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[45] **Sept. 24, 1974**

[54] **PROTECTIVE COATINGS FOR MAGNETICALLY CODABLE CREDIT CARD**

[75] Inventors: **John E. Hynes**, Danbury; **Joseph F. Braca**, Huntington, both of Conn.

[73] Assignee: **Pitney-Bowes, Inc.**, Stamford, Conn.

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[21] Appl. No.: **227,960**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 16,118, July 9, 1971, Pat. No. 3,626,214.

[52] **U.S. Cl.** .... **235/61.12 M,** 235/61.7 B, 360/2
[51] **Int. Cl.** **G06k 19/06**
[58] **Field of Search**................ 235/61.12 M, 61.7 B; 360/2; 340/149 A

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Primary Examiner—Daryl W. Cook
Attorney, Agent, or Firm—William D. Soltow, Jr.; Albert W. Scribner; Peter Vrahotes

[57] **ABSTRACT**

The magnetically encoded stripe of a plastic credit card is protected from abrasion and wear by precisely coating the stripe in a manner which does not adversely affect the readability of the magnetically encoded stripe. The coating is a vinyl polymer such as polyvinylchloride applied in a thickness of about 0.1 mills. The polymer is suspended or dissolved in a carrier liquid which is a substantial non-solvent for the material of the magnetic stripe on which it is applied. The magnetic stripe is pre-coated and then applied to the credit card.

6 Claims, 9 Drawing Figures

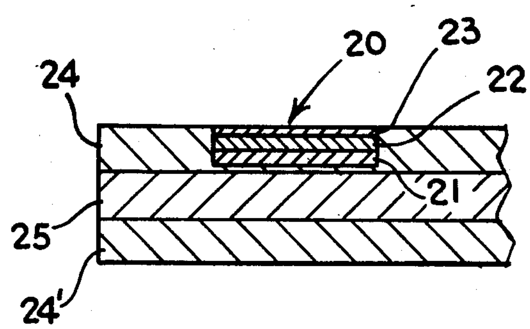
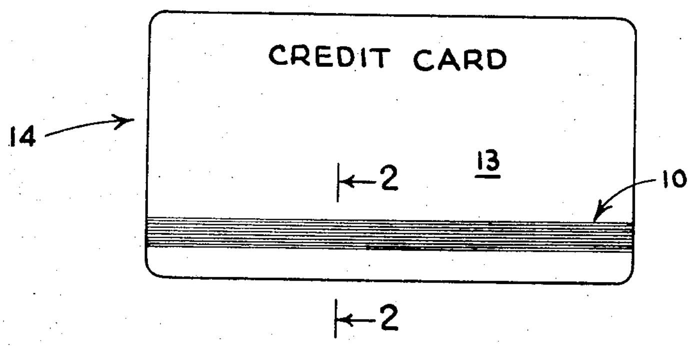


