inch. The width of the film and web was four feet. The surface of the film was heated to 160° C. and the surface of the ribbon was heated to 167° C. and subjected to a pressure of five pounds per square inch. After cooling, stripping, and impregnation

with ink, the laminar structure was cut into one-half inch widths.

Figure 2 shows a preferred embodiment comprising the preformed film backing **5** and a woven web **3***a* comprising warp threads **40** and filling threads **41**. The filling threads are impregnated by the substance of the preformed film **5** to a slight depth indicated by the dotted line **42**. This limited impregnation which generally amounts to less than 15% of the thickness of the web **3***a*, maintains substantially the entire ink-carrying capacity of the porous web **3***a*, the interstitial spaces **43** adjacent the back film **5** serving to provide capillary ink-retaining spaces which would ordinarily not contain ink in the absence of the film **5** and which compensate for the loss of porosity caused by the limited impregnation at **42**. The film **5** retains its smooth rear or exposed surface and the laminar structure is essentially as flexible as the web **3***a* alone because of the limited impregnation of the film into the filling yarns **41**. The smooth back surface of film **5** assures good distribution of pressure from the type character so that the extent of indentation is reduced and is less liable to become so excessive as to leave occasional permanent indentations, such as would occur when the back surface of the film has high spots initially.

Figure 3 illustrates a modification comprising the backing film **5** and the ink-retaining non-woven, paper-like web **3***b*. The interface **52** of the film **5** is adhesively joined to the fibers adjacent that face leaving the remainder of the non-fibrous web in its original inherently porous condition. In Figure 4, the non-woven fibrous web **3***c* comprises a plurality of twisted yarns **44** in the form of a warp sheet without any filling yarns. The backing film **5** is adhesively joined by impregnation of the web to the depth of the dotted line **42** as in the embodiment of Figure 2. As in that previous embodiment, the interstices **43** extending longitudinally between the adjacent yarns **44** and the interface of film **5** provides capillary ink retaining spaces adapted to compensate for the extent of impregnation at **42**. In the embodiments of Figures 3 and 4, the back face of the film **5** is smooth as in Figure 2 and provides the same advantages.

It is to be understood that changes and variations may be made without departing from the spirit and scope of the present invention as defined in the appended claims.

I claim:

1. In a transfer element, a thin, porous fibrous web impregnated with an ink transfer medium, and a thin, tough, flexible, thermoplastic film impervious to the ink transfer medium adhesively joined by a portion of its own substance to one face of the web and having a smooth exposed face, the fibers of the web being also impregnated by the substance of the film at the adjoining surface of the web to a depth not exceeding one-fourth of the web thickness.

2. A transfer element as defined in claim 1 in which the film has a thickness of 0.0005 to 0.002 inch.

3. A transfer element as defined in claim 1 in which the web is a woven web having a thickness of 0.002 to 0.02 inch.

4. A transfer element as defined in claim 1 in which the web is a non-woven comprising yarns extending lengthwise of the web only and having a thickness of 0.002 to 0.02 inch.

5. A transfer element as defined in claim 1 in which the web comprises a non-woven felt-like mass of fibers having a thickness of 0.002 to 0.02 inch.

6. A transfer element as defined in claim 5 in which some of the fibers of the web are thermoplastic.

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