FIG. 1



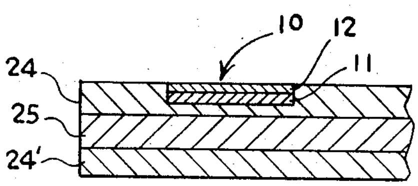


FIG. 2

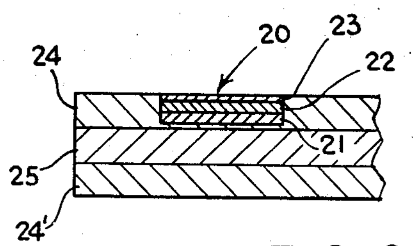


FIG. 3

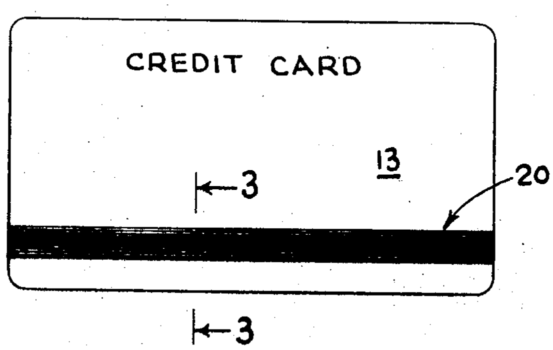


FIG. 4

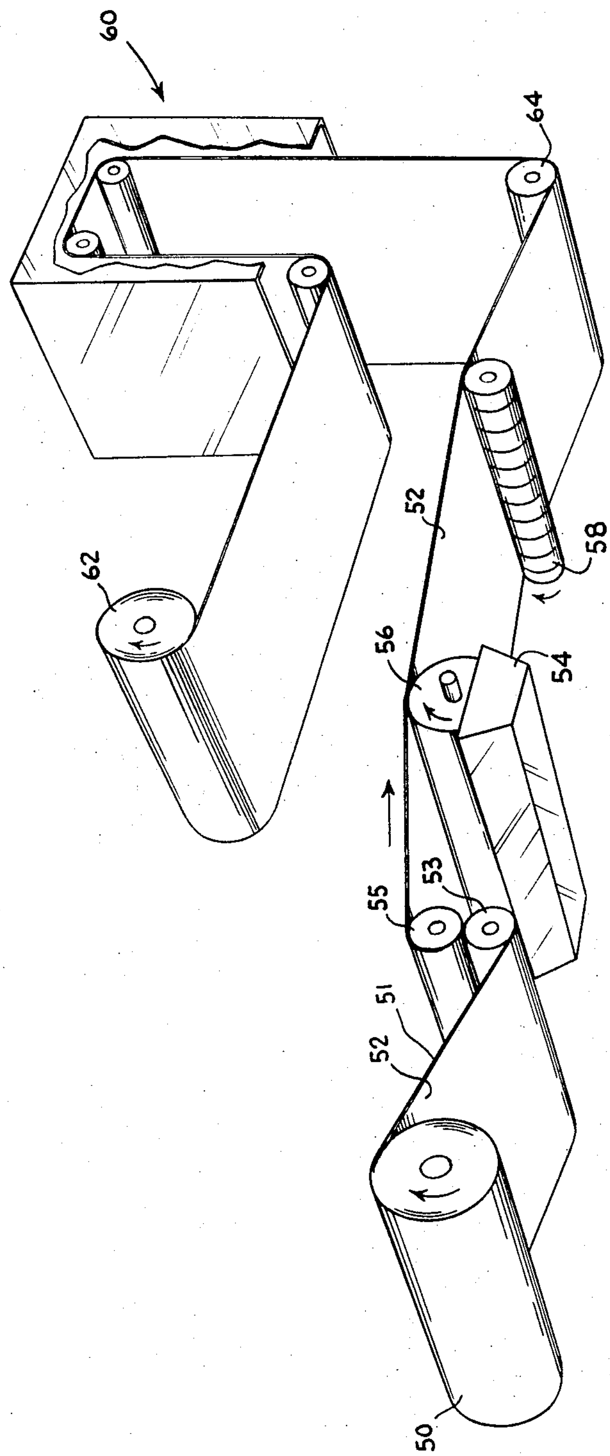


FIG. 5

FIG. 6

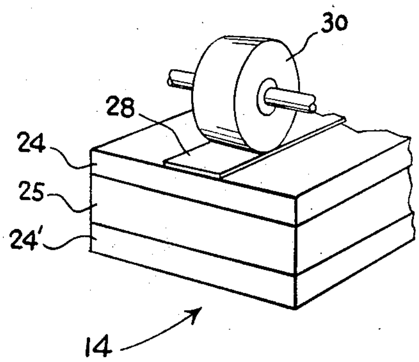


FIG. 7

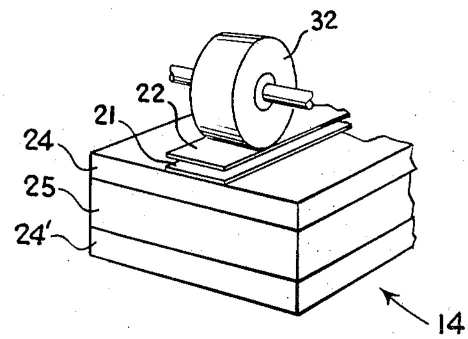


FIG. 8

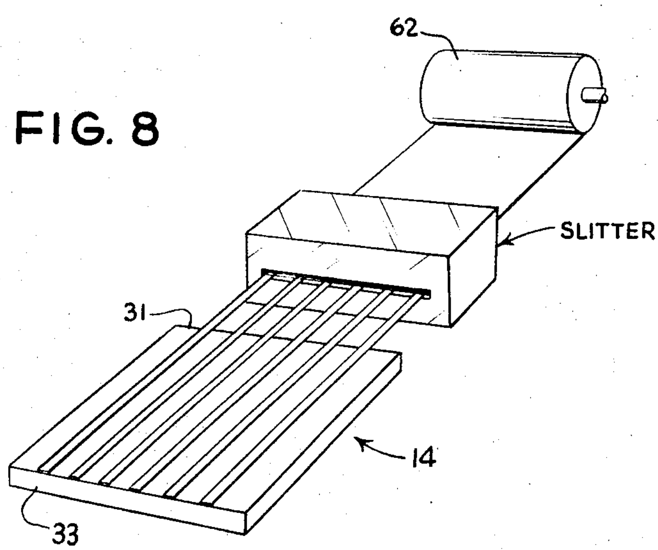
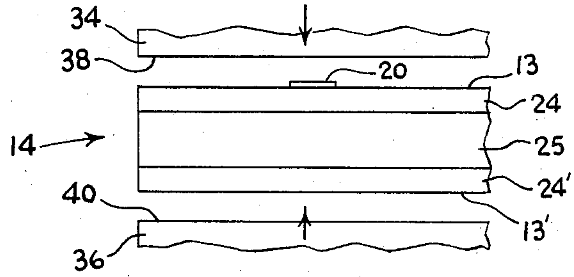


FIG. 9



PROTECTIVE COATINGS FOR MAGNETICALLY CODABLE CREDIT CARD

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation in part of U.S. patent application Ser. No. 161,118 filed July 9, 1971, in the name of Joseph F. Braca and now U.S. Pat. No. 3,626,214.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a protective coating for the magnetically readable region of a magnetically coatable machine readable credit card and to the process for applying the protective coating.

2. Brief Description of the Prior Art

Magnetically encoded credit cards require that the surface of the magnetic stripe remain exposed so that it may be moved into intimate operational contact with a magnetic readhead which is adapted to sense the information encoded on the stripe. When the card is not in use, the stripe surface in most cases is subject to various ware and/or abrasion forces that occur during card storage handling. These reading and storage contact forces are thus apt, over a period of time, to damage the stripe material to the extent of destroying all or part of the magnetically encoded information thereon, or rendering it difficult to properly read the encoded information. Previous attempts to place a protective coating or layer on the magnetic stripe have not proved satisfactory, but rather have proved to adversely affect the readability of the encoded information. The use of a coating for the protection of the magnetic stripe has been found to interfere with the reading of the magnetic signal for various reasons. For example, an excessive loss of the magnetic signal strength can result in the coating acting as a spacer which prevents the magnetic readhead from being adequately close to the magnetic stripe surface of the coating may offer excessive magnetic-electrical interference, or the coating process may adversely affect the magnetic material in the magnetic stripe and produce an uneven oxide surface.

The primary object of the instant invention is to provide a practical protective coating for a magnetic stripe on a credit card type of element, which coating offers protection for the stripe material while not interferring with the magnetic reading thereof.

Another object of the invention is to provide a novel method of preparing a magnetically coded credit card having a protective coating on the encoded areas thereof.

SUMMARY OF THE INVENTION

It has now been found that the problems encountered when attempting to protect a magnetic stripe on a credit card can be overcome by means of a novel method of applying a protective coating to the magnetic stripe and by employing an ultra-thin coating of a vinyl polymer.

In accordance with the present invention, a water dispersible or soluable vinyl polymer is mixed with a carrier liquid, and coated on a magnetic tape. The coating thickness is in a range from 0.1 mil to 0.2 mil. A vinyl cloride homopolymer or copolymer is mixed with a carrier liquid such as water and applied uniformly to a magnetic tape. The tape is then cut into a plurality of magnetic stripes of required width and then each stripe is fusion bonded to a substrate. The stripe is bonded to the stock by solvent welding. The magnetic tape is preferrably a vinyl cloride-based carrier covered with a magnetic material. The carrier liquid for the vinyl polymer coating material must be a substantially non-solvent for the vinyl cloride-based carrier and must not be a solvent for the material of the substrate.

BRIEF DESCRIPTION OF THE DRAWINGS

The above subjects, as well as additional object features and advantages of the present invention, will become apparent upon consideration of the following disclosure of the invention, especially when taken in conjunction with the accompanying drawings wherein:

FIG. **1** is a plan view of a credit card having a magnetic stripe;

FIG. **2** is a transverse cross-sectional view of the magnetic tape used in connection with the credit card of FIG. **1**;

FIG. **3** is a transverse cross-sectional view taken along the section line corresponding to line **3—3** of FIG. **4**;

FIG. **4** is a plan view of a credit card in accordance with the present invention;

FIG. **5** is a prospective view of a coating operation;

FIG. **6** is a fragmentary prospective view of the application of a solvent-weld;

FIG. **7**, is a fragmentary prospective view of the application of the coated magnetic tape over the solvent weld;

FIG. **8** is a schematic illustration showing the simultaneous application of a plurality of magnetic stripes to a stock material; and

FIG. **9** is a fragmentary schematic illustration of the step of fusing a magnetic stripe to a substrate.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A credit card indicated generally at **14**, is provided with a magnetic tape or stripe **10**, which is applied to the outer surface layer **13** of the credit card. The manufacturing technique is such that the magnetic stripe **10** is flush with the outer surface layer **13**.

As shown in FIG. **2**, the magnetically coatable credit card **14** is formed of three layers **24**, **25** and **24'** of a polyvinyl chloride acetate sheet stock material laminated together. Clear vinyl layers **24** and **24'** overlay the front and back surfaces respectively of the opaque inner layer **25** which typically contains suitable indicia. The magnetic stripe **10** includes a polyvinyl chloride carrier **11** which is imbeded in the clear vinyl top layer **24**. The magnetic oxide coating **12** of the stripe **10** is substantially flush with the top surface **13** of the upper clear vinyl layer **24**. The magnetic tape **10** is of the kind usually prepared for use in audio recording.

The manufacture of the credit card **14** is conveniently and economically carried out by utilizing, a large polyvinyl chloride acetate credit card stock sheet sized to form a plurality of credit cards which are cut from the stock sheet.

The credit card of FIG. **3** employs a coated magnetic stripe **20**. An ultra-thin polymer coating **23** is applied over the magnetic oxide layer **22** which in turn is carried on a polymer chloride carrier **21**.

The coating operation as shown in FIG. 5 is critical because of the extreme criticality of the coating thickness. The coating technique must provide a uniform coating and must not adversely affect the magnetic oxide coating or the base material of the magnetic tape. Magnetic tape **51** is fed from a feed roll **50** to a region in which the coating emulsion is applied to the lower surface **52** of the magnetic tape by means of a coating solution reservoir **54** and a stainless steel roller **56** which uniformally spreads the coating on the surface **52** of the tape. A wire wound rod **58** serves to closely control the thickness of the coating. The tape is then passed through a drying oven **60** wherein the tape is heated to a temperature of approximately 150° F. Finally, the dried, coated tape is wound on a take-up roll **62.**

The coating operation must be carefully controlled so that the coating thickness is held to less than 0.2 mils but no less than 0.1 mil and preferably the coating thickness does not vary by more than plus or minus 0.04. Factors which come into play in the controlling of the coating are the tension on the tape **52** which is controlled by factors such as the speed of the powered takeup roll **62** and the resistance exerted by the tension rollers **53** and **55,** the speed of rotation of the roller **56** which serves to uniformally distribute the formulation on the bottom surface of the tape, the speed of rotation of the wire wound rod **58,** the diameter of the wire on the wire wound rod, and the pressure of the wire wound rod against the tape. Although it would appear that in view of the large number of variables which come into play, and the numerous empirical determinations which must be made that it would be impossible or at least impractable to apply an ultra-thin protective coating on a magnetic tape, it is evident from the following examples that the required coatings can be consistently produced.

In selecting a material for the coating process it is essential that the material be capable of undergoing the credit card processing cycle without excessive deterioration. Applying the coating to the credit card after the magnetic stripe has been solvent-welded thereto encounters extreme difficulties because the rigid, inflexible, insufficiently flat surface of the credit card stock **14.** Ordinary protective coatings which are typically applied to materials such as credit card stock **14** are applied in much greater thicknesses than are required in the instance invention and variations in thickness are typically tolerable; however, in the application of ultra-thin coatings problems are encountered which are not typically encountered in these coating operations.

In selecting the polymer for the coating, it is essential that the polymer be capable of forming an ultra-thin film having abrasion resistant qualities. The polymer must be soluble or dispersible in a liquid carrier which does not adversely affect the magnetic oxide material of the tape, the binders which are used in combination with the magnetic oxides, or the base material of the tape. It is also essential that the polymer unite with sufficient tenacity to the magnetic stripe so that it is not removed during the polishing operation to which credit cards are typically subjected. It has been found for example that rubber suspensions tend to stick to the polishing plate and are not feasible for use in combination with polyvinyl chloride base magnetic stripe. Polyurethanes typically have extremely high abrasion resistance but most urethanes require a carrier which adversely affects the polyvinyl chloride base of the magnetic stripe. The use of a carrier liquid such as toluene will cause curling of the magnetic tape if the tape is coated prior to being fused to the credit card stock or separation of the magnetic stripe from the credit card stock if the coating is applied after the fusing of the magnetic stripe to the credit card. It has also been found that acrylics tend to attach to a polisher during the finishing operation of the credit card and for this reason are difficult to use as a coating material. Also, acrylics require solvents such as iso-propyl-alcohol, and naptha which tend to curl the magnetic tape. The curling induced by iso-propyl-alcohol is considerably less than that induced by naptha and particularly when employed in combination with water as a carrier does not adversely affect the magnetic tape base material. The polyvinyl chloride acrylic copolymer laytex sold by the B. F. Goodrich Company under the trademark GEON 2600 x 138 and the acrylic latex sold under the trademark HYCAR 2600 x 138, have been found to produce acceptable films.

The coating polymer must be either usable in a non-plasticized state or plasticized with an internal plasticizer such as an acrylic in order to avoid migration of the plasticizer from the polyvinyl chloride coating to the polyvinyl credit card stock. Such migration of the plasticizer results in the creation of soft regions in the credit card stock material and can also result in excessive drying of the coating material.

EXAMPLE

A 3.5 inch wide roll of polyvinyl chloride base, iron oxide coated magnetic recording tape, manufactured by BASF was coated with a polyvinyl latex formulation. The formulation was prepared by mixing equal parts by weight of a polyvinyl chloride latex, sold under the trademark, POLYCO 2607, by the Bordon Company and a polyvinyl chloride copolymer latex sold under the trademark POLYCO 2612 by the Bordon Company. The POLYCO 2607 is internally plasticized, has a solid content of 55 ± 1% by weight, a surface tension of 42–48 dynes/cm., a specific gravity of 1.070–1.080 and a viscosity at 25° C. (Brookfield LVF 2/60) of 100–250 cps. It is a film former at room temperatures but the film is excessively tacky. The POLYCO 2612 is a vinyl chloride-acrylic copolymer, unplasticized non-film former at room temperatures, has a solids content of 56 ± 1% (by weight) viscosity (Brookfield LVF 1/30, 25° C.) of 15–35, a pH (at 25° C.) of 8.5–10.0, surface tension 42–48 dynes/cm., specific gravity 1.18, and contains no more than 0.5% free monomer. The emulsion was diluted to 72.5% water and 27.5% solids (by weight) by mixing 2 parts emulsion with 3 parts distilled water (by weight).

The formulation is applied to the magnetic tape using the coating apparatus as illustrated in FIG. **5.** in partial contact with the formulation in a reservoir. The cylinder rotates up to meet the moving magnetic tape and the formulation is transferred to the lower surface of the tape while the tape is in contact with the coated cylinder. A pair of wiper blades on each edge of the tape removes approximately ⅛ of the coating to reduce a buildup of the coating at the edges. The coating is then passed over a rotating number 3 Mayer rod, which meters the coating to the desired thickness. The coating is then passed through a warm air drying oven at 150° F. The coated tape is dry to the touch upon leaving the drying oven and is wound onto a takeup roll. The tape traveled at a speed of about 40 feet per minute (ft./min.) resulting in a coating thickness of 0.150 ± 0.030 mills. The thickness is determined by comparing an uncoated tape's signal output to that of a coated tape. From the percent signal loss the thickness can be calculated using the formula:

$$d = \lambda/55\ [20 \log_{10} (V_1/V_2)\ ]$$

where

d is the thickness of the coating

λ is the recorded wavelength (4.75 mils for 210 bpi, all ONE's)

V_1 is the coated tape's voltage output

V_2 is the uncoated tape's voltage output

The POLYCO 2612-POLYCO 2607, formulation can range from 45 parts to 55 parts of one component to 55 parts to 45 parts to the other component. It is noted that the use of the POLYCO 2601 alone is impracticable because of the excessive tackiness of the film while the use of the POLYCO 2612 alone is impractical because it is not a film former at the requisite temperatures for coating the magnetic tape. Because of the ultra-thin condition of the protective coating, the use of conventional additives for reducing or eliminating tackiness have not been found to be effective. The coated tapes as produced in accordance with the example is slit into a plurality of stripes depending upon the required width of the magnetic stripe on a credit card and the width of the tape which is coated. In order to apply a stripe of magnetic tape to the credit card stock **14**, the stock sheet is painted, as shown in FIG. **6**, with a plurality of stripes of a solvent-weld such as **28**, applied with rollers such as **30**. The stripes **28** are located over the areas where the magnetic stripes **20** are to be placed, so that the stripes may then be held in place during further handling of the stock sheet **14**. Solvent-weld stripes **28** are of a material which is solvent for both the vinyl chloride-acetate sheet **14** and the polyvinyl chloride carrier **21** of the magnetic tape **20**. A suitable material for the solvent weld **21**, is a solvent-grade cyclo-hexanone. The solvent-weld should possess about the viscosity of a watery liquid, and is applied by the rollers **30** to about the width of the magnetic tape **20**. All other solvent-weld materials such as methyl ethel ketone (MEK), methyl isobutyl ketone (MIBK), methyl isoamyl ketone (MIAK) and/or mixtures thereof may be used, as long as both the tape carrier **21** and the layer **24** are at least partially soluble in the solvent-weld to form a firm, intrical bond with one another.

Within seconds following the deposit of adhesive stripes **21**, a magnetic tape **20** is pressed over the stripes **28** by rollers **32** as shown in FIG. **7**, and the tapes are severed from the tape supply at the boundries **31** and **33** of the sheet stock **14**.

The magnetic tapes **20** are then firmly heat fused to the credit card stock sheet **14** with heat and pressure. The credit card stock sheet, with the magnetic tapes **20** solvent-tacked thereto is placed between a pair of pressure plates **34** and **36** as shown in FIG. **9**. The plates **34** and **36** have flat contact surfaces **38** and **40** with a smooth mirror finish to render the credit card sheet surfaces **13** and **13** glossy and achieve flush seating of the tape **20**. The plates **34** and **36** are heated to raise the credit card stock sheet **14** to a temperature between about 275° F. and about 300° F when pressed against the stock sheet. Pressure of about 400 pounds per square inch (psi) is employed for about 3 minutes. This pressure may be varied, which should be low enough to avoid stock sheet defamation, it be sufficient to preclude future delamination of the tape **20** from the sheet **14**.

As a result of the heat fusing step, the tape **20** is imbedded in the layer **24** of the credit card stock sheet **14** as shown in FIG. **3**, so that the oxide layer coating **23** is flush with the top surface **13**. The imbedding or lamination step also removes any surface imperfections in the coating which may have occured during the coating operation. The stock sheet **14** may now be cut into individual credit cards in the manner well known in the art. The protective coating layer **23** is subjected to a temperature in excess of of the film-forming temperature of the POLYCO 2612 polyvinyl chloride copolymer material. The resultant film is smooth, of high gloss and sufficiently abrasion resistant to protect the magnetic stripe **20** from the type of wear and tear to which a credit card is typically subjected. For example, the magnetic oxide contamination of the magnetic read head and embosser use in processing cards can be eliminated. The problem of card discoloration due to iron oxide credit card of FIG. **3** is not appreciable greater than that of the credit card of FIG. **2**.

It is essential that the coating operation be applied to a relatively wide tape roll and that the slitting operation follow the coating operation. Attempts to coat narrow stripes on the order of ¼ inch wide meets with extreme difficulty and a lack of uniformity is encountered when a plurality of such stripes are individually coated.

What is claimed is:

1. A magnetically codable credit card comprising:

a generally rectangular card base member made of a plastic material and having a thickness considerably smaller than its length and width;

a magnetic tape stripe extending intermediate two sides of said base member, said stripe comprising a backing layer of plastic material having one side bonded to said base member and a layer of magnetic material secured to the other side of said backing layer; and

a tape stripe protective layer having a thickness of 0.1 to 0.2 mils coated on said magnetic layer.

2. The apparatus as defined by claim **1** wherein said plastic material comprises a polyvinyl chloride and said protective coating comprises a polymeric material which is at least dispersible in a carrier liquid which is substantially a non-solvent for polyvinyl chloride.

3. The article of claim **1** wherein said plastic material is polyvinyl chloride and said protective layer comprises polyvinyl chloride.

4. The article of claim **3** wherein said polyvinyl chloride copolymer is a film former at a temperature in excess of 200° F.

5. A magnetically codeable article comprising:

a generally rectangular polyvinyl chloride substrate;

a magnetic tape stripe extending intermediate two sides of said substrate, said stripe comprising a backing layer of polyvinyl chloride fused to said substrate and a layer of magnetic material coating on said backing layer; and

a tape stripe protective layer having a thickness of 0.1 to 0.2 mils coated on said magnetic layer, said protective layer being a polyvinyl chloride bonded to said magnetic layer.

6. The article of claim **1** wherein said protective layer is substantially flush with the surface of said base member.

